Ependymal cilia beating induces an actin network to protect centrioles against shear stress

Multiciliated ependymal cells line all brain cavities. The beating of their motile cilia contributes to the flow of cerebrospinal fluid, which is required for brain homoeostasis and functions. Motile cilia, nucleated from centrioles, persist once formed and withstand the forces produced by the external fluid flow and by their own cilia beating. Here, we show that a dense actin network around the centrioles is induced by cilia beating, as shown by the disorganisation of the actin network upon impairment of cilia motility. Moreover, disruption of the actin network, or specifically of the apical actin network, causes motile cilia and their centrioles to detach from the apical surface of ependymal cell. In conclusion, cilia beating controls the apical actin network around centrioles; the mechanical resistance of this actin network contributes, in turn, to centriole stability.
Phone-based metric as a predictor for basic personality traits

Basic personality traits are believed to be expressed in, and predictable from, smart phone data. We investigate the extent of this predictability using data (n = 636) from the Copenhagen Network Study, which to our knowledge is the most extensive study concerning smartphone usage and personality traits. Based on phone usage patterns, earlier studies have reported surprisingly high predictability of all Big Five personality traits. We predict personality trait tertiles (low, medium, high) from a set of behavioral variables extracted from the data, and find that only extraversion can be predicted significantly better (35.6%) than by a null model. Finally, we show that the higher predictabilities in the literature are likely due to overfitting on small datasets.
Stress response and cognitive performance modulation in classroom versus natural environments: A quasi-experimental pilot study with children

Stress during childhood can have mental and somatic health influences that track throughout life. Previous research attributes stress-reducing effects to natural environments, but has mainly focused on adults and often following leisurely relaxation in natural environments. This pilot study explores the impact of natural environments on stress response during rest and mental load and cognitive performance in 47 children aged 10–12 years in a school context. Heart rate variability measures indexing tonic, event, and phasic vagal tone and attention scores were compared across classroom and natural environments. Tonic vagal tone was higher in the natural environment than the classrooms, but no differences were found in event or phasic vagal tone or cognitive performance measures. These findings suggest a situational aspect of the conditions under which natural environments may give rise to stress-buffering influences. Further research is warranted to understand the potential benefits in a real-life context, in particular with respect to the underpinning mechanisms and effects of accumulated exposure over time in settings where children spend large proportions of time in natural environments.
How a 10-day heatwave impacts barley grain yield when superimposed onto future levels of temperature and CO₂ as single and combined factors

Heatwaves pose a threat to crop production and are predicted to increase in frequency, length and intensity as a consequence of global warming. Future heatwaves will occur in addition to the ongoing increase of mean temperature and CO₂. To test effects of heatwaves superimposed to future climate scenarios, 22 barley accessions were cultivated with elevated temperature (+5 °C) and CO₂ (700 ppm) as single factors and in combination. The control treatment mimicked ambient Scandinavian early summer conditions (19/12 °C, day/night; 400 ppm CO₂). Around flowering a 10-day heatwave of 33/28 °C (day/night) was superimposed to all treatments. The lowest average grain yield was observed when the
heatwave was superimposed onto the combined elevated temperature and CO₂ treatment. Here the yield decreased by 42% compared to no heatwave and 52% compared to ambient conditions. When the heatwave was superimposed onto ambient conditions the average grain yield decreased by 37% compared to no heatwave. There was no significant difference between the relative grain yield decrease caused by the heatwave in the ambient and future climate scenarios. In contrast, the vegetative aboveground biomass increased upon heatwave exposure, leading to a strong decline in the harvest index. Our results strongly emphasize the need to produce heatwave resilient cultivars.

**General information**
State: Published
Organisations: Department of Environmental Engineering, Air, Land & Water Resources, Technical University of Denmark, Statistics and Data Analysis, University of Copenhagen, Natural Resources Institute Finland (Luke)
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Number of pages: 8
Pages: 45-52
Publication date: 1 May 2018
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Agriculture, Ecosystems and Environment
Volume: 259
ISSN (Print): 0167-8809
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.34
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.38
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.84
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.96
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.91
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.59
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.84
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Web of Science (2007): Indexed yes
Web of Science (2006): Indexed yes
Web of Science (2005): Indexed yes
Web of Science (2003): Indexed yes
Web of Science (2002): Indexed yes
Web of Science (2000): Indexed yes
Original language: English
Spatio-temporal pattern formation in predator-prey systems with fitness taxis

We pose a spatial predator–prey model in which the movement of animals is not purely diffusive, but also contains a drift term in the direction of higher specific growth rates. We refer to this as fitness taxis. We conduct a linear stability analysis of the resulting coupled reaction–advection–diffusion equations and derive conditions under which spatial patterns form. We find that for some parameters the problem is ill posed and short waves grow with unbounded speeds. To eliminate this, we introduce spatial kernels in the model, yielding coupled integro-differential equations, and conduct a similar stability analysis for this system. Through numerical simulation, we find that a variety of patterns can emerge, including stationary spatial patterns, standing and travelling waves, and seemingly chaotic spatio-temporal patterns. We argue that fitness taxis represents a simple and generic extension of diffusive motion, is ecologically plausible, and provides an alternative mechanism for formation of patterns in spatially explicit ecosystem models, with emphasis on non-stationary spatio-temporal dynamics.
Transcription factor co-expression networks of adipose RNA-Seq data reveal regulatory mechanisms of obesity

Background: Transcription Factors (TFs) control actuation of genes in the genome and are key mediators of complex processes such as obesity. Master Regulators (MRs) are the genes at the top of a regulation hierarchy which regulate other genes. Objective: To elucidate clusters of highly co-expressed TFs (modules), involved pathways, highly interconnected TFs (hub-TFs) and MRs leading to obesity and leanness, using porcine model for human obesity.

Methods: We identified 817 expressed TFs in RNA-Sequencing dataset representing extreme degrees of obesity (DO; lean, obese). We built a single Weighted Transcription Factor Co-expression Network (WTFCN) and TF sub-networks (based on the DO). Hub-TFs and MRs (using iRegulon) were identified in biologically relevant WTFCNs modules. Results: Single WTFCN detected the Red module significantly associated with DO (P < 0.03). This module was enriched for regulation processes in the immune system, e.g.: Immune system process (Padj = 2.50E-06) and metabolic lifestyle disorders, e.g. Circadian rhythm - mammal pathway (Padj = 2.33E-11). Detected MR, hub-TF SPI1 was involved in obesity, immunity and osteoporosis. Within the obese sub-network, the Red module suggested possible associations with immunity, e.g. TGF-beta signaling pathway (Padj = 1.73E-02) and osteoporosis, e.g. Osteoclast differentiation (Padj = 1.94E-02). Within the lean sub-network, the Magenta module displayed associations with type 2 diabetes, obesity and osteoporosis e.g. Notch signaling pathway (Padj = 2.40E-03), osteoporosis e.g. hub-TF VDR (a prime candidate gene for osteoporosis). Conclusion: Our results provide insights into the regulatory network of TFs and biologically relevant hub TFs in obesity.
Electricity consumption clustering using smart meter data

Electricity smart meter consumption data is enabling utilities to analyze consumption information at unprecedented granularity. Much focus has been directed towards consumption clustering for diversifying tariffs; through modern clustering methods, cluster analyses have been performed. However, the clusters developed exhibit a large variation with resulting shadow clusters, making it impossible to truly identify the individual clusters. Using clearly defined dwelling types, this paper will present methods to improve clustering by harvesting inherent structure from the smart meter data. This paper clusters domestic electricity consumption using smart meter data from the Danish city of Esbjerg. Methods from time series analysis and wavelets are applied to enable the K-Means clustering method to account for autocorrelation in data and thereby improve the clustering performance. The results show the importance of data knowledge and we identify sub-clusters of consumption within the dwelling types and enable K-Means to produce satisfactory clustering by accounting for a temporal component. Furthermore our study shows that careful preprocessing of the data to account for intrinsic structure enables better clustering performance by the K-Means method.

General information
State: Published
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Publication date: 1 Apr 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Energies
Volume: 11
Issue number: 4
Article number: 859
ISSN (Print): 1996-1073
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.11 SJR 0.67 SNIP 1.34
Web of Science (2017): Indexed yes
Type-2 fuzzy elliptic membership functions for modeling uncertainty

Whereas type-1 and type-2 membership functions (MFs) are the core of any fuzzy logic system, there are no performance criteria available to evaluate the goodness or correctness of the fuzzy MFs. In this paper, we make extensive analysis in terms of the capability of type-2 elliptic fuzzy MFs in modeling uncertainty. Having decoupled parameters for its support and width, elliptic MFs are unique amongst existing type-2 fuzzy MFs. In this investigation, the uncertainty distribution along the elliptic MF support is studied, and a detailed analysis is given to compare and contrast its performance with existing type-2 fuzzy MFs. Furthermore, fuzzy arithmetic operations are also investigated, and our finding is that the elliptic MF has similar features to the Gaussian and triangular MFs in addition and multiplication operations. Moreover, we have tested the prediction capability of elliptic MFs using interval type-2 fuzzy logic systems on oil price prediction problem for a data set from 2nd Jan 1985 till 25th April 2016. Throughout the simulation studies, an extreme learning machine is used to train the interval type-2 fuzzy logic system. The prediction results show that, in addition to their various advantages mentioned above, elliptic MFs have comparable prediction results when compared to Gaussian and triangular MFs. Finally, in order to test the performance of fuzzy logic controller with elliptic interval type-2 MFs, extensive real-time experiments are conducted for the 3D trajectory tracking problem of a quadrotor. We believe that the results of this study will open the doors to elliptic MFs' wider use of real-world identification and control applications as the proposed MF is easy to interpret in addition to its unique features.

General information

State: Published
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Pages: 170-183
Publication date: 1 Apr 2018
Formalization of the Resolution Calculus for First-Order Logic

I present a formalization in Isabelle/HOL of the resolution calculus for first-order logic with formal soundness and completeness proofs. To prove the calculus sound, I use the substitution lemma, and to prove it complete, I use Herbrand
interpretations and semantic trees. The correspondence between unsatisfiable sets of clauses and finite semantic trees is formalized in Herbrand’s theorem. I discuss the difficulties that I had formalizing proofs of the lifting lemma found in the literature, and I formalize a correct proof. The completeness proof is by induction on the size of a finite semantic tree. Throughout the paper I emphasize details that are often glossed over in paper proofs. I give a thorough overview of formalizations of first-order logic found in the literature. The formalization of resolution is part of the IsaFoL project, which is an effort to formalize logics in Isabelle/HOL.

General information
State: Published
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Pages: 455–484
Publication date: 20 Jan 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Automated Reasoning
Volume: 61
Issue number: 1–4
ISSN (Print): 0168-7433

Approximation of ruin probabilities via Erlangized scale mixtures
In this paper, we extend an existing scheme for numerically calculating the probability of ruin of a classical Cramér–Lundberg reserve process having absolutely continuous but otherwise general claim size distributions. We employ a dense class of distributions that we denominate Erlangized scale mixtures (ESM) that correspond to nonnegative and absolutely continuous distributions which can be written as a Mellin–Stieltjes convolution \( \Pi \ast G \) of a nonnegative distribution \( \Pi \) with an Erlang distribution \( G \). A distinctive feature of such a class is that it contains heavy-tailed distributions. We suggest a simple methodology for constructing a sequence of distributions having the form \( \Pi \ast G \) with the purpose of approximating the integrated tail distribution of the claim sizes. Then we adapt a recent result which delivers an explicit expression for the probability of ruin in the case that the claim size distribution is modeled as an Erlangized scale mixture. We provide simplified expressions for the approximation of the probability of ruin and construct explicit bounds for the error of approximation. We complement our results with a classical example where the claim sizes are heavy-tailed.
5 år og fuld fart frem "BIOPRO World Talent Campus byder endnu en gruppe talenter fra hele verden velkommen til Danmark."

General information
State: Published
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Pages: 136-156
Publication date: 1 Jan 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Insurance: Mathematics and Economics
Volume: 78
ISSN (Print): 0167-6687
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): SNIP 1.284 SJR 1.083 CiteScore 1.58
Scopus rating (2016): CiteScore 1.55 SNIP 1.493 SJR 0.968
Scopus rating (2015): CiteScore 1.57 SNIP 1.407 SJR 1.056
Scopus rating (2014): CiteScore 1.49 SNIP 1.568 SJR 1.096
Scopus rating (2013): CiteScore 1.69 SNIP 1.509 SJR 1.25
Scopus rating (2012): CiteScore 1.63 SNIP 1.687 SJR 1.247
Scopus rating (2011): CiteScore 1.67 SNIP 1.685 SJR 1.313
Scopus rating (2010): SNIP 1.576 SJR 1.391
Scopus rating (2009): SNIP 1.311 SJR 1.583
Scopus rating (2008): SNIP 1.953 SJR 1.668
Scopus rating (2007): SNIP 1.239 SJR 1.528
Scopus rating (2006): SNIP 1.709 SJR 1.517
Scopus rating (2005): SNIP 1.264 SJR 1.35
Scopus rating (2004): SNIP 1.328 SJR 1.2
Scopus rating (2003): SNIP 1.621 SJR 0.933
Scopus rating (2002): SNIP 1.611 SJR 0.817
Scopus rating (2001): SNIP 1.055 SJR 0.665
Scopus rating (2000): SNIP 1.035 SJR 0.995
Scopus rating (1999): SNIP 1.028 SJR 1.268
Original language: English
Erlang, Heavy-tailed, Infinite mixtures, Phase-type, Ruin probability, Scale mixtures
DOIs:
Source: Scopus
Source-ID: 85039988411
Publication: Research - peer-review Journal article – Annual report year: 2018

5 år og fuld fart frem "BIOPRO World Talent Campus byder endnu en gruppe talenter fra hele verden velkommen til Danmark."
Ab initio study of the CO-N2 complex: a new highly accurate intermolecular potential energy surface and rovibrational spectrum

A new, highly accurate ab initio ground-state intermolecular potential-energy surface (IPES) for the CO-N2 complex is presented. Thousands of interaction energies calculated with the CCSD(T) method and Dunning's aug-cc-pVQZ basis set extended with midbond functions were fitted to an analytical function. The global minimum of the potential is characterized by an almost T-shaped structure and has an energy of -118.2 cm⁻¹. The symmetry-adapted Lanczos algorithm was used to compute rovibrational energies (up to J = 20) on the new IPES. The RMSE with respect to experiment was found to be on the order of 0.038 cm⁻¹ which confirms the very high accuracy of the potential. This level of agreement is among the best reported in the literature for weakly bound systems and considerably improves on those of previously published potentials.

General information
State: Published
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Number of pages: 13
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Physical Chemistry Chemical Physics
ISSN (Print): 1463-9076
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.04 SJR 1.686 SNIP 1.089
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.06 SJR 1.685 SNIP 1.113
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.725 SNIP 1.205 CiteScore 4.45
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.771 SNIP 1.239 CiteScore 4.29
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.72 SNIP 1.207 CiteScore 4.05
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.921 SNIP 1.177 CiteScore 3.67
ISI indexed (2012): ISI indexed yes
Identifying the factors that influence academic performance is an essential part of educational research. Previous studies have documented the importance of personality traits, class attendance, and social network structure. Because most of these analyses were based on a single behavioral aspect and/or small sample sizes, there is currently no quantification of the interplay of these factors. Here, we study the academic performance among a cohort of 538 undergraduate students forming a single, densely connected social network. Our work is based on data collected using smartphones, which the students used as their primary phones for two years. The availability of multi-channel data from a single population allows us to directly compare the explanatory power of individual and social characteristics. We find that the most informative indicators of performance are based on social ties and that network indicators result in better model performance than individual characteristics (including both personality and class attendance). We confirm earlier findings that class attendance is the most important predictor among individual characteristics. Finally, our results suggest the presence of strong homophily and/or peer effects among university students.
A Convex Reconstruction Model for X-ray Tomographic Imaging with Uncertain Flat-fields

Classical methods for X-ray computed tomography are based on the assumption that the X-ray source intensity is known, but in practice, the intensity is measured and hence uncertain. Under normal operating conditions, when the exposure time is sufficiently high, this kind of uncertainty typically has a negligible effect on the reconstruction quality. However, in time- or dose-limited applications such as dynamic CT, this uncertainty may cause severe and systematic artifacts known as ring artifacts. By carefully modeling the measurement process and by taking uncertainties into account, we derive a new convex model that leads to improved reconstructions despite poor quality measurements. We demonstrate the effectiveness of the methodology based on simulated and real datasets.
Activity-based DEVS modeling

Use of model-driven approaches has been increasing to significantly benefit the process of building complex systems. Recently, an approach for specifying model behavior using UML activities has been devised to support the creation of DEVS models in a disciplined manner based on the model driven architecture and the UML concepts. In this paper, we further this work by grounding Activity-based DEVS modeling and developing a fully-fledged modeling engine to demonstrate applicability. We also detail the relevant aspects of the created metamodel in terms of modeling and simulation. A significant number of the artifacts of the UML 2.5 activities and actions, from the vantage point of DEVS behavioral modeling, is covered in details. Their semantics are discussed to the extent of time-accurate requirements for simulation. We characterize them in correspondence with the specification of the atomic model behavior. We demonstrate the approach with simple, yet expressive DEVS models.

General information
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Number of pages: 16
Pages: 116-131
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Simulation Notes Europe
Volume: 82
ISSN (Print): 2305-9974
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): CiteScore 2.78
Web of Science (2017): Indexed Yes
Scopus rating (2016): CiteScore 2.4
Scopus rating (2015): CiteScore 2.26
Scopus rating (2014): CiteScore 2.22
Scopus rating (2013): CiteScore 2.08
Scopus rating (2012): CiteScore 2.12
Scopus rating (2011): CiteScore 1.73
Web of Science (2007): Indexed yes
Web of Science (2006): Indexed yes
Original language: English
Activity modeling, Behavioral modeling, DEVS, GMF, Model Driven Development, UML
DOIs:
10.1016/j.simpat.2017.12.009
Source: FindIt
Source-ID: 2395116938
Publication: Research - peer-review › Journal article – Annual report year: 2018

Adaptive model predictive control for a dual-hormone artificial pancreas

We report the closed-loop performance of adaptive model predictive control (MPC) algorithms for a dual-hormone artificial pancreas (AP) intended for patients with type 1 diabetes. The dual-hormone AP measures the interstitial glucose concentration using a subcutaneous continuous glucose monitor (CGM) and administers glucagon and rapid-acting insulin subcutaneously. The discrete-time transfer function models used in the insulin and glucagon MPCs comprise a deterministic part and a stochastic part. The deterministic part of the MPC model is individualized using patient-specific information and describes the glucose-insulin and glucose-glucagon dynamics. The stochastic part of the MPC model describes the uncertainties that are not included in the deterministic part of the MPC model. Using closed-loop simulation of the MPCs, we evaluate the performance obtained using the different deterministic and stochastic models for the MPC on three virtual patients. We simulate a scenario including meals and daily variations in the model parameters for two settings. In the first setting, we try five different models for the deterministic part of the MPC model and use a fixed model for the stochastic part of the MPC model. In the second setting, we use a second-order model for the deterministic part of the MPC model and estimate the stochastic part of the MPC model adaptively. The results show that the controller is robust to daily variations in the model parameters. The numerical results also suggest that the deterministic part of the MPC model does not play a major role in the closed-loop performance of MPC. This is ascribed to the availability of feedback and the poor prediction capability of the model, i.e. the large disturbances and model-patient mismatch. Moreover, a second order adaptive model for the stochastic part of the MPC model offers a marginally better performance
in closed-loop, in particular if the model-patient mismatch is large.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Dynamical Systems, Department of Environmental Science and Engineering, Slovak University of Technology
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Number of pages: 13
Pages: 105-117
Publication date: 2018
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Journal of Process Control
Volume: 68
ISSN (Print): 0959-1524
Ratings:
- BFI (2018): BFI-level 1
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Scopus rating (2017): CiteScore 3.85 SJR 1.108 SNIP 1.971
- Web of Science (2017): Indexed Yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 3.41 SJR 1.037 SNIP 2.138
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 2
- Scopus rating (2015): SJR 1.346 SNIP 2.028 CiteScore 3.35
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 2
- Scopus rating (2014): SJR 1.397 SNIP 2.642 CiteScore 3.92
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 2
- Scopus rating (2013): SJR 1.421 SNIP 2.537 CiteScore 3.47
- ISI indexed (2013): ISI indexed yes
- BFI (2012): BFI-level 2
- Scopus rating (2012): SJR 1.435 SNIP 2.883 CiteScore 3.39
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 2
- Scopus rating (2011): SJR 1.236 SNIP 2.535 CiteScore 2.9
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 2
- Scopus rating (2010): SJR 1.237 SNIP 2.135
- BFI (2009): BFI-level 2
- Scopus rating (2009): SJR 1.246 SNIP 2.72
- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 2
- Scopus rating (2008): SJR 1.445 SNIP 2.593
- Web of Science (2008): Indexed yes
- Scopus rating (2007): SJR 1.413 SNIP 2.148
- Scopus rating (2006): SJR 1.697 SNIP 2.35
- Scopus rating (2005): SJR 0.931 SNIP 2.347
- Scopus rating (2004): SJR 0.957 SNIP 1.839
- Scopus rating (2003): SJR 1.547 SNIP 2.202
- Scopus rating (2002): SJR 1.287 SNIP 1.723
A Diagnostic and Predictive Framework for Wind Turbine Drive Train Monitoring

Vast amount of data are collected minute by minute from wind turbines around the world. This thesis represents a focused research effort into discovering new ways of processing these data streams in order to gain insights which can be used to lower the maintenance costs of wind turbines and increase the turbine availability.

First, it is demonstrated how simple sensor data streams can be leveraged based on a combination of non-linear predictive models and unsupervised fault detection to provide warnings of a critical bearing failure more than a month earlier compared to existing alarm systems. Second, early fault identification based on analysis of complex vibration patterns which is a domain previously reserved for human experts, is shown to be solved with high accuracy using deep learning architecture strained in a fully supervised sense from the data collected in a large scale wind turbine monitoring platform. The research shows a way towards a fully automatized data-driven wind turbine diagnostic processing system that is highly scalable and requires little or no feature engineering and system modeling.

General information
State: Published
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Number of pages: 111
Publication date: 2018

Publication information
Publisher: Technical University of Denmark (DTU)
Original language: English
Series: DTU Compute PHD-2017
Volume: 449
ISSN: 0909-3192
Main Research Area: Technical/natural sciences
Electronic versions: phd449_BachAndersen_M.pdf

Relations
Projects:
A Diagnostic and Predictive Framework for Wind Turbine Drive Train Monitoring
Publication: Research › Ph.D. thesis – Annual report year: 2018

A Dynamic Logic for Learning Theory

Building on previous work that bridged Formal Learning Theory and Dynamic Epistemic Logic in a topological setting, we introduce a Dynamic Logic for Learning Theory (DLLT), extending Subset Space Logics with dynamic observation modalities, as well as with a learning operator, which encodes the learner’s conjecture after observing a finite sequence of data. We completely axiomatise DLLT, study its expressivity and use it to characterise various notions of knowledge, belief, and learning.

General information
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Pages: 35-54
Publication date: 2018

Host publication information
A Fitts' law study of click and dwell interaction by gaze, head and mouse with a head-mounted display

Gaze and head tracking, or pointing, in head-mounted displays enables new input modalities for point-select tasks. We conducted a Fitts' law experiment with 41 subjects comparing head pointing and gaze pointing using a 300 ms dwell \( (<i>n</i>/n = 22) \) or click \( (<i>n</i>/n = 19) \) activation, with mouse input providing a baseline for both conditions. Gaze and head pointing were equally fast but slower than the mouse; dwell activation was faster than click activation. Throughput was highest for the mouse (2.75 bits/s), followed by head pointing (2.04 bits/s) and gaze pointing (1.85 bits/s). With dwell activation, however, throughput for gaze and head pointing were almost identical, as was the effective target width (≈ 55 pixels; about 2°) for all three input methods. Subjective feedback rated the physical workload less for gaze pointing than head pointing.

A General Microscopic Traffic Model Yielding Dissipative Shocks

We consider a general microscopic traffic model with a delay. An algebraic traffic function reduces the equation to the Aw-Rascle microscopic model while a sigmoid function gives the standard "follow the leader". For zero delay we prove that the homogeneous solution is globally stable. For a positive delay, it becomes unstable and develops dispersive and dissipative shocks. These are followed by a finite time singularity for the algebraic traffic function and by kinks for the sigmoid function.
Agent Programming Languages and Logics in Agent-Based Simulation

Research in multi-agent systems has resulted in agent programming languages and logics that are used as a foundation for engineering multi-agent systems. Research includes reusable agent programming platforms for engineering agent systems with environments, agent behavior, communication protocols and social behavior, and work on verification. Agent-based simulation is an approach for simulation that also uses the notion of agents. Although agent programming languages and logics are much less used in agent-based simulation, there are successful examples with agents designed according to the BDI paradigm, and work that combines agent-based simulation platforms with agent programming platforms. This paper analyzes and evaluates benefits of using agent programming languages and logics for agent-based simulation. In particular, the paper considers the use of agent programming languages and logics in a case study of simulating emergency care units.

A hamiltonian cycle in the square of a 2-connected graph in linear time

Fleischner's theorem says that the square of every 2-connected graph contains a Hamiltonian cycle. We present a proof resulting in an \(<i>O</i>(|E|)\) algorithm for producing a Hamiltonian cycle in the square \(<i>G</i>^2\) of a 2-connected graph \(<i>G</i> = (V, E)\). The previous best was \(<i>O</i>(|V|^2)\) by Lau in 1980. More generally, we get an \(<i>O</i>(|E|)\) algorithm for producing a Hamiltonian path between any two prescribed vertices, and we get an \(<i>O</i>(|V|^3)\) algorithm for producing cycles \(<i>G</i>^2\) of lengths 3, 4, \ldots, \(|V|\), respectively.
A Holistic Approach for Collaborative Workload Execution in Volunteer Clouds

The demand for provisioning, using, and maintaining distributed computational resources is growing hand in hand with the quest for ubiquitous services. Centralized infrastructures such as cloud computing systems provide suitable solutions for many applications, but their scalability could be limited in some scenarios, such as in the case of latency-dependent applications. The volunteer cloud paradigm aims at overcoming this limitation by encouraging clients to offer their own spare, perhaps unused, computational resources. Volunteer clouds are thus complex, large-scale, dynamic systems that demand for self-adaptive capabilities to offer effective services, as well as modeling and analysis techniques to predict their behavior. In this article, we propose a novel holistic approach for volunteer clouds supporting collaborative task execution services able to improve the quality of service of compute-intensive workloads. We instantiate our approach by extending a recently proposed ant colony optimization algorithm for distributed task execution with a workload-based partitioning of the overlay network of the volunteer cloud. Finally, we evaluate our approach using simulation-based statistical analysis techniques on a workload benchmark provided by Google. Our results show that the proposed approach outperforms some traditional distributed task scheduling algorithms in the presence of compute-intensive workloads.
We discuss α-particle velocity-space diagnostic in ITER based on the planned collective Thomson scattering (CTS) and γ-ray spectrometry (GRS) systems as well as ASCOT simulations of the α-particle distribution function. GRS is sensitive to α-particles with energies MeV at all pitches p, and CTS for MeV and . The remaining velocity space is not observed. GRS and CTS view the plasma (almost) perpendicularly to the magnetic field. Hence we cannot determine the sign of the pitch of the α-particles and cannot distinguish co- and counter-going α-particles with the currently planned α-particle diagnostics. Therefore we can only infer the sign-insensitive 2D distribution function by velocity-space tomography for MeV. This is a serious limitation, since co- and counter-going α-particle populations are expected to have different birth rates and neoclassical transport as well as different anomalous transport due to interaction with modes such as Alfvén eigenmodes. We propose the installation of an oblique GRS system on ITER to allow us to diagnostically track such anisotropy effects and to infer the full, sign-sensitive for MeV. α-particles with MeV are diagnosed by CTS only, which does not allow velocity-space tomography on its own. Nevertheless, we show that measurements of the α-particle energy spectrum, which is an ITER measurement requirement, are now feasible for MeV using a velocity-space tomography formalism assuming isotropy in velocity space.
Altered auditory processing and effective connectivity in 22q11.2 deletion syndrome

22q11.2 deletion syndrome (22q11.2DS) is one of the most common copy number variants and confers a markedly increased risk for schizophrenia. As such, 22q11.2DS is a homogeneous genetic liability model which enables studies to delineate functional abnormalities that may precede disease onset. Mismatch negativity (MMN), a brain marker of change detection, is reduced in people with schizophrenia compared to healthy controls. Using dynamic causal modelling (DCM), previous studies showed that top-down effective connectivity linking the frontal and temporal cortex is reduced in schizophrenia relative to healthy controls in MMN tasks. In the search for early risk-markers for schizophrenia we investigated the neural basis of change detection in a group with 22q11.2DS. We recorded high-density EEG from 19 young non-psychotic 22q11.2 deletion carriers, as well as from 27 healthy non-carriers with comparable age distribution and sex ratio, while they listened to a sequence of sounds arranged in a roving oddball paradigm. Despite finding no significant reduction in the MMN responses, whole-scalp spatiotemporal analysis of responses to the tones revealed a greater fronto-temporal N1 component in the 22q11.2 deletion carriers. DCM showed reduced intrinsic connection within right primary auditory cortex as well as in the top-down, connection from the right inferior frontal gyrus to right superior temporal gyrus for 22q11.2 deletion carriers although not surviving correction for multiple comparison. We discuss these findings in terms of reduced adaptation and a general increased sensitivity to tones in 22q11.2DS.
In this paper, we prove some relaxations of Hedetniemi's conjecture in terms of altermatic number and strong altermatic number of graphs, two combinatorial parameters introduced by the present authors Alishahi and Hajiabolhassan (2015) providing two sharp lower bounds for the chromatic number of graphs. In terms of these parameters, we also introduce some sharp lower bounds for the chromatic number of the categorical product of two graphs. Using these lower bounds, we present some new families of graphs supporting Hedetniemi's conjecture.

**General information**

State: Published

Organisations: Department of Applied Mathematics and Computer Science, Shahrood University of Technology

Authors: Alishahi, M. (Ekstern), Hajiabolhassan, H. (Intern)

Pages: 1316-1324

Publication date: 2018

Main Research Area: Technical/natural sciences

**Publication information**

Journal: Discrete Mathematics

Volume: 341

Issue number: 5

ISSN (Print): 0012-365X

Ratings:

BFI (2018): BFI-level 1

Web of Science (2018): Indexed yes

BFI (2017): BFI-level 1

Scopus rating (2017): SNIP 1.227 SJR 0.851 CiteScore 0.77

Web of Science (2017): Indexed Yes

BFI (2016): BFI-level 1

Scopus rating (2016): CiteScore 0.72 SJR 0.877 SNIP 1.034

Web of Science (2016): Indexed yes

BFI (2015): BFI-level 1

Scopus rating (2015): SJR 0.877 SNIP 1.133 CiteScore 0.64

Web of Science (2015): Indexed yes

BFI (2014): BFI-level 1

Scopus rating (2014): SJR 0.974 SNIP 1.206 CiteScore 0.68

Web of Science (2014): Indexed yes

BFI (2013): BFI-level 1

Scopus rating (2013): SJR 0.931 SNIP 1.229 CiteScore 0.74

ISI indexed (2013): ISI indexed yes

Web of Science (2013): Indexed yes

BFI (2012): BFI-level 1

Scopus rating (2012): SJR 0.923 SNIP 1.156 CiteScore 0.7

ISI indexed (2012): ISI indexed yes

BFI (2011): BFI-level 1

Scopus rating (2011): SJR 0.824 SNIP 0.978 CiteScore 0.66

ISI indexed (2011): ISI indexed yes

BFI (2010): BFI-level 1
A method for the characterization of the reflectance of anisotropic functional surfaces
The functional properties of micro-structured surfaces have gained increasing interest thanks to many applications such as wetting, adhesion, thermal and/or electrical conductivity. In this study, directional optical properties, i.e. contrast between two regions of a surface, were achieved with an anisotropic microstructure composed of a close array of ridges. The anisotropic surface, designed as a combination of ridges, has been milled on a steel bar and replicated through hot embossing of Acrylonitrile butadiene styrene (ABS) and through replica technology using silicone rubber. The directional reflectance of the surface for a range of design-specific view-illumination configurations was determined using a method that involves a Hirox RH-2000 digital microscope, used as a gonioreflectometer. This method allows the empirical determination of the optimum surface microstructure for maximizing contrast between two horizontally orthogonal views. The results show that even if the uncertainty related to the instrumentation is up to 20% in some cases, this procedure is suitable for the characterization of the surface of both metal and plastic counterpart.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics
Authors: Regi, F. (Intern), Nielsen, J. B. (Intern), Li, D. (Intern), Zhang, Y. (Intern), Frisvad, J. R. (Intern), Aanæs, H. (Intern), Tosello, G. (Intern)
Number of pages: 7
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Surface Topography: Metrology and Properties
Volume: 6
Issue number: 3
Article number: 034005
ISSN (Print): 2051-672X
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): CiteScore 1.73 SJR 0.491 SNIP 1.118
Web of Science (2017): Indexed yes
A modular reconfigurable digital microfluidics platform

Miniaturizing the traditional wet lab processes and realizing the full potential of lab-on-a-chip technology (LOC) has been a great challenge for scientists and engineers in the quest of providing health care where such does not exist, or to increase lab efficiency and lower the operational cost. A range of practical LOC fabrication technologies has already been demonstrated, and as a result, the research of real life applications has been steadily increasing. However, due to the variety of used technologies and LOC form factors, it often requires a modification or even a complete redesign of the available instrumentation systems. Standardization and flexible instrumentation has seen limited development in the LOC field even though developing on all application levels has been proven as an effective way to stimulate a growth in a research field. To address this, we present a modular digital microfluidics (DMF) instrumentation platform and a concept of integrated chip-instrument co-design that has the potential to solve a wide range of LOC instrumentation challenges.

A multicore processor for time-critical applications

This article presents T-CREST many-core architecture specially designed and optimized for time-critical systems. —Tulika Mitra, National University of Singapore —Jürgen Teich, Friedrich-Alexander-Universität Erlangen-Nürnberg —Lothar Thiele, ETH Zurich.

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A multimodal data-set of a unidirectional glass fibre reinforced polymer composite

A unidirectional (UD) glass fibre reinforced polymer (GFRP) composite was scanned at varying resolutions in the micro-scale with several imaging modalities. All six scans capture the same region of the sample, containing well-aligned fibres inside a UD load-carrying bundle. Two scans of the cross-sectional surface of the bundle were acquired at a high resolution, by means of scanning electron microscopy (SEM) and optical microscopy (OM), and four volumetric scans were acquired through X-ray computed tomography (CT) at different resolutions. Individual fibres can be resolved from these scans to investigate the micro-structure of the UD bundle. The data is hosted at https://doi.org/10.5281/zenodo.1195879 and it was used in [1] to demonstrate that precise and representative characterisations of fibre geometry are possible with relatively low X-ray CT resolutions if the analysis method is robust to image quality.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Statistics and Data Analysis, Department of Wind Energy, Composites and Materials Mechanics
An algorithm for gradient-based dynamic optimization of UV flash processes

This paper presents a novel single-shooting algorithm for gradient-based solution of optimal control problems with vapor-liquid equilibrium constraints. Such optimal control problems are important in several engineering applications, for instance in control of distillation columns, in certain two-phase flow problems, and in operation of oil reservoirs. The single-shooting algorithm uses an adjoint method for the computation of gradients. Furthermore, the algorithm uses either a simultaneous or a nested approach for the numerical solution of the dynamic vapor-liquid equilibrium model equations. Two numerical examples illustrate that the simultaneous approach is faster than the nested approach and that the efficiency of the underlying thermodynamic computations is important for the overall performance of the single-shooting algorithm. We compare the performance of different optimization software as well as the performance of different compilers in a Linux operating system. These tests indicate that real-time nonlinear model predictive control of UV flash processes is computationally feasible.
Analysis of MRI by fractals for prediction of sensory attributes: A case study in loin

This study investigates the use of fractal algorithms to analyse MRI of meat products, specifically loin, in order to determine sensory parameters of loin. For that, the capability of different fractal algorithms was evaluated (Classical Fractal Algorithm, CFA; Fractal Texture Algorithm, FTA and One Point Fractal Texture Algorithm, OPFTA). Moreover, the influence of the acquisition sequence of MRI (Gradient echo, GE; Spin Echo, SE and Turbo 3D, T3D) and the predictive technique of data mining (Isotonic regression, IR and Multiple Linear regression, MLR) on the accuracy of the prediction was analysed. Results on this study firstly demonstrate the capability of fractal algorithms to analyse MRI from meat product. Different combinations of the analysed techniques can be applied for predicting most sensory attributes of loins adequately (R > 0.5). However, the combination of SE, OPFTA and MLR offered the most appropriate results. Thus, it could be proposed as an alternative to the traditional food technology methods.
Analysis of preemption costs for the stack cache

The design of tailored hardware has proven a successful strategy to reduce the timing analysis overhead for (hard) real-time systems. The stack cache is an example of such a design that was shown to provide good average-case performance, while remaining easy to analyze. So far, however, the analysis of the stack cache was limited to individual tasks, ignoring aspects related to multitasking. A major drawback of the original stack cache design is that, due to its simplicity, it cannot hold the data of multiple tasks at the same time. Consequently, the entire cache content needs to be saved and restored when a task is preempted. We propose (a) an analysis exploiting the simplicity of the stack cache to bound the overhead induced by task preemption, (b) preemption mechanisms for the stack cache exploiting the previous analysis and, finally, (c) an extension of the design that allows to (partially) hide the overhead by virtualizing stack caches.
An Applied Anatomical Study of the Ethmoidal Arteries: Computed Tomographic and Direct Measurements in Human Cadavers: Computed Tomographic and Direct Measurements in Human Cadavers

Computed tomography (CT) images have been used in very few studies on distances to the ethmoidal arteries in the orbit. Most other studies have included direct measurements on cadavers and frequently quote the 24-12-6 mm rule to describe distances from the anterior lacrimal crest to the anterior and posterior ethmoidal foramina (AEF and PEF), optic canal (OC), respectively. However, the large interindividual variation of distances renders absolute values less applicable in a clinical setting. Preoperative measurements on CT images may provide more precise distances than absolute rules and thus lead to safer orbital surgery. The authors hypothesize that the distances to the ethmoidal arteries and the length of the medial wall are positively correlated and that measurements of the distances from the posterior lacrimal crest (PLC) on CT images are feasible with a low intra-and interobserver variability. Fifty intact orbits from 25 Caucasian cadavers were exenterated and examined. In addition, high-resolution CT scans of 48 orbits from 24 other Caucasian nonexenterated cadavers were examined. Distances were measured from 4 different anterior landmarks to the AEF and PEF and the OC. Distances from the most anterior landmarks to the arteries were positively correlated with the length of the medial wall. Measurements of the distances from the PLC to the ethmoidal arteries on CT images were feasible with a low intra-and interobserver variability. In conclusion, iatrogenic damage to the ethmoidal arteries in the orbit may be best avoided by using CT measurements in presurgical planning.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Rigshospitalet, University of Copenhagen
Number of pages: 5
Pages: 212-216
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Craniofacial Surgery
Volume: 29
Issue number: 1
ISSN (Print): 1536-3732
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): CiteScore 0.76
Scopus rating (2016): CiteScore 0.63
Scopus rating (2015): CiteScore 0.69
An Automatically Generated Texture-based Atlas of the Lungs

Many pulmonary diseases can be characterized by visual abnormalities on lung CT scans. Some diseases manifest similar defects but require completely different treatments, as is the case for Pulmonary Hypertension (PH) and Pulmonary Embolism (PE): both present hypo- and hyper-perfused regions but with different distribution across the lung and require different treatment protocols. Finding these distributions by visual inspection is not trivial even for trained radiologists who currently use invasive catheterism to diagnose PH. A Computer-Aided Diagnosis (CAD) tool that could facilitate the non-invasive diagnosis of these diseases can benefit both the radiologists and the patients. Most of the visual differences in the parenchyma can be characterized using texture descriptors. Current CAD systems often use texture information but the texture is either computed in a patch-based fashion, or based on an anatomical division of the lung. The difficulty of precisely finding these divisions in abnormal lungs calls for new tools for obtaining new meaningful divisions of the lungs.

In this paper we present a method for unsupervised segmentation of lung CT scans into subregions that are similar in terms of texture and spatial proximity. To this extent, we combine a previously validated Riesz-wavelet texture descriptor with a well-known superpixel segmentation approach that we extend to 3D. We demonstrate the feasibility and accuracy of our approach on a simulated texture dataset, and show preliminary results for CT scans of the lung comparing subjects suffering either from PH or PE. The resulting texture-based atlas of individual lungs can potentially help physicians in diagnosis or be used for studying common texture distributions related to other diseases.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Department of Electrical Engineering, Center for Magnetic Resonance, Image Analysis & Computer Graphics, University of Applied Sciences Western Switzerland, University Hospital of Geneva
Authors: Cid, Y. D. (Ekstern), Puonti, O. (Intern), Platon, A. (Ekstern), Van Leemput, K. (Intern), Mueller, H. (Ekstern), Poletti, P. (Ekstern)
Number of pages: 8
Publication date: 2018

Host publication information
Title of host publication: Medical Imaging 2018: Computer-Aided Diagnosis
Volume: 10575
Publisher: SPIE - International Society for Optical Engineering
Article number: 105753A
Main Research Area: Technical/natural sciences
Conference: SPIE Medical Imaging 2018, Houston, United States, 10/02/2018 - 10/02/2018
Lung atlas, 3D texture, Riesz-wavelet, Supervoxels
DOIs: 10.1117/12.2294004
Source: FindIt
Source-ID: 2419132379
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

Ancillary Services 4.0: A Top-To-Bottom Control-Based Approach for Solving Ancillary Services Problems in Smart Grids

Power systems are experiencing a large amount of renewable generation with highly stochastic and partly unpredictable characteristics. This change in energy production implies significant consequences related to the provision of ancillary services (AS). Current markets dedicated to the provision of AS are not able to benefit from the flexible energy resources. They also cannot cope with the new level of stochasticity, non-linearity, and dynamics of generation and flexibility. To overcome such issues and exploit the potential of flexibility resources, a new strategy is required. In this paper, by capitalizing on flexibility resources' potential, AS 4.0 approach is proposed, which offers a comprehensive solution for the AS provision in the smart grid era.

General information
A new method for estimating transmission rates of mastitis-causing pathogens

General information
State: Published
Organisations: National Veterinary Institute, Epidemiology, Department of Applied Mathematics and Computer Science
Authors: Kirkeby, C. (Intern), Halasa, T. (Intern), Gussmann, M. K. (Intern), Græsbøll, K. (Intern)
Publication date: 2018
Main Research Area: Technical/natural sciences
Electronic versions: NMC_2018_poster_v5.pdf
Source: PublicationPreSubmission
Source-ID: 143856174
Publication: Research - peer-review » Poster – Annual report year: 2018

An Integrated Framework to Specify Domain-Specific Modeling Languages

In this paper, we propose an integrated framework that can be used by DSL designers to implement their desired graphical domain-specific languages. This framework relies on Microsoft DSL Tools, a meta-modeling framework to build graphical domain-specific languages, and an extension of ForSpec, a logic-based specification language. The drawback of MS DSL Tools is it does not provide a formal and rigorous approach for semantics specifications. In this framework, we use Microsoft DSL Tools to define the metamodel and graphical notations of DSLs, and an extended version of ForSpec as a formal language to define their semantics. Integrating these technologies under the umbrella of Microsoft Visual Studio IDE allows DSL designers to utilize a single development environment for developing their desired domain-specific languages.

General information
State: Published
Authors: Zarrin, B. (Intern), Baumeister, H. (Intern)
Pages: 83-94
Publication date: 2018

Host publication information
Title of host publication: Proceedings of 6th International Conference on Model-Driven Engineering and Software Development
AntibIoTic: Protecting IoT Devices Against DDoS Attacks

The 2016 is remembered as the year that showed to the world how dangerous Distributed Denial of Service attacks can be. Gauge of the disruptiveness of DDoS attacks is the number of bots involved: the bigger the botnet, the more powerful the attack. This character, along with the increasing availability of connected and insecure IoT devices, makes DDoS and IoT the perfect pair for the malware industry. In this paper we present the main idea behind AntibIoTic, a palliative solution to prevent DDoS attacks perpetrated through IoT devices.

A Numerical Study of Fractured Reservoirs' Productivity Behavior through Coupled Hydromechanical Model

In this study, we develop a state-of-the-art coupled hydromechanical model that captures the spatial and temporal evolution of fractures' aperture. Subsequently, a set of numerical experiments, which considers coupled hydromechanics features, is designed to investigate an inflow performance relationship of fractured reservoirs. In this work, we construct an inflow performance relationship based on multi-rate test concept. Fracture geometry (i.e., different sets of fractures), initial pressure, stresses in horizontal directions, deformable parameters and matrix permeability are utilised to investigate factors that affect productivity behaviour of the system. Our study shows that the inversion of productivity index takes either a quadratic or linear form depending on a permeability contrast between fractures and matrix. Furthermore, quadratic coefficients depend on all the investigated factors. However, the contrast between the magnitude of second- and first-order coefficients mainly depends on the contrast between matrix and fractures’ conductivity or permeability. Hence, we conclude that deliverability reduction due to reservoir depletion in fractured reservoirs becomes more severe when the contrast between matrix and fractures’ conductivity grows.
Application of data clustering to railway delay pattern recognition

K-means clustering is employed to identify recurrent delay patterns on a high traffic railway line north of Copenhagen, Denmark. The clusters identify behavioral patterns in the very large ("big data") datasets generated automatically and continuously by the railway signal system. The results reveal where corrective actions are necessary, showing where recurrent delay patterns take place. Delay profiles and delay-change profiles are generated from timestamps to compare different train runs, and to partition the set of observations into groups of similar elements. K-means clustering can identify and discriminate different patterns affecting the same stations, which is otherwise difficult in previous approaches based on visual inspection. Classical methods of univariate analysis do not reveal these patterns. The demonstrated methodology is scalable and can be applied to any system of transport.
Applications of the Deformable Simplicial Complex in Image Segmentation and Fluid Simulation

This thesis is devoted to explore the potentialities of the Deformable Simplicial Complex (DSC) method for solving various problems. The DSC is an explicit interface tracking method that relies on meshes, triangle in 2D and tetrahedra in 3D, to represent piecewise constant functions. One can consider the DSC as the potential alternative for the popular level set method with additional explicit-geometric-information. In particular, the goals of this thesis include: the applications of the DSC in image segmentation, fluid simulation, and a method for DSC efficiency optimization. Image segmentation faces many difficulties in dealing with volume data sets that represent multiple materials (phases) such as CT and MRI scans. In this thesis, we propose a novel method for 2D and 3D image segmentation using the DSC. The most important advantage of the method is multi-phase support with accurately defined boundaries. Besides, this method is robust to noise because we distinguish the image space (the fixed grid) and feature space (segmentation represented by the DSC meshes). Additionally, the outputs of our method, which are meshes, are useful for simulation and analysis. Simulation of fluid is important for understanding fluid properties and visualization, but it is challenging due to a massive amount of topological changes (surface splits and merges). With the DSC, handling the topology becomes trivial. We show that the DSC can be used for multi-phase fluid tracking with complex topology. The DSC is primarily designed for memory efficiency and accuracy. In many cases, including image segmentation and fluid tracking problem, performance is highly concerning. Our last contribution is a caching scheme that stores computed mesh data for later retrievals. The proposed method helps improving the DSC performance up to five times and enabling parallel mesh processing.
algorithm is applicable for scatter data inversion provided that the attenuation map is assumed to be constant. The results of the numerical experiments are presented.
Assessing spatial correlations of sea surges around Copenhagen

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, National Food Institute, Research Group for Risk-Benefit, Department of Environmental Engineering, Urban Water Systems, Statistics and Data Analysis
Authors: Georgiadis, S. (Intern), Sørup, H. J. D. (Intern), Nielsen, B. F. (Intern), Arnbjerg-Nielsen, K. (Intern)
Pages: 36-36
Publication date: 2018

Host publication information
Title of host publication: Danish Water Forum Annual Water Conference 2018 - abstract book
Place of publication: Lyngby, Denmark
Publisher: Danish Water Forum
Main Research Area: Technical/natural sciences
Conference: 12th Annual Water Research Meeting of Danish Water Forum, Lyngby, Denmark, 30/01/2018 - 30/01/2018
Electronic versions:
Abstract book
Publication: Research - peer-review » Conference abstract in proceedings – Annual report year: 2018

Associations Between DrugStar App Events and Perceived benefits of Diabetes Patients

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis
Authors: Lyndgaard, C. B. (Intern)
Number of pages: 48
Publication date: 2018

Publication information
Publisher: DTU Compute
Original language: English
Main Research Area: Technical/natural sciences

Bibliographical note
FORTROLIG RAPPORT. Må ikke være offentlig tilgængelig
Source: PublicationPreSubmission
Source-ID: 149067019
Publication: Research » Report – Annual report year: 2018

A systematic approach to transforming composite 3d images into meso-scale computational models

High performance polymer matrix composites (PMC) have a high specific stiffness and can be used to easily manufacture highly complex components. Many types of defects can occur during molding. Flaws and damage degrade the resulting mechanical properties of the composites material. It is difficult to assess the actual stiffness, strength and fatigue limit of flawed and damaged structures. Among these the fatigue limit is the most difficult to predict. Through a combination of modern imaging techniques and finite element analysis of in-situ fiber bundles, it is now becoming possible to estimate fatigue limits for polymer matrix composites structures with flaws or damage. Composite materials can be imaged with 3D X-ray Computed Tomography (CT) in a sufficient detail to view 3D fiber bundle matrix interfaces. These images can then be directly imported into physical models to be used in finite element analysis. The process of converting these images into computer models for analysis is currently extremely time consuming, difficult and subjective. The method presented here has been developed to bridge this gap.

General information
State: Published
Automatic skull segmentation from MR images for realistic volume conductor models of the head: Assessment of the state-of-the-art

Anatomically realistic volume conductor models of the human head are important for accurate forward modeling of the electric field during transcranial brain stimulation (TBS), electro- (EEG) and magnetoencephalography (MEG). In particular, the skull compartment exerts a strong influence on the field distribution due to its low conductivity, suggesting the need to represent its geometry accurately. However, automatic skull reconstruction from structural magnetic resonance (MR) images is difficult, as compact bone has a very low signal in magnetic resonance imaging (MRI). Here, we evaluate three methods for skull segmentation, namely FSL BET2, the unified segmentation routine of SPM12 with extended spatial tissue priors, and the skullfinder tool of BrainSuite. To our knowledge, this study is the first to rigorously assess the accuracy of these state-of-the-art tools by comparison with CT-based skull segmentations on a group of ten subjects. We demonstrate several key factors that improve the segmentation quality, including the use of multi-contrast MRI data, the optimization of the MR sequences and the adaptation of the parameters of the segmentation methods. We conclude that FSL and SPM12 achieve better skull segmentations than BrainSuite. The former methods obtain reasonable results for the upper part of the skull when a combination of T1- and T2-weighted images is used as input. The SPM12-based results can be improved slightly further by means of simple morphological operations to fix local defects. In contrast to FSL BET2, the SPM12-based segmentation with extended spatial tissue priors and the BrainSuite-based segmentation provide coarse reconstructions of the vertebrae, enabling the construction of volume conductor models that include the neck. We exemplarily demonstrate that the extended models enable a more accurate estimation of the electric field distribution during transcranial direct current stimulation (tDCS) for montages that involve extraencephalic electrodes. The methods provided by FSL and SPM12 are integrated into pipelines for the automatic generation of realistic head models based on tetrahedral meshes, which are distributed as part of the open-source software package SimNIBS for field calculations for transcranial brain stimulation.
A Vibrotactile Alarm System for Pleasant Awakening

There has been a vast development of personal informatics devices combining sleep monitoring with alarm systems, in order to find an optimal time to awaken a sleeping person in a pleasant way. Most of these systems implement auditory feedback, which is not always pleasant and may disturb other sleepers. We present an adaptive alarm system that detects sleeping cycles and triggers alarm signal during shallow sleep, to minimize sleep inertia. Since tactile sensation is associated with positive valence, vibrotactile stimulation is investigated as a silent alarm to enhance pleasant awakening. Three modulation techniques to render the tactile stimuli for pleasant awakening are considered, namely simultaneous, continuous, and successive stimulation. Two experimental studies are conducted. Experiment 1 studied exogenous attention towards tactile stimulation in a multimodal scenario (involving visual and haptic interactions) with fully awake individuals. Results from the attention task and the subjective valence rating suggest that the vibrotactile stimulation
should be based on the continuous modulation, since this not only is very perceivable but also associated with positive attention. Experiment 2 evaluated the user experience with tactile stimulation patterns during sleep. Results confirmed the findings of experiment 1. Continuous modulation was rated highest for pleasant yet arousing sleep-awake transition.

**General information**
State: Accepted/In press
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Number of pages: 11
Publication date: 2018
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Ieee Transactions on Haptics
ISSN (Print): 2329-4051
Ratings: Web of Science (2018): Indexed yes
Scopus rating (2017): CiteScore 2.36
Scopus rating (2016): CiteScore 2.83
Scopus rating (2015): CiteScore 2.16
Scopus rating (2014): CiteScore 2.79
Scopus rating (2013): CiteScore 3.1
Scopus rating (2012): CiteScore 2.73
Scopus rating (2011): CiteScore 2.62
Original language: English
Vibrotactile Stimulation, Affective Haptics, Evaluation/Methodology, Haptic I/O, Pervasive Computing, Health Care, Psychology, User-centered Design
Electronic versions: 08289328_1_.pdf
DOIs: 10.1109/TOH.2018.2804952
Source: FindIt
Source-ID: 2434684636
Publication: Research - peer-review › Journal article – Annual report year: 2018

**Benchmarking and monitoring framework for interconnected file synchronization and sharing services**
On-premise file synchronization and sharing services are increasingly used in research collaborations and academia. The main motivation for the on-premise deployment is connected with the requirements on the physical location of the data, data protection policies and integration with existing computing and storage infrastructure in the research labs. In this work we present a benchmarking and monitoring framework for file synchronization and sharing services. It allows service providers to monitor the operational status of their services, understand the service behavior under different load types and with different network locations of the synchronization clients. The framework is designed as a monitoring and benchmarking tool to provide performance and robustness metrics for interconnected file synchronization and sharing services such as Open Cloud Mesh.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, IT Service, CERN
Authors: Mrówczyński, P. (Intern), Mościcki, J. T. (Ekstern), Lamanna, M. (Ekstern), Orellana, F. (Intern)
Pages: 1083-1090
Publication date: 2018
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Future Generation Computer Systems
Volume: 78
ISSN (Print): 0167-739X
Ratings: BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Benders' Decomposition for Curriculum-Based Course Timetabling

In this paper we applied Benders’ decomposition to the Curriculum-Based Course Timetabling (CBCT) problem. The objective of the CBCT problem is to assign a set of lectures to time slots and rooms. Our approach was based on segmenting the problem into time scheduling and room allocation problems. The Benders’ algorithm was then employed to generate cuts that connected the time schedule and room allocation. We generated only feasibility cuts, meaning that most of the solutions we obtained from a mixed integer programming solver were infeasible, therefore, we also provided a heuristic in order to regain feasibility.

We compared our algorithm with other approaches from the literature for a total of 32 data instances. We obtained a lower bound on 23 of the instances, which were at least as good as the lower bounds obtained by the state-of-the-art, and on eight of these, our lower bounds were higher. On two of the instances, our lower bound was an improvement of the currently best-known. Lastly, we compared our decomposition to the model without the decomposition on an additional six instances, which are much larger than the other 32. To our knowledge, this was the first time that lower bounds were calculated for these six instances.
Benefits of spatiotemporal modeling for short-term wind power forecasting at both individual and aggregated levels

The share of wind energy in total installed power capacity has grown rapidly in recent years. Producing accurate and reliable forecasts of wind power production, together with a quantification of the uncertainty, is essential to optimally integrate wind energy into power systems. We build spatiotemporal models for wind power generation and obtain full probabilistic forecasts from 15 min to 5 h ahead. Detailed analyses of forecast performances on individual wind farms and aggregated wind power are provided. The predictions from our models are evaluated on a data set from wind farms in western Denmark using a sliding window approach, for which estimation is performed using only the last available measurements. The case study shows that it is important to have a spatiotemporal model instead of a temporal one to achieve calibrated aggregated forecasts. Furthermore, spatiotemporal models have the advantage of being able to produce spatially out-of-sample forecasts. We use a Bayesian hierarchical framework to obtain fast and accurate forecasts of wind power generation not only at wind farms where recent data are available but also at a larger portfolio including wind farms without recent observations of power production. The results and the methodologies are relevant for wind power forecasts across the globe and for spatiotemporal modeling in general.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, Norwegian University of Science and Technology
Authors: Lenzi, A. (Intern), Steinsland, I. (Ekstern), Pinson, P. (Intern)
Number of pages: 17
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Environmetrics
Article number: e2493
ISSN (Print): 1180-4009
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.36 SJR 1.014 SNIP 0.875
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.59 SJR 0.989 SNIP 1.029
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.979 SNIP 0.852 CiteScore 1.48
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.056 SNIP 1.153 CiteScore 1.64
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.067 SNIP 1.216 CiteScore 1.65
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.571 SNIP 0.921 CiteScore 1.12
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.54 SNIP 0.994 CiteScore 1.3
Benefits of spatio-temporal modelling for short term wind power forecasting at both individual and aggregated levels

The share of wind energy in total installed power capacity has grown rapidly in recent years. Producing accurate and reliable forecasts of wind power production, together with a quantification of the uncertainty, is essential to optimally integrate wind energy into power systems. We build spatio-temporal models for wind power generation and obtain full probabilistic forecasts from 15 minutes to 5 hours ahead. Detailed analysis of the forecast performances on the individual wind farms and aggregated wind power are provided. The predictions from our models are evaluated on a data set from wind farms in western Denmark using a sliding window approach, for which estimation is performed using only the last available measurements. The case study shows that it is important to have a spatio-temporal model instead of a temporal one to achieve calibrated aggregated forecasts. Furthermore, spatio-temporal models have the advantage of being able to produce spatially out-of-sample forecasts. We use a Bayesian hierarchical framework to obtain fast and accurate forecasts of wind power generation at wind farms where recent data are available, but also at a larger portfolio including wind farms without recent observations of power production. The results and the methodologies are relevant for wind power forecasts across the globe as well as for spatial-temporal modelling in general.

General information
State: Submitted
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Cognitive Systems, Norwegian University of Science and Technology
Authors: Lenzi, A. (Intern), Pinson, P. (Intern), Steinsland, I. (Ekstern)
Number of pages: 35
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Environmetrics
ISSN (Print): 1180-4009
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
Bézier curves that are close to elastica

We study the problem of identifying those cubic Bézier curves that are close in the L2 norm to planar elastic curves. The problem arises in design situations where the manufacturing process produces elastic curves; these are difficult to work with in a digital environment. We seek a sub-class of special Bézier curves as a proxy. We identify an easily computable quantity, which we call the λ-residual eλ, that accurately predicts a small L2 distance. We then identify geometric criteria on the control polygon that guarantee that a Bézier curve has λ-residual below 0.4, which effectively implies that the curve is within 1% of an elastic curve in the L2 norm. Finally, we give two projection algorithms that take an input Bézier curve and adjust its length and shape, whilst keeping the end-points and end-tangent angles fixed, until it is close to an elastic curve.
Blockchain technology offers a sizable promise to rethink the way inter-organizational business processes are managed because of its potential to realize execution without a central party serving as a single point of trust (and failure). To stimulate research on this promise and the limits thereof, in this paper we outline the challenges and opportunities of blockchain for Business Process Management (BPM). We first reflect how blockchains could be used in the context of the established BPM lifecycle and second how they might become relevant beyond. We conclude our discourse with a summary of seven research directions for investigating the application of blockchain technology in the context of BPM.

**General information**

**State:** Published

**Organisations:** Department of Applied Mathematics and Computer Science, Software and Process Engineering, Vienna University of Economics and Business, University of New South Wales, Eindhoven University of Technology, University of Liechtenstein, Politecnico di Milano, IT University of Copenhagen, University of Tartu, Technische Universität Wien, Technion-Israel Institute of Technology, Data61, IBM Research, Vrije Universiteit Amsterdam, Universität Stuttgart, University of Ulm, University of Vienna, Queensland University of Technology, North Carolina State University, University of Copenhagen, Humboldt-University of Berlin, Universität Potsdam


**Number of pages:** 16

**Publication date:** 2018

**Main Research Area:** Technical/natural sciences

**Publication information**

**Journal:** ACM Transactions on Management Information Systems
**Volume:** 9
**Issue number:** 1
**Article number:** 4
**ISSN (Print):** 2158-656X

**Ratings:**
- Scopus rating (2017): SNIP 1.611 SJR 0.591 CiteScore 2.41
- Scopus rating (2016): CiteScore 2.5 SNIP 1.844 SJR 1.03
- Scopus rating (2015): CiteScore 2.29 SNIP 1.712 SJR 0.612
- Scopus rating (2014): CiteScore 2.02 SNIP 1.296 SJR 0.725
- Scopus rating (2013): CiteScore 2.31 SNIP 1.504 SJR 0.894
- Scopus rating (2012): CiteScore 0.97 SNIP 0.657 SJR 0.558
- Scopus rating (2011): CiteScore 0.43 SNIP 0.037 SJR 0.148

**Original language:** English

**Blockchain, Business Process Management, Research Challenges**

**Electronic versions:**
- 1704.03610_1.pdf

**Can we train a single deep learning model to detect and segment nuclei images acquired with any microscope or staining modality?**

**General information**

**State:** Published

**Organisations:** Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics

**Authors:** Shihavuddin, A. (Intern), Gawrilowicz, F. (Intern), Jeppesen, N. (Intern), Paulsen, R. R. (Intern)

**Publication date:** 2018

**Event:** Abstract from SCANDEM 2018 - The 69th Annual Conference of the Nordic Microscopy Society, Kgs. Lyngby, Denmark.
Carbon dioxide not suitable for extinguishment of smouldering silo fires: static electricity may cause silo explosion

Smouldering fires in wood pellet silos are not uncommon. The fires are often difficult to deal with and extinguishment is a lengthy process. Injection of inert gasses to prevent oxygen from reaching the smouldering fire zone and suppress combustion is a new firefighting strategy. This article argues that injection of inert carbon dioxide into the silo headspace is unsafe. Carbon dioxide is generally available as a liquid under high pressure. When discharged, small particles of dry ice are formed. The rapid flow of particles can generate considerable amounts of static electricity, which can act as a source of ignition if ignitable pyrolysis gasses are present. This article discusses a serious wood pellet smouldering fire and silo explosion in Norway in 2010, which took place when firefighters discharged portable CO2 fire extinguishers into the headspace. The attempt to suppress the fire may have ignited pyrolysis gasses. The article examines selected guidelines, standards, popular wood pellet handbooks and other literature and argues that the electrostatic hazard is widely under-appreciated. In the past, major explosions have been attributed to electrostatic ignition of flammable vapours during the release of CO2 for fire prevention purposes. There is evidence to suggest that those early lessons learned have at least partly passed out of sight.
Chaos in Kuramoto Oscillator Networks

Kuramoto oscillators are widely used to explain collective phenomena in networks of coupled oscillatory units. We show that simple networks of two populations with a generic coupling scheme can exhibit chaotic dynamics as conjectured by Ott and Antonsen [Chaos, 18, 037113 (2008)]. These chaotic mean field dynamics arise universally across network size, from the continuum limit of infinitely many oscillators down to very small networks with just two oscillators per population. Hence, complicated dynamics are expected even in the simplest description of oscillator networks.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, University of Oxford, Hillsdale College
Authors: Bick, C. (Ekstern), Panaggio, M. J. (Ekstern), Martens, E. A. (Intern)
Number of pages: 10
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Chaos
Volume: 28
Article number: 071102
ISSN (Print): 1054-1500
Ratings:
Characterization of highly multiplexed monolithic PET / gamma camera detector modules: Paper

PET detectors use signal multiplexing to reduce the total number of electronics channels needed to cover a given area. Using measured thin-beam calibration data, we tested a principal component based multiplexing scheme for scintillation detectors. The highly-multiplexed detector signal is no longer amenable to standard calibration methodologies. In this study we report results of a prototype multiplexing circuit, and present a new method for calibrating the detector module with multiplexed data. A 50 × 50 × 10 mm3 LYSO scintillation crystal was affixed to a position-sensitive photomultiplier tube with 8 × 8 position-outputs and one channel that is the sum of the other 64. The 65-channel signal was multiplexed in a resistive circuit, with 65:5 or 65:7 multiplexing. A 0.9 mm beam of 511 keV photons was scanned across the face of the crystal in a 1.52 mm grid pattern in order to characterize the detector response. New methods are developed to reject scattered events and perform depthestimation to characterize the detector responses of the calibration data. Photon interaction position estimation of the testing data was performed using a Gaussian Maximum Likelihood estimator and the resolution and scatter-rejection capabilities of the detector were analyzed. We found that using a 7-channel multiplexing scheme (65.7 compression ratio) with 1.67 mm depth bins had the best performance with a beam-contour of 1.2 mm FWHM (from the 0.9 mm beam) near the center of the crystal and 1.9 mm FWHM near the edge of the crystal. The positioned events followed the expected BeerLambert depth distribution. The proposed calibration and positioning method exhibited a scattered photon rejection rate that was a 55% improvement over the summed signal energy-windowing method.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, University of Washington, Harvard Medical School
Authors: Pierce, L. A. (Ekstern), Pedemonte, S. (Ekstern), Dewitt, S. (Ekstern), Macdonald, L. (Ekstern), Hunter, W. C. J. (Ekstern), Leemput, V. (Intern), Miyaoka, R. (Ekstern)
Number of pages: 16
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Physics in Medicine and Biology
Volume: 63
Issue number: 7
Article number: 075017
ISSN (Print): 0031-9155
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.398 SJR 1.263 CiteScore 2.85
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.08 SJR 1.381 SNIP 1.449
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.621 SNIP 1.738 CiteScore 3.31
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.832 SNIP 1.708 CiteScore 3.16
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.971 SNIP 1.913 CiteScore 3.4
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.592 SNIP 1.967 CiteScore 3.12
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.803 SNIP 1.556 CiteScore 3.08
Characterizing the energy flexibility of buildings and districts

The large penetration rate of renewable energy sources leads to challenges in planning and controlling the energy production, transmission, and distribution in power systems. A potential solution is found in a paradigm shift from traditional supply control to demand control. To address such changes, a first step lays in a formal and robust characterization of the energy flexibility on the demand side. The most common way to characterize the energy flexibility is by considering it as a static function at every time instant. The validity of this approach is questionable because energy-based systems are never at steady-state. Therefore, in this paper, a novel methodology to characterize the energy flexibility as a dynamic function is proposed, which is titled as the Flexibility Function. The Flexibility Function brings new possibilities for enabling the grid operators or other operators to control the demand through the use of penalty signals (e.g., price, CO2, etc.). For instance, CO2-based controllers can be used to accelerate the transition to a fossil-free society.

Contrary to previous static approaches to quantify Energy Flexibility, the dynamic nature of the Flexibility Function enables a Flexibility Index, which describes to which extent a building is able to respond to the grid’s need for flexibility. In order to validate the proposed methodologies, a case study is presented, demonstrating how different Flexibility Functions enable the utilization of the flexibility in different types of buildings, which are integrated with renewable energies.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Centre of Technology and Systems/UNINOVA, Universidade Nova de Lisboa, Norwegian Water Resources and Energy Directorate
Pages: 175-82
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information

Journal: Applied Energy
Volume: 225
ISSN (Print): 0306-2619
Ratings:

BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
Energy flexibility, Demand response, Flexibility function, Smart building, Flexibility index, Smartness

Electronic versions:
1_s2.0_S030626191830730X_main.pdf

DOIs:
10.1016/j.apenergy.2018.05.037
Characterizing the energy flexibility of buildings and districts
The large penetration rate of renewable energy sources leads to challenges in planning and controlling the energy production, transmission, and distribution in power systems. A potential solution is found in a paradigm shift from traditional supply control to demand control. To address such changes, a first step lays in a formal and robust characterization of the energy flexibility on the demand side. The most common way to characterize the energy flexibility is by considering it as a static function at every time instant. The validity of this approach is questionable because energy-based systems are never at steady-state. Therefore, in this paper, a novel methodology to characterize the energy flexibility as a dynamic function is proposed, which is titled as the Flexibility Function. The Flexibility Function brings new possibilities for enabling the grid operators or other operators to control the demand through the use of penalty signals (e.g., price, CO2, etc.). For instance, CO2-based controllers can be used to accelerate the transition to a fossil-free society. Contrary to previous static approaches to quantify Energy Flexibility, the dynamic nature of the Flexibility Function enables a Flexibility Index, which describes to which extent a building is able to respond to the grid’s need for flexibility. In order to validate the proposed methodologies, a case study is presented, demonstrating how different Flexibility Functions enable the utilization of the flexibility in different types of buildings, which are integrated with renewable energies.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Centre for IT-Intelligent Energy Systems in Cities, Universidade Nova de Lisboa, Norwegian University of Science and Technology, KU Leuven
Pages: 175-182
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Applied Energy
Volume: 225
ISSN (Print): 0306-2619
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 8.44 SJR 3.162 SNIP 2.765
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 7.78 SJR 3.011 SNIP 2.61
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.835 SNIP 2.593 CiteScore 6.4
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 3.158 SNIP 3.218 CiteScore 6.93
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 3.06 SNIP 3.346 CiteScore 6.59
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.778 SNIP 3.076 CiteScore 5.69
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.416 SNIP 2.827 CiteScore 5.5
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Clinical Processes - The Killer Application for Constraint-Based Process Interactions

For more than a decade, the interest in aligning information systems in a process-oriented way has been increasing. To enable operational support for business processes, the latter are usually specified in an imperative way. The resulting process models, however, tend to be too rigid to meet the flexibility demands of the actors involved. Declarative process modeling languages, in turn, provide a promising alternative in scenarios in which a high level of flexibility is demanded. In the scientific literature, declarative languages have been used for modeling rather simple processes or synthetic examples. However, to the best of our knowledge, they have not been used to model complex, real-world scenarios that comprise constraints going beyond control-flow. In this paper, we propose the use of a declarative language for modeling a sophisticated healthcare process scenario from the real world. The scenario is subject to complex temporal constraints and entails the need for coordinating the constraint-based interactions among the processes related to a patient treatment process. As demonstrated in this work, the selected real process scenario can be suitably modeled through a declarative approach.

General information
State: Accepted/In press
Organisations: Department of Applied Mathematics and Computer Science, Software and Process Engineering, University of Seville, University of Ulm
Authors: Jiménez-Ramírez, A. (Ekstern), Barba, I. (Ekstern), Reichert, M. (Ekstern), Weber, B. (Intern), Del Valle, C. (Ekstern)
Number of pages: 15
Publication date: 2018

Host publication information
Title of host publication: Proceedings of 30th International Conference on Advanced Information Systems Engineering:
Main Research Area: Technical/natural sciences
Conference: 30th International Conference on Advanced Information Systems Engineering, Tallinn, Estonia, 11/06/2018 - 11/06/2018
Process flexibility, Declarative process model, Healthcare process, Temporal constraints
Closed loop identification of a piezoelectrically controlled radial gas bearing: Theory and experiment

Gas bearing systems have extremely small damping properties. Feedback control is thus employed to increase the damping of gas bearings. Such a feedback loop correlates the input with the measurement noise which in turn makes the assumptions for direct identification invalid. The originality of this article lies in the investigation of the impact of using different identification methods to identify a rotor-bearing systems’ dynamic model when a feedback loop is active. Two different identification methods are employed. The first method is open loop Prediction Error Method, while the other method is the modified Hansen scheme. Identification based on the modified Hansen scheme is conducted by identifying the Youla deviation system using subspace identification. Identification of the Youla deviation system is based on the Youla–Jabr–Bongiorno–Kucera parametrisation of plant and controller. By using the modified Hansen scheme, identification based on standard subspace identification methods can be used to identify the Youla deviation system of the gas bearing. This procedure ensures the input to the Youla deviation system, and the noise is uncorrelated even though the system is subject to feedback control. The effect of identifying the Youla deviation system compared to direct subspace identification of the gas bearing is further investigated through a simulation example. Experiments are conducted on the piezoelectrically controlled radial gas bearing. A dynamic model is identified using the modified Hansen scheme as well as using Prediction Error Method identification. The resulting models are compared for different imperfect nominal models, to examine under which conditions each method should be used.

General information
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, Department of Applied Mathematics and Computer Science, Dynamical Systems, Department of Mechanical Engineering, Solid Mechanics
Authors: Sekunda, A. K. (Intern), Niemann, H. H. (Intern), Poulsen, N. K. (Intern), Santos, I. F. (Intern)
Number of pages: 11
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Article number: 095965181876923
ISSN (Print): 0959-6518
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.703 SJR 0.394 CiteScore 1.39
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.4 SNIP 0.759 SJR 0.437
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.18 SNIP 0.789 SJR 0.44
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.29 SNIP 1.17 SJR 0.54
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.3 SNIP 0.872 SJR 0.471
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.13 SNIP 0.84 SJR 0.406
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 0.79 SNIP 0.744 SJR 0.287
BFI (2010): BFI-level 1
Scopus rating (2010): SNIP 0.922 SJR 0.338
BFI (2009): BFI-level 1
Scopus rating (2009): SNIP 0.724 SJR 0.269
BFI (2008): BFI-level 1
Scopus rating (2008): SNIP 0.425 SJR 0.264
Scopus rating (2007): SNIP 0.717 SJR 0.311
Comammox Nitrospira are abundant ammonia oxidizers in diverse groundwater-fed rapid sand filter communities

The recent discovery of completely nitrifying Nitrospira demands a re-examination of nitrifying environments to evaluate their contribution to nitrogen cycling. To approach this challenge, tools are needed to detect and quantify comammox Nitrospira. We present primers for the simultaneous quantification and diversity assessment of both comammox Nitrospira clades. The primers cover a wide range of comammox diversity, spanning all available high quality sequences. We applied these primers to 12 groundwater-fed rapid sand filters, and found comammox Nitrospira to be abundant in all filters. Clade B comammox comprise the majority (~75%) of comammox abundance in all filters. Nitrosomonadaceae were present in all filters, although at low abundance (mean = 1.8%). Ordination suggests that temperature impacts the structure of nitrifying communities, and in particular that increasing temperature favours Nitrospira. The nitrogen content of the filter material, sulfate concentration and surface ammonium loading rates shape the structure of the comammox guild in the filters. This work provides an assay for simultaneous detection and diversity assessment of clades A and B comammox Nitrospira, expands our current knowledge of comammox Nitrospira diversity and demonstrates a key role for comammox Nitrospira in nitrification in groundwater-fed biofilters.

General information
State: Published
Organisations: Department of Environmental Engineering, Water Technologies, Department of Micro- and Nanotechnology, Surface Engineering, Department of Applied Mathematics and Computer Science, Technical University of Denmark
Authors: Fowler, S. J. (Ekstern), Palomo, A. (Intern), Dechesne, A. (Intern), Mines, P. D. (Intern), Smets, B. F. (Intern)
Pages: 1002-1015
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Environmental Microbiology
Volume: 20
Issue number: 3
ISSN (Print): 1462-2912
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.83 SJR 2.209 SNIP 1.31
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.02 SJR 2.377 SNIP 1.383
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 3.02 SNIP 1.571 CiteScore 5.61
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.862 SNIP 1.599 CiteScore 5.6
Web of Science (2014): Indexed yes
Comparison of different image analysis algorithms on MRI to predict physico-chemical and sensory attributes of loin

Computer vision algorithms on MRI have been presented as an alternative to destructive methods to determine the quality traits of meat products. Since, MRI is non-destructive, non-ionizing and innocuous methods. The use of fractals to analyze MRI could be another possibility for this purpose. In this paper, a new fractal algorithm is developed, to obtain features from MRI based on fractal characteristics. This algorithm is called OPFTA (One Point Fractal Texture Algorithm). Three fractal algorithms (Classical Fractal Algorithm –CFA-, Fractal Texture Algorithm –FTA- and OPFTA) and three classical texture algorithms (Grey level co-occurrence matrix –GLCM-, Grey level run length matrix –GLRLM- and Neighbouring grey level dependence matrix –NGLDM- ) were tested in this study. The results obtained by means of these computer vision algorithms were correlated to the results obtained by means of physico-chemical and sensory analysis. CFA reached low relationship for the quality parameters of loins, the remaining algorithms achieved correlation coefficients higher than 0.5 noting OPFTA that reached the highest correlation coefficients in all cases except for the L* coordinate color that GLCM obtained the highest correlation coefficient. These high correlation coefficients confirm the new algorithm as an alternative to the other computer vision approaches in order to compute the physico chemical and sensory parameters of meat products in a non-destructive and efficient way.
Comparison of linear and non-linear monotonicity-based shape reconstruction using exact matrix characterizations
Detecting inhomogeneities in the electrical conductivity is a special case of the inverse problem in electrical impedance tomography, that leads to fast direct reconstruction methods. One such method can, under reasonable assumptions, exactly characterize the inhomogeneities based on monotonicity properties of either the Neumann-to-Dirichlet map (non-linear) or its Fréchet derivative (linear). We give a comparison of the non-linear and linear approach in the presence of measurement noise, and show numerically that the two methods give essentially the same reconstruction in the unit disk domain. For a fair comparison, exact matrix characterizations are used when probing the monotonicity relations to avoid errors from numerical solution to PDEs and numerical integration. Using a special factorization of the Neumann-to-Dirichlet map also makes the non-linear method as fast as the linear method in the unit disk geometry.
Complex Spreading Phenomena in Social Systems: Influence and Contagion in Real-World Social Networks

This text is about spreading of information and influence in complex networks. Although previously considered similar and modeled in parallel approaches, there is now experimental evidence that epidemic and social spreading work in subtly different ways. While previously explored through modeling, there is currently an explosion of work on revealing the mechanisms underlying complex contagion based on big data and data-driven approaches.

This volume consists of four parts. Part 1 is an Introduction, providing an accessible summary of the state-of-the-art. Part 2 provides an overview of the central theoretical developments in the field. Part 3 describes the empirical work on observing spreading processes in real-world networks. Finally, Part 4 goes into detail with recent and exciting new developments: dedicated studies designed to measure specific aspects of the spreading processes, often using randomized control trials to isolate the network effect from confounders, such as homophily.

Each contribution is authored by leading experts in the field. This volume, though based on technical selections of the most important results on complex spreading, remains quite accessible to the newly interested. The main benefit to the reader is that the topics are carefully structured to take the novice to the level of expert on the topic of social spreading processes. This book will be of great importance to a wide field: from researchers in physics, computer science, and sociology to professionals in public policy and public health.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, Indiana University Bloomington
Authors: Jørgensen, S. L. (ed.) (Intern), Ahn, Y. (Ekstern)
Number of pages: 361
Publication date: 2018

Publication information
Publisher: Springer
ISBN (Print): 978-3-319-77331-5
ISBN (Electronic): 978-3-319-77332-2
Original language: English

Series: Computational Social Sciences
ISSN: 2509-9574
Main Research Area: Technical/natural sciences
DOIs:
10.1007/978-3-319-77332-2
Publication: Research - peer-review » Book – Annual report year: 2018
Compressed and Practical Data Structures for Strings

In this dissertation, I will cover a number of different topics related to strings in compressed and practical settings. I will first present some fundamental techniques from the area, and then cover 6 different topics within the area. A short introduction to each of these topics is given in the following. Finger Search in Grammar-Compressed Strings. Grammar-based compression, where one replaces a long string by a small context-free grammar that generates the string, is a simple and powerful paradigm that captures many popular compression schemes. Given a grammar, the random access problem is to compactly represent the grammar while supporting random access, that is, given a position in the original uncompressed string report the character at that position. We study the random access problem with the finger search property, that is, the time for a random access query should depend on the distance between a specified index i, called the finger, and the query index j. We consider both a static variant, where we first place a finger and subsequently access indices near the finger efficiently, and a dynamic variant where also moving the finger such that the time depends on the distance moved is supported. Let n be the size of the grammar, and let N be the size of the string. For the static variant we give a linear space representation that supports placing the finger in \( O(\log N) \) time and subsequently accessing in \( O(\log D) \) time, where D is the distance between the finger and the accessed index. For the dynamic variant we give a linear space representation that supports placing the finger in \( O(\log N) \) time and accessing and moving the finger in \( O(\log D + \log \log N) \) time. Compared to the best linear space solution to random access, we improve a \( O(\log N) \) query bound to \( O(\log D) \) for the static variant and to \( O(\log D + \log \log N) \) for the dynamic variant, while maintaining linear space. As an application of our results we obtain an improved solution to the longest common extension problem in grammar compressed strings. To obtain our results, we introduce several new techniques of independent interest, including a novel van Emde Boas style decomposition of grammars. Compressed Indexing with Signature Grammars. The compressed indexing problem is to preprocess a string \( S \) of length n into a compressed representation that supports pattern matching queries. That is, given a string \( P \) of length m report all occurrences of \( P \) in \( S \). We present a data structure that supports pattern matching queries in \( O(m + \text{occ}(lgm+lg z)) \) time using \( O(2 lg(n/z)) \) space where \( z \) is the size of the LZ77 parse of \( S \) and \( z > 0 \), when the alphabet is small or the compression ratio is at least polynomial. We also present two data structures for the general case; one where the space is increased by \( O(2 lgz) \), and one where the query time changes from worst-case to expected. In all cases, the results improve the previously best known solutions. Notably, this is the first data structure that decides if \( P \) occurs in \( S \) in \( O(m) \) time using \( O(2 lg(n/z)) \) space. Our results are mainly obtained by a novel combination of a randomized grammar construction algorithm with well known techniques relating pattern matching to 2D-range reporting. Dynamic Relative Compression, Dynamic Partial Sums, and Substring Concatenation. Given a static reference string \( R \) and a source string \( S \), a relative compression of \( S \) with respect to \( R \) is an encoding of \( S \) as a sequence of references to substrings of \( R \). Relative compression schemes are a classic model of compression and have recently proved very successful for compressing highly-repetitive massive data sets such as genomes and web-data. We initiate the study of relative compression in a dynamic setting where the compressed source string \( S \) is subject to edit operations. The goal is to maintain the compressed representation compactly, while supporting edits and allowing efficient random access to the (uncompressed) source string. We present new data structures that achieve optimal time for updates and queries while using space linear in the size of the optimal relative compression, for nearly all combinations of parameters. We also present solutions for restricted and extended sets of updates. To achieve these results, we revisit the dynamic partial sums problem and the substring concatenation problem. We present new optimal or near optimal bounds for these problems. Plugging in our new results we also immediately obtain new bounds for the string indexing for patterns with wildcards problem and the dynamic text and static pattern matching problem. Succinct Partial Sums and Fenwick Trees. We consider the well-studied partial sums problem in succinct space where one is to maintain an array of n k-bit integers subject to updates such that partial sums queries can be efficiently answered. We present twosuccintversionsoftheFenwickTree–whichisknownforitssimplicityandpracticality. Our results hold in the encoding model where one is allowed to reuse the space from the inputdata. Our main result is the first that only requires \( n k + o(n) \) bits of space while still supporting sum/update in \( O(\log b n) / O(\log b n) \) time where \( 2 \leq b \leq \log(1)n \). The second result shows how optimal time for sum/update can be achieved while only slightly increasing the space usage to \( n k + o(nk) \) bits. Beyond Fenwick Trees, the results are primarily based on bit-packing and sampling – making them very practical – and they also allow for simple optimal parallelization. Fast Dynamic Arrays. We present a highly optimized implementation of tiered vectors, a data structure for maintaining a sequence of n elements supporting access in time \( O(1) \) and insertion and deletion in time \( O(n) \) for \( n = 0 \) while using \( o(n) \) extra space. We consider several different implementation optimizations in C++ and compare their performance to that of vector and multiset from the standard library on sequences with up to 108 elements. Our fastest implementation uses much less space than multiset while providing speedups of 40× for access operations compared to multiset and speedups of 10,000× compared to vector for insertion and deletion operations while being competitive with both data structures for all other operations. Parallel Lookups in String Indexes. Here we consider the indexing problem on in the parallel random access machine model. Recently, the first PRAM algorithms were presented for looking up a pattern in a suffix tree. We improve the bounds, achieving optimal results for all parameters but the preprocessing. Given a text \( T \) of length \( n \) we create a data structure of size \( O(n) \) that answers pattern matching queries for a pattern \( P \) of length \( m \) in \( O(\log m) \) time and \( O(m) \) work.

General information
State: Published
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Number of pages: 149
Publication date: 2018
Computation of Phase Equilibrium in Reservoir Simulation and Optimization

In this paper, we discuss mathematical models and computational methods for computation of vapor-liquid equilibrium in systems relevant to reservoir simulation and optimization. We formulate the phase equilibrium problem as an optimization problem and discuss the UV-flash, the TV-flash, and the PT-flash. The UV-flash occurs for thermal and compositional dynamical simulation problems, the TV-flash occurs for compositional dynamical simulation problems, and the PT-flash occurs for steady-state problems.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Center for Energy Resources Engineering
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Pages: 94-101
Publication date: 2018
Conference: 3rd IFAC Workshop on Automatic Control in Offshore Oil and Gas Production, Esbjerg, Denmark, 30/05/2018 - 30/05/2018
Main Research Area: Technical/natural sciences

Publication information
Journal: IFAC-PapersOnLine
Volume: 51
Issue number: 8
ISSN (Print): 2405-8963
Ratings:
Scopus rating (2017): CiteScore 0.68 SJR 0.26 SNIP 0.434
Scopus rating (2016): CiteScore 0.45 SJR 0.234 SNIP 0.328
Scopus rating (2015): SJR 0.298 SNIP 0.39
Scopus rating (2014): SJR 0.298 SNIP 0.383
Scopus rating (2013): SJR 0.326 SNIP 0.41
Scopus rating (2012): SJR 0.265 SNIP 0.331
Scopus rating (2011): SJR 0.257 SNIP 0.324
Scopus rating (2010): SJR 0.197 SNIP 0.276
Scopus rating (2009): SJR 0.211 SNIP 0.29
Scopus rating (2008): SJR 0.172 SNIP 0.239
Scopus rating (2007): SJR 0.195 SNIP 0.271
Scopus rating (2006): SJR 0.21 SNIP 0.284
Scopus rating (2005): SJR 0.192 SNIP 0.445
Scopus rating (2004): SJR 0.245 SNIP 0.419
Scopus rating (2003): SJR 0.26 SNIP 0.403
Original language: English
Thermodynamics, Vapor-Liquid Equilibrium, Oil, Gas, Optimization
Electronic versions:
1_s2.0_S2405896318306918_main.pdf
DOIs:
10.1016/j.ifacol.2018.06.361
Source: FindIt
Computing segmentations directly from x-ray projection data via parametric deformable curves: Paper

We describe an efficient algorithm that computes a segmented reconstruction directly from x-ray projection data. Our algorithm uses a parametric curve to define the segmentation. Unlike similar approaches which are based on level-sets, our method avoids a pixel or voxel grid; hence the number of unknowns is reduced to the set of points that define the curve, and attenuation coefficients of the segments. Our current implementation uses a simple closed curve and is capable of separating one object from the background. However, our basic algorithm can be applied to an arbitrary topology and multiple objects corresponding to different attenuation coefficients in the reconstruction. Through systematic tests we demonstrate a high robustness to the noise, and an excellent performance under a small number of projections.

General information
State: Published
Authors: Dahl, V. A. (Intern), Dahl, A. B. (Intern), Hansen, P. C. (Intern)
Number of pages: 16
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Measurement Science and Technology
Volume: 29
Issue number: 1
Article number: 014003
ISSN (Print): 0957-0233
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.061 SJR 0.53 CiteScore 1.81
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.75 SJR 0.672 SNIP 1.234
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.704 SNIP 1.368 CiteScore 1.71
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.704 SNIP 1.416 CiteScore 1.58
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.639 SNIP 1.417 CiteScore 1.53
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.748 SNIP 1.604 CiteScore 1.65
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.851 SNIP 1.704 CiteScore 1.77
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.67 SNIP 1.465
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.884 SNIP 1.563
Constrained information flows in temporal networks reveal intermittent communities

Many real-world networks represent dynamic systems with interactions that change over time, often in uncoordinated ways and at irregular intervals. For example, university students connect in intermittent groups that repeatedly form and dissolve based on multiple factors, including their lectures, interests, and friends. Such dynamic systems can be represented as multilayer networks where each layer represents a snapshot of the temporal network. In this representation, it is crucial that the links between layers accurately capture real dependencies between those layers. Often, however, these dependencies are unknown. Therefore, current methods connect layers based on simplistic assumptions that do not capture node-level layer dependencies. For example, connecting every node to itself in other layers with the same weight can wipe out dependencies between intermittent groups, making it difficult or even impossible to identify them. In this paper, we present a principled approach to estimating node-level layer dependencies based on the network structure within each layer. We implement our node-level coupling method in the community detection framework Infomap and demonstrate its performance compared to current methods on synthetic and real temporal networks. We show that our approach more effectively constrains information inside multilayer communities so that Infomap can better recover planted groups in multilayer benchmark networks that represent multiple modes with different groups and better identify intermittent communities in real temporal contact networks. These results suggest that node-level layer coupling can improve the modeling of information spreading in temporal networks and better capture intermittent community structure.
Controlling entity ICT reference architecture: distributed control architecture for distributed systems

Automatic control by controlling entities (aggregators and local controllers) enables Distributed Energy Resources (DERs) to participate in the operation of the power grid. This helps to solve the problems of reliability and efficiency caused by the intermittent production of weather dependent energy sources, and the lack of control by system operators, caused by the increasing share of distributed energy sources. A DER ICT architecture and controlling entity ICT architecture are required to enable automatic control. The paper aims to describe the software components required for a generic scalable controlling entity ICT architecture, which does not require additional work for additional DERs and DER types. The paper presents concepts and ideas for the ICT architecture, and a case study illustrating the use of the ICT architecture, and the capabilities of the architecture. The plug 'n' play section describes self-healing and topology filtering for automatic setup and robust operation of control algorithms as part of the controlling entity ICT architecture.

General information
State: Published
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Number of pages: 6
Publication date: 2018

Host publication information
Title of host publication: Proceedings of the 2018 IEEE 12th International Conference on Compatibility, Power Electronics and Power Engineering (CPE-PowerEng 2018)
Publisher: IEEE
Main Research Area: Technical/natural sciences
Conference: 12th International Conference on Compatibility, Power Electronics and Power Engineering, Doha, Qatar, 10/04/2018 - 10/04/2018
Smart grid, Distributed systems, Communication infrastructure, Network discovery, Communication negotiation, Service discovery, Capability discovery, IEC 61850, OpenADR, Serialization, Communication middleware, Control algorithms, Case study, Plug 'n' play, Self-healing, Topology filtering
DOIs: 10.1109/CPE.2018.8372505
Source: FindIt
Source-ID: 2435338247
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

Convolutional Neural Networks - Generalizability and Interpretations

Sufficient data is key when training Machine Learning algorithms in order to obtain models that generalize for operational use. Sometimes sufficient data is infeasible to obtain and this prevents the use of Machine Learning in many applications. The goal of this thesis is to gain insights and learn from data despite it being limited in amount or context representation. Within Machine Learning this thesis focuses on Convolutional Neural Networks for Computer Vision. The research aims to answer how to explore a model’s generalizability to the whole population of data samples and how to interpret the model’s function. The thesis presents three overall approaches to gaining insights on generalizability and interpretation. First, one can change the main objective of a problem to study expected insufficiencies and based on this make a better choice of model. For this first approach the thesis presents both a study on translational invariance as well as an example of changing the objective of a problem from classification to segmentation to robustly extract lower level information. The second approach is the use of simulated data which can help by inferring knowledge in our model if real data is scarce. The results show clear advantages both when using rendered Synthetic Aperture Radar images, but also when predictions from physical models are used as target variables which are matched with real data to form a large dataset. The third approach to cope with data insufficiencies is to visualize and understand the internal representations of a model. This approach is explored and concrete examples of learnings that can be obtained are shown. There is no doubt that large quantities of well representing data is the best foundation for training Machine Learning models. On the other hand, there are many tools and techniques available to interpret and understand properties of our models. With these at hand we can still learn about our models and use this knowledge to e.g. collect better datasets or improve on the modeling.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, National Space Institute, Microwaves and Remote Sensing
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Number of pages: 139
Publication date: 2018

Publication information
Cyber-physical architecture assisted by programmable networking

Cyber-physical technologies are prone to attacks in addition to faults and failures. The issue of protecting cyber-physical systems should be tackled by jointly addressing security at both cyber and physical domains in order to promptly detect and mitigate cyber-physical threats. Toward this end, this letter proposes a new architecture combining control-theoretic solutions together with programmable networking techniques to jointly handle crucial threats to cyber-physical systems. The architecture paves the way for new interesting techniques research directions and challenges which we discuss in our work.

Dangers of releasing CO₂ to fight fires in the cargo hold of seagoing bulk carriers

On seagoing general cargo vessels, the cargo is stored in bulk in the holds. Fire protection for cargo holds comprises detection and firefighting capability. Detection normally incorporates a smoke sampling system that continuously draws air from each cargo hold and passes it to a smoke detector cabinet. The fire can be fought by flooding the cargo hold with inert carbon dioxide. The carbon dioxide is stored in its liquid form at pressures in excess of 50 bar and kept in multiple vertical steel cylinders arranged in a battery. For firefighting to be effective, SOLAS regulations require that a large fraction (80-90 percent) of the gas is delivered to the space of the cargo hold over a few minutes. When discharged, the liquid carbon dioxide undergoes a change of phase to a mixture of gas and solid (“dry ice”). The sliding action of particles of dry ice can produce electrostatic discharges with sufficient energy to ignite flammable fuel/air mixtures. Because no vaporizer is present, considerable generation of static electricity is likely upon activation of the CO₂ extinguishment system and the large flow rate. Certain biological materials carried in bulk, in particular wood pellets, can self-ignite and burn as an oxygen-deficient smoldering fire. Such fires produce flammable pyrolysis gases that can travel, accumulate and enter the explosive range. If carbon dioxide is released at this stage, a gas explosion in the cargo hold may result. NFPA 12 on carbon dioxide extinguishing systems endorses the application of CO₂ to deep-seated fires involving solids subject to smoldering, but without identifying or alerting the reader to the potential presence of explosive pyrolysis gases. NFPA 12 on carbon dioxide extinguishing systems endorses the application of CO₂ to deep-seated fires involving solids subject to smoldering, but without identifying or alerting the reader to the potential presence of explosive pyrolysis gases. NFPA 12 appears to presume that electrostatic discharges will dissipate if metal nozzles are used and the entire system is grounded to earth. Lessons learned from past serious explosions appear to contraindicate this expectation. In conclusion, the application of carbon dioxide is excellent for extinguishing a fire with flames but unsuitable for quenching a deep-seated smoldering fire without flame. If detection of fire in a cargo hold is based merely on presence of smoke, not detection of fire with flames, an activation of the CO₂ system may lead to explosion.
Dangers of using CO₂ to quench wood pellet silo fires

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Statistics and Data Analysis, Industrial Fire Prevention LLC
Authors: Hedlund, F. H. (Intern), Nichols, J. (Ekstern)
Publication date: 2018

Publication information
Type: Electronic resource
Source/Publisher: Canadian biomass
Last modified date: 12/02/2018
Main Research Area: Technical/natural sciences
Electronic versions:

Links:
https://www.canadianbiomassmagazine.ca/pellets/hazards-of-using-co2-to-quench-silo-fires-6715

Bibliographical note
https://www.canadianbiomassmagazine.ca/pellets/hazards-of-using-co2-to-quench-silo-fires-6715
Source-ID: 145756000
Publication: Communication › Internet publication – Annual report year: 2018

Data-Driven Learning In High-Resolution Activity Sampling From Patients With Bipolar Depression: Mixed-Methods Study.

Background: Behavioral activation is a pen and paper-based therapy form for treating depression. The patient registers their activity hourly, and together with the therapist, they agree on a plan to change behavior. However, with the limited clinical personnel, and a growing patient population, new methods are needed to advance behavioral activation.

Objective: The objectives of this paper were to (1) automatically identify behavioral patterns through statistical analysis of the paper-based activity diaries, and (2) determine whether it is feasible to move the behavioral activation therapy format to a digital solution.

Methods: We collected activity diaries from seven patients with bipolar depression, covering in total 2,480 hours of self-reported activities. A pleasure score, on a 1-10 rating scale, was reported for each activity. The activities were digitalized into 6 activity categories, and statistical analyses were conducted.

Results: Across all patients, movement-related activities were associated with the highest pleasure score followed by social activities. On an individual level, through a nonparametric Wilcoxon Signed-Rank test, one patient had a statistically significant larger amount of spare time activities when feeling bad (z=−2.045, P=.041). Through a within-subject analysis of covariance, the patients were found to have a better day than the previous, if that previous day followed their diurnal rhythm (p=.265, P=.029). Furthermore, a second-order trend indicated that two hours of daily social activity was optimal for the patients (β2=−0.08, t(63)=−1.22, P=.23).

Conclusions: The data-driven statistical approach was able to find patterns within the behavioral traits that could assist the therapist in as well as help design future technologies for behavioral activation.
Data driven quantification of the temporal scope of building LCAs

In the construction sector, LCAs typically apply an approach based on fixed or partially fixed building lifespans/service lives/reference study period. The temporal scopes applied in building LCAs are hence typically not reflecting that the timeframes buildings can provide the service they are intended to provide, are (highly) dependent on numerous factors e.g.: building location, materials used to construct the building, energy supply and the use of the building. Inaccurate estimation of the temporal scope of a building LCA will lead to incorrect quantification of the environmental impacts of buildings. Incorrect quantification of the environmental performance of buildings may, in the worst case, derange/decelerate the development within the building sector towards more sustainable buildings. In this paper, a data set consisting of 20999 Danish buildings, demolished between 2009 and 2015, is analyzed. A multiple linear regression model is derived and used to quantify the temporal scope (often referred to as the reference study period) of building LCAs in an attempt to improve the accuracy of sustainability assessment of buildings, taking several influencing factors into account. The results obtained from the derived model are subsequently compared with several fixed/partially fixed building lifespan/service life/reference study period quantification approaches. The regression model proved to estimate the lifespan with lower errors (compared to observed values) than the prevailing approach relying on a single fixed value for all building locations, uses and building materials. The application of model based site, use, and/or material specific etc. temporal scope quantification in LCA is new and provides a mean to reduce the uncertainty of LCA results; however, the approach needs to be formalized.
DDoS-Capable IoT Malwares: Comparative Analysis and Mirai Investigation

The Internet of Things (IoT) revolution has not only carried the astonishing promise to interconnect a whole generation of traditionally "dumb" devices, but also brought to the Internet the menace of billions of badly protected and easily hackable objects. Not surprisingly, this sudden flooding of fresh and insecure devices fueled older threats, such as Distributed Denial of Service (DDoS) attacks. In this paper, we first propose an updated and comprehensive taxonomy of DDoS attacks, together with a number of examples on how this classification maps to real-world attacks. Then, we outline the current situation of DDoS-enabled malwares in IoT networks, highlighting how recent data support our concerns about the growing in popularity of these malwares. Finally, we give a detailed analysis of the general framework and the operating principles of Mirai, the most disruptive DDoS-capable IoT malware seen so far.

Deep Generative Models for Molecular Science

Generative deep machine learning models now rival traditional quantum-mechanical computations in predicting properties of new structures, and they come with a significantly lower computational cost, opening new avenues in computational molecular science. In the last few years, a variety of deep generative models have been proposed for modeling molecules, which differ in both their model structure and choice of input features. We review these recent advances within deep generative models for predicting molecular properties, with particular focus on models based on the probabilistic
autoencoder (or variational autoencoder, VAE) approach in which the molecular structure is embedded in a latent vector space from which its properties can be predicted and its structure can be restored.
Deep Generative Models for Semi-Supervised Machine Learning

The re-introduction of deep neural networks has a large impact on the modeling capabilities of modern machine learning. This re-ignites the general public’s dream of achieving artificial intelligence, and spawns rapid progress in large scale industrial machine learning development, such as autonomous driving. However, the leaps in development are still confined to a rather limited learning domain, in which labeled data is required. Labeled data is hard and costly to acquire, due to the amount needed to efficiently learn a modern machine learning model, and that many data sources are not directly interpretable. Consequently, research in different learning paradigms that utilize vast amounts of unlabeled data is getting more and more attention. Albeit possessing intriguing theoretical properties, machine learning models that learn from unlabeled data are still an unsolved research topic. The thesis comprises methods that utilize the power of deep neural networks to learn from both labeled and unlabeled data. A background for the theoretical foundation of the proposed methods are described and empirical results showing their capabilities within generation and classification tasks are presented. Finally, a real-life application within condition monitoring for sustainable energy is demonstrated, proving that the proposed methods have the expected impact and are applicable.

General information
State: Submitted
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems
Authors: Maaløe, L. (Intern)
Number of pages: 155
Publication date: 2018

Publication information
Publisher: DTU Compute
Original language: English

Series: DTU Compute PHD-2018
Volume: 472
ISSN: 0909-3192
Main Research Area: Technical/natural sciences

Relations
Projects:
Deep Generative Models for Semi-Supervised Machine Learning
Publication: Research › Ph.D. thesis – Annual report year: 2018

Deep Latent Variable Models for Sequential Data

Over the last few decades an ever-increasing amount of data is being collected in a wide range of applications. This has boosted the development of mathematical models that are able to analyze it and discover its underlying structure, and use the extracted information to solve a multitude of different tasks, such as for predictive modelling or pattern recognition. The available data is however often complex and high-dimensional, making traditional data analysis methods ineffective in many applications. In the recent years there has then been a big focus on the development of more powerful models, that need to be general enough to be able to handle many diverse applications and kinds of data. Some of the most interesting advancements in this research direction have been recently obtained combining ideas from probabilistic modelling and deep learning. Variational auto-encoders (VAEs), that belong to the broader family of deep latent variable models, are powerful and scalable models that can be used for unsupervised learning of complex high-dimensional data distributions. They achieve this by parameterizing expressive probability distributions over the latent variables of the model using deep neural networks. VAEs can be used in applications with static data, for example as a generative model of images, but they are not suitable to model temporal data such as the sequences of images that form a video. However, a major part of the data that is being collected has a sequential nature, and finding powerful architectures that are able to model it is therefore fundamental. In the first part of the thesis we will introduce a broad class of deep latent variable models for sequential data, that can be used for unsupervised learning of complex and high-dimensional sequential data distributions. We obtain these models by extending VAEs to the temporal setting, and further combining ideas from deep learning (e.g. deep and recurrent neural networks) and probabilistic modelling (e.g. state-space models) to define generative models for the data that use deep neural networks to parameterize very flexible probability distributions. This results in a family of powerful architectures that can model a wide range of complex temporal data, and can be trained in a scalable way using large unlabelled datasets. In the second part of the thesis we will then present in detail three architectures belonging to this family of models. First, we will introduce stochastic recurrent neural networks (Fraccaro et al., 2016c), that combine the expressiveness of recurrent neural networks and the ability of state-space models to model the uncertainty in the learned latent representation. We will then present Kalman variational auto-encoders (Fraccaro et al., 2017), that can learn from data disentangled and more interpretable visual and dynamic representations. Finally, we will show that to deal with temporal applications that require a high memory capacity we can combine deep latent variable models with external memory architectures, as in the generative temporal model with spatial memory of Fraccaro et al. (2018).
Deep learning for automated drivetrain fault detection
A novel data-driven deep-learning system for large-scale wind turbine drivetrain monitoring applications is presented. It uses convolutional neural network processing on complex vibration signal inputs. The system is demonstrated to learn successfully from the actions of human diagnostic experts and provide early and robust fault detection on both rotor bearing, planetary and helical stage gear box bearings from analysis of multisensor vibration patterns using only a high-level feature selection. On the basis of data from 251 actual wind turbine bearing failures, we are able to accurately quantify the fleet-wide diagnostic model performance. The analysis also explores the time dependence of the diagnostic performance, providing a detailed view of the timeliness and accuracy of the diagnostic outputs across the different architectures. Deep architectures are shown to outperform the human analyst as well as shallow-learning architectures, and the results demonstrate that when applied in a large-scale monitoring system, machine intelligence is now able to handle some of the most challenging diagnostic tasks related to wind turbines.
Deformable Curves for Outlining Objects Directly From Projections

General information
State: Published
Authors: Dahl, V. A. (Intern), Koo, J. (Intern), Hansen, P. C. (Intern), Dahl, A. B. (Intern)
Number of pages: 1
Publication date: 2018
Main Research Area: Technical/natural sciences
Tomographic reconstruction, Deformable models, Segmentation, Meshing
Electronic versions: Scandem_2018_abstract_1_.pdf
Density of Real Zeros of the Tutte Polynomial

The Tutte polynomial of a graph is a two-variable polynomial whose zeros and evaluations encode many interesting properties of the graph. In this article we investigate the real zeros of the Tutte polynomials of graphs, and show that they form a dense subset of certain regions of the plane. This is the first density result for the real zeros of the Tutte polynomial in a region of positive volume. Our result almost confirms a conjecture of Jackson and Sokal except for one region which is related to an open problem on flow polynomials.
Designing interactively with elastic splines
We present an algorithm for designing interactively with C1 elastic splines. The idea is to design the elastic spline using a C1 cubic polynomial spline where each polynomial segment is so close to satisfying the Euler-Lagrange equation for elastic curves that the visual difference becomes negligible. Using a database of cubic Bézier curves we are able to interactively modify the cubic spline such that it remains visually close to an elastic spline.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics, Image Analysis & Computer Graphics
Authors: Brander, D. (Intern), Bærentzen, J. A. (Intern), Fisker, A. (Intern), Gravesen, J. (Intern)
Number of pages: 11
Pages: 181-191
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Computer-Aided Geometric Design
Volume: 62
ISSN (Print): 0167-8396
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 1.32 SJR 0.683 SNIP 0.886
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.55 SJR 0.687 SNIP 1.156
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.91 SNIP 1.498 CiteScore 1.71
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.269 SNIP 1.864 CiteScore 2.09
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.688 SNIP 1.596 CiteScore 1.18
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.641 SNIP 1.656 CiteScore 1.41
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.59 SNIP 1.412 CiteScore 1.37
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.679 SNIP 1.499
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 0.728 SNIP 1.988
**Design of a time-predictable multicore processor: the T-CREST project**

Real-time systems need to deliver results in time and often this timely production of a result needs to be guaranteed. Static timing analysis can be used to bound the worst-case execution time of tasks. However, this timing analysis is only possible if the processor architecture is analysis friendly. This paper presents the T-CREST processor, a real-time multicore processor developed to be time-predictable and an easy target for static worst-case execution time analysis. We present how to achieve time-predictability at all levels of the architecture, from the processor pipeline, via a network-on-chip, up to the memory controller. The main architectural feature to provide time predictability is to use static arbitration of shared resources in a time-division multiplexing way.

**General information**

State: Published  
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering  
Authors: Schoeberl, M. (Intern)  
Pages: 909-12  
Publication date: 2018

**Host publication information**

Title of host publication: Proceedings of 2018 Design, Automation & Test in Europe Conference & Exhibition (DATE)  
Publisher: IEEE  
ISBN (Print): 978-3-9819263-0-9  
Main Research Area: Technical/natural sciences  
Conference: 2018 Design, Automation & Test in Europe Conference & Exhibition, Dresden, Germany, 19/03/2018 - 19/03/2018  
DOIs:  
10.23919/DATE.2018.8342138  
Source: FindIt  
Source-ID: 2419630360  
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

**Design process robustness: A bi-partite network analysis reveals the central importance of people**

Design processes require the joint effort of many people to collaborate and work on multiple activities. Effective techniques to analyse and model design processes are important for understanding organisational dynamics, for improving collaboration, and for planning robust design processes, reducing the risk of rework and delays. Although there has been much progress in modelling and understanding design processes, little is known about the interplay between people and the activities they perform and its influence on design process robustness. To analyse this interplay, we model a large-scale design process of a biomass power plant with people and activities as a bipartite network. Observing that some people act as bridges between activities organised to form nearly independent modules, in order to evaluate process fragility, we simulate random failures and targeted attacks to people and activities. We find that our process is more vulnerable to attacks to people rather than activities. These findings show how the allocation of people to activities can obscure an inherent fragility, making the process highly sensitive and dependent on specific people. More generally, we show that the behaviour of robustness is determined by the degree distributions, the heterogeneity of which can be leveraged to improve robustness and resilience to cascading failures. Overall, we show that it is important to carefully plan
Detector design for active fault diagnosis in closed-loop systems

Fault diagnosis of closed-loop systems is extremely relevant for high-precision equipment and safety critical systems. Fault diagnosis is usually divided into 2 schemes: active and passive fault diagnosis. Recent studies have highlighted some advantages of active fault diagnosis based on dual Youla-Jabr-Bongiorno-Kucera parameters. In this paper, a method for closed-loop active fault diagnosis based on statistical detectors is given using dual Youla-Jabr-Bongiorno-Kucera parameters. The goal of this paper is 2-fold. First, the authors introduce a method for measuring a residual signal subject to white noise. Second, an optimal detector design is presented for single and multiple faults using the amplitude and phase shift of the residual signal to conduct diagnosis. Here, both the optimal case of a perfect model and the suboptimal case of a model with uncertainties are discussed. The method is successfully tested on a simulated system with parametric faults.
Do Not Release Carbon Dioxide If Flammable Vapors Are Present – Static Electricity May Lead To Explosion

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Statistics and Data Analysis
Authors: Hedlund, F. H. (Intern)
Publication date: 2018

Publication information
Type: Electronic resource
Source/Publisher: Sciencetrends.com
Last modified date: 06/04/2018
Main Research Area: Technical/natural sciences
Electronic versions:
Do_Not_Release_Carbon_Dioxide_If_Flammable_Vapors_Are_Present_Static_Electricity_May_Lead_To_Explosion_Science_Trends.pdf

Bibliographical note
Double-Loop Health Technology: Enabling Socio-technical Design of Personal Health Technology in Clinical Practice

Personal health technology is rapidly emerging as a response to the challenges associated with significant increase in chronic noncommunicable diseases. The overall design paradigm behind most of these applications is to manually and automatically sample data from sensors and smartphones and use this to provide patients with an awareness of their illness and give recommendation for treatment, care, and healthy living. Few of these systems are, however, designed to be part of a complex socio-technical care and treatment processes in existing healthcare systems and clinical pathways. In this chapter, we present a case of designing personal health technology for mental health, which is integrated into hospital-based treatment. This system helps patients to manage their disease by tracking and correlation behavior and disease progression and provide feedback to them, while also deployed as part of a clinical outpatient treatment. Hence, clinicians are “in the loop” and can monitor and provide feedback to patients. The chapter outlines the case and discusses lessons learned from it with respect to the socio-technical design of personal health technologies to be embedded as part of clinical treatment.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, IT University of Copenhagen
Authors: Bardram, J. E. (Intern), Frost, M. (Ekstern)
Pages: 167–186
Publication date: 2018

Drawing Trees
We formally prove in Isabelle/HOL two properties of an algorithm for laying out trees visually. The first property states that removing layout annotations recovers the original tree. The second property states that nodes are placed at least a unit of distance apart. We have yet to formalize three additional properties: That parents are centered above their children, that drawings are symmetrical with respect to reflection and that identical subtrees are rendered identically.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Technical University of Denmark
Authors: Halkjær From, A. (Ekstern), Schlichtkrull, A. (Intern), Villadsen, J. (Intern)
Number of pages: 7
Publication date: 2018

Dynamic Allocation or Diversification: A Regime-Based Approach to Multiple Assets
This article investigates whether regime-based asset allocation can effectively respond to changes in financial regimes at the portfolio level in an effort to provide better long-term results when compared to a static 60/40 benchmark. The potential benefit from taking large positions in a few assets at a time comes at the cost of reduced diversification. The authors analyze this trade-off in a multi-asset universe with great potential for static diversification. The regime-based approach is centered around a regime-switching model with time-varying parameters that can match financial markets’ behavior and a
new, more intuitive way of inferring the hidden market regimes. The empirical results show that regime-based asset allocation is profitable, even when compared to a diversified benchmark portfolio. The results are robust because they are based on available market data with no assumptions about forecasting skills.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Sampension, Lund University
Authors: Nystrup, P. (Intern), Hansen, B. W. (Ekstern), Larsen, H. O. (Ekstern), Madsen, H. (Intern), Lindström, E. (Ekstern)
Number of pages: 12
Pages: 62-73
Publication date: 2018
Main Research Area: Technical/natural sciences

**Publication information**
Journal: The Journal of Portfolio Management
Volume: 44
Issue number: 2
ISSN (Print): 0095-4918
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.085 SJR 0.486 CiteScore 0.73
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 0.54 SJR 1.078 SNIP 0.849
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.899 SNIP 1.006 CiteScore 0.6
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.425 SNIP 0.999 CiteScore 0.6
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.792 SNIP 0.916 CiteScore 0.57
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.846 SNIP 0.921 CiteScore 0.65
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.626 SNIP 0.614 CiteScore 0.51
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.738 SNIP 0.837
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.506 SNIP 0.936
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.291 SNIP 0.468
Scopus rating (2007): SJR 0.455 SNIP 0.754
Scopus rating (2006): SJR 0.507 SNIP 0.88
Scopus rating (2005): SJR 0.845 SNIP 1.015
Scopus rating (2004): SJR 0.87 SNIP 0.842
Scopus rating (2003): SJR 0.76 SNIP 0.853
Scopus rating (2002): SJR 0.524 SNIP 0.618
Scopus rating (2001): SJR 0.796 SNIP 0.576
Scopus rating (2000): SJR 0.855 SNIP 0.916
Scopus rating (1999): SJR 0.822 SNIP 0.755

Original language: English
DOIs:
10.3905/jpm.2018.44.2.062
Source: FindIt
**Dynamic bridge-finding in $\tilde{O}(\log^2 n)$ amortized time**

We present a deterministic fully-dynamic data structure for maintaining information about the bridges in a graph. We support updates in $\tilde{O}(\log \log n)$ amortized time, and can find a bridge in the component of any given vertex, or a bridge separating any two given vertices, in $O(\log \log n)$ worst case time. Our bounds match the current best for bounds for deterministic fully-dynamic connectivity up to $\log \log n$ factors. The previous best dynamic bridge finding was an $\tilde{O}(\log^3 n)$ amortized time algorithm by Thorup [STOC2000], which was a bittrick-based improvement on the $O((\log \log n)^2)$ amortized time algorithm by Holm et al.[STOC98, JACM2001]. Our approach is based on a different and purely combinatorial improvement of the algorithm of Holm et al., which by itself gives a new combinatorial $\tilde{O}(\log \log n)$ amortized time algorithm. Combining it with Thorup's bittrick, we get down to the claimed $\tilde{O}(\log \log n)$ amortized time. Essentially the same new trick can be applied to the biconnectivity data structure from [STOC98, JACM2001], improving the amortized update time to $\tilde{O}(\log \log n)$. We also offer improvements in space. We describe a general trick which applies to both of our new algorithms, and to the old ones, to get down to linear space, where the previous best use $O(m + n \log n \log \log n)$. Our result yields an improved running time for deciding whether a unique perfect matching exists in a static graph.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, University of Copenhagen
Authors: Holm, J. (Ekstern), Rotenberg, E. (Intern), Thorup, M. (Ekstern)
Pages: 35-52
Publication date: 2018

**Host publication information**

Title of host publication: Proceedings of the Twenty-Ninth Annual ACM-SIAM Symposium on Discrete Algorithms
Publisher: SIAM - Society for Industrial and Applied Mathematics
ISBN (Electronic): 978-1-61197-503-1

Series: Proceedings of the Twenty-ninth Annual Acm-siam Symposium
Main Research Area: Technical/natural sciences
Conference: Twenty-Ninth Annual ACM-SIAM Symposium on Discrete Algorithms, New Orleans, United States, 07/01/2018 - 07/01/2018
Electronic versions: 1707.06311.pdf
Source: FindIt
Source-ID: 2394615985
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

**Effects of additive noise on formation of spatial patterns in an activator-inhibitor system**

We explore the impact of additive noise on the spatial patterns emerging in an activator-inhibitor system, which is modeled by a stochastic reaction-diffusion system. By means of multiscale analysis we derive an amplitude equation around the onset of the Hopf bifurcation. Most importantly, we formulate a threshold value in terms of the noise tensor, which determines whether the additive noise will sustain or destroy the Hopf bifurcation. Finally, we carry out numerical simulations to demonstrate how the additive noise can induce the emergence of spiral and target wave patterns when a Hopf bifurcation occurs.

**General information**

State: Submitted
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Yangzhou University
Authors: Tian, C. (Ekstern), Ling, Z. (Ekstern), Zhang, L. (Ekstern), Pedersen, M. (Intern)
Number of pages: 8
Publication date: 2018
Main Research Area: Technical/natural sciences

**Publication information**

ISSN (Print): 2470-0045
Ratings: BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
Effect of DrugStars App Use on Life Quality and Attitudes of Diabetes Patients

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis
Authors: Lyndgaard, C. B. (Intern)
Number of pages: 68
Publication date: 2018
Effects of Lifestyle on Muscle Strength in a Healthy Danish Population

Background: Life style is expected to influence muscle strength. This study aimed at assessing a possible relationship between smoking, alcohol intake and physical activity, and muscle strength in a healthy Danish population aged 20-79 years. Population study based on data collected from The Copenhagen City Heart Study (CCHS) and measurements of Isokinetic muscle strength from a sub-study of randomly selected healthy participants from CCHS.

Methods: 126 women and 63 men were studied. All participants completed a questionnaire regarding their lifestyle, including physical activity, alcohol intake and smoking habits. Isokinetic muscle strength was measured over the upper extremities (UE), trunk, and lower extremities (LE). Multivariate analyses including all of the variables were carried out.

Results: The level of daily physical activity during leisure was positively correlated to muscle strength in the lower extremities (p = 0.03) for women, and lower extremities (p = 0.03) and trunk (p = 0.007) for men. Alcohol Intake was in general not correlated to muscle strength. No clear effect of smoking was seen on muscle strength. Conclusions: Our results show that physical activity during leisure is associated with a positive effect on muscle strength in both sexes. When keeping alcohol intake within the recommended limits, alcohol does not seem to affect muscle strength negatively. No effect of smoking on muscle strength was found in our group of healthy subjects. The findings are of importance when considering recommendation on life style when wishing to keeping fit with age to be able to carry out daily activities.

Effects of menopause and high-intensity training on insulin sensitivity and muscle metabolism

To investigate peripheral insulin sensitivity and skeletal muscle glucose metabolism in premenopausal and postmenopausal women, and evaluate whether exercise training benefits are maintained after menopause. Sedentary, healthy, normal-weight, late premenopausal (n=21), and early postmenopausal (n=20) women were included in a 3-month high-intensity exercise training intervention. Body composition was assessed by magnetic resonance imaging and dual-energy x-ray absorptiometry, whole body glucose disposal rate (GDR) by hyperinsulinemic euglycemic clamp (40 mU/m/min), and femoral muscle glucose uptake by positron emission tomography/computed tomography, using the glucose analog fluorodeoxyglucose, expressed as estimated metabolic rate (eMRR). Insulin signaling was investigated in muscle biopsies. Age difference between groups was 4.5 years, and no difference was observed in body composition. Training increased lean body mass (estimate [95% confidence interval] 0.5 [0.2-0.9]kg, P

General information
State: Accepted/In press
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Copenhagen University Hospital, University of Copenhagen, Frederiksberg Hospital
Authors: Bartels, E. M. (Ekstern), Robertson, S. (Ekstern), Danneskiold-Samsøe, B. (Ekstern), Appleyard, M. (Ekstern), Stockmarr, A. (Intern)
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Lifestyle Medicine
Volume: 8
Issue number: 1
ISSN (Print): 2234-8549
Original language: English
Muscle Strength, Aging, Activity of daily living, Lifestyle
Electronic versions:
Bartels_et_al_2018_proof.pdf
DOIs:
10.15280/jlm.2018.8.1.1
Source: PublicationPreSubmission
Source-ID: 143856673
Publication: Research - peer-review › Journal article – Annual report year: 2018

Effects of menopause and high-intensity training on insulin sensitivity and muscle metabolism

To investigate peripheral insulin sensitivity and skeletal muscle glucose metabolism in premenopausal and postmenopausal women, and evaluate whether exercise training benefits are maintained after menopause. Sedentary, healthy, normal-weight, late premenopausal (n=21), and early postmenopausal (n=20) women were included in a 3-month high-intensity exercise training intervention. Body composition was assessed by magnetic resonance imaging and dual-energy x-ray absorptiometry, whole body glucose disposal rate (GDR) by hyperinsulinemic euglycemic clamp (40 mU/m/min), and femoral muscle glucose uptake by positron emission tomography/computed tomography, using the glucose analog fluorodeoxyglucose, expressed as estimated metabolic rate (eMRR). Insulin signaling was investigated in muscle biopsies. Age difference between groups was 4.5 years, and no difference was observed in body composition. Training increased lean body mass (estimate [95% confidence interval] 0.5 [0.2-0.9]kg, P

General information
State: Published
Engineering a Multi-Agent System in Jason and CArtAgO

This paper presents the overall strategy utilized by Jason-DTU to achieve a shared second place in the annual Multi-Agent Programming Contest. It provides an overview of the implementation details considering perception, task handling, agent logic and more. The paper analyzes the team’s results in each match, and is summarized by evaluating strengths and weaknesses of the proposed multi-agent system.

General information
State: Accepted/In press
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Technical University of Denmark
Authors: Villadsen, J. (Intern), Fleckenstein, O. (Ekstern), Hatteland, H. (Ekstern), Larsen, J. B. (Intern)
Pages: 1–18
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Annals of Mathematics and Artificial Intelligence
ISSN (Print): 1012-2443
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SJR 0.413 SNIP 1.046 CiteScore 1.21
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.438 SNIP 0.982 CiteScore 1.27
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.562 SNIP 0.94 CiteScore 0.93
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.532 SNIP 1.333 CiteScore 1.08
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.405 SNIP 0.89 CiteScore 0.94
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.367 SNIP 1.012 CiteScore 0.65
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.416 SNIP 1.084 CiteScore 0.78
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.395 SNIP 0.837
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.503 SNIP 1.245
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.751 SNIP 1.149
Scopus rating (2007): SJR 0.624 SNIP 1.121
Scopus rating (2006): SJR 0.547 SNIP 1.064
Scopus rating (2005): SJR 0.663 SNIP 1.325
Scopus rating (2004): SJR 0.542 SNIP 1.614
Scopus rating (2003): SJR 0.505 SNIP 0.978
Scopus rating (2002): SJR 0.541 SNIP 1.318
Environmental sustainable decision making – The need and obstacles for integration of LCA into decision analysis

Decision analysis is often used to help decision makers choose among alternatives, based on the expected utility associated to each alternative as function of its consequences and potential impacts. Environmental impacts are not always among the prioritized concerns of traditional decision making. This has fostered the development of several environmental problems and is nowadays a reason of concern. Life Cycle Assessment (LCA) can assess an extensive range of environmental impacts associated with a product or service system and support a life cycle perspective on the alternative products or service systems, revealing potential problem shifting between life cycle stages. Through the integration with traditional risk based decision analysis, LCA may thus facilitate a better informed decision process. In this study we explore how environmental impacts are taken into account in different fields of interest for decision makers to identify the need, potential and obstacles for integrating LCA into conventional approaches to decision problems. Three application areas are used as examples: transportation planning, flood management, and food production and consumption. The analysis of these cases shows that environmental impacts are considered only to a limited extent in traditional evaluation of transport and food projects. They are rarely, if at all, addressed in flood risk management. Hence, in each of the three cases studied, there is a clear need for the inclusion of a better and systematic assessment of environmental impacts. Some LCA studies have been conducted in all three research areas, mainly on infrastructures and production systems. The three cases show the potential of integrating LCA into existing decision analysis by providing the environmental profiles of the alternatives. However, due to different goals and scopes of LCA and other decision analysis approaches, there is a general lack of consistency in study system scoping in terms of considered elements and boundaries, in uncertainty treatment, and in applied metrics. In the present paper, we discuss the obstacles arising when trying to integrate LCA with conventional evaluation tools and we propose a research agenda to eventually make such integration feasible and consistent.
**ePNK Applications and Annotations: A Simulator for YAWL Nets**

The ePNK is an Eclipse based platform and framework for developing and integrating Petri net tools and applications. New types of Petri nets can be realized and plugged into the ePNK without any programming by simply providing a model of the concepts of the new Petri net type. Moreover, the ePNK allows developers to customize the graphical appearance of the features of a new Petri net type.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Software and Process Engineering
Authors: Kindler, E. (Intern)
Pages: 339-350
Publication date: 2018

**Host publication information**

Title of host publication: Application and Theory of Petri Nets and Concurrency
Volume: 10877
Publisher: Springer
ISBN (Print): 9783319912684
Series: Application and Theory of Petri Nets and Concurrency
Series: Lecture Notes in Computer Science
Volume: 10877
ISSN: 0302-9743

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Department of Physics, Plasma Physics and Fusion Energy, Dynamical Systems, Bogolyubov Institute for Theoretical Physics Nasu
Authors: Christiansen, P. L. (Intern), Iermakova, S. V. (Ekstern), Gaididei, Y. B. (Intern), Sørensen, M. P. (Intern)
Number of pages: 1
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Physics A: Mathematical and Theoretical
Volume: 51
Issue number: 19
Article number: 199601
ISSN (Print): 1751-8113
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.924 SJR 0.843 CiteScore 1.74
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.45 SJR 0.935 SNIP 0.959
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.028 SNIP 1.048 CiteScore 1.34
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.936 SNIP 0.945 CiteScore 1.36
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.935 SNIP 0.998 CiteScore 1.42
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.047 SNIP 1.067 CiteScore 1.49
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.947 SNIP 0.948 CiteScore 1.41
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.06 SNIP 1.022
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.077 SNIP 0.993
Estimating the Density of Fluid in a Pipeline System with an Electropump

To transfer petroleum products, a common pipeline is often used to continuously transfer various products in batches. Separating the different products requires detecting the interface between the batches at the storage facilities or pump stations along the pipelines. The conventional technique to detect the product in the pipeline is to sample the fluid in a laboratory and perform an offline measurement of its physical characteristics. The measurement requires sophisticated laboratory equipment and can be time-consuming and susceptible to human error. In this paper, for performing the online detection and separation of the batches, two methods are suggested that do not need extra equipment and are more practical. Because different petroleum products have different densities, the goal of both methods was to estimate the density of each product to detect its type. To estimate the fluid density, the first method used a recursive Kalman filtering algorithm and a model that defined the relationship among the pump's differential pressure, the volume flow rate, and the rotational speed. The second method was suggested for the cases when the measurement of pressure and flow rate are not possible but the motor current and rotational speed are directly measurable. For that purpose, first the load torque was estimated. Then, by using a model that has parameters that depend on the density and that defines the relationship between the required pump torque and its rotational speed, the parameters of this model and consequently the density of the fluid were estimated. (C) 2018 American Society of Civil Engineers.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Department of Electrical Engineering, Automation and Control, Iran University of Science and Technology
Authors: Sadeghi, H. (Ekstern), Poshtan, J. (Ekstern), Poulsen, N. K. (Intern), Niemann, H. H. (Intern)
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Pipeline Systems Engineering and Practice
Volume: 9
Issue number: 2
Article number: 06018002
ISSN (Print): 1949-1190
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): SNIP 1.059 SJR 0.421 CiteScore 1.09
Scopus rating (2016): CiteScore 1.08 SNIP 1.308 SJR 0.487
Scopus rating (2015): CiteScore 1.15 SNIP 1.614 SJR 0.412
Scopus rating (2014): CiteScore 1.09 SNIP 1.34 SJR 0.536
Scopus rating (2013): CiteScore 0.81 SNIP 1.342 SJR 0.363
Scopus rating (2012): CiteScore 0.53 SNIP 0.729 SJR 0.253
Evaluating the Impact of Juice Filming Charging Attack in Practical Environments

Nowadays, smartphones are widely adopted in people’s daily lives. With the increasing capability, phone charging has become a basic requirement and a large number of public charging facilities are under construction for this purpose. However, public charging stations may open a hole for cyber-criminals to launch various attacks, especially charging attacks, to steal phone user’s private information. Juice filming charging (JFC) attack is one such threat, which can refer users’ sensitive information from both Android OS and iOS devices, through automatically monitoring and recording phone screen during the whole charging period. Due to the potential damage of JFC attacks, there is a need to investigate its influence in practical scenarios. Motivated by this, in this work, we firstly conduct a large user survey with over 2500 participants about their awareness and attitude towards charging attacks. We then for the first time investigate the impact of JFC attack under three practical scenarios. Our work aims to complement the state-of-the-art and stimulate more research in this area.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cyber Security, Advanced Digital Sciences Center, Singapore, Singapore, Institute for Infocomm Research, University of Luxembourg, University of Aizu
Authors: Meng, W. (Intern), Lee, W. (Ekstern), Liu, Z. (Ekstern), Su, C. (Ekstern), Li, Y. (Ekstern)
Pages: 327-338
Publication date: 2018

Host publication information
Title of host publication: Information Security and Cryptology
Volume: 10779
Publisher: Springer
ISBN (Print): 9783319785554
Main Research Area: Technical/natural sciences
Computer Science, Systems and Data Security, Data Encryption, Artificial Intelligence (incl. Robotics), Smartphone privacy, Android and iOS, Video recording, Charging station, Juice filming charging attack, Practical evaluation

Evaluating the impact of transmission mode, calibration level and farmer compliance in simulation models of paratuberculosis in dairy herds

Simulation models can predict the outcome of different strategies for the control and eradication of paratuberculosis (PTB) in dairy herds. Two main transmission modes have previously been used to simulate the spread of PTB: direct (contact between animals) and indirect (through the environment). In addition, previous models were calibrated to either low or high within-herd prevalence levels, which we refer to as normal and low hygiene levels, respectively. We simulated both direct and indirect transmission with the same model in both normal and low hygiene level scenarios. The effectiveness of a test-and-cull strategy was dependent on the calibration level of the simulation model, and eradication occurred less frequently with the more biologically plausible indirect transmission mode. The results were compared to within-herd prevalence records from 314 dairy herds. The prevalence in 50% of the herds varied less than 0.9% per year on average, and less than 4% in 90% of the herds. We therefore conclude that the normal-hygiene scenario best describes most dairy herds in Denmark. Finally, we simulated different levels of farmer compliance with a test-and-cull strategy and found that a 60% compliance level was not sufficient to reach eradication within 10 years.

General information
State: Published
Organisations: National Veterinary Institute, Epidemiology, Department of Applied Mathematics and Computer Science, Dynamical Systems
Authors: Kirkeby, C. T. (Intern), Græsbøll, K. (Intern), Halasa, T. (Intern)
Number of pages: 12
Explicit MDS Codes with Complementary Duals
In 1964, Massey introduced a class of codes with complementary duals which are called Linear Complimentary Dual (LCD for short) codes. He showed that LCD codes have applications in communication system, side-channel attack (SCA) and so on. LCD codes have been extensively studied in literature. On the other hand, MDS codes form an optimal family of classical codes which have wide applications in both theory and practice. The main purpose of this paper is to give an explicit construction of several classes of LCD MDS codes, using tools from algebraic function fields. We exemplify this construction and obtain several classes of explicit LCD MDS codes for the odd characteristic case.
Face Recognition using Approximate Arithmetic

Face recognition is image processing technique which aims to identify human faces and found its use in various different fields for example in security. Throughout the years this field evolved and there are many approaches and many different algorithms which aim to make the face recognition as effective as possible. The use of different approaches such as neural networks and machine learning can lead to fast and efficient solutions however, these solutions are expensive in terms of hardware resources and power consumption. A possible solution to this problem can be use of approximate arithmetic. In many image processing applications the results do not need to be completely precise and use of the approximate arithmetic can lead to reduction in terms of delay, space and power consumption. In this paper we examine possible use of approximate arithmetic in face recognition using Eigenfaces algorithm.
FindZebra - using machine learning to aid diagnosis of rare diseases

FindZebra is a search engine for rare diseases intended to act as a diagnosis decision support system (DDSS) capable of assisting the user both during and after a search. Rare diseases are diseases that affect only a small part of the population (less than one in two thousand). Currently around seven thousand rare diseases are known and it is estimated that 6–8% of the population will be affected by a rare disease during their lifetime. Due to their rarity and large number, diagnosis of rare diseases is difficult and often associated with year long delays and diagnostic errors. These difficulties with diagnosis have a profound human and societal cost. This means that even a small increase in success rate when using a tool such as FindZebra could potentially have a great impact on society. In this dissertation we explore four lines of research for improving FindZebra using machine learning methods. The first line of research is on how to improve the retrieval performance of FindZebra. By using a combination of improved models, medical databases and corpus expansion we show that it is possible to obtain a substantial improvement in retrieval performance compared to current state-of-the-art document retrieval systems. Improving retrieval performance is important, but is not the only way of improving the success rate of a DDSS such as FindZebra. Following an unsuccessful search, the search engine should assist the user by indicating what information is likely to be missing. This idea is called Information Completion (IC) and will be explored in the second line of research. In order to represent words (and other discrete tokens) in a neural network it is necessary to transform each word to a vector form. This is typically accomplished by using a word embedding, which is an essential component in any word based neural network. The third line of research is on how to improve this basic component. Users of FindZebra who do not have English as their primary language often have difficulty expressing complex medical queries in English. Optimally, a user should be able to write a query in his or her native language and the search engine should then give a suggestion for a differential diagnosis based on all the information contained in a multilingual corpus, not only in the native corpus. Methods for performing multilingual search will be the fourth line of research explored in this dissertation.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems
Authors: Svenstrup, D. T. (Intern)
Number of pages: 118
Publication date: 2018
Food groups for allergen risk assessment: Combining food consumption data from different countries in Europe
To prevent allergic reactions, food producers have to be able to make a knowledge based decision on whether to label their products with precautionary labelling. As many manufactured food products are sold in different countries across Europe, the allergen risk assessment should be estimated at the European levels. As currently, there are no pan-European food data suitable for food allergy risk assessment. The aim of this paper is to investigate if consumption data, at a meal level, from National Food Consumption Surveys, can be combined to form a common Food Consumption database. In this first attempt we developed a procedure to investigate, if national food consumption data can be combined and grouped using data from Netherlands, France and Denmark. The homogeneity of consumption patterns and the relevance of difference in risk of allergic reaction were compared, using a fixed framework of allergen concentration levels and threshold distribution. Thus, the relevance of using common consumption data across countries was verified. The food groups formed were subsequently evaluated and adjusted based on practical considerations. It resulted in designing 61 food groups that can be used for allergen risk assessment. The summary statistics and descriptive names for each food group are included.
Formalization of Bachmair and Ganzinger's Ordered Resolution Prover

This Isabelle/HOL formalization covers Sections 2 to 4 of Bachmair and Ganzinger’s “Resolution Theorem Proving” chapter in the Handbook of Automated Reasoning. This includes soundness and completeness of unordered and ordered variants of ground resolution with and without literal selection, the standard redundancy criterion, a general framework for refutational theorem proving, and soundness and completeness of an abstract first-order prover.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Vrije Universiteit Amsterdam, ETH Zurich, Max-Planck-Institut fur Informatik
Authors: Schlichtkrull, A. (Intern), Blanchette, J. C. (Ekstern), Traytel, D. (Ekstern), Waldmann, U. (Ekstern)
Number of pages: 117
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Archive of Formal Proofs
ISSN (Print): 2150-914X
Original language: English
Electronic versions:
document_2_.pdf

Bibliographical note
Frame properties of systems arising via iterated actions of operators

Motivated by recent progress in dynamical sampling we prove that every frame which is norm-bounded below can be represented as a finite union of sequences $\{T_j\}$ and elements $\phi_j$ in the underlying Hilbert space. The result is optimal, in the sense that it turns out to be problematic to replace the collection of generators $\phi_1, \ldots, \phi_J$ by a singleton: indeed, for linearly independent frames we prove that we can represent the frame in terms of just one system $T$ but unfortunately this representation often forces the operator $T$ to be unbounded. Several examples illustrate the connection of the results to typical frames like Gabor frames and wavelet frames, as well as generic constructions in arbitrary separable Hilbert spaces.

General information

State: Accepted/In press
Organisations: Department of Applied Mathematics and Computer Science, Mathematics
Authors: Christensen, O. (Intern), Hasannasabjaldehbakhani, M. (Intern)
Number of pages: 15
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information

Journal: Applied and Computational Harmonic Analysis
ISSN (Print): 1063-5203
Ratings:
  BFI (2018): BFI-level 2
  Web of Science (2018): Indexed yes
  BFI (2017): BFI-level 2
  Scopus rating (2017): SNIP 2.036 SJR 1.227 CiteScore 2.89
  Web of Science (2017): Indexed Yes
  BFI (2016): BFI-level 2
  Scopus rating (2016): CiteScore 2.73 SJR 1.426 SNIP 1.777
  BFI (2015): BFI-level 2
  Scopus rating (2015): SJR 1.403 SNIP 1.797 CiteScore 2.46
  Web of Science (2015): Indexed yes
  BFI (2014): BFI-level 2
  Scopus rating (2014): SJR 1.751 SNIP 2.829 CiteScore 3.27
  Web of Science (2014): Indexed yes
  BFI (2013): BFI-level 2
  Scopus rating (2013): SJR 1.626 SNIP 2.849 CiteScore 3.3
  ISI indexed (2013): ISI indexed yes
  Web of Science (2013): Indexed yes
  BFI (2012): BFI-level 2
  Scopus rating (2012): SJR 2.586 SNIP 3.559 CiteScore 4.63
  ISI indexed (2012): ISI indexed yes
  Web of Science (2012): Indexed yes
  BFI (2011): BFI-level 2
  Scopus rating (2011): SJR 2.976 SNIP 3.337 CiteScore 4.4
  ISI indexed (2011): ISI indexed yes
  BFI (2010): BFI-level 2
  Scopus rating (2010): SJR 2.915 SNIP 2.71
  Web of Science (2010): Indexed yes
  BFI (2009): BFI-level 2
  Scopus rating (2009): SJR 1.974 SNIP 2.502
  BFI (2008): BFI-level 2
  Scopus rating (2008): SJR 2.224 SNIP 2.173
  Scopus rating (2007): SJR 1.512 SNIP 1.903
Frames, operator representations, and open problems

A frame in a Hilbert space $H$ is a countable collection of elements in $H$ that allows each $f \in H$ to be expanded as an (infinite) linear combination of the frame elements. Frames generalize the wellknown orthonormal bases, but provide much more flexibility and can often be constructed with properties that are not possible for orthonormal bases. We will present the basic facts in frame theory with focus on their operator theoretical characterizations and discuss open problems concerning representations of frames in terms of iterations of a fixed operator. These problems come up in the context of dynamical sampling, a topic that has recently attracted considerably interest within harmonic analysis. The goal of the paper is twofold, namely, that experts in operator theory will explore the potential of frames, and that frame theory will benefit from insight provided by the operator theory community.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics
Authors: Christensen, O. (Intern), Hasannasab, M. (Intern)
Pages: 155-165
Publication date: 2018

From Monolithic to Microservices An Experience Report from the Banking Domain
Microservices have seen their popularity blossoming with an explosion of concrete applications in real-life software. Several companies are currently involved in a major refactoring of their back-end systems in order to improve scalability. This article presents an experience report of a real-world case study, from the banking domain, in order to demonstrate how scalability is positively affected by reimplementing a monolithic architecture into microservices. The case study is based on the FX Core system for converting from one currency to another. FX Core is a mission-critical system of Danske Bank, the largest bank in Denmark and one of the leading financial institutions in Northern Europe.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, Vienna University of Technology, Danske Bank Group, IRST Fondazione Bruno Kessler, Innopolis University
Authors: Bucchiarone, A. (Ekstern), Dragoni, N. (Intern), Dustdar, S. (Ekstern), Larsen, S. T. (Ekstern), Mazzara, M. (Ekstern)
Frontal Brain Asymmetry and Willingness to Pay

Consumers frequently make decisions about how much they are willing to pay (WTP) for specific products and services, but little is known about the neural mechanisms underlying such calculations. In this study, we were interested in testing whether specific brain activation—the asymmetry in engagement of the prefrontal cortex—would be related to consumer
choice. Subjects saw products and subsequently decided how much they were willing to pay for each product, while undergoing neuroimaging using electroencephalography. Our results demonstrate that prefrontal asymmetry in the gamma frequency band, and a trend in the beta frequency band that was recorded during product viewing was significantly related to subsequent WTP responses. Frontal asymmetry in the alpha band was not related to WTP decisions. Besides suggesting separate neuropsychological mechanisms of consumer choice, we find that one specific measure—the prefrontal gamma asymmetry—was most strongly related to WTP responses, and was most coupled to the actual decision phase. These findings are discussed in light of the psychology of WTP calculations, and in relation to the recent emergence of consumer neuroscience and neuromarketing.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, Singularity University, Neurons Inc., Copenhagen Business School
Authors: Ramsøy, T. Z. (Ekstern), Skov, M. (Ekstern), Christensen, M. K. (Ekstern), Stahlhut, C. (Intern)
Number of pages: 12
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Frontiers in Neuroscience
Volume: 12
Article number: Article 138
ISSN (Print): 1662-4548
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.146 SJR 1.769 CiteScore 3.94
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.85 SJR 1.941 SNIP 1.092
Scopus rating (2015): SJR 2.041 SNIP 1.088 CiteScore 3.72
Scopus rating (2014): SJR 2.079 SNIP 1.089 CiteScore 3.84
Scopus rating (2013): SJR 2.096 SNIP 1.101 CiteScore 3.61
Scopus rating (2012): SJR 1.741 SNIP 1.001 CiteScore 3.25
Scopus rating (2011): SJR 1.716 SNIP 1.233
Scopus rating (2010): SJR 1.347 SNIP 0.693
Original language: English
Willingness to pay, Electroencephalography, Neuroimaging, Consumer neuroscience, Neuromarketing, Neuroeconomics
Electronic versions:
fnins_12_00138.pdf
DOIs:
10.3389/fnins.2018.00138
Source: FindIt
Source-ID: 2397251059
Publication: Research - peer-review › Journal article – Annual report year: 2018

Functional Connectivity using a Wishart Mixture Model
General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems
Authors: Nielsen, S. F. V. (Intern), Madsen, K. H. (Intern), Schmidt, M. N. (Intern), Mørup, M. (Intern)
Publication date: 2018

Host publication information
Title of host publication: Proceedings of International Workshop on Pattern Recognition in Neuroimaging
Main Research Area: Technical/natural sciences
Conference: 2017 International Workshop on Pattern Recognition in Neuroimaging, Toronto, Canada, 21/06/2017 - 21/06/2017
Source: FindIt
Source-ID: 2395895984
Functional neuroimaging of recovery from motor conversion disorder: A case report

A patient with motor conversion disorder presented with a functional paresis of the left hand. After exclusion of structural brain damage, she was repeatedly examined with whole-brain functional magnetic resonance imaging, while she performed visually paced finger-tapping tasks. The dorsal premotor cortex showed a bilateral deactivation in the acute-subacute phase. Recovery from unilateral hand paresis was associated with a gradual increase in task-based activation of the dorsal premotor cortex bilaterally. The right medial prefrontal cortex displayed the opposite pattern, showing initial task-based activation that gradually diminished with recovery. The inverse dynamics of premotor and medial prefrontal activity over time were found during unimanual finger-tapping with the affected and non-affected hand as well as during bimanual finger-tapping. These observations suggest that reduced premotor and increased medial prefrontal activity reflect an effector-independent cortical dysfunction in conversion paresis which gradually disappears in parallel with clinical remission of paresis. The results link the medial prefrontal and dorsal premotor areas to the generation of intentional actions. We hypothesise that an excessive ‘veto’ signal generated in medial prefrontal cortex along with decreased premotor activity might constitute the functional substrate of conversion disorder. This notion warrants further examination in a larger group of affected patients.

General information
State: Accepted/In press
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, University of Copenhagen
Authors: Dogonowski, A. M. (Ekstern), Andersen, K. W. (Ekstern), Sellebjerg, F. (Ekstern), Schreiber, K. (Ekstern), Madsen, K. H. (Intern), Siebner, H. R. (Ekstern)
Pages: 1-6
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Neuroimage
ISSN (Print): 1053-8119
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 6.15 SJR 3.679 SNIP 1.806
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 6.31 SJR 3.967 SNIP 1.759
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 4.583 SNIP 1.852 CiteScore 6.71
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 4.323 SNIP 2.03 CiteScore 6.9
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 4.489 SNIP 2.028 CiteScore 7.06
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 4.026 SNIP 1.972 CiteScore 6.86
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.728 SNIP 1.818 CiteScore 6.31
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
**Generalized Hamming weights of affine Cartesian codes**

Let $F$ be any field and $A_1,\ldots,A_m$ be finite subsets of $F$. We determine the maximum number of common zeroes a linearly independent family of $r$ polynomials of degree at most $d$ of $F[x_1,\ldots,x_m]$ can have in $A_1\times\cdots\times A_m$. In the case when $F$ is a finite field, our results resolve the problem of determining the generalized Hamming weights of affine Cartesian codes. This is a generalization of the work of Heijnen and Pellikaan where these were determined for the generalized Reed–Muller codes. Finally, we determine the duals of affine Cartesian codes and compute their generalized Hamming weights as well.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics
Authors: Beelen, P. (Intern), Datta, M. (Intern)
Pages: 130-145
Publication date: 2018
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Finite Fields and Their Applications
Volume: 51
ISSN (Print): 1071-5797
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
Geometric singular perturbation analysis of systems with friction

This thesis is concerned with the application of geometric singular perturbation theory to mechanical systems with friction. The mathematical background on geometric singular perturbation theory, on the blow-up method, on non-smooth dynamical systems and on regularization is presented. Thereafter, two mechanical problems with two different formulations of the friction force are introduced and analysed. The first mechanical problem is a one-dimensional spring-
block model describing earthquake faulting. The dynamics of earthquakes is naturally a multiple timescale problem: the timescale of earthquake ruptures is very short, when compared to the time interval between two consecutive ruptures. We identify a small parameter $\varepsilon$ that describes the separation between the timescales, so that $\varepsilon = 0$ idealises the complete timescale separation. Earthquake faulting problems also have multiple spatial scales. The action of friction is generally explained as the loss and restoration of linkages between the surface asperities at the molecular scale. However, the consequences of friction are noticeable at much larger scales, like hundreds of kilometers. By using geometric singular perturbation theory and the blow-up method, we provide a detailed description of the periodicity of the earthquake episodes. In particular, we show that attracting limit cycles arise from a degenerate Hopf bifurcation, whose degeneracy is due to an underlying Hamiltonian structure that leads to large amplitude oscillations. We use a Poincaré compactification to study the system near infinity. At infinity, the critical manifold loses hyperbolicity with an exponential rate. We use an adaptation of the blow-up method to recover the hyperbolicity. This enables the identification of a new attracting manifold, that organises the dynamics at infinity for $\varepsilon = 0$. This in turn leads to the formulation of a conjecture on the behaviour of the limit cycles as the timescale separation increases for $0 < \varepsilon < 1$. We illustrate our findings with numerics, and outline the proof of the conjecture. We also discuss how our results can be used to study a similar class of problems. The second mechanical problem is a friction oscillator subject to stiction. The vector field of this discontinuous model does not follow the Filippov convention, and the concept of Filippov solutions cannot be used. Furthermore, some Carathéodory solutions are unphysical. Therefore, we introduce the concept of stiction solutions: these are the Carathéodory solutions that are physically relevant, i.e. the ones that follow the stiction law. However, we find that some of the stiction solutions are forward non-unique in subregions of the slip onset. We call these solutions singular, in contrast to the regular stiction solutions that are forward unique. In order to further the understanding of the non-unique dynamics, we introduce a regularization of the model. This gives a singularly perturbed problem that captures the main features of the original discontinuous problem. We identify a repelling slow manifold that separates the forward slipping to forward sticking solutions, leading to a high sensitivity to the initial conditions. On this slow manifold we find canard trajectories, that have the physical interpretation of delaying the slip onset. We show numerically that the regularized problem has a family of periodic orbits interacting with the canards. We observe that this family is unstable of saddle type and that it connects, in the rigid body limit, the two regular, slip-stick branches of the discontinuous problem, that were otherwise disconnected.
Harvest time prediction for batch processes

Batch processes usually exhibit variation in the time at which individual batches are stopped (referred to as the harvest time). Harvest time is based on the occurrence of some criterion and there may be great uncertainty as to when this criterion will be satisfied. This uncertainty increases the difficulty of scheduling downstream operations and results in fewer completed batches per day. A real case study is presented of a bacteria fermentation process. We consider the problem of predicting the harvest time of a batch in advance to reduce variation and improving batch quality. Lasso regression is used to obtain an interpretable model for predicting the harvest time at an early stage in the batch. A novel method for updating the harvest time predictions as a batch progresses is presented, based on information obtained from online alignment using dynamic time warping.
In this study, a new hybrid PET/MRI method for quantitative regional cerebral blood flow (rCBF) measurements in healthy newborn infants was assessed and the low values of rCBF in white matter previously obtained by arterial spin labeling (ASL) were tested. Four healthy full-term newborn subjects were scanned in a PET/MRI scanner during natural sleep after median intravenous injection of 14 MBq $^{15}$O-water. Regional CBF was quantified using a one-tissue-compartment model employing an image-derived input function (IDIF) from the left ventricle. PET rCBF showed the highest values in the thalami, mesencephalon and brain stem and the lowest in cortex and unmyelinated white matter. The average global CBF was 17.8 ml/100 g/min. The average frontal and occipital unmyelinated white matter CBF was 10.3 ml/100 g/min and average thalamic CBF 31.3 ml/100 g/min. The average white matter/thalamic ratio CBF was 0.36, significantly higher than previous ASL data. The rCBF ASL measurements were all unsuccessful primarily owing to subject movement. In this study, we demonstrated for the first time, a minimally invasive PET/MRI method using low activity $^{15}$O-water PET for quantitative rCBF assessment in unsedated healthy newborn infants and found a white/grey matter CBF ratio similar to that of the adult human brain.
Impossible meet-in-the-middle fault analysis on the LED lightweight cipher in VANETs

With the expansion of wireless technology, vehicular ad-hoc networks (VANETs) are emerging as a promising approach for realizing smart cities and addressing many serious traffic problems, such as road safety, convenience, and efficiency. To avoid any possible rancorous attacks, employing lightweight ciphers is most effective for implementing encryption/decryption, message authentication, and digital signatures for the security of the VANETs. Light encryption device (LED) is a lightweight block cipher with two basic keysize variants: LED-64 and LED-128. Since its inception, many fault analysis techniques have focused on provoking faults in the last four rounds to derive the 64-bit and 128-bit secret...
keys. It is vital to investigate whether injecting faults into a prior round enables breakage of the LED. This study presents a novel impossible meet-in-the-middle fault analysis on a prior round. A detailed analysis of the expected number of faults is used to uniquely determine the secret key. It is based on the propagation of truncated differentials and is surprisingly reminiscent of the computation of the complexity of a rectangle attack. It shows that the impossible meet-in-the-middle fault analysis could successfully break the LED by fault injections.

**General information**

State: Published

Organisations: Department of Applied Mathematics and Computer Science, Cyber Security, Donghua University, Katholieke Universiteit Leuven, Chinese Academy of Sciences, National University of Defense Technology, University of Shanghai for Science and Technology

Authors: Li, W. (Ekstern), Rijmen, V. (Ekstern), Tao, Z. (Ekstern), Wang, Q. (Intern), Chen, H. (Ekstern), Liu, Y. (Ekstern), Li, C. (Ekstern), Liu, Y. (Ekstern)

Number of pages: 13

Publication date: 2018

Main Research Area: Technical/natural sciences

**Publication information**

Journal: Science China Information Sciences

Volume: 61

Issue number: 3

Article number: 032110

ISSN (Print): 1869-1919

Ratings:

Web of Science (2018): Indexed yes

Scopus rating (2017): SNIP 1.027 SJR 0.462 CiteScore 1.89

Scopus rating (2016): CiteScore 1.56 SJR 0.431 SNIP 0.945

Scopus rating (2015): CiteScore 1.09 SNIP 0.79 SJR 0.357

Scopus rating (2014): CiteScore 1.27 SNIP 1.228 SJR 0.381

Scopus rating (2013): CiteScore 1.14 SNIP 1.202 SJR 0.34

Scopus rating (2012): CiteScore 1.08 SNIP 1.063 SJR 0.321

Scopus rating (2011): CiteScore 0.56 SNIP 1.082 SJR 0.286

Scopus rating (2010): SNIP 1.182 SJR 0.371

Scopus rating (2009): SNIP 0.811 SJR 0.274

Scopus rating (2008): SNIP 0.995 SJR 0.335

Scopus rating (2007): SNIP 0.747 SJR 0.266

Scopus rating (2006): SNIP 0.633 SJR 0.262

Scopus rating (2005): SNIP 0.944 SJR 0.174

Scopus rating (2004): SNIP 1.04 SJR 0.129

Scopus rating (2003): SNIP 0 SJR 0.101

Original language: English

VANETs, LED, Lightweight cipher, Impossible meet-in-the-middle, Fault analysis

DOIs:

10.1007/s11432-017-9209-0

Source: FindIt

Source-ID: 2395454186

Publication: Research - peer-review → Journal article – Annual report year: 2018

**Improved meet-in-the-middle attacks on reduced-round Piccolo**

Piccolo is a lightweight block cipher that adopts a generalized Feistel network structure with 4 branches, each of which is 16 bit long. The key length is 80 or 128 bit, denoted by Piccolo-80 and Piccolo-128, respectively. In this paper, we mounted meet-in-the-middle attacks on 14-round Piccolo-80 without preand post-whitening keys and 18-round Piccolo-128 with post-whitening keys by exploiting the properties of the key schedule and Maximum Distance Separable (MDS) matrix. For Piccolo-80, we first constructed a 5-round distinguisher. Then 4 rounds and 5 rounds were appended at the beginning and at the end, respectively. Based on this structure, we mounted an attack on 14-round Piccolo-80 from the 5th round to the 18th round. The data, time, and memory complexities were 252 chosen plaintexts, 267.44 encryptions, and 264.91 blocks, respectively. For Piccolo-128, we built a 7-round distinguisher to attack 18-round Piccolo-128 from the 4th round to the 21st round. The data, time, and memory complexities were 252 chosen plaintexts, 2126.63 encryptions, and 2125.29 blocks, respectively. If not considering results on biclique cryptanalysis, these are currently the best public results on this reduced version of the Piccolo block cipher.
Incomplete understanding of biogas chemical hazards – Serious gas poisoning accident while unloading food waste at biogas plant

At a biogas plant, a truck driver was overcome by toxic fumes while unloading food waste slurry collected at sites that operate a shredder and tank system. Trucks unload their cargo into a feedstock pit. While unloading, hydrogen sulfide, carbon dioxide and possibly other toxic gases were released. Ventilation systems were overwhelmed. The driver narrowly escaped death. Several would-be rescuers collapsed. Under marginally different conditions, this accident could have led to five fatalities. The case offers a rich account of the actions of fellow workers who with stubborn determination sought to extract the unconscious driver. Even after having collapsed themselves, been extracted and recovered, they re-entered the building - amazingly still without realizing the gas danger. The article argues that long retention time in the logistics chain may alter the hazard profile of food waste slurry. This emerging risk appears overlooked and under-studied. The case exposes insufficient attention to safety in the rapidly expanding biogas sector. The biogas plant was unprepared. The investigation was quick, superficial and woefully inadequate. Root causes were not identified. Broad information sharing is limited or non-existent.

General information
State: Accepted/In press
Organisations: Department of Applied Mathematics and Computer Science , Dynamical Systems, Statistics and Data Analysis
Authors: Hedlund, F. H. (Intern), Madsen, M. (Ekstern)
Number of pages: 26
Publication date: 2018
Main Research Area: Technical/natural sciences
In-place sparse suffix sorting

Suffix arrays encode the lexicographical order of all suffixes of a text and are often combined with the Longest Common Prefix array (LCP) to simulate navigational queries on the suffix tree in reduced space. In space-critical applications such as sparse and compressed text indexing, only information regarding the lexicographical order of a size-b subset of all n text suffixes is often needed. Such information can be stored space-efficiently (in b words) in the sparse suffix array (SSA). The SSA and its relative sparse LCP array (SLCP) can be used as a space-efficient substitute of the sparse suffix tree. Very recently, Gawrychowski and Kociumaka [11] showed that the sparse suffix tree (and therefore SSA and SLCP) can be built in asymptotically optimal O(b) space with a Monte Carlo algorithm running in O(n) time. The main reason for using the SSA and SLCP arrays in place of the sparse suffix tree is, however, their reduced space of b words each. This leads naturally to the quest for in-place algorithms building these arrays. Franceschini and Muthukrishnan [8] showed that the full suffix array can be built in-place and in optimal running time. On the other hand, finding sub-quadratic in-place algorithms for building the SSA and SLCP for general subsets of suffixes has been an elusive task for decades. In this paper, we give the first solution to this problem. We provide the first in-place algorithm building the full LCP array in O(n \log n) expected time and the first Monte Carlo in-place algorithms building the SSA and SLCP in O(n + b \log 2 n) expected time. We moreover describe the first in-place solution for the suffix selection problem: to compute the i-th smallest text suffix. In order to achieve these results, we show that we can quickly overwrite the text with a reversible and implicit data structure supporting Longest Common Extension queries in polylogarithmic time and text extraction in optimal time: this structure is strictly more powerful than a plain text representation and is of independent interest.

Integration of different CHP steam extraction modes in the stochastic unit commitment problem

This paper provides a formulation that integrates different operational modes for CHP units in the form of steam extraction configurations into the scenario-based two-stage stochastic and robust unit commitment problems under renewable power production uncertainty. The proposed formulation provides an additional flexibility to adapt to the imbalances in the power system through the interplay and real-time scheduling of the different operational modes for the CHP units. In addition, an improved solution approach based on heuristics, clustering and parallelization to speed up the model solution time is developed. Finally, the quality of the solutions is tested using a realistic test case based on the Danish transmission grid.
Intensive versus conventional blood pressure monitoring in a general practice population. The Blood Pressure Reduction in Danish General Practice trial: a randomized controlled parallel group trial

To compare the effect of a conventional to an intensive blood pressure monitoring regimen on blood pressure in hypertensive patients in the general practice setting. Randomized controlled parallel group trial with 12-month follow-up. One hundred and ten general practices in all regions of Denmark. One thousand forty-eight patients with essential hypertension. Conventional blood pressure monitoring ('usual group') continued usual ad hoc blood pressure monitoring by office blood pressure measurements, while intensive blood pressure monitoring ('intensive group') supplemented this with frequent home blood pressure monitoring and 24-hour ambulatory blood pressure monitoring. Mean day- and night-time systolic and diastolic 24-hour ambulatory blood pressure. Change in systolic and diastolic office blood pressure and change in cardiovascular risk profile. Of the patients, 515 (49%) were allocated to the usual group, and 533 (51%) to the intensive group. The reductions in day- and night-time 24-hour ambulatory blood pressure were similar (usual group: 4.6 ± 13.5/2.8 ± 82 mmHg; intensive group: 5.6 ± 13.0/3.5 ± 8.2 mmHg; P = 0.27/P = 0.20). Cardiovascular risk scores were reduced in both groups at follow-up, but more so in the intensive than in the usual group (P = 0.02). An intensive blood pressure monitoring strategy led to a similar blood pressure reduction to conventional monitoring. However, the intensive strategy appeared to improve patients’ cardiovascular risk profile through other effects than a reduction of blood pressure. Clinical Trials NCT00244660.
Internal Fiber Structure of a High-Performing, Additively Manufactured Injection Molding Insert

A standard mold is equipped with additively manufactured inserts in a rectangular shape produced with vat photo polymerization. While the lifetime compared to conventional materials such as brass, steel, and aluminum is reduced, the prototyping and design phase can be shortened significantly by using flexible and cost-effective additive manufacturing technologies. Higher production volumes still exceed the capability of additively manufactured inserts, which are overruled by the stronger performance of less-flexible but mechanically advanced materials. In this contribution, the internal structure of a high-performing, fiber-reinforced injection molding insert has been analyzed. The insert reached a statistically proven and reproducible lifetime of 4,500 shots, which significantly outperforms any other previously published additively manufactured inserts. Computer tomography, tensile tests and life cycle analysis have been performed in order to provide an understanding of the internal structure of the fiber-reinforced, additively manufactured injection molding inserts.

Inverse scale space decomposition: Paper

We investigate the inverse scale space flow as a decomposition method for decomposing data into generalised singular vectors. We show that the inverse scale space flow, based on convex and even and positively one-homogeneous regularisation functionals, can decompose data represented by the application of a forward operator to a linear combination of generalised singular vectors into its individual singular vectors. We verify that for this decomposition to hold true, two additional conditions on the singular vectors are sufficient: orthogonality in the data space and inclusion of partial sums of the subgradients of the singular vectors in the subdifferential of the regularisation functional at zero. We also address the converse question of when the inverse scale space flow returns a generalised singular vector given that the initial data is arbitrary (and therefore not necessarily in the range of the forward operator). We prove that the inverse scale space flow is guaranteed to return a singular vector if the data satisfies a novel dual singular vector condition. We conclude the paper with numerical results that validate the theoretical results and that demonstrate the importance of the additional conditions required to guarantee the decomposition result.
Investigating the influence of special on-off attacks on challenge-based collaborative intrusion detection networks

Intrusions are becoming more complicated with the recent development of adversarial techniques. To boost the detection accuracy of a separate intrusion detector, the collaborative intrusion detection network (CIDN) has thus been developed by allowing intrusion detection system (IDS) nodes to exchange data with each other. Insider attacks are a great threat for such types of collaborative networks, where an attacker has the authorized access within the network. In literature, a challenge-based trust mechanism is effective at identifying malicious nodes by sending challenges. However, such mechanisms are heavily dependent on two assumptions, which would cause CIDNs to be vulnerable to advanced insider attacks in practice. In this work, we investigate the influence of advanced on-off attacks on challenge-based CIDNs, which can respond truthfully to one IDS node but behave maliciously to another IDS node. To evaluate the attack performance, we have conducted two experiments under a simulated and a real CIDN environment. The obtained results demonstrate...
that our designed attack is able to compromise the robustness of challenge-based CIDNs in practice; that is, some malicious nodes can behave untruthfully without a timely detection.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cyber Security, University of Hong Kong
Authors: Li, W. (Ekstern), Meng, W. (Intern), Kwok, L. F. (Ekstern)
Number of pages: 16
Publication date: 2018
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Future Internet
Volume: 10
Issue number: 1
ISSN (Print): 1999-5903
Ratings:
Scopus rating (2017): SNIP 1.038 SJR 0.219 CiteScore 1.25
Scopus rating (2016): CiteScore 0.32 SJR 0.287 SNIP 1.801
Scopus rating (2015): SJR 0.604 SNIP 2.369
Scopus rating (2014): SJR 0.345 SNIP 1.556
Scopus rating (2013): SNIP 1.874 SJR 0.318
BFI (2012): BFI-level 1
Original language: English
Collaborative network, On–off attack, Challenge-based Mechanism, Trust computation and management, Intrusion detectors
Electronic versions:
futureinternet_10_00006.pdf
DOIs:
10.3390/fi10010006
Source: FindIt
Source-ID: 2395290739
Publication: Research - peer-review » Journal article – Annual report year: 2018

**Investigation of a Monturaqui Impactite by Means of Bi-Modal X-ray and Neutron Tomography**

X-ray and neutron tomography are applied as a bi-modal approach for the 3D characterisation of a Monturaqui impactite formed by shock metamorphism during the impact of an iron meteorite with the target rocks in the Monturaqui crater (Chile). The particular impactite exhibits structural heterogeneities on many length scales: its composition is dominated by silicate-based glassy and crystalline materials with voids and Fe/Ni-metal and oxihydroxides particles generally smaller than 1 mm in diameter. The non-destructive investigation allowed us to apply a novel bi-modal imaging approach that provides a more detailed and quantitative understanding of the structural and chemical composition compared to standard single mode imaging methods, as X-ray and neutron interaction with matter results in different attenuation coefficients with a non-linear relation. The X-ray and neutron data sets have been registered, and used for material segmentation, porosity and metallic content characterization. The bimodal data enabled the segmentation of a large number of different materials, their morphology as well as distribution in the specimen including the quantification of volume fractions. The 3D data revealed an evaporite type of material in the impactite not noticed in previous studies. The present study is exemplary in demonstrating the potential for non-destructive characterisation of key features of complex multi-phase objects such as impactites.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Image Analysis & Computer Graphics, Department of Physics, Neutrons and X-rays for Materials Physics, University of Copenhagen, Laboratoire Léon Brillouin, European Spallation Source ESS AB, Technical University of Denmark
Number of pages: 24
Publication date: 2018
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Journal of Electronic Imaging
Volume: 4
Issue number: 5
Investigation on the Productivity Behaviour in Deformable Heterogeneous Fractured Reservoirs

Several hydrocarbon production wells in the North Sea reservoirs suffer from productivity reduction during primary production. Since the affected reservoirs are highly fractured, closure of natural/induced fractures around wells, due to effective stress increase is expected to be one of the main reasons for this reduction. Discrete fracture and matrix (DFM)
modelling is selected in this investigation because of its ability to represent fracture behaviours more realistically. Moreover, it has become a preferential method for modelling flow in fractured formations for the past decade (Bisdom et al., 2017; Salimzadeh et al., 2018).

**General information**
State: Published
Organisations: Centre for oil and gas – DTU, Department of Applied Mathematics and Computer Science
Authors: Kadeethum, T. (Intern), Salimzadeh, S. (Intern), Nick, H. (Intern)
Number of pages: 2
Publication date: 2018
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
Source-ID: 147877341
Publication: Research - peer-review › Paper – Annual report year: 2018

**Iterative Reconstruction Methods for Inverse Problems in Tomography with Hybrid Data**
This thesis provides a theoretical and numerical investigation of two important problems in the field of tomography based on hybrid data from coupled physics phenomena. The first problem is related to Acousto-Electrical Tomography, while the second problem deals with Quantitative Elastography. The goal of these modalities is to quantify physical parameters of materials or tissues inside an object from given interior data, which is measured everywhere inside the object. The advantage of these modalities is that large variations in physical parameters can be resolved and therefore, they have important applications in both medical and industrial imaging. Mathematically, we face a nonlinear Inverse Problem of parameter identification type in both modalities. The applied physical phenomena are typically chosen in such a way that they interact with and complement each other, and most often they are described by models based on coupled partial differential equations. In contrast to common methods, e.g., Electrical Impedance Tomography, where the reconstruction is solely based on boundary measurements, methods based on coupled phenomena lead to internal measurements. Availability of this so-called hybrid data is precisely the reason why reconstructions with a high contrast and a high resolution can be expected. The main contributions of this thesis consist in formulating the underlying mathematical problems with interior data as nonlinear operator equations, theoretically analysing them within the framework of nonlinear Inverse Problems and designing computational methods for identifying the unknown parameters. Furthermore, the theoretical investigations are supported by a number of numerical examples from both simulated and experimental data. Iterative regularization methods based on Landweber iteration and the Levenberg-Marquardt method are employed for solving the problems.
The first problem considered in this thesis is a problem of conductivity estimation from interior measurements of the power density, known as Acousto-Electrical Tomography. A special case of limited angle tomography is studied for this problem, where only a part of the boundary is accessible to electrostatic measurements. Numerical examples support the intuition that stably reconstructing the conductivity becomes difficult far away from the accessible part of the measurement boundary. This is also supported by a quantitative numerical study of the ill-posedness of the problem in dependence on the completeness of the data. The second problem deals with Quantitative Elastography, where Lamé parameters are estimated from full internal static displacement field measurements obtained using both Photo-Acoustic Tomography and Optical Coherence Tomography. The developed computational method is successfully applied to both numerically simulated and experimental data.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing
Authors: Sherina, E. (Intern)
Number of pages: 135
Publication date: 2018

**Publication information**
Publisher: DTU Compute
Original language: English
Series: DTU Compute PHD-2017
Number: 468
ISSN: 0909-3192
Main Research Area: Technical/natural sciences
Electronic versions: phd468_Sherina_E.pdf

**Relations**
Projects:
Iterative Reconstruction Methods for Inverse Problems in Tomography with Hybrid Data
JFCGuard: Detecting juice filming charging attack via processor usage analysis on smartphones

Smartphones have become necessities in people's lives, so that many more public charging stations are under deployment worldwide to meet the increasing demand of phone charging (i.e., in airports, subways, shops, etc). However, this situation may expose a hole for cyber-criminals to launch various attacks especially charging attacks and threaten user's privacy. As an example, juice filming charging (JFC) attack is able to steal users' sensitive and private information from both Android OS and iOS devices, through automatically recording phone-screen and monitoring users' inputs during the whole charging period. More importantly, this attack does not need any permission or installing any pieces of apps on user’s side. The rationale is that users' information can be leaked through a standard micro USB connector that employs the Mobile High-Definition Link (MHL) standard. Motivated by the potential damage of JFC attack, in this work, we investigate the impact of JFC attack on processor usage including both CPU- and GPU-usage. It is found that JFC attack would cause a noticeable usage increase when connecting the phone to the JFC charger. Then, we design a security mechanism, called JFCGuard, to detect JFC attack based on processor usage analysis for smartphone users. In the evaluation, we perform a user study with over 250 participants and the results demonstrate that JFCGuard can identify JFC attack in an effective way. Our work aims to complement existing research results and stimulate more research in this area.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cyber Security, Guangzhou University, Swinburne University of Technology
Authors: Meng, W. (Intern), Jiang, L. (Ekstern), Wang, Y. (Ekstern), Li, J. (Ekstern), Zhang, J. (Ekstern), Xiang, Y. (Ekstern)
Number of pages: 13
Pages: 252-264
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Computers & Security
Volume: 76
ISSN (Print): 0167-4048
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.86 SJR 0.684 SNIP 2.158
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.59 SJR 0.815 SNIP 2.158
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.819 SNIP 2.346 CiteScore 3.03
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.641 SNIP 2.133 CiteScore 2.39
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.697 SNIP 2.601 CiteScore 2.48
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.68 SNIP 2.475 CiteScore 2.56
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.518 SNIP 2.146 CiteScore 2.44
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.464 SNIP 1.425
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.514 SNIP 1.772
Web of Science (2009): Indexed yes
Joining Jolie to Docker Orchestration of Microservices on a Containers-as-a-Service Layer: Orchestration of Microservices on a Containers-as-a-Service Layer

Cloud computing is steadily growing and, as IaaS vendors have started to offer pay-as-you-go billing policies, it is fundamental to achieve as much elasticity as possible, avoiding over-provisioning that would imply higher costs. In this paper, we briefly analyse the orchestration characteristics of PaaSSOA, a proposed architecture already implemented for Jolie microservices, and Kubernetes, one of the various orchestration plugins for Docker; then, we outline similarities and differences of the two approaches, with respect to their own domain of application. Furthermore, we investigate some ideas to achieve a federation of the two technologies, proposing an architectural composition of Jolie microservices on Docker Container-as-a-Service layer.

Joint image reconstruction method with correlative multi-channel prior for x-ray spectral computed tomography: Paper

Rapid developments in photon-counting and energy-discriminating detectors have the potential to provide an additional spectral dimension to conventional x-ray grayscale imaging. Reconstructed spectroscopic tomographic data can be used to distinguish individual materials by characteristic absorption peaks. The acquired energy-binned data, however, suffer from low signal-to-noise ratio, acquisition artifacts, and frequently angular undersampled conditions. New regularized
iterative reconstruction methods have the potential to produce higher quality images and since energy channels are mutually correlated it can be advantageous to exploit this additional knowledge. In this paper, we propose a novel method which jointly reconstructs all energy channels while imposing a strong structural correlation. The core of the proposed algorithm is to employ a variational framework of parallel level sets to encourage joint smoothing directions. In particular, the method selects reference channels from which to propagate structure in an adaptive and stochastic way while preferring channels with a high data signal-to-noise ratio. The method is compared with current state-of-the-art multi-channel reconstruction techniques including channel-wise total variation and correlative total nuclear variation regularization. Realistic simulation experiments demonstrate the performance improvements achievable by using correlative regularization methods.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, University of Manchester
Authors: Kazantsev, D. (Ekstern), Jørgensen, J. S. (Ekstern), Andersen, M. S. (Intern), Lionheart, W. R. B. (Ekstern), Lee, P. D. (Ekstern), Withers, P. J. (Ekstern)
Publication date: 2018
Main Research Area: Technical/natural sciences
Julia Sets of Orthogonal Polynomials

For a probability measure with compact and non-polar support in the complex plane we relate dynamical properties of the associated sequence of orthogonal polynomials $P_n$ to properties of the support. More precisely we relate the Julia set of $P_n$ to the outer boundary of the support, the filled Julia set to the polynomial convex hull $K$ of the support, and the Green's function associated with $P_n$ to the Green's function for the complement of $K$.

General information
State: Accepted/In press
Organisations: Department of Applied Mathematics and Computer Science, Mathematics, Lund University, University of Copenhagen, Roskilde University
Authors: Christiansen, J. S. (Ekstern), Henriksen, C. (Intern), Pedersen, H. L. (Ekstern), Petersen, C. L. (Ekstern)
Pages: 1-13
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Potential Analysis
ISSN (Print): 0926-2601
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SJR 1.51 SNIP 1.133 CiteScore 0.99
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.438 SNIP 1.117 CiteScore 0.92
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.44 SNIP 0.965 CiteScore 0.87
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.314 SNIP 1.312 CiteScore 1.04
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.346 SNIP 1.466 CiteScore 1.11
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.003 SNIP 1.374 CiteScore 0.94
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.028 SNIP 0.826 CiteScore 0.73
Lamé Parameter Estimation from Static Displacement Field Measurements in the Framework of Nonlinear Inverse Problems

We consider a problem of quantitative static elastography, the estimation of the Lamé parameters from internal displacement field data. This problem is formulated as a nonlinear operator equation. To solve this equation, we investigate the Landweber iteration both analytically and numerically. The main result of this paper is the verification of a nonlinearity condition in an infinite dimensional Hilbert space context. This condition guarantees convergence of iterative regularization methods. Furthermore, numerical examples for recovery of the Lamé parameters from displacement data
simulating a static elastography experiment are presented.

**General information**

State: Published  
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Johannes Kepler University of Linz, University of Vienna  
Authors: Hubmer, S. (Ekstern), Sherina, E. (Intern), Neubauer, A. (Ekstern), Scherzer, O. (Ekstern)  
Pages: 1268-1293  
Publication date: 2018  
Main Research Area: Technical/natural sciences

**Publication information**

Journal: SIAM Journal on Imaging Sciences  
Volume: 11  
Issue number: 2  
ISSN (Print): 1936-4954  
Ratings:  
BFI (2018): BFI-level 2  
Web of Science (2018): Indexed yes  
BFI (2017): BFI-level 2  
Scopus rating (2017): SNIP 1.999 SJR 1.371 CiteScore 3.16  
Web of Science (2017): Indexed Yes  
BFI (2016): BFI-level 2  
Scopus rating (2016): CiteScore 3.5 SJR 1.626 SNIP 1.787  
BFI (2015): BFI-level 2  
Scopus rating (2015): SJR 1.728 SNIP 2.222 CiteScore 3.64  
Web of Science (2015): Indexed yes  
BFI (2014): BFI-level 2  
Scopus rating (2014): SJR 1.337 SNIP 2.353 CiteScore 3.28  
BFI (2013): BFI-level 2  
Scopus rating (2013): SJR 1.709 SNIP 3.427 CiteScore 5.05  
ISI indexed (2013): ISI indexed yes  
Web of Science (2013): Indexed yes  
BFI (2012): BFI-level 2  
Scopus rating (2012): SJR 3.376 SNIP 5.524 CiteScore 4.26  
ISI indexed (2012): ISI indexed yes  
BFI (2011): BFI-level 2  
Scopus rating (2011): SJR 3.157 SNIP 3.657 CiteScore 2.17  
ISI indexed (2011): ISI indexed no  
BFI (2010): BFI-level 2  
Scopus rating (2010): SNIP 4.568 SJR 2.059  
BFI (2009): BFI-level 2  
Scopus rating (2009): SNIP 1.988 SJR 1.329  
Web of Science (2009): Indexed yes  
BFI (2008): BFI-level 1

Original language: English  
Elastography, Inverse Problems, Nonlinearity condition, Linearized elasticity, Lamé parameters, Parameter identification, Landweber iteration

**Land-use planning risk estimates for a chemical industrial park in China - A longitudinal study**

A chemical industrial park (CIP) can centralize the management of companies and facilitate mutual communication between different businesses. Due to these advantages, an increasing number of chemical companies are forced into CIP, especially in developing countries such as China. Thus, the land-use planning of CIP associated with safety becomes an important issue. To illustrate the importance of the continuous risk supervision and give more experiences to other similar

Land-use planning risk estimates for a chemical industrial park in China - A longitudinal study

A chemical industrial park (CIP) can centralize the management of companies and facilitate mutual communication between different businesses. Due to these advantages, an increasing number of chemical companies are forced into CIP, especially in developing countries such as China. Thus, the land-use planning of CIP associated with safety becomes an important issue. To illustrate the importance of the continuous risk supervision and give more experiences to other similar
changing CIP, we apply a simplified quantitative risk assessment procedure to estimate the risk to a Chinese chemical industrial park (19 x 10 km²) near a rather densely populated off-site region for the years 2014 and 2017. Estimated levels of individual risk and societal risk are compared with Chinese risk acceptance criteria for land-use planning. Off-site risk levels have increased significantly from 2014 to 2017. While off-site risk levels are still low and within the acceptable region, the study concludes that the authorities should review carefully and monitor the risk level in case of future development activities around and within the chemical industrial park, e.g. preserving a buffer zone should be considered. For future chemical park design, it is highly recommended to proactively include QRA analysis especially to deal with risk in an efficient way.

**General information**

State: Published  
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Statistics and Data Analysis, Department of Chemical and Biochemical Engineering, PROSYS - Process and Systems Engineering Centre, China University of Mining And Technology, COWI AS, China Academy of Safety Science and Technology  
Authors: Hu, X. (Ekstern), Wu, Z. (Ekstern), Hedlund, F. H. (Intern), Pedersen, J. B. (Ekstern), Wang, R. (Ekstern), Duo, Y. (Ekstern), Sin, G. (Intern)  
Pages: 124-133  
Publication date: 2018  
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Process Safety Progress  
Volume: 37  
Issue number: 2  
ISSN (Print): 1066-8527  
Ratings:  
BFI (2018): BFI-level 1  
Web of Science (2018): Indexed yes  
BFI (2017): BFI-level 1  
Scopus rating (2017): SJR 0.623 SNIP 0.831 CiteScore 0.85  
Web of Science (2017): Indexed Yes  
BFI (2016): BFI-level 1  
Scopus rating (2016): CiteScore 0.9 SJR 0.464 SNIP 0.8  
BFI (2015): BFI-level 1  
Scopus rating (2015): SJR 0.409 SNIP 0.73 CiteScore 0.75  
BFI (2014): BFI-level 1  
Scopus rating (2014): SJR 0.409 SNIP 0.91 CiteScore 0.59  
BFI (2013): BFI-level 1  
Scopus rating (2013): SJR 0.604 SNIP 2.027 CiteScore 0.81  
ISI indexed (2013): ISI indexed yes  
BFI (2012): BFI-level 1  
Scopus rating (2012): SJR 0.494 SNIP 1.603 CiteScore 1.02  
ISI indexed (2012): ISI indexed yes  
BFI (2011): BFI-level 1  
Scopus rating (2011): SJR 0.348 SNIP 1.59 CiteScore 0.82  
ISI indexed (2011): ISI indexed yes  
BFI (2010): BFI-level 1  
Scopus rating (2010): SJR 0.555 SNIP 1.65  
BFI (2009): BFI-level 1  
Scopus rating (2009): SJR 0.414 SNIP 1.163  
BFI (2008): BFI-level 1  
Scopus rating (2008): SJR 0.326 SNIP 1.426  
Scopus rating (2007): SJR 0.354 SNIP 1.598  
Web of Science (2007): Indexed yes  
Scopus rating (2006): SJR 0.245 SNIP 0.822  
Scopus rating (2005): SJR 0.385 SNIP 0.875  
Scopus rating (2004): SJR 0.336 SNIP 1.011  
Scopus rating (2003): SJR 0.459 SNIP 0.624
Layered Surface Detection for Virtual Unrolling

We present a method for virtual unrolling of a thin rolled object. From a volumetric image of the rolled object we obtain a flat image of the object's surface, which allows visual inspection of the object and has a number of applications. Our method exploits the geometric constrains of the problem and detects a single rolled surface. For surface detection we adapt a solution to an optimal net surface problem, previously used for terrain-like and tubular surfaces. We present our approach on an example of a rolled sheet of microelectronic, which has a layer of flexible polymer substrate and a thin metal layer lithographically coated onto the polymer. Our approach is automatic and robust. The unrolled image is undistorted, and the surface structures may be accurately quantified making our approach a good candidate for an industrial application of virtual unrolling.

Leading the Teacher Team - Balancing Between Formal and Informal Power in Program Leadership

This continuous research within Nordic engineering institutions targets the contexts and possibilities for leadership among engineering education program directors. The IFP-model, developed based on analysis of interviews with program leaders in these institutions, visualizes the program director's informal and formal power. The model is presented as a tool for starting a shared discussion on the complexities of the leadership of engineering program development. The authors liken program development to hunting in teams. Each individual expert in the program is needed, and all experts will need to work and collaborate for the same target. This calls for strategic and long-term thinking of engineering education development. Institutions should support the development of both formal structures as well as informal leadership skills among their program directors, but never fall for the temptation to see the program director as the only actor on the stage.
Length measurement methods of Atlantic mackerel (Scomber scombrus) and Atlantic horse mackerel (Trachurus trachurus) – current practice, conversion keys and recommendations

International monitoring of Atlantic mackerel (Scomber scombrus) and Atlantic horse mackerel (Trachurus trachurus), two commercial and ecologically epipelagic fish species in the North Atlantic, is currently done inconsistently. Depending on the country and institute, the length of a specimen is measured as either 'Fork Length', 'Pinched Tail Length' or 'Total Length'. This inconsistency increases the uncertainty of results from data analyses that are based on international data compilations. Here we provide conversion tables between all three methods for both species, based on field sampling in Greenlandic and Scottish waters. For both species, we recommend the use of 'Fork Length' or 'Pinched Tail Length' rather than 'Total Length'.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, Department of Applied Mathematics and Computer Science, Dynamical Systems, Marine Scotland Science, Greenland Institute of Natural Resources
Pages: 57-64
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisheries Research
Volume: 205
ISSN (Print): 0165-7836
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.94 SJR 0.941 SNIP 0.959
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.21 SJR 1.183 SNIP 1.153
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.092 SNIP 1.131 CiteScore 2.01
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.122 SNIP 1.305 CiteScore 2.17
Web of Science (2014): Indexed yes
Linear, Transfinite and Weighted Method for Interpolation from Grid Lines Applied to OCT Images

When performing a line scan using optical coherence tomography (OCT), the distance between the successive scan lines is often large compared to the resolution along each scan line. If two sets of such line scans are acquired orthogonal to each other, intensity values are known along the lines of a square grid, but are unknown inside each square. To view these values as an image, intensities need to be interpolated at regularly spaced pixel positions. In this paper we evaluate three methods for interpolation from grid lines: linear, transfinite and weighted. The linear method does not preserve the known values along the grid lines. The transfinite method, known from mesh generation, preserves the known values but might cause artifacts further away from the grid lines. The weighted method, which we propose, is designed to combine the desired properties of the transfinite method close to grid lines and the stability of the linear method further away. An important parameter influencing the performance of the interpolation methods is the upsampling rate. We perform an extensive evaluation of the three interpolation methods across a range of upsampling rates. Our statistical analysis shows significant difference in the performance of the three methods. We find that the transfinite interpolation works well for small upsampling rates and the proposed weighted interpolation method performs very well for all upsampling rates typically used in practice. On the basis of these findings we propose an approach for combining two OCT scans, acquired such that
the lines of the second scan are orthogonal to the first.
Lipsi: Probably the Smallest Processor in the World

While research on high-performance processors is important, it is also interesting to explore processor architectures at the other end of the spectrum: tiny processor cores for auxiliary functions. While it is common to implement small circuits for such functions, such as a serial port, in dedicated hardware, usually as a state machine or a combination of communicating state machines, these functionalities may also be implemented by a small processor. In this paper, we present Lipsi, a very tiny processor to make it possible to implement classic finite state machine logic in software at a minimal cost.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering
Authors: Schoeberl, M. (Intern)
Pages: 18-30
Publication date: 2018

Host publication information
Title of host publication: Architecture of Computing Systems
Volume: 10793
Publisher: Springer
ISBN (Print): 9783319776095
Series: Lecture Notes in Computer Science
Volume: 10793
ISSN: 0302-9743
Main Research Area: Technical/natural sciences
DOI: 10.1007/978-3-319-77610-1_2
Source: FindIt
Source-ID: 2398002603
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

Machine learning-based screening of complex molecules for polymer solar cells

Polymer solar cells admit numerous potential advantages including low energy payback time and scalable high-speed manufacturing, but the power conversion efficiency is currently lower than for their inorganic counterparts. In a Phenyl-C_61-Butyric-Acid-Methyl-Ester (PCBM)-based blended polymer solar cell, the optical gap of the polymer and the energetic alignment of the lowest unoccupied molecular orbital (LUMO) of the polymer and the PCBM are crucial for the device efficiency. Searching for new and better materials for polymer solar cells is a computationally costly affair using density functional theory (DFT) calculations. In this work, we propose a screening procedure using a simple string representation for a promising class of donor-acceptor polymers in conjunction with a grammar variational autoencoder. The model is trained on a dataset of 3989 monomers obtained from DFT calculations and is able to predict LUMO and the lowest optical transition energy for unseen molecules with mean absolute errors of 43 and 74 meV, respectively, without knowledge of the atomic positions. We demonstrate the merit of the model for generating new molecules with the desired LUMO and optical gap energies which increases the chance of finding suitable polymers by more than a factor of five in comparison to the randomised search used in gathering the training set.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, Department of Energy Conversion and Storage, Atomic scale modelling and materials, Department of Physics, Theoretical Atomic-scale Physics, Center for Nanostructured Graphene
Number of pages: 13
Publication date: 2018
Main Research Area: Technical/natural sciences
Publication information
Journal: Journal of Chemical Physics
Volume: 148
Article number: 241735
ISSN (Print): 0021-9606
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 2.5 SJR 1.252 SNIP 0.926
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.13 SJR 1.486 SNIP 0.964
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.255 SNIP 0.964 CiteScore 1.98
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.446 SNIP 1.02 CiteScore 2.54
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.559 SNIP 1.174 CiteScore 2.95
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.832 SNIP 1.137 CiteScore 2.86
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.845 SNIP 1.215 CiteScore 3.07
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.777 SNIP 1.064
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.04 SNIP 1.119
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.27 SNIP 1.144
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.245 SNIP 1.13
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.254 SNIP 1.287
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.323 SNIP 1.349
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.272 SNIP 1.39
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.275 SNIP 1.395
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 2.28 SNIP 1.382
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 2.549 SNIP 1.375
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.947 SNIP 1.441
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 2.036 SNIP 1.408
Original language: English
Machine Learning meets Mathematical Optimization to predict the optimal production of offshore wind parks

In this paper we propose a combination of Mathematical Optimization and Machine Learning to estimate the value of optimized solutions. In particular, we investigate if a machine, trained on a large number of optimized solutions, could accurately estimate the value of the optimized solution for new instances. In this paper we will focus on a specific application: the offshore wind farm layout optimization problem. Mixed Integer Programming models and other state-of-the-art optimization techniques, have been developed to solve this problem. Given the complexity of the problem and the big difference in production between optimized/non optimized solutions, it is not trivial to understand the potential value of a new site without running a complete optimization. This could be too time consuming if a lot of sites need to be evaluated, therefore we propose to use Machine Learning to quickly estimate the potential of new sites (i.e., to estimate the optimized production of a site without explicitly running the optimization). To do so, we trained and tested different Machine Learning models on a dataset of 3000+ optimized layouts found by the optimizer. Thanks to the close collaboration with a leading company in the energy sector, our model was trained on real-world data. Our results show that Machine Learning is able to efficiently estimate the value of optimized instances for the offshore wind farm layout problem.
Magnetic resonance temporal diffusion tensor spectroscopy of disordered anisotropic tissue

Molecular diffusion measured with diffusion weighted MRI (DWI) offers a probe for tissue microstructure. However, inferring microstructural properties from conventional DWI data is a complex inverse problem and has to account for heterogeneity in sizes, shapes and orientations of the tissue compartments contained within an imaging voxel. Alternative experimental means for disentangling the signal signatures of such features could provide a stronger link between the data and its interpretation. Double diffusion encoding (DDE) offers the possibility to factor out variation in compartment shapes from orientational dispersion of anisotropic domains by measuring the correlation between diffusivity in multiple directions. Time dependence of the diffusion is another effect reflecting the dimensions and distributions of barriers. In this paper we extend on DDE with a modified version of the oscillating gradient spin echo (OGSE) experiment, giving a basic contrast mechanism closely linked to both the temporal diffusion spectrum and the compartment anisotropy. We demonstrate our new method on post mortem brain tissue and show that we retrieve the correct temporal diffusion spectrum in synthetic data from Monte Carlo simulations of random walks in a range of disordered geometries of different sizes and shapes.
Measuring and Explaining Cognitive Load During Design Activities: A fine-grained approach
Recent advances in neuro-physiological measurements resulted in reliable and objective measures of Cognitive Load (CL), e.g., using pupillary responses. However, continuous measurement of CL in software design activities, e.g., conceptual modeling, has received little attention. In this paper, we present the progress of our work intended to close this gap by continuously measuring cognitive load during design activities. This work aims at advancing our understanding of WHEN and WHY designers face challenges. For this, we attempt to explore and explain the occurrence of CL using fine-granular units of analysis (e.g., type of subtasks, evolution of design artifact's quality, and manner of technology use). We expect implications for the future development of intelligent software systems, which are aware WHEN a particular designer experiences challenges, but also WHY challenges occur.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Software and Process Engineering, University of Innsbruck, University of South Florida
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Number of pages: 47
Publication date: 2018

Host publication information
Title of host publication: Information Systems and Neuroscience - Gmunden Retreat on NeuroIS 2017
Volume: 25
Publisher: Springer
Editors: Davis, F., Riedl, R., vom Brocke, J., Léger, P., Randolph, A.
ISBN (Electronic): 9783319674315, 9783319674308
Series: Lecture Notes in Information Systems and Organisation
ISSN: 2195-4968
Main Research Area: Technical/natural sciences
Conference: Gmunden Retreat on NeuroIS, Gmunden, Austria, 12/06/2017 - 12/06/2017

Business process management, Process Modeling, Process model creation, Eye tracking, Cognitive load
DOIs:
10.1007/978-3-319-67431-5_6
Source: PublicationPreSubmission
Methods and tools for the statistical data analysis of large datasets collected from bio-based manufacturing processes

In bio-manufacturing, biological systems are harnessed for the production of useful organic materials to be used in, for example, the food, medicine or agricultural industries. The most common mode of production in this sector is through batch processes. In a batch process a reactor vessel is filled with raw materials such as bacteria culture, water and sugar. It is then subjected to controlled conditions for a finite duration during which its contents undergo transformation, and finally the end-product is harvested from the reactor. Typically, a variety of sensors measure conditions in the reactor throughout each batch, such as temperature, pressure and concentration. With advances in sensor technology, and computational power, the volume of data collected in this way is ever increasing. The goal of the thesis is to contribute new techniques for utilising this data to improve process understanding and product quality. The existing literature on statistical monitoring, and quality prediction, for batch processes is reviewed, highlighting the challenges presented by batch process data. These include its three dimensional structure (conventionally represented as I batches × J variables × K time-points) comprising highly multivariate, cross-correlated, autocorrelated and non-stationary variable trajectories for each batch. An aspect of the data which leads to a number of contributions in the thesis is the variation in the time dimension often present in batch processes, meaning that comparable events occur at different times in different batches, so that the shapes and features in the resulting variable trajectories are not synchronised. In addition, the overall duration of different batches in a process may vary leading to different numbers of observations, complicating the application of standard bi-linear or tri-linear methods. Dynamic time warping (DTW) has previously been applied to synchronise batch process data and address these issues. The DTW algorithm identifies an optimal warping function, which stretches and compresses each batch in order to synchronise the variable trajectories. The warping function obtained for each batch may be interpreted as the progress signature of the batch. Using a case study of a bacteria culture batch process from Chr. Hansen, the advantages of including local constraints in the DTW algorithm, so that the warping function is a more realistic representation of batch progress, are demonstrated, and a method for selecting the local constraint is presented. In another case study using data from Chr. Hansen, a novel method is developed for predicting the harvest time of a batch at an early stage, whilst the batch is in progress. The method utilises lasso regression for selection of important variables for making the prediction, and combines the prediction with the progress information contained in the warping function from online alignment with DTW. Early harvest time prediction can contribute to scheduling of down-stream resources. In a third real industrial case study, lasso regression is again utilised to obtain quality predictions for batches of pectin produced by CP Kelco. The approach is contrasted with partial least squares models, and comparable estimated prediction error is obtained using lasso regression, in addition to a more parsimonious and interpretable model. Finally, the ability of DTW to quantify similarity between time series is exploited to develop a method for monitoring batch processes online to detect if a fault occurs. This method is based on the nearest neighbour principle, comparing a non going batch to its k nearest neighbours in a database of successful batches, according to the DTW distance. If the distance to the k nearest neighbours increases too quickly, an alarm is signalled to indicate that a fault has occurred. The method is demonstrated using a simulated dataset, representing batch production of penicillin, which contains a wide variety of fault types, magnitudes and onset times. The performance of the novel method is contrasted with a benchmark principle component analysis based approach, and shown to have a higher detection rate and faster detection speed when there is clustering of batches in the reference dataset.

General information
State: Submitted
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis
Authors: Spooner, M. P. (Intern)
Number of pages: 148
Publication date: 2018

Publication information
Publisher: DTU Compute
Original language: English
Series: DTU Compute PHD-2018
Volume: 478
ISSN: 0909-3192
Main Research Area: Technical/natural sciences

Relations
Projects:
Methods and tools for the statistical data analysis of large datasets collected from bio-based manufacturing processes
Publication: Research › Ph.D. thesis – Annual report year: 2018

Mining Developers' Workflows from IDE Usage
An increased understanding of how developers’ approach the development of software and what individual challenges they face, has a substantial potential to better support the process of programming. In this paper, we adapt Rabbit Eclipse, an existing Eclipse plugin, to generate event logs from IDE usage enabling process mining of developers’ workflows.
Moreover, we describe the results of an exploratory study in which the event logs of 6 developers using Eclipse together with Rabbit Eclipse were analyzed using process mining. Our results demonstrate the potential of process mining to better understand how developers' approach a given programming task.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Software and Process Engineering
 Authors: Ioannou, C. (Intern), Burattin, A. (Intern), Weber, B. (Intern)
 Pages: 167-179
Publication date: 2018

**Host publication information**
Title of host publication: Advanced Information Systems Engineering Workshops
Publisher: Springer
Editors: Matulevičius, R., Dijkman, R.
ISBN (Print): 978-3-319-92897-5

Series: Lecture Notes in Business Information Processing
Volume: 316
ISSN: 1865-1348
Main Research Area: Technical/natural sciences
Conference: 30th International Conference on Advanced Information Systems Engineering, Tallinn, Estonia, 11/06/2018 - 11/06/2018
Process mining, Tracking IDE interactions, Developers’ workflows, Source code
Electronic versions:
Article_Mining_Developer_s_Workflow_from_IDE_Usage.pdf
DOIs:
10.1007/978-3-319-92898-2_14

**Bibliographical note**
https://link.springer.com/chapter/10.1007/978-3-319-92898-2_14
Source: PublicationPreSubmission
Source-ID: 148993928
Publication: Research - peer-review » Article in proceedings – Annual report year: 2018

**Minisymposium: New Developments in Models of Traffic and Crowds**
Modern society is increasingly faced with problems arising from overcrowded and congested motorways, and control of large crowds (sometimes failing, resulting in casualties, even loss of life). Over-engineering or oversizing available space is not always an option, and there is a need for mathematically sophisticated solutions arising from dynamical systems modelling.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Mathematical Statistics
Authors: Hjorth, P. G. (Intern), Sørensen, M. (Intern)
 Pages: 365-366
Publication date: 2018

**Host publication information**
Title of host publication: Progress in Industrial Mathematics at Ecmi 2016
Publisher: Springer
ISBN (Print): 9783319630816
Series: Mathematics in Industry
Volume: 26
Main Research Area: Technical/natural sciences
DOIs:
10.1007/978-3-319-63082-3_57
Source: FindIt
Source-ID: 2397935459
Publication: Research - peer-review » Article in proceedings – Annual report year: 2018
Modeling Clinic for Industrial Mathematics: A Collaborative Project Under Erasmus+ Program
Modeling Clinic for Industrial Mathematics (MODCLIM) is a Strategic Partnership for the Development of Training Workshops and Modeling Clinic for Industrial Mathematics, funded through the European Commission under the Erasmus Plus Program, Key Action 2: Cooperation for innovation and the exchange of good practices.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Wroclaw University of Science and Technology, Universidade Técnica de Lisboa, Università di Catania, Universidad de Las Palmas, Lappeenranta University of Technology, University of Alabama, University of Koblenz-Landau
Authors: Jurlewicz, A. (Ekstern), Nunes, C. (Ekstern), Russo, G. (Ekstern), Rocha, J. (Ekstern), Heilio, M. (Ekstern), Jablonska-Sabuka, M. (Ekstern), Khoury, N. (Ekstern), Hjorth, P. G. (Intern), Serna, S. (Ekstern), Goetz, T. (Ekstern)
Pages: 347-353
Publication date: 2018

Host publication information
Title of host publication: Progress in Industrial Mathematics at ECMI 2016
Volume: 26
Publisher: Springer
ISBN (Print): 9783319630816
Series: Mathematics in Industry
Volume: 26
Main Research Area: Technical/natural sciences
DOIs: 10.1007/978-3-319-63082-3_54
Source: FindIt
Source-ID: 2397935559
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

Modelling of adequate and safe vitamin D intake in Danish women using different fortification and supplementation scenarios to inform fortification policies
Fortification of foods with vitamin D may be a population-based solution to low vitamin D intake. We performed modelling of vitamin D from diet, fortified foods and supplements in a population of Danish women 18-50 years, a risk group of vitamin D deficiency, to inform fortification policies on safe and adequate levels. Based on individual habitual dietary vitamin D intake of female participants from the Danish National Survey of Dietary Habits and Physical Activity (DANSDA) (n=855), we performed graded intake modelling to predict the intake in six scenarios increasing the vitamin D intake from a habitual diet without fish to habitual diet including fish, fortified foods and supplements (40/80 µg). Four different foods were used as potential foods to fortify with vitamin D. The vitamin D intake was below the Average Requirement (AR) of 7.5 µg/day for 88% of the assessed women. Safe levels of intake (}

General information
State: Accepted/In press
Organisations: National Food Institute, Research Group for Risk-Benefit, Division of Risk Assessment and Nutrition, Department of Applied Mathematics and Computer Science, University of Copenhagen
Authors: Grønborg, I. M. (Intern), Telens, I. (Ekstern), Ege, M. (Intern), Christensen, T. (Intern), Andersen, E. W. (Intern), Andersen, R. (Intern)
Number of pages: 6
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: European Journal of Nutrition
ISSN (Print): 1436-6207
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SJR 1.408 SNIP 1.076 CiteScore 3.36
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.22 SJR 1.328 SNIP 1.158
Modelling Spatial Compositional Data: Reconstructions of past land cover and uncertainties

In this paper, we construct a hierarchical model for spatial compositional data, which is used to reconstruct past land-cover compositions (in terms of coniferous forest, broadleaved forest, and unforested/open land) for five time periods during the past $6,000$ years over Europe. The model consists of a Gaussian Markov Random Field (GMRF) with Dirichlet observations. A block updated Markov chain Monte Carlo (MCMC), including an adaptive Metropolis adjusted Langevin step, is used to estimate model parameters. The sparse precision matrix in the GMRF provides computational advantages leading to a fast MCMC algorithm. Reconstructions are obtained by combining pollen-based estimates of vegetation cover at a limited number of locations with scenarios of past deforestation and output from a dynamic vegetation model. To evaluate uncertainties in the predictions a novel way of constructing joint confidence regions for the entire composition at each prediction location is proposed. The hierarchical model's ability to reconstruct past land cover is
Models and Methods for Dynamic Computed Tomography.

X-ray computed tomography (CT) is a widely used non-invasive technology that is used to image the internal structure of objects without cutting and breaking them. Since the inception of the first prototype of a CT scanner in 1969, the industrial and medical applications of CT are rapidly increasing. The standard image reconstruction models for X-ray CT are based on the assumption that the object of interest remains stationary during data acquisition in a CT scanner. However, this assumption fails for dynamic CT where the object of interest deforms over time, for example, scanning a beating heart, a pill dissolving in a liquid, etc. The violation of the stationarity assumption can lead to severe motion artifacts in the images reconstructed with the standard image reconstruction models.

The standard reconstruction models that are based on a stationarity assumption can be used for dynamic CT if a sufficient number of projections are acquired within a short period of time such that the object deforms within a tolerable limit. However, limited acquisition time leads to noisy measurements, and X-ray source intensity estimates based on such measurement can be highly uncertain. These uncertainties cause severe and systematic artifacts, known as ring artifacts, which may hide the important information in a reconstructed image. To mitigate this problem, we derive a new convex reconstruction model by carefully modelling the measurement process and by taking uncertainties into account. The experimental results indicate that the model effectively mitigates ring artifacts not only with simulated data, but also with real data sets.

If the stationarity assumption cannot be fulfilled, we can compensate the motion effects by incorporating the motion behaviour of the object of interest into a reconstruction model. In practice, the motion behaviour of the object is unknown. Therefore, we jointly conduct motion estimation and image reconstruction with motion-compensated reconstruction models. These models generally assume that deformations in the object are continuous and smooth over time. Thus, they...
are not suitable for non-smooth deformations, such as the formation of cracks. In this thesis, we derive a motion model to represent the formation and closing of cracks based on the underlying physics of the crack formation. The proposed model effectively regularizes non-smooth and large deformations along cracks with minimal influence on the nearby regions. The motion-compensated reconstruction models implicitly exploit the redundant motion information present in the measurements acquired over time from different projection angles. Variability in the acquired projections is highly important. In view of this, we propose an interlaced projection scheme to distribute projection views over time based on the family of metallic angles. This scheme is a fixed angular gap scheme, and hence, easy to implement in practice. Moreover, this scheme is suitable for scanning a fast-deforming object. We demonstrate that the proposed interlaced distribution of projection views over time greatly enhances the spatio-temporal resolution of the motion-compensated reconstructions.

In this thesis, our investigations bring forth methodologies which have the potential to achieve high spatio-temporal resolution reconstructions of objects deforming over time. These methodologies pave the way to study the rapid dynamic behaviors, such as the fluid flowing through porous rock and the formation of cracks in drying paint, through tomographic measurements.

General information
State: Submitted
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing
Authors: Aggrawal, H. O. (Intern)
Number of pages: 172
Publication date: 2018

Publication information
Publisher: DTU Compute
Original language: English
Series: DTU Compute PHD-2018
Volume: 477
ISSN: 0909-3192
Main Research Area: Technical/natural sciences

Relations
Projects:
Models and Methods for Dynamic Computed Tomography.

Publication: Research › Ph.D. thesis – Annual report year: 2018

Modulation of task-related cortical connectivity in the acute and subacute phase after stroke
The functional relevance of cortical reorganization post-stroke is still not well understood. In this study, we investigated task-specific modulation of cortical connectivity between neural oscillations in key motor regions during the early phase after stroke. EEG and EMG recordings were examined from 15 patients and 18 controls during a precision grip task using the affected hand. Each patient attended two sessions in the acute and subacute phase (median of 3 and 34 days) post-stroke. Dynamic causal modelling (DCM) for induced responses was used to investigate task-specific modulations of oscillatory couplings in a bilateral network comprising supplementary motor area (SMA), dorsal premotor cortex (PMd) and primary motor cortex (M1). Fourteen models were constructed for each subject, and the input induced by the experimental manipulation (task) was set to inferior parietal lobule (IPL). Bayesian model selection favoured a fully connected model. A reduced coupling from SMA and intact M1 in the \( \beta \)-band (15-30 Hz) to lesioned M1 in the \( \beta \)-band (15-30 Hz) was observed in patients in the acute phase compared to controls. Behavioural performance improved significantly in the subacute phase, while an increased positive coupling from intact PMd to lesioned M1 and a less negative modulation from lesioned M1 to intact M1 were observed for patients compared to controls both from the \( \beta \)-band to the \( \beta \)-band. We infer that the observed differences in cross-frequency cortical interactions are important for functional recovery.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, University of Copenhagen
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Pages: 1024–1032
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: European Journal of Neuroscience
Volume: 47
ISSN (Print): 1460-9568
Ratings:
Monge surfaces and planar geodesic foliations

A Monge surface is a surface obtained by sweeping a generating plane curve along a trajectory that is orthogonal to the moving plane containing the curve. Locally, they are characterized as being foliated by a family of planar geodesic lines of curvature. We call surfaces with the latter property PGF surfaces, and investigate the global properties of these two naturally defined objects. The only compact orientable PGF surfaces are tori; these are globally Monge surfaces, and they have a simple characterization in terms of the directrix. We show how to produce many examples of Monge tori and Klein bottles, as well as tori that do not have a closed directrix.
Monotonicity and enclosure methods for the p-Laplace equation

We show that the convex hull of a monotone perturbation of a homogeneous background conductivity in the p-conductivity equation is determined by knowledge of the nonlinear Dirichlet-Neumann operator. We give two independent proofs: one is based on the monotonicity method and the other on the enclosure method. Our results are constructive and require no jump or smoothness properties on the conductivity perturbation or its support.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Goethe University Frankfurt, National Taiwan University, University of Jyväskylä
Authors: Brander, T. O. (Intern), Harrach, B. (Ekstern), Kar, M. (Ekstern), Salo, M. (Ekstern)
Pages: 742-758
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication Information
Journal: S I A M Journal on Applied Mathematics
Volume: 78
Issue number: 2
ISSN (Print): 0036-1399
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
We provide a detailed description of the Python-DTU system, including the overall system design and the tools used in the agent contest.

**Multi-Agent Programming Contest 2016 – The Python-DTU Team**

We provide a detailed description of the Python-DTU system, including the overall system design and the tools used in the agent contest.

**General information**

- **State:** Published
- **Organisations:** Department of Applied Mathematics and Computer Science, Algorithms and Logic, Technical University of Denmark
- **Authors:** Villadsen, J. (Intern), Halkjær From, A. (Ekstern), Jacobi, S. (Ekstern), Larsen, N. N. (Ekstern)
- **Pages:** 86-100
- **Publication date:** 2018
- **Main Research Area:** Technical/natural sciences

**Publication information**
Multi-period portfolio selection with drawdown control

In this article, model predictive control is used to dynamically optimize an investment portfolio and control drawdowns. The control is based on multi-period forecasts of the mean and covariance of financial returns from a multivariate hidden Markov model with time-varying parameters. There are computational advantages to using model predictive control when estimates of future returns are updated every time new observations become available, because the optimal control actions are reconsidered anyway. Transaction and holding costs are discussed as a means to address estimation error and regularize the optimization problem. The proposed approach to multi-period portfolio selection is tested out of sample over two decades based on available market indices chosen to mimic the major liquid asset classes typically considered by institutional investors. By adjusting the risk aversion based on realized drawdown, it successfully controls drawdowns with little or no sacrifice of mean–variance efficiency. Using leverage it is possible to further increase the return without increasing the maximum drawdown.

General information

State: Accepted/In press
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Stanford University, Lund University
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Pages: 1–27
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information

ISSN (Print): 0254-5330
Ratings:
Natural Deduction and the Isabelle Proof Assistant

We describe our Natural Deduction Assistant (NaDeA) and the interfaces between the Isabelle proof assistant and NaDeA. In particular, we explain how NaDeA, using a generated prover that has been verified in Isabelle, provides feedback to the student, and also how NaDeA, for each formula proved by the student, provides a generated theorem that can be verified in Isabelle.
Near-wellbore modeling of a horizontal well with Computational Fluid Dynamics

The oil production by horizontal wells is a complex phenomenon that involves flow through the porous reservoir, completion interface and the well itself. Conventional reservoir simulators can hardly resolve the flow through the completion into the wellbore. On the contrary, Computational Fluid Dynamics (CFD) is capable of modeling the complex interaction between the creeping reservoir flow and turbulent well flow for single phases, while capturing both the completion geometry and formation damage. A series of single phase steady-state simulations are undertaken, using such fully coupled three dimensional numerical models, to predict the inflow to the well. The present study considers the applicability of CFD for near-wellbore modeling through benchmark cases with available analytical solutions. Moreover, single phase steady-state numerical investigations are performed on a specific perforated horizontal well producing from the Siri field, offshore Denmark. The performance of the well is investigated with an emphasis on the inflow profile and the productivity index for different formation damage scenarios. A considerable redistribution of the inflow profile were found when the filtrate invasion extended beyond the tip of the perforations.
New Basis Set for the Evaluation of Specific Rotation in Flexible Biological Molecules in Solution

A detailed theoretical investigation of specific rotation is carried out in solution for nine flexible molecules of biological importance. Systematic search for the main conformers is followed by time-dependent density functional theory (TD-DFT) calculations of specific rotation employing a wide range of basis sets. Due to conformational flexibility of the compounds under study, the possibility of basis set size reduction without deterioration of the results is investigated. The increasing size (d-)aug-cc-pVXZ (X=D, T, Q) bases of Dunning et al., and the ORP basis set, recently developed to efficiently provide
molecular specific rotation, are used for this purpose. The polarizable continuum model is employed at all steps of the investigation. Comparison of the present results with the available data obtained in vacuum reveals considerable differences, being the values in solvent much closer to the experimental specific rotation data available. The ORP basis set proves to be competitive with the d-aug-cc-pVDZ set of Dunning in specific rotation calculations carried out in solvent. While having the same number of functions, the former yields in general results considerably closer to the reference triple-zeta values. We can thus recommend the ORP basis set to study the optical rotation in conformationally flexible molecules in solvent.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics, Kazimierz Wielki University, Nicolaus Copernicus University in Torun, University of Santiago de Compostela
Authors: Baranowska-ŁAczkowska, A. (Ekstern), Łaczkowski, K. Z. (Ekstern), Henriksen, C. (Intern), Fernandez, B. (Ekstern)
Number of pages: 7
Pages: 5477-5483
Publication date: 2018
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Journal of Physical Chemistry A
Volume: 122
Issue number: 24
ISSN (Print): 1089-5639
Ratings:

BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.75
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.64
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.78
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.65
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.84
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.78
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.87
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Web of Science (2008): Indexed yes
Web of Science (2007): Indexed yes
Notat om fremskrivning af andelen af multisyre i Danmark frem til 2025

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis
Authors: Stockmarr, A. (Intern)
Number of pages: 2
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Number of pages: 2
Original language: English
Source: PublicationPreSubmission
Source-ID: 150055264
Publication: Commissioned › Memorandum – Annual report year: 2018

Observed rapid bedrock uplift in Amundsen Sea Embayment promotes ice-sheet stability
The marine portion of the West Antarctic Ice Sheet (WAIS) in the Amundsen Sea Embayment (ASE) accounts for one-fourth of the cryospheric contribution to global sea-level rise and is vulnerable to catastrophic collapse. The bedrock response to ice mass loss, glacial isostatic adjustment (GIA), was thought to occur on a time scale of 10,000 years. We used new GPS measurements, which show a rapid (41 millimeters per year) uplift of the ASE, to estimate the viscosity of the mantle underneath. We found a much lower viscosity (4 × 10¹⁸ pascal-second) than global average, and this shortens the GIA response time scale from tens to hundreds of years. Our finding requires an upward revision of ice mass loss from gravity data of 10% and increases the potential stability of the WAIS against catastrophic collapse.

General information
State: Published
Organisations: National Space Institute, Geodynamics, Department of Applied Mathematics and Computer Science, Geodesy, Technical University of Denmark, Ohio University, University of Washington, University of Colorado Boulder, University of Texas at Austin, University of Memphis, Colorado State University, Pennsylvania State University, Washington University St. Louis
Authors: Barletta, V. R. (Intern), Bevis, M. (Ekstern), Smith, B. E. (Ekstern), Wilson, T. (Ekstern), Brown, A. (Ekstern), Bordoni, A. (Intern), Willis, M. (Ekstern), Khan, S. A. (Intern), Rovira-Navarro, M. (Ekstern), Dalziel, I. (Ekstern), Smalley, R. (Ekstern), Kendrick, E. (Ekstern), Konfal, S. (Ekstern), Caccamise, D. J. (Ekstern), Aster, R. C. (Ekstern), Nyblade, A. (Ekstern), Wiens, D. A. (Ekstern)
Pages: 1335-1339
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Science
Volume: 360
Issue number: 6395
ISSN (Print): 0036-8075
Ratings:
  BFI (2018): BFI-level 3
Web of Science (2018): Indexed yes
**One-way shared memory**

Standard multicore processors use the shared main memory via the on-chip caches for communication between cores. However, this form of communication has two limitations: (1) it is hardly time-predictable and therefore not a good solution for real-time systems and (2) this single shared memory is a bottleneck in the system. This paper presents a communication architecture for time-predictable multicore systems where core-local memories are distributed on the chip. A network-on-chip constantly copies data from a sender core-local memory to a receiver core-local memory. As this copying is performed in one direction we call this architecture a one-way shared memory. With the use of time-division multiplexing for the memory accesses and the network-on-chip routers we achieve a time-predictable solution where the communication latency and bandwidth can be bounded. An example architecture for a 3×3 core processor and 32-bit wide links and memory ports provides a cumulative bandwidth of 29 bytes per clock cycle. Furthermore, the evaluation shows that this architecture, due to its simplicity, is small compared to other network-on-chip solutions.

**Online bipartite matching with amortized O(log^2 n) replacements**

In the online bipartite matching problem with replacements, all the vertices on one side of the bipartition are given, and the vertices on the other side arrive one by one with all their incident edges. The goal is to maintain a maximum matching while minimizing the number of changes (replacements) to the matching. We show that the greedy algorithm that always takes the shortest augmenting path from the newly inserted vertex (denoted the SAP protocol) uses at most amortized $O(n \log \log n)$ replacements per insertion, where $n$ is the total number of vertices inserted. This is the first analysis to achieve a polylogarithmic number of replacements for any replacement strategy, almost matching the $\Omega(n \log n)$ lower bound. The previous best strategy known achieved amortized $O(n \log \log n)$ replacements [Bosek, Leniowski, Sankowski, Zych, FOCS 2014]. For the SAP protocol in particular, nothing better than the trivial $O(n \log n)$ bound was known except in special cases. Our analysis immediately implies the same upper bound of $O(n \log \log n)$ for the capacitated assignment problem, where each vertex on the static side of the bipartition is initialized with the capacity to serve a number of vertices. We also analyze the problem of minimizing the maximum server load. We show that if the final graph has maximum server load $L$, then the SAP protocol makes amortized $O((\log \log n + \log \log \log n) \log n)$ replacements. We also show that this is close to tight because $\Omega(\min(n, \log n))$ reassignments are necessary.
Online Conformance Checking Using Behavioural Patterns

New and compelling regulations (e.g., the GDPR in Europe) impose tremendous pressure on organizations, in order to adhere to standard procedures, processes, and practices. The field of conformance checking aims to quantify the extent to which the execution of a process, captured within recorded corresponding event data, conforms to a given reference process model. Existing techniques assume a post-mortem scenario, i.e. they detect deviations based on complete executions of the process. This limits their applicability in an online setting. In such context, we aim to detect deviations online, in order to provide recovery possibilities before the execution of a process instance is completed. Also, current techniques assume cases to start from the initial stage of the process, whereas this assumption is not feasible in online settings. In this paper, we present a generic framework for online conformance checking, in which the underlying process is represented in terms of behavioural patterns and no assumption on the starting point of cases is needed. We instantiate the framework on the basis of Petri nets, with an accompanying new unfolding technique. The approach is implemented in the process mining tool ProM, and evaluated by means of several experiments including a stress-test and a comparison with a similar technique.

On the Approximation Ratio of Lempel-Ziv Parsing

Shannon’s entropy is a clear lower bound for statistical compression. The situation is not so well understood for dictionary-based compression. A plausible lower bound is \( b \), the least number of phrases of a general bidirectional parse of a text, where phrases can be copied from anywhere else in the text. Since computing \( b \) is NP-complete, a popular gold standard is \( z \), the number of phrases in the Lempel-Ziv parse of the text, where phrases can be copied only from the left. While \( z \) can be computed in linear time, almost nothing has been known for decades about its approximation ratio with respect to \( b \). In this paper we prove that \( z = \Omega(b \log (n/b)) \) where \( n \) is the text length. We also show that the bound is tight as a function of \( n \), by exhibiting a string family where \( z = \varOmega(b \log n) \). Our upper bound is obtained by building a run-length context-free grammar based on a locally consistent parsing of the text. Our lower bound is obtained by relating \( b \) with \( r \), the number of equal-letter runs in the Burrows-Wheeler transform of the text. On our way, we prove other relevant bounds between compressibility measures.

General information
State: Published
On the Björling problem for Willmore surfaces

We solve the analogue of Björling's problem for Willmore surfaces via a harmonic map representation. For the umbilic-free case the problem and solution are as follows: given a real analytic curve $y_0$ in $S^3$, together with the prescription of the values of the surface normal and the dual Willmore surface along the curve, lifted to the light cone in Minkowski 5-space $\mathbb{R}^5_1$, we prove, using isotropic harmonic maps, that there exists a unique pair of dual Willmore surfaces $y$ and $\hat{y}$ satisfying the given values along the curve. We give explicit formulae for the generalized Weierstrass data for the surface pair. For the three dimensional target, we use the solution to explicitly describe the Weierstrass data, in terms of geometric quantities, for all equivariant Willmore surfaces. For the case that the surface has umbilic points, we apply the more general half-isotropic harmonic maps introduced by Hélein to derive a solution: in this case the map $\hat{y}$ is not necessarily the dual surface, and the additional data of a derivative of $\hat{y}$ must be prescribed. This solution is generalized to higher codimensions.
On wind turbine down-regulation control strategies and rotor speed set-point
The use of down-regulation or curtailment control strategies for wind turbines offers means of supporting the stability of the power grid and also improving the efficiency of a wind farm. Typically, wind turbine derating is performed by modifying the power set-point and subsequently, the turbine control input, namely generator torque and blade pitch, are acted on to such changes in the power reference. Nonetheless, in addition to changes in the power reference, derating can be also performed by modifying the rotor speed set-point. Thus, in this work, we investigate the performance of derating strategies with different rotor speed set-point, and in particular, their effect on the turbine structural fatigue and thrust coefficient were evaluated. The numerical results obtained from the high-fidelity turbine simulations showed that compared to the typical derating strategy, the derated turbines might perform better with lower rotor speed set-point but it is crucial to ensure such a set-point does not drive the turbine into stalled operations.
We study the (1+\lambda) EA, a classical population-based evolutionary algorithm, with mutation probability c / n, where c > 0 and \lambda are constant, on the benchmark function OneMax, which counts the number of 1-bits in a bitstring. We improve a well-established result that allows to determine the first hitting time from the expected progress (drift) of a stochastic process, known as the variable drift theorem. Using our improved result, we show that upper and lower bounds on the expected runtime of the (1+\lambda) EA obtained from variable drift theorems are at most apart by a small lower order term if the exact drift is known. This reduces the analysis of expected optimization time to finding an exact expression for the drift. We then give an exact closed-form expression for the drift and develop a method to approximate it very efficiently, enabling us to determine approximate optimal mutation rates for the (1+\lambda) EA for various parameter settings of c and \lambda and also for moderate sizes of n. This makes the need for potentially lengthy and costly experiments in order to optimize c for fixed n and \lambda for the optimization of OneMax unnecessary. Interestingly, even for moderate n and not too small \lambda it turns out that mutation rates up to 10% larger than the asymptotically optimal rate 1 / n minimize the expected runtime. However, in absolute terms the expected runtime does not change by much when replacing 1 / n with the optimal mutation rate.
Optimal-time text indexing in BWT-runs bounded space

Indexing highly repetitive texts such as genomic databases, software repositories and versioned text collections has become an important problem since the turn of the millennium. A relevant compressibility measure for repetitive texts is \( r \), the number of runs in their Burrows-Wheeler Transform (BWT). One of the earliest indexes for repetitive collections, the Run-Length FMindex, used \( O(r) \) space and was able to efficiently count the number of occurrences of a pattern of length \( m \) in the text (in loglogarithmic time per pattern symbol, with current techniques). However, it was unable to locate the positions of those occurrences efficiently within a space bounded in terms of \( r \). Since then, a number of other indexes with space bounded by other measures of repetitiveness such as the number of phrases in the Lempel-Ziv parse, the size of the smallest grammar generating the text, the size of the smallest automaton recognizing the text factors have been proposed for efficiently locating, but not directly counting, the occurrences of a pattern. In this paper we close this longstanding problem, showing how to extend the Run-Length FMindex so that it can locate the \( occ \) occurrences efficiently within \( O(r) \) space (in loglogarithmic time each), and reaching optimal time \( O(m + occ) \) within \( O(r \log(n/r)) \) space, on a RAM machine with words of \( w = \log n \) bits. Raising the space to \( O(rw \log(\sigma(n/r))) \), we support locate in \( O(m \log(\sigma(n/r))w + occ) \) time, which is optimal in the packed setting and had not been obtained before in compressed space. We also describe a structure using \( O(r \log(n/r)) \) space that replaces the text and efficiently extracts any text substring, with an \( O(\log(n/r)) \) additive time penalty over the optimum. Preliminary experiments show that our new structure outperforms the alternatives by orders of magnitude in the space/time tradeoff map.

Optimizing targeted vaccination across cyber-physical networks: an empirically based mathematical simulation study

Targeted vaccination, whether to minimize the forward transmission of infectious diseases or their clinical impact, is one of the 'holy grails' of modern infectious disease outbreak response, yet it is difficult to achieve in practice due to the challenge of identifying optimal targets in real time. If interruption of disease transmission is the goal, targeting requires knowledge of underlying person-to-person contact networks. Digital communication networks may reflect not only virtual but also physical interactions that could result in disease transmission, but the precise overlap between these cyber and physical networks has never been empirically explored in real-life settings. Here, we study the digital communication activity of more than 500 individuals along with their person-to-person contacts at a 5-min temporal resolution. We then simulate different disease transmission scenarios on the person-to-person physical contact network to determine whether cyber communication networks can be harnessed to advance the goal of targeted vaccination for a disease spreading on the network of physical proximity. We show that individuals selected on the basis of their closeness centrality within cyber networks (what we call 'cyber-directed vaccination') can enhance vaccination campaigns against diseases with short-range (but not full-range) modes of transmission.
Digital networks, Disease transmission, Epidemiology, Physical proximity, Social networks, Vaccination

OSSINT - Open Source Social Network Intelligence: An efficient and effective way to uncover "private" information in OSN profiles

Online Social Networks (OSNs), such as Facebook, provide users with tools to share information along with a set of privacy controls preferences to regulate the spread of information. Current privacy controls are efficient to protect content data. However, the complexity of tuning them undermine their efficiency when shielding contextual information (such as the social network structure) that many users believe being kept private. In this paper, we demonstrate the extent of the problem of information leakage in Facebook. In particular, we show the possibility of inferring, from the network "surrounding" a victim user, some information that the victim set as hidden. We developed a system, named OSSINT (Open Source Social Network INTelligence), on top of our previous tool SocialSpy, that can infer hidden information of a victim profile and retrieve private information from public one. OSSINT retrieves the friendship network of a victim and shows how it is possible to infer additional private information (e.g., personal user preferences and hobbies). Our
proposed system OSSINT goes extra mile about the network topology information, i.e., predicting new friendships using the victim’s friends of friends network (2-hop of distance from the victim profile), and hence possibly deduce private information of the full Facebook network. OSSINT correctly improved the previous results of SocialSpy predicting an average of 11 new friendships with peaks of 20 new friends. Moreover, OSSINT, for the considered victim profiles demonstrated how it is possible to infer real-life information such as current city, hometown, university, supposed being private.

**General information**

State: Accepted/In press
Organisations: Department of Applied Mathematics and Computer Science, Software and Process Engineering, University of Rome La Sapienza, KU Leuven, University of Padua
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Pages: 58 - 68
Publication date: 2018
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Online Social Networks and Media
ISSN (Print): 2468-6964
Original language: English
DOI: 10.1016/j.osnem.2018.04.003
Source: PublicationPreSubmission
Source-ID: 149585080
Publication: Research - peer-review › Journal article – Annual report year: 2018

**Overnight glucose control in people with type 1 diabetes**

This paper presents an individualized model predictive control (MPC) algorithm for overnight blood glucose stabilization in people with type 1 diabetes (T1D). The MPC formulation uses an asymmetric objective function that penalizes low glucose levels more heavily. We compute the model parameters in the MPC in a systematic way based on a priori available patient information. The model used by the MPC algorithm for filtering and prediction is an autoregressive integrated moving average with exogenous input (ARIMAX) model implemented as a linear state space model in innovation form. The control algorithm uses frequent glucose measurements from a continuous glucose monitor (CGM) and its decisions are implemented by a continuous subcutaneous insulin infusion (CSII) pump. We provide guidelines for tuning the control algorithm and computing the Kalman gain in the linear state space model in innovation form. We test the controller on a cohort of 100 randomly generated virtual patients with a representative inter-subject variability. We use the same control algorithm for a feasibility overnight study using 5 real patients. In this study, we compare the performance of this control algorithm with the patient’s usual pump setting. We discuss the results of the numerical simulations and the in vivo clinical study from a control engineering perspective. The results demonstrate that the proposed control strategy increases the time spent in euglycemia.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Dynamical Systems, University of Copenhagen
Pages: 503-512
Publication date: 2018
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Biomedical Signal Processing and Control
Volume: 39
ISSN (Print): 1746-8094
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.654 SJR 0.723 CiteScore 3.62
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.82 SJR 0.674 SNIP 1.69
Paper-based sensors for rapid detection of virulence factor produced by Pseudomonas aeruginosa

Pyocyanin is a toxin produced by Pseudomonas aeruginosa. Here we describe a novel paper-based electrochemical sensor for pyocyanin detection, manufactured with a simple and inexpensive approach based on electrode printing on paper. The resulting sensors constitute an effective electrochemical method to quantify pyocyanin in bacterial cultures without the conventional time consuming pretreatment of the samples. The electrochemical properties of the paper-based sensors were evaluated by ferri/ferrocyanide as a redox mediator, and showed reliable sensing performance. The paper-based sensors readily allow for the determination of pyocyanin in bacterial cultures with high reproducibility, achieving a limit of detection of 95 nM and a sensitivity of 4.30 μA/μM in standard culture media. Compared to the similar commercial ceramic based sensors, it is a 2.3-fold enhanced performance. The simple in-house fabrication of sensors for pyocyanin quantification allows researchers to understand in vitro adaptation of P. aeruginosa infections via rapid screenings of bacterial cultures that otherwise are expensive and time-consuming.

General information
State: Published
Organisations: Department of Biotechnology and Biomedicine, Department of Micro- and Nanotechnology, Nano Bio Integrated Systems, Infection Microbiology, Novo Nordisk Foundation Center for Biosustainability, Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, Copenhagen Center for Health Technology, Roskilde University, University of Copenhagen
Number of pages: 9
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: P L o S One
Volume: 13
Issue number: 3
Article number: e0194157
ISSN (Print): 1932-6203
Ratings:
Passenger arrival and waiting time distributions dependent on train service frequency and station characteristics: A smart card data analysis

Waiting time at public transport stops is perceived by passengers to be more onerous than in-vehicle time, hence it strongly influences the attractiveness and use of public transport. Transport models traditionally assume that average waiting times are half the service headway by assuming random passenger arrivals. However, research agree that two distinct passenger behaviour types exist: one group arrives randomly, whereas another group actively tries to minimise their waiting time by arriving in a timely manner at the scheduled departure time. This study proposes a general framework for estimating passenger waiting times which incorporates the arrival patterns of these two groups explicitly, namely by using a mixture distribution consisting of a uniform and a beta distribution. The framework is empirically validated using a large-scale automatic fare collection system from the Greater Copenhagen Area covering metro, suburban, and regional rail stations thereby giving a range of service headways from 2 to 60 min. It was shown that the proposed mixture
distribution is superior to other distributions proposed in the literature. This can improve waiting time estimations in public transport models. The results show that even at 5-min headways 43% of passengers arrive in a timely manner to stations when timetables are available. The results bear important policy implications in terms of providing actual timetables, even at high service frequencies, in order for passengers to be able to minimise their waiting times.

**General information**
State: Published
Organisations: Department of Management Engineering, Transport DTU, Transport Modelling, Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Pontificia Universidad Catolica de Chile, Technical University of Denmark
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Pages: 292-306
Publication date: 2018
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Transportation Research. Part C: Emerging Technologies
Volume: 90
ISSN (Print): 0968-090X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SJR 2.293 SNIP 2.907 CiteScore 5.17
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.43 SJR 1.998 SNIP 2.638
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.026 SNIP 2.714 CiteScore 4.23
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.045 SNIP 3.169 CiteScore 3.84
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.851 SNIP 3.648 CiteScore 4.01
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.542 SNIP 2.823 CiteScore 2.76
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.42 SNIP 3.157 CiteScore 2.85
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.937 SNIP 2.356
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.088 SNIP 2.369
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.977 SNIP 2.523
Scopus rating (2007): SJR 0.901 SNIP 1.581
Scopus rating (2006): SJR 1.915 SNIP 2.76
Scopus rating (2005): SJR 1.49 SNIP 3.074
Scopus rating (2004): SJR 1.336 SNIP 2.802
Scopus rating (2003): SJR 0.84 SNIP 1.858
A personalized estimation of the cochlear shape can be used to create computational anatomical models to aid cochlear implant (CI) surgery and CI audio processor programming ultimately resulting in improved hearing restoration. The purpose of this work is to develop and test a method for estimation of the detailed patient-specific cochlear shape from CT images. From a collection of temporal bone CT images, we build a cochlear statistical deformation model (SDM), which is a description of how a human cochlea deforms to represent the observed anatomical variability. The model is used for regularization of a non-rigid image registration procedure between a patient CT scan and a CT image, allowing us to estimate the detailed patient-specific cochlear shape. We test the accuracy and precision of the predicted cochlear shape using both CT and CT images. The evaluation is based on classic generic metrics, where we achieve competitive accuracy with the state-of-the-art methods for the task. Additionally, we expand the evaluation with a few anatomically specific scores. The paper presents the process of building and using the SDM of the cochlea. Compared to current best practice, we demonstrate competitive performance and some useful properties of our method.
Patmos: a time-predictable microprocessor

Current processors provide high average-case performance, as they are optimized for general purpose computing. However, those optimizations often lead to a high worst-case execution time (WCET). WCET analysis tools model the architectural features that increase average-case performance. To keep analysis complexity manageable, those models need to abstract from implementation details. This abstraction further increases the WCET bound. This paper presents a way out of this dilemma: a processor designed for real-time systems. We design and optimize a processor, called Patmos, for low WCET bounds rather than for high average-case performance. Patmos is a dual-issue, statically scheduled RISC processor. A method cache serves as the cache for the instructions and a split cache organization simplifies the WCET analysis of the data cache. To fill the dual-issue pipeline with enough useful instructions, Patmos relies on a customized compiler. The compiler also plays a central role in optimizing the application for the WCET instead of average-case performance.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, Vienna University of Technology
Authors: Schoeberl, M. (Intern), Puffitsch, W. (Intern), Hepp, S. (Ekstern), Huber, B. (Ekstern), Prokesch, D. (Ekstern)
Pages: 1-35
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Real-Time Systems
Volume: 54
Issue number: 2
ISSN (Print): 0922-6443
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 2.237 SJR 0.257 CiteScore 2.28
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.26 SJR 0.392 SNIP 1.703
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.407 SNIP 1.904 CiteScore 1.85
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.448 SNIP 1.674 CiteScore 1.72
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.504 SNIP 1.509 CiteScore 1.59
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Functional magnetic resonance imaging is capable of estimating functional activation and connectivity in the human brain, and lately there has been increased interest in the use of these functional modalities combined with machine learning for identification of psychiatric traits. While these methods bear great potential for early diagnosis and better understanding of disease processes, there are wide ranges of processing choices and pitfalls that may severely hamper interpretation and generalization performance unless carefully considered. In this perspective article, we aim to motivate the use of machine learning schizotypy research. To this end, we describe common data processing steps while commenting on best practices and procedures. First, we introduce the important role of schizotypy to motivate the importance of reliable classification, and summarize existing machine learning literature on schizotypy. Then, we describe procedures for extraction of features based on fMRI data, including statistical parametric mapping, parcellation, complex network analysis, and decomposition methods, as well as classification with a special focus on support vector classification and deep learning. We provide more detailed descriptions and software as supplementary material. Finally, we present current challenges in machine learning for classification of schizotypy and comment on future trends and perspectives.
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.989 SJR 4.039 CiteScore 5.95
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 6.53 SJR 4.122 SNIP 1.964
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 4.166 SNIP 2.254 CiteScore 7.25
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 3.95 SNIP 2.465 CiteScore 6.96
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 4.327 SNIP 2.606 CiteScore 7.3
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 4.801 SNIP 2.795 CiteScore 7.39
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 4.674 SNIP 2.846 CiteScore 7.62
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 4.22 SNIP 2.404
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 3.691 SNIP 2.185
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 3.736 SNIP 2.027
Scopus rating (2007): SJR 2.729 SNIP 1.97
Scopus rating (2006): SJR 1.956 SNIP 1.643
Scopus rating (2005): SJR 1.691 SNIP 1.305
Scopus rating (2004): SJR 1.876 SNIP 1.437
Scopus rating (2003): SJR 2.403 SNIP 2.117
Scopus rating (2002): SJR 3.256 SNIP 2.09
Scopus rating (2001): SJR 3.207 SNIP 2.719
Scopus rating (2000): SJR 2.955 SNIP 2.739
Scopus rating (1999): SJR 3.013 SNIP 2.992
Original language: English
Functional magnetic resonance imaging, Feature extraction, Neuroimaging, Schizotypy, Schizophrenia spectrum disorder
DOIs: 10.1093/schbul/sby026

Relations
Projects:
Perspectives on Machine Learning for Classification of Schizotypy Using fMRI Data
Source: FindIt
Source-ID: 2396785971
Publication: Research - peer-review › Journal article – Annual report year: 2018

Phase function of a spherical particle when scattering an inhomogeneous electromagnetic plane wave
In absorbing media, electromagnetic plane waves are most often inhomogeneous. Existing solutions for the scattering of an inhomogeneous plane wave by a spherical particle provide no explicit expressions for the scattering components. In addition, current analytical solutions require evaluation of the complex hypergeometric function 2F1 for every term of a series expansion. In this work, I develop a simpler solution based on associated Legendre functions with argument zero. It is similar to the solution for homogeneous plane waves but with new explicit expressions for the angular dependency of the far-field scattering components, that is, the phase function. I include recurrence formulae for practical evaluation and provide numerical examples to evaluate how well the new expressions match previous work in some limiting cases. The predicted difference in the scattering phase function due to inhomogeneity is not negligible for light entering an absorbing medium at an oblique angle. The presented theory could thus be useful for predicting scattering behavior in dye based
Polarization noise places severe constraints on coherence of all-normal dispersion femtosecond supercontinuum generation

Supercontinuum (SC) generated with all-normal dispersion (ANDi) fibers has been of special interest in recent years due to its potentially superior coherence properties when compared to anomalous dispersion-pumped SC. However, care must be taken in the design of such sources since too long pump pulses and fiber length has been demonstrated to degrade the...
coherence. To assess the noise performance of ANDi fiber SC generation numerically, a scalar single-polarization model has so far been used, thereby excluding important sources of noise, such as polarization modulational instability (PMI). In this work we numerically study the influence of pump power, pulse length and fiber length on coherence and relative intensity noise (RIN), taking into account both polarization components in a standard ANDi fiber for SC generation pumped at 1064 nm. We demonstrate that the PMI introduces a power dependence not found in a scalar model, which means that even with short ~120 fs pump pulses the coherence of ANDi SC can be degraded at reasonable power levels above ~40 kW. We further demonstrate how the PMI significantly decreases the pump pulse length and fiber length at which the coherence of the ANDi SC is degraded. The numerical predictions are confirmed by RIN measurements of fs-pumped ANDi fiber SC.

General information
State: Published
Organisations: Department of Photonics Engineering, Fiber Sensors and Supercontinuum Generation, Department of Applied Mathematics and Computer Science, Dynamical Systems
Authors: Bravo Gonzalo, I. (Intern), Engelsholm, R. D. (Intern), Sørensen, M. P. (Intern), Bang, O. (Intern)
Number of pages: 13
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Scientific Reports
Volume: 8
Article number: 6579
ISSN (Print): 2045-2322
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.36 SJR 1.533 SNIP 1.245
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.63 SJR 1.692 SNIP 1.354
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.034 SNIP 1.597 CiteScore 5.3
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.163 SNIP 1.554 CiteScore 4.75
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.998 SNIP 1.57 CiteScore 4.06
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.531 SNIP 0.962 CiteScore 2.44
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
ISI indexed (2011): ISI indexed no
Original language: English
Electronic versions:
DOIs:
10.1038/s41598-018-24691-7
Source: PublicationPreSubmission
Source-ID: 147225461
Publication: Research - peer-review › Journal article – Annual report year: 2018

Porosity and density measurements of sodium acetate trihydrate for thermal energy storage
Sodium acetate trihydrate (SAT) can be used as phase change material in latent heat storage with or without utilizing supercooling. The change of density between liquid to solid state leads to formation of cavities inside the bulk SAT during
solidification. Samples of SAT which had solidified from supercooled state at ambient temperature and samples which had solidified with a minimal degree supercooled were investigated. The temperature dependent densities of liquid and the two types of solid SAT were measured with a density meter and a thermomechanical analyzer. The cavities formed inside samples of solid SAT, which had solidified after a high or minimal degree of supercooling, were investigated by X-ray scanning and computer tomography. The apparent density of solid SAT depended on whether it solidified from a supercooled state or not. A sample which solidified from a supercooled liquid contained 15% cavities and had a density of 1.26 g/cm³ at 25 °C. SAT which had solidified with minimal supercooling contained 9% cavities and had a density of 1.34 g/cm³ at 25 °C. The apparent densities of the solid SAT samples were significant lower than the value of solid SAT reported in literature of 1.45 g/cm³. The density of liquid and supercooled SAT with extra water was also determined at different temperatures.
Power decoding Reed-Solomon codes up to the Johnson radius

Power decoding, or "decoding using virtual interleaving" is a technique for decoding Reed-Solomon codes up to the Sudan radius. Since the method's inception, it has been an open question if it is possible to use this approach to decode up to the Johnson radius - the decoding radius of the Guruswami-Sudan algorithm. In this paper we show that this can be done by incorporating a notion of multiplicities. As the original Power decoding, the proposed algorithm is a one-pass algorithm: decoding follows immediately from solving a shift-register type equation, which we show can be done in quasi-linear time. It is a "partial bounded-distance decoding algorithm" since it will fail to return a codeword for a few error patterns within its decoding radius; we investigate its failure behaviour theoretically as well as give simulation results.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics
Authors: Rosenkilde, J. S. H. (Intern)
Pages: 81-106
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Advances in Mathematics of Communications
Volume: 12
Issue number: 1
ISSN (Print): 1930-5346
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.839 SJR 0.421 CiteScore 0.62
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.65 SJR 0.417 SNIP 0.845
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.512 SNIP 1.024 CiteScore 0.72
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.69 SNIP 1.273 CiteScore 0.84
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.675 SNIP 1.045 CiteScore 0.82
ISI indexed (2013): ISI indexed yes
Predicting Clinical Control from DrugStars App Medication Reviews

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis
Authors: Lynggaard, C. B. (Intern)
Number of pages: 18
Publication date: 2018

Publication information
Publisher: DTU Compute
Original language: English
Main Research Area: Technical/natural sciences

Bibliographical note
FORTROLIG RAPPORT. Må ikke være offentlig tilgængelig
Source: PublicationPreSubmission
Source-ID: 149066974
Publication: Research › Report – Annual report year: 2018

Predictive assessment of models for dynamic functional connectivity
In neuroimaging, it has become evident that models of dynamic functional connectivity (dFC), which characterize how intrinsic brain organization changes over time, can provide a more detailed representation of brain function than traditional static analyses. Many dFC models in the literature represent functional brain networks as a meta-stable process with a discrete number of states; however, there is a lack of consensus on how to perform model selection and learn the number of states, as well as a lack of understanding of how different modeling assumptions influence the estimated state dynamics. To address these issues, we consider a predictive likelihood approach to model assessment, where models are evaluated based on their predictive performance on held-out test data. Examining several prominent models of dFC (in their probabilistic formulations) we demonstrate our framework on synthetic data, and apply it on two real-world examples: a face recognition EEG experiment and resting-state fMRI. Our results evidence that both EEG and fMRI are better characterized using dynamic modeling approaches than by their static counterparts, but we also demonstrate that one must be cautious when interpreting dFC because parameter settings and modeling assumptions, such as window lengths and emission models, can have a large impact on the estimated states and consequently on the interpretation of the brain dynamics.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems
Authors: Nielsen, S. F. V. (Intern), Schmidt, M. N. (Intern), Madsen, K. H. (Intern), Mørup, M. (Intern)
Number of pages: 35
Publication date: 2018
Main Research Area: Technical/natural sciences
Probabilistic sparse non-negative matrix factorization

In this paper, we propose a probabilistic sparse non-negative matrix factorization model that extends a recently proposed variational Bayesian non-negative matrix factorization model to explicitly account for sparsity. We assess the influence of imposing sparsity within a probabilistic framework on either the loading matrix, score matrix, or both and further contrast the influence of imposing an exponential or truncated normal distribution as prior. The probabilistic methods are compared to conventional maximum likelihood based NMF and sparse NMF on three image datasets; (1) A (synthetic) swimmer dataset, (2) The CBCL face dataset, and (3) The MNIST handwritten digits dataset. We find that the probabilistic sparse NMF is able to automatically learn the level of sparsity and find that the existing probabilistic NMF as well as the proposed probabilistic sparse NMF prunes inactive components and thereby automatically learns a suitable number of components. We further find that accounting for sparsity can provide more part based representations but for the probabilistic modeling the choice of priors and how sparsity is imposed can have a strong influence on the extracted representations.
Production Optimization of a Rigorous Thermal and Compositional Reservoir Flow Model This project is funded by Innovation Fund Denmark in the OPTION project (63-2013-3)

We model thermal and compositional reservoir production as mass and energy balances combined with a phase equilibrium constraint. The phase equilibrium constraint is modeled as a thermodynamically rigorous UV flash process. The UV flash problem is a mathematical statement of the second law of thermodynamics, and it replaces the condition of equality of fugacities that is often used. We demonstrate that such a thermal and compositional reservoir model is in a semi-explicit index-1 differential-algebraic form, and we briefly describe a gradient-based single-shooting algorithm for the solution of production optimization problems. We implement the algorithm in C/C++ using the software DUNE, the thermodynamic software ThermoLib, and the optimization software KNITRO. We present an example of optimal waterflooding where the injected water has a higher temperature than the reservoir fluid.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Center for Energy Resources Engineering
Authors: Ritschel, T. K. S. (Intern), Jørgensen, J. B. (Intern)
Pages: 76-81
Publication date: 2018
Conference: 3rd IFAC Workshop on Automatic Control in Offshore Oil and Gas Production, Esbjerg, Denmark, 30/05/2018 - 30/05/2018
Main Research Area: Technical/natural sciences

Publication information
Journal: IFAC-PapersOnLine
Volume: 51
Issue number: 8
ISSN (Print): 2405-8963
Ratings:
Scopus rating (2017): CiteScore 0.68 SJR 0.26 SNIP 0.434
Scopus rating (2016): CiteScore 0.45 SJR 0.234 SNIP 0.328
Scopus rating (2015): SJR 0.298 SNIP 0.39
Scopus rating (2014): SJR 0.298 SNIP 0.383
Scopus rating (2013): SJR 0.326 SNIP 0.41
Scopus rating (2012): SJR 0.265 SNIP 0.331
Scopus rating (2011): SJR 0.257 SNIP 0.324
Scopus rating (2010): SJR 0.197 SNIP 0.276
Scopus rating (2009): SJR 0.211 SNIP 0.29
Scopus rating (2008): SJR 0.172 SNIP 0.239
Scopus rating (2007): SJR 0.195 SNIP 0.271
Scopus rating (2006): SJR 0.21 SNIP 0.284
Scopus rating (2005): SJR 0.192 SNIP 0.445
Scopus rating (2004): SJR 0.245 SNIP 0.419
Scopus rating (2003): SJR 0.26 SNIP 0.403
Original language: English
Thermal, Compositional model, Phase equilibrium, Optimal control
Electronic versions:
1_s2.0_S2405896318306888_main.pdf
DOIs:
10.1016/j.ifacol.2018.06.358
Source: FindIt
Source-ID: 2437931605
Publication: Research - peer-review > Journal article – Annual report year: 2018

Programming and Verifying a Declarative First-Order Prover in Isabelle/HOL
We certify in the proof assistant Isabelle/HOL the soundness of a declarative first-order prover with equality. The LCF-style prover is a translation we have made, to Standard ML, of a prover in John Harrison’s Handbook of Practical Logic and Automated Reasoning. We certify it by replacing its kernel with a certified version that we program, certify and generate
code from; all in Isabelle/HOL. In a declarative proof each step of the proof is declared, similar to the sentences in a thorough paper proof. The prover allows proofs to mix the declarative style with automatic theorem proving by using a tableau prover. Our motivation is teaching how automated and declarative provers work and how they are used. The prover allows studying concrete code and a formal verification of correctness. We show examples of proofs and how they are made in the prover. The entire development runs in Isabelle’s ML environment as an interactive application or can be used standalone in OCaml or Standard ML (or in other functional programming languages like Haskell and Scala with some additional work).

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Authors: Jensen, A. B. (Intern), Larsen, J. B. (Intern), Schlichtkrull, A. (Intern), Villadsen, J. (Intern)
Pages: 281-299
Publication date: 2018
Main Research Area: Technical/natural sciences

Putting Wings on SPHINCS
SPHINCS is a recently proposed stateless hash-based signature scheme and promising candidate for a post-quantum secure digital signature scheme. In this work we provide a comparison of the performance when instantiating SPHINCS with different cryptographic hash functions on both recent Intel and AMD platforms found in personal computers and the ARMv8-A platform which is prevalent in mobile phones.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cyber Security
Authors: Kölbl, S. (Intern)
Pages: 205-226
Host publication information
Title of host publication: Post-quantum Cryptography
Volume: 10786
Publisher: Springer
ISBN (Print): 9783319790633
Series: Lecture Notes in Computer Science
Volume: 10786
ISSN: 0302-9743
Main Research Area: Technical/natural sciences
Conference: 9th International Workshop on Post-Quantum Cryptography, Fort Lauderdale, United States, 09/04/2018 - 09/04/2018
Post-quantum cryptography, Hash-based signature schemes, SPHINCS, Implementation, ARM
DOIs:
10.1007/978-3-319-79063-3_10
Source: FindIt
Source-ID: 2398001076
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

Querying Social Practices in Hospital Context
Understanding the social contexts in which actions and interactions take place is of utmost importance for planning one’s goals and activities. People use social practices as means to make sense of their environment, assessing how that context relates to past, common experiences, culture and capabilities. Social practices can therefore simplify deliberation and planning in complex contexts. In the context of patient-centered planning, hospitals seek means to ensure that patients and their families are at the center of decisions and planning of the healthcare processes. This requires on one hand that patients are aware of the practices being in place at the hospital and on the other hand that hospitals have the means to evaluate and adapt current practices to the needs of the patients. In this paper we apply a framework for formalizing social practices of an organization to an emergency department that carries out patient-centered planning. We indicate how such a formalization can be used to answer operational queries about the expected outcome of operational actions.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Technical University of Denmark, Delft University of Technology
Authors: Larsen, J. B. (Intern), Dignum, V. (Ekstern), Villadsen, J. (Intern), Dignum, F. (Ekstern)
Pages: 405-412
Publication date: 2018

Host publication information
Title of host publication: Proceedings of the 10th International Conference on Agents and Artificial Intelligence - Volume 2: ICAART
Publisher: SCITEPRESS Digital Library
Main Research Area: Technical/natural sciences
Conference: 10th International Conference on Agents and Artificial Intelligence, Funchal, Madeira, Portugal, 16/01/2018 - 16/01/2018
Social Practices, Hospital Staff Planning, Multi-Agent Goals, Decision Support
Electronic versions:
ICAART_2018_42_CR.pdf
DOIs:
10.5220/0006580904050412
Source: PublicationPreSubmission
Source-ID: 145691862
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

Real-time fault detection and diagnosis using sparse principal component analysis
With the emergence of smart factories, large volumes of process data are collected and stored at high sampling rates for improved energy efficiency, process monitoring and sustainability. The data collected in the course of enterprise-wide operations consists of information from broadly deployed sensors and other control equipment. Interpreting such large volumes of data with limited workforce is becoming an increasingly common challenge. Principal component analysis (PCA) is a widely accepted procedure for summarizing data while minimizing information loss. It does so by finding new variables, the principal components (PCs) that are linear combinations of the original variables in the dataset. However, interpreting PCs obtained from many variables from a large dataset is often challenging, especially in the context of fault
Sparse principal component analysis (SPCA) is a relatively recent technique proposed for producing PCs with sparse loadings via variance-sparsity trade-off. Using SPCA, some of the loadings on PCs can be restricted to zero. In this paper, we introduce a method to select the number of non-zero loadings in each PC while using SPCA. The proposed approach considerably improves the interpretability of PCs while minimizing the loss of total variance explained. Furthermore, we compare the performance of PCA- and SPCA-based techniques for fault detection and fault diagnosis. The key features of the methodology are assessed through a synthetic example and a comparative study of the benchmark Tennessee Eastman process.
Reconfiguration of Computation and Communication Resources in Multi-Core Real-Time Embedded Systems

Reconfigurable computing allows application programmers to significantly increase the speed of software algorithms by implementing computationally demanding tasks in hardware while maintaining a certain degree of flexibility. This can be achieved by using FPGAs to implement hardware accelerators that can be reconfigured when no longer needed, enabling the re-use of the resources of the FPGAs to realise new functionalities. For multi-core platforms, reconfiguration can be extended to the infrastructure supporting intercore communication and used to dynamically modify the characteristics of the communication channels between the tasks that are affected by the reconfiguration. This thesis investigates the use of reconfiguration in the context of multicore realtime systems targeting embedded applications. We address the reconfiguration of both the computation and the communication resources of a multi-core platform. Our approach is to associate reconfiguration with operational mode changes where the system, during normal operation, changes a subset of the executing tasks to adapt its behaviour to new conditions. Reconfiguration is therefore used during a mode change to modify the real-time guaranteed services provided by the hardware platform to fit the requirements of the current mode. The reconfiguration of the computation resources consists of altering the hardware implementation of selected resources, such as accelerators, and it is achieved by using the dynamic partial reconfiguration feature offered by FPGAs. With regards to this, we also present a lightweight reconfiguration controller, named RT-ICAP, specially developed to support time predictable dynamic partial reconfiguration. There configuration of the communication resources consists of setting up and tearing down the end-to-end channels offered by the communication fabric between the cores of the platform. To support this, we present a new network on chip architecture, named Argo 2, that allows instantaneous and time-predictable reconfiguration of the communication channels. Our reconfiguration-capable architecture is prototyped using the existing time-predictable multi-processor platform T-CREST. The thesis also presents low-level reconfiguration time analysis for these architectures. The evaluation of the proposed approach and the developed architectures is carried out using synthetic benchmarks and hardware accelerators generated by high-level synthesis tools. For the reconfiguration of computation resources, the results show that the use of accelerators in combination with dynamic partial reconfiguration leads to better utilisation of the FPGA resources and tighter worst-case execution time bounds than a pure software solution. Moreover, the results show that using a configurable solution delivers a worst case performance comparable with that of a non-reconfigurable solution. For the reconfiguration of communication resources, the results show that the worst-case reconfiguration time ranges from hundreds to thousands of clock cycles, making our solution considerably faster than other functionally equivalent networks-on-chips. In addition to the evaluation based on synthetic benchmarks, we also present a proof-of-concept case study based on a multi-core audio digital signal-processing application that combines reconfiguration of both the computation and communication resources. The case study shows that the presented approaches for reconfiguration can be effectively used in a real-world application and can lead to a reduction of the overall hardware size and better use of the platform resources while maintaining comparable computation performance with respect to a non-reconfigurable approach.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering
Authors: Pezzarossa, L. (Intern)
Number of pages: 152
Publication date: 2018

Publication information
Publisher: DTU Compute
Original language: English
Series: DTU Compute PHD-2018
Volume: 469
ISSN: 0909-3192
Main Research Area: Technical/natural sciences
“A Holistic Approach for Collaborative Workload Execution in Volunteer Clouds” [3] proposes a novel approach to task scheduling in volunteer clouds. Volunteer clouds are decentralized cloud systems based on collaborative task execution, where clients voluntarily share their own unused computational resources. By using simulation-based statistical analysis techniques—in particular, statistical model checking—the authors show that their approach can outperform existing distributed task scheduling algorithms in the case of computation-intensive workloads. The analysis considered a realistic workload benchmark provided by Google. This replicated computations results report focuses on the prototypical tool implementation used in the article to perform such analysis. The software was straightforward to install and use, and a representative part of the experimental results from the article could be reproduced in reasonable time using a standard laptop.
Rigorous optimisation of multilinear discriminant analysis with Tucker and PARAFAC structures

Background: We propose rigorously optimised supervised feature extraction methods for multilinear data based on Multilinear Discriminant Analysis (MDA) and demonstrate their usage on Electroencephalography (EEG) and simulated data. While existing MDA methods use heuristic optimisation procedures based on ambiguous Tucker structure, we propose a rigorous approach via optimisation on the cross-product of Stiefel manifolds. We also introduce MDA methods with the PARAFAC structure. We compare the proposed approaches to existing MDA methods and unsupervised multilinear decompositions.

Results: We find that manifold optimisation substantially improves MDA objective functions relative to existing methods and on simulated data in general improve classification performance. However, we find similar classification performance when applied to the electroencephalography data. Furthermore, supervised approaches substantially outperform unsupervised multilinear methods whereas methods with the PARAFAC structure perform similarly to those with Tucker structures. Notably, despite applying the MDA procedures to raw Brain-Computer Interface data, their performances are on par with results employing ample pre-processing and they extract discriminatory patterns similar to the brain activity known to be elicited in the investigated EEG paradigms.

Conclusion: The proposed usage of manifold optimisation constitutes the first rigorous and monotonous optimisation approach for MDA methods and allows for MDA with the PARAFAC structure. Our results show that MDA methods applied to raw EEG data can extract discriminatory patterns when compared to traditional unsupervised multilinear feature extraction approaches, whereas the proposed PARAFAC structured MDA models provide meaningful patterns of activity.
Robust Backlash Estimation for Industrial Drive-Train Systems—Theory and Validation

Backlash compensation is used in modern machinetool controls to ensure high-accuracy positioning. When wear of a machine causes deadzone width to increase, high-accuracy control may be maintained if the deadzone is accurately estimated. Deadzone estimation is also an important parameter to indicate the level of wear in a machine transmission, and tracking its development is essential for condition-based maintenance. This paper addresses the backlash estimation problem using sliding-mode and adaptive estimation principles and shows that prognosis of the development of wear is possible in both theory and practice. This paper provides the proof of asymptotic convergence of the suggested estimator,
and it shows how position offset between motor and load is efficiently utilized in the design of a very efficient estimator. The algorithm is experimentally tested on a drive-train system with the state-of-the-art Siemens equipment. The experiments validate the theory and show that expected performance and robustness to parameter uncertainties are both achieved.

**General information**

State: Accepted/In press

Organisations: Department of Electrical Engineering, Automation and Control, Department of Applied Mathematics and Computer Science, Siemens

Authors: Papageorgiou, D. (Intern), Blanke, M. (Intern), Niemann, H. H. (Intern), Richter, J. H. (Ekstern)

Number of pages: 15

Publication date: 2018

Main Research Area: Technical/natural sciences

**Publication information**

Journal: IEEE Transactions on Control Systems Technology

ISSN (Print): 1063-6536

Ratings:

BFI (2018): BFI-level 2

Web of Science (2018): Indexed yes

BFI (2017): BFI-level 2

Scopus rating (2017): CiteScore 5.89 SJR 1.832 SNIP 2.728

Web of Science (2017): Indexed Yes

BFI (2016): BFI-level 2

Scopus rating (2016): CiteScore 5.17 SJR 1.655 SNIP 2.643

Web of Science (2016): Indexed yes

BFI (2015): BFI-level 2

Scopus rating (2015): SJR 1.966 SNIP 2.798 CiteScore 4.72

Web of Science (2015): Indexed yes

BFI (2014): BFI-level 2

Scopus rating (2014): SJR 1.786 SNIP 3.006 CiteScore 4.34

Web of Science (2014): Indexed yes

BFI (2013): BFI-level 2

Scopus rating (2013): SJR 1.707 SNIP 3.41 CiteScore 4.41

ISI indexed (2013): ISI indexed yes

Web of Science (2013): Indexed yes

BFI (2012): BFI-level 2

Scopus rating (2012): SJR 1.495 SNIP 3.011 CiteScore 3.7

ISI indexed (2012): ISI indexed yes

BFI (2011): BFI-level 2

Scopus rating (2011): SJR 1.585 SNIP 2.909 CiteScore 3.26

ISI indexed (2011): ISI indexed yes

Web of Science (2011): Indexed yes

BFI (2010): BFI-level 2

Scopus rating (2010): SJR 1.098 SNIP 2.391

BFI (2009): BFI-level 2

Scopus rating (2009): SJR 1.587 SNIP 2.789

BFI (2008): BFI-level 2

Scopus rating (2008): SJR 1.43 SNIP 2.736

Scopus rating (2007): SJR 1.082 SNIP 2.205

Scopus rating (2006): SJR 1.021 SNIP 2.306

Scopus rating (2005): SJR 0.968 SNIP 2.593

Scopus rating (2004): SJR 1.173 SNIP 2.183

Scopus rating (2003): SJR 1.537 SNIP 2.355

Scopus rating (2002): SJR 2.342 SNIP 2.886

Scopus rating (2001): SJR 2.073 SNIP 2.262

Scopus rating (2000): SJR 0.608 SNIP 2.15
Scattering of flexural waves in Euler-Bernoulli beams by short-range potentials: Paper

Time-harmonic flexural waves on a beam and on two elastically coupled beams with short-range localized imperfections in the mass distribution and in the position dependant coupling are considered. Thus scattering of an incident wave solution to the Euler-Bernoulli equation by a Dirac delta function and its derivative up to order three is studied, and the possible physical interpretations are outlined. Reflected, transmitted and evanescent waves exist, and their scattering data are determined. For $\delta(x)$ and $\delta'(x)$, the scattering problem is solved by standard integration. For $\delta''(x)$ and $\delta'''(x)$, the standard integration procedure does not work and solutions are obtained by regularization. In the latter case the scatterer is in general nontransparent and only partially penetrable at discrete resonances. The first few of these as well as their scattering data are determined numerically.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Department of Physics, Dynamical Systems, Bogolyubov Institute for Theoretical Physics Nasu
Authors: Christiansen, P. L. (Intern), Iermakova, S. V. (Ekstern), Gaididei, Y. B. (Ekstern), Sørensen, M. P. (Intern)
Number of pages: 16
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Physics A-mathematical and Theoretical
Volume: 51
Issue number: 9
Article number: 095202
ISSN (Print): 1751-8113
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.924 SJR 0.843 CiteScore 1.74
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.45 SJR 0.935 SNIP 0.959
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.028 SNIP 1.048 CiteScore 1.34
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.936 SNIP 0.945 CiteScore 1.36
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.935 SNIP 0.998 CiteScore 1.42
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.047 SNIP 1.067 CiteScore 1.49
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.947 SNIP 0.948 CiteScore 1.41
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.06 SNIP 1.022
Screening wells by multi-scale grids for multi-stage Markov Chain Monte Carlo simulation

For improved prediction of subsurface flows and representation of the uncertainties of geostatistical properties, we use the framework of Bayesian statistical interface in combination with the Markov Chain Monte Carlo (MCMC) method which needs many fine-scale simulations. Hence it is essential to apply cheap screening stages, such as coarse-scale simulation to remove irrelevant proposals of the generated Markov chain, reduce fine-scale computational cost and increase the acceptance rate of MCMC. We propose a screening step, that is examination of subsurface characteristics around injection/production wells, aiming at accurate breakthrough capturing as well as above mentioned efficiency goals. However this short time simulation needs fine-scale structure of the geological model around wells and running a fine-scale model is not as cheap as necessary for screening steps. On the other hand applying it on a coarse-scale model declines important data around wells and causes inaccurate results, particularly accurate breakthrough capturing which is important for prediction applications. Therefore we propose a multi-scale grid which preserves the fine-scale model around wells (as well as high permeable regions and fractures) and coarsens rest of the field and keeps efficiency and accuracy for the screening well stage and coarse-scale simulation, as well. A discrete wavelet transform is used as a powerful tool to generate the desired unstructured multi-scale grid efficiently. Finally an accepted proposal on coarse-scale models (screening well stage and coarse-scale simulation) will be assessed by fine-scale simulation. Accepted proposals are saved for prediction. Numerical results admit increment in acceptance rate, improvement in breakthrough capturing and significant reduction in computational cost by avoiding many forward simulations.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing
Authors: Akbari, H. (Intern), Engsig-Karup, A. P. (Intern)
Pages: 15-28
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Mathematics and Computers in Simulation
Volume: 151
ISSN (Print): 0378-4754
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Secure information release in timed automata

One of the key demands of cyberphysical systems is that they meet their safety goals. Timed automata has established itself as a formalism for modeling and analyzing the real-time safety aspects of cyberphysical systems. Increasingly it is also demanded that cyberphysical systems meet a number of security goals for confidentiality and integrity. Notions of security based on Information flow control, such as non-interference, provide strong guarantees that no information is leaked; however, many cyberphysical systems leak intentionally some information in order to achieve their purposes. In
this paper, we develop a formal approach of information flow for timed automata that allows intentional information leaks. The security of a timed automaton is then defined using a bisimulation relation that takes account of the non-determinism and the clocks of timed automata. Finally, we define an algorithm that traverses a timed automaton and imposes information flow constraints on it and we prove that our algorithm is sound with respect to our security notion.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Formal Methods
Authors: Vasilikos, P. (Intern), Nielson, F. (Intern), Nielson, H. R. (Intern)
Pages: 28-52
Publication date: 2018

**Host publication information**
Title of host publication: POST 2018: Principles of Security and Trust
Publisher: Springer
ISBN (Print): 978-3-319-89721-9

Series: Lecture Notes in Computer Science
Volume: 10804
Main Research Area: Technical/natural sciences
Conference: 7th International Conference on Principles of Security and Trust, Thessaloniki, Greece, 14/04/2018 - 14/04/2018
Electronic versions: 978_3_319_89722_6_2.pdf
DOIs: 10.1007/978-3-319-89722-6_2
Source: FindIt
Source-ID: 2434572427
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

**Segmentation-Driven Tomographic Reconstruction.**
The tomographic reconstruction problem is concerned with creating a model of the interior of an object from some measured data, typically projections of the object. After reconstructing an object it is often desired to segment it, either automatically or manually. For computed tomography (CT), the classical reconstruction methods suffer from their inability to handle limited and/or corrupted data. Form any analysis tasks computationally demanding segmentation methods are used to automatically segment an object, after using a simple reconstruction method as a first step. In the literature, methods that completely combine reconstruction and segmentation have been suggested, but these are often non-convex and have very high computational demand. We propose to move the computational effort from the segmentation process to the reconstruction process, and instead design reconstruction methods such that the segmentation subsequently can be carried out by use of a simple segmentation method, for instance just a thresholding method. We tested the advantages of going from a two-stage reconstruction method to a one stage segmentation-driven reconstruction method for the phase contrast tomography reconstruction problem. The tests showed a clear improvement for realistic materials simulations and that the one-stage method was clearly more robust toward noise. The noise-robustness result could be a step toward making this method more applicable for lab-scale experiments. We have introduced a segmentation-driven reconstruction method which incorporates information about the main texture direction in an object. We proved that this method has mathematically desirable properties such as being convex and lower semicontinuous. We have also demonstrated the practical applicability of the method.

within image denoising, image deblurring and CT reconstruction. In order to use the proposed method we also proposed efficient and robust methods for estimating the main direction in either corrupted images or from limited and corrupted CT projection data. For directional object we also proposed two different reconstruction methods that separates the directional parts in the object from the non-directional parts. These method could for example be used for objects consisting of fibres and cracks. The results can be categorized as either completely combined reconstruction and segmentation of the object, or as highly supporting for the following segmentation process. Computed tomography is used within medical diagnosis, food science, materials science, production inspection, quality assessment, etc. Segmentation-driven reconstruction methods can help improve both manual and automated segmentation processes that are used to analyze an object after the scanning. The results in this thesis are both of theoretical interest within regularization theory and directly applicable for image denoising, image deblurring and surely within tomographic reconstruction

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing
Authors: Kongskov, R. D. (Intern), Dong, Y. (Intern), Knudsen, K. (Intern)
Number of pages: 136
Selected papers from the 2nd IEEE Nordic Circuits and Systems Conference (NorCAS), 2016.
This special issue includes selected papers from the 2nd IEEE Nordic Circuits and Systems Conference (NorCAS), held in Linköping, Sweden, October 24-25, 2016. The IEEE NorCAS conference is the main circuits and systems event of the Nordic and Baltic countries representing both academia and the electronics industry. The NorCAS conference emerged in 2015 from the merger of the Norchip conference held annually in different Nordic and Baltic countries since 1983, and the International Symposium on Systems on chip held annually in Tampere, Finland since 1999.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering
Authors: Sparsø, J. (Intern)
Pages: 38-39
Publication date: 2018
Conference: Nordic Circuits and Systems Conference (NORCAS): NORCHIP and International Symposium of System-on-Chip (SoC), Linköping, Sweden, 23/10/2017 - 23/10/2017
Main Research Area: Technical/natural sciences

Publication Information
Journal: Microprocessors and Microsystems
Volume: 60
ISSN (Print): 0141-9331
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.19 SJR 0.24 SNIP 0.771
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.11 SJR 0.225 SNIP 0.822
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.25 SNIP 0.857 CiteScore 0.89
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.236 SNIP 1.057 CiteScore 0.97
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.225 SNIP 1.182 CiteScore 1.02
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.214 SNIP 0.729 CiteScore 0.94
ISI indexed (2012): ISI indexed yes
Silo response - The dangers of using carbon dioxide to quench silo fires

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Statistics and Data Analysis, Industrial Fire Prevention LLC
Authors: Hedlund, F. H. (Intern), Nichols, J. (Ekstern)
Pages: 16-17
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Canadian Biomass
Volume: 18
Issue number: 2
ISSN (Print): 2290-3097
Original language: English
Electronic versions:
2018_Canadian_Biomass_Silo_response_The_dangers_of_using_carbon_dioxide_to_quench_silo_fires.pdf
Source: PublicationPreSubmission
Source-ID: 145756029
Publication: Communication › Journal article – Annual report year: 2018

Simulating flood risk under non-stationary climate and urban development conditions - Experimental setup for multiple hazards and a variety of scenarios
A framework for assessing economic flood damage for a large number of climate and urban development scenarios with limited computational effort is presented. Response surfaces are applied to characterize flood damage based on physical variables describing climate-driven hazards and changing vulnerability resulting from urban growth. The framework is embedded in an experimental setup where flood damage obtained from combined hydraulic-urban development simulations is approximated using kriging-metamodels. Space-filling, sequential and stratified sequential sampling strategies are tested. Reliable approximations of economic damage are obtained in a theoretical case study involving pluvial and coastal hazards, and the stratified sequential sampling strategy is most robust to irregular surface shapes. The setup is currently limited to considering only planned urban development patterns and flood adaptation options implemented over short time horizons. However, the number of simulations is reduced by up to one order of magnitude compared to scenario-based methods, highlighting the potential of the approach.
Simulation tools for scattering corrections in spectrally resolved X-ray Computed Tomography using McXtrace

Spectral computed tomography is an emerging imaging method that involves using recently developed energy discriminating photon-counting detectors (PCDs). This technique enables measurements at isolated high-energy ranges, in which the dominating underlying interaction between the x-ray and the sample is the incoherent scattering. The scattered radiation causes a loss of contrast in the results, and its correction has proven to be a complex problem, due to its dependence on energy, material composition, and geometry. Monte Carlo simulations can utilize a physical model to estimate the scattering contribution to the signal, at the cost of high computational time. We present a fast Monte Carlo simulation tool, based on McXtrace, to predict the energy resolved radiation being scattered and absorbed by objects of complex shapes. We validate the tool through measurements using a CdTe single PCD (Multix ME-100) and use it for scattering correction in a simulation of a spectral CT. We found the correction to account for up to 7% relative amplification in the reconstructed linear attenuation. It is a useful tool for x-ray CT to obtain a more accurate material discrimination, especially in the high-energy range, where the incoherent scattering interactions become prevailing (>50keV).
Skull segmentation from MR scans using a higher-order shape model based on convolutional restricted Boltzmann machines

Transcranial brain stimulation (TBS) techniques such as transcranial magnetic stimulation (TMS), transcranial direct current stimulation (tDCS) and others have seen a strong increase as tools in therapy and research within the last 20 years. In order to precisely target the stimulation, it is important to accurately model the individual head anatomy of a subject. Of particular importance is accurate reconstruction of the skull, as it has the strongest impact on the current pathways due to its low conductivity. Thus providing automated tools, which can reliably reconstruct the anatomy of the human head from magnetic resonance (MR) scans would be highly valuable for the application of transcranial stimulation methods. These head models can also be used to inform source localization methods such as EEG and MEG. Automated segmentation of the skull from MR images is, however, challenging as the skull emits very little signal in MR. In order to avoid topological defects, such as holes in the segmentations, a strong model of the skull shape is needed. In this paper we propose a new shape model for skull segmentation based on the so-called convolutional restricted Boltzmann machines (cRBMs). Compared to traditionally used lower-order shape models, such as pair-wise Markov random fields (MRFs), the cRBMs model local shapes in larger spatial neighborhoods while still allowing for efficient inference. We compare the skull segmentation accuracy of our approach to two previously published methods and show significant improvement.

General information

State: Published
Organisations: Department of Electrical Engineering, Center for Magnetic Resonance, Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Cognitive Systems, Hvidovre Hospital
Authors: Puonti, O. (Intern), Van Leemput, K. (Intern), Nielsen, J. D. (Intern), Bauer, C. (Ekstern), Siebner, H. R. (Ekstern), Madsen, K. H. (Intern), Thielscher, A. (Intern)
Slice-wise motion tracking during simultaneous EEG-fMRI
Slice-wise motion tracking during combined electroencephalography (EEG) and echo planar imaging (EPI) is developed. Using gradient-induced noise on the EEG for tracking, no interleaved navigator modules or additional hardware is needed. The motion parameters are determined after a calibration and training scan. The method is explored in a phantom and in vivo.

Smart Buildings Retrofit Accelerator: "Making Housing Energy Renovation an Investment Opportunity"
Communication between distributed energy resources and aggregators is necessary to improve the efficiency of power use and solve stability issues. For the communication, the probability of delivery for measurements and control commands, determines the possible power system services. The probability of delivery is determined by the processing units, data connection, middleware, and serialization. The comparison is made based on multiple experimental setups to test the performance of different middleware and serialization with different processing units and data connections in a
Smart Grid context. The hardware includes Beagle Bones, Raspberry Pi's, and Dell laptops processing units, and the data connection bandwidths include 1, 10, 100 and 1000 Mbit/s. The results show that there are better alternatives to XMPP and Web Services middleware and XML serialization as advocated for by the prevalent communication standards. The paper gives guidance in choosing the best software and hardware for communication depending on the use case.

**General information**

State: Published
Authors: Petersen, B. S. (Intern), Bindner, H. W. (Intern), Poulsen, B. (Intern), You, S. (Intern)
Number of pages: 8
Pages: 7-14
Publication date: 2018
Main Research Area: Technical/natural sciences

**Publication information**

Journal: International Journal of Electrical and Electronic Engineering and Telecommunications
Volume: 7
Issue number: 1
ISSN (Print): 2319-2518
Original language: English
Computer Networks and Communications, Electrical and Electronic Engineering, Instrumentation, Communication, Infrastructure, Middleware, Serialization, Smart grid
DOIs:
10.18178/ijeetc.7.1.7-14
Source: FindIt
Source-ID: 2395733390
Publication: Research - peer-review › Journal article – Annual report year: 2018

**Smart grids innovation challenge**

**General information**

State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management, Energy Analytics and Markets, Department of Applied Mathematics and Computer Science, Dynamical Systems, Ricerca Sistema Energetico SpA
Pages: 37-46
Publication date: 2018

**Host publication information**

Title of host publication: Accelerating the clean energy revolution - perspectives on innovation challenges: DTU International Energy Report 2018
Publisher: Technical University of Denmark (DTU)
ISBN (Electronic): 978-87-93458-57-4
Chapter: 5
Main Research Area: Technical/natural sciences
Electronic versions:
Publication: Research - peer-review › Report chapter – Annual report year: 2018

**Sparse Classification - Methods & Applications**

With increasing number of more sophisticated tools to acquire data, we are faced with the important question of what matters in the sea of information at hand. This challenge is becoming more prevalent across virtually all scientific disciplines. Improvements over state of the art methods for analysing such data carry the potential to revolutionize tasks such as medical diagnostics where often decisions need to be based on only a few high-dimensional observations. This explosion in data dimensionality has sparked the development of novel statistical methods. In contrast, classical statistics build upon the assumption that we have more samples than variables, and the main asymptotic results, such as the central limit theorem, reflect that. As the assumption of having many samples does not hold for modern datasets, we need new tools and methods to find the signal within the dataset which is predictive of the relevant response variable. The focus in this thesis is on sparse methods where sparse implies that the method selects only a few variables. Different types of data call for different methods. In this thesis the sparse methods we study concern settings where the response variable is ordinal. Such ordinal labeling is common in many fields, for example, medical doctors often summarize their observations into a single class of disease severity, which is known as a medical rating score. Automation offers the potential to
improve both the reliability and objectivity of such tasks. To demonstrate the effectiveness of the sparse methods developed in this thesis, they were applied to both challenging and diverse real-world problems: Predicting the severity of motion disorders from Parkinson’s patients, generating short summaries of content from hundreds of online user reviews and detecting foreign objects from Multispectral X-ray scans. It may be noted, that to achieve these results, novel optimization approaches and open-source software were implemented.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Statistics and Data Analysis
Authors: Einarsson, G. (Intern)
Number of pages: 283
Publication date: 2018

Publication information
Publisher: DTU Compute
Original language: English
Series: DTU Compute PHD-2018
Volume: 471
ISSN: 0909-3192
Main Research Area: Technical/natural sciences
Electronic versions:
phd471_Einarsson_G.pdf

Relations
Projects:
Sparse Classification - Methods & Applications
Publication: Research › Ph.D. thesis – Annual report year: 2018

SpaSM: A MATLAB Toolbox for Sparse Statistical Modeling
Applications in biotechnology such as gene expression analysis and image processing have led to a tremendous development of statistical methods with emphasis on reliable solutions to severely underdetermined systems. Furthermore, interpretations of such solutions are of importance, meaning that the surplus of inputs has been reduced to a concise model. At the core of this development are methods which augment the standard linear models for regression, classification and decomposition such that sparse solutions are obtained. This toolbox aims at making public available carefully implemented and well-tested variants of the most popular of such methods for the MATLAB programming environment. These methods consist of easy-to-read yet efficient implementations of various coefficient-path following algorithms and implementations of sparse principal component analysis and sparse discriminant analysis which are not available in MATLAB. The toolbox builds on code made public in 2005 and which has since been used in several studies.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, National Food Institute, Image Analysis & Computer Graphics, EXINI Diagnostics AB
Authors: Sjöstrand, K. (Ekstern), Clemmensen, L. H. (Intern), Larsen, R. (Intern), Einarsson, G. (Intern), Erskbøll, B. K. (Intern)
Number of pages: 37
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Statistical Software
Volume: 84
Issue number: 10
ISSN (Print): 1548-7660
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 9.273 SJR 13.802 CiteScore 16.32
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Spatial and temporal variation in the abundance of Culicoides biting midges (Diptera: Ceratopogonidae) in nine European countries

Biting midges of the genus Culicoides (Diptera: Ceratopogonidae) are vectors of bluetongue virus (BTV), African horse sickness virus and Schmallenberg virus (SBV). Outbreaks of both BTV and SBV have affected large parts of Europe. The spread of these diseases depends largely on vector distribution and abundance. The aim of this analysis was to identify and quantify major spatial patterns and temporal trends in the distribution and seasonal variation of observed Culicoides abundance in nine countries in Europe. We gathered existing Culicoides data from Spain, France, Germany, Switzerland, Austria, Sweden, Norway and Poland. In total, 31,429 Culicoides trap collections were available from 904 ruminant farms across these countries between 2007 and 2013. The Obsoletus ensemble was distributed widely in Europe and accounted for 83% of all 8,842,998 Culicoides specimens in the dataset, with the highest mean monthly abundance recorded in France, Germany and southern Norway. The Pulicaris ensemble accounted for only 12% of the specimens and had a relatively southerly and easterly spatial distribution compared to the Obsoletus ensemble. Culicoides imicola Kieffer was only found in Spain and the southernmost part of France. There was a clear spatial trend in the accumulated annual abundance from southern to northern Europe, with the Obsoletus ensemble steadily increasing from 4000 per year in southern Europe to 500,000 in Scandinavia. The Pulicaris ensemble showed a very different pattern, with an increase in the accumulated annual abundance from 1600 in Spain, peaking at 41,000 in northern Germany and then decreasing again toward northern latitudes. We present the first maps of seasonal Culicoides abundance in large parts of Europe covering a gradient from southern Spain to northern Scandinavia. The identified temporal trends and spatial patterns are useful for planning the allocation of resources for international prevention and surveillance programmes in the European Union.
Spatio-temporal methods for EEG analysis in cognitive neuroscience

Electroencephalography (EEG) records electrical activity from the brain by measuring the resulting potential differences across the scalp. It has a long tradition in both a clinical and neuroscientific setting, and recently it has also started being used for consumer-oriented applications. While EEG can be a useful tool, it can be difficult to decipher information from its raw signals. In this thesis I will present three projects with the common goal of analysing EEG in ways that both extract meaningful information and visualise it in intuitive ways. The first project describes how we took neuroscience out of the laboratory and into the classroom. We reproduced an attention-tracking paradigm in a classroom and simultaneously recorded the neural activity of up to nine people. We had a focus on using equipment that was wireless and portable as well being relatively low-cost and computational methods in a setup that is feasible to extend into everyday scenarios. The second project revolved around creating a toolbox for the research field of microstate analysis, with a focus on open access and transparency of the applied methods. The toolbox is followed by a methodological guide that reviews the most commonly applied algorithms in microstate analysis. In the final project I investigated the feasibility of using the complexity of EEG as a neural marker of conscious processing. This project spans two studies investigating the capability of EEG complexity in two different scenarios; while people are sleeping, and while navigating a helicopter simulator.

General information
State: Submitted
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems
Authors: Poulsen, A. T. (Intern)
Number of pages: 152
Publication date: 2018

Publication information
Publisher: DTU Compute
Original language: English

Series: DTU Compute PHD-2018
Volume: 473
ISSN: 0909-3192
Main Research Area: Technical/natural sciences

Relations
Projects:
Spatio-temporal methods for EEG analysis in cognitive neuroscience
Publication: Research › Ph.D. thesis – Annual report year: 2018

Spectral/hp element methods: Recent developments, applications, and perspectives

The spectral/hp element method combines the geometric flexibility of the classical h-type finite element technique with the desirable numerical properties of spectral methods, employing high-degree piecewise polynomial basis functions on coarse finite element-type meshes. The spatial approximation is based upon orthogonal polynomials, such as Legendre or Chebychev polynomials, modified to accommodate a C⁰ - continuous expansion. Computationally and theoretically, by increasing the polynomial order \( p \), high-precision solutions and fast convergence can be obtained and, in particular, under certain regularity assumptions an exponential reduction in approximation error between numerical and exact solutions can be achieved. This method has now been applied in many simulation studies of both fundamental and practical engineering flows. This paper briefly describes the formulation of the spectral/hp element method and provides an overview of its application to computational fluid dynamics. In particular, it focuses on the use of the spectral/hp element method in transitional flows and ocean engineering. Finally, some of the major challenges to be overcome in order to use the spectral/hp element method in more complex science and engineering applications are discussed.
Stable source reconstruction from a finite number of measurements in the multi-frequency inverse source problem

We consider the multi-frequency inverse source problem for the scalar Helmholtz equation in the plane. The goal is to reconstruct the source term in the equation from measurements of the solution on a surface outside the support of the...
source. We study the problem in a certain finite dimensional setting: From measurements made at a finite set of frequencies we uniquely determine and reconstruct sources in a subspace spanned by finitely many Fourier-Bessel functions. Further, we obtain a constructive criterion for identifying a minimal set of measurement frequencies sufficient for reconstruction, and under an additional, mild assumption, the reconstruction method is shown to be stable.” Our analysis is based on a singular value decomposition of the source-to-measurement forward operators and the distribution of positive zeros of the Bessel functions of the first kind. The reconstruction method is implemented numerically and our theoretical findings are supported by numerical experiments.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Neutrons and X-rays for Materials Physics
Authors: Karamehmedovic, M. (Intern), Kirkeby, A. (Intern), Knudsen, K. (Intern)
Number of pages: 24
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Inverse Problems
Volume: 34
Article number: 065004
ISSN (Print): 0266-5611
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.419 SJR 1.209 CiteScore 1.91
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.84 SJR 1.49 SNIP 1.414
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.416 SNIP 1.431 CiteScore 1.82
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.252 SNIP 1.408 CiteScore 1.63
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.215 SNIP 1.615 CiteScore 2.13
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.258 SNIP 1.838 CiteScore 2.15
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.208 SNIP 1.563 CiteScore 1.9
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.409 SNIP 1.63
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.397 SNIP 1.757
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.228 SNIP 1.853
Scopus rating (2007): SJR 1.042 SNIP 1.966
Scopus rating (2006): SJR 0.924 SNIP 1.788
Scopus rating (2005): SJR 1.15 SNIP 1.936
Scopus rating (2004): SJR 0.8 SNIP 1.567
Statistical Image Analysis of Tomograms with Application to Fibre Geometry Characterisation

The goal of this thesis is to develop statistical image analysis tools to characterise the micro-structure of complex materials used in energy technologies, with a strong focus on fibre composites. These quantification tools are based on extracting geometrical parameters defining structures from 2D and 3D images, especially acquired through X-ray computed tomography (CT). Fibre composites are extensively used in transportation and energy technologies such as wind turbines. It is of high importance to characterise composites accurately and to understand their behaviour under load to ensure efficiency and longevity of these technologies.

Imaging with X-ray CT has been the foundation of the thesis. This enables analysis in 3D and at the micro-scale, where individual fibres are distinguishable. Additionally, ultra-fast X-ray CT and in-situ loading environments are able to image these composites with high resolution both in space and time to observe fast micro-structural changes.

This thesis demonstrates that statistical image analysis combined with X-ray CT opens up numerous possibilities for understanding the behaviour of fibre composites under real life conditions. Besides enabling characterisation of material properties, estimating individual fibre centre lines and diameters allows for quantification of small micro-structural changes with a high degree of accuracy, as it is possible to follow how each individual fibre changes across data-sets acquired under progressive loading conditions. Finally, the thesis demonstrates the precision to which fibre geometry can be characterised through X-ray CT and the developed data analysis tools.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics
Authors: Emerson, M. J. (Intern)
Number of pages: 192
Publication date: 2018

Publication information
Publisher: DTU Compute
Original language: English
Series: DTU Compute PHD-2017
Number: 466
ISSN: 0909-3192
Main Research Area: Technical/natural sciences
Electronic versions:
phd466_Emerson_MJ_reduced.pdf

Relations
Projects:
Statistical Image Analysis of Tomograms with Application to Fibre Geometry Characterisation
Publication: Research › Ph.D. thesis – Annual report year: 2018

Statistical models for wifi data and educational peer review
With a growing amount of available data, the approach we take in working with and investigating this data is of paramount importance. While the scientific method is underlying for data science as well, a modern approach to solving data-based problems should be more iterative since the issue of having too much data is becoming as common as having too little data. In this work we describe an agile approach to data science called lean data science and give examples of how to approach problems this way. We then describe our work on two specific problems, namely inferring other data sources from WiFi data and effectively scaffolding educational peer review. From The Copenhagen Network Study [Stopczynski et al., 2014] we have been able to work with a dataset collected using more than 1,000 smartphones from students over multiple years. Using this dataset we look at how well WiFi scans are able to replace other data sources such as Bluetooth and GPS. We show that WiFi data can accurately detect so-called stop-locations of the same quality as state-of-the-art GPS-based methods and that WiFi data can mirror Bluetooth data for the purpose of detecting face-to-face interactions between people. Peergrade is a web-based system for facilitating educational peer review built by us. Conceptually the
idea of having students review work by other students serves many purposes, including a potential for saving time on grading for teachers and a way to train taxonomically complex skills for students. Because peer review is a complex process (many people reviewing many people) and requires things such as anonymity, evaluation criteria and the ability for instructors to moderate, it is best facilitated using a digital tool. We first describe Peergrade and some of the features it offers to educators. We then describe different research projects around Peergrade that attempts to help quantify the quality of reviews, allocate reviewers in an optimal way and automatically flag problematic feedback for moderation.

General information
State: Submitted
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems
Authors: Wind, D. K. (Intern)
Number of pages: 123
Publication date: 2018

Publication information
Publisher: DTU Compute
Original language: English
Series: DTU Compute PHD-2018
Volume: 482
ISSN: 0909-3192
Main Research Area: Technical/natural sciences

Relations
Projects:
Statistical models for wifi data and educational peer review
Publication: Research › Ph.D. thesis – Annual report year: 2018

Statistical validation of individual fibre segmentation from tomograms and microscopy
Imaging with X-ray computed tomography (CT) enables non-destructive 3D characterisations of the micro-structure inside fibre composites. In this paper we validate the use of X-ray CT coupled with image analysis for characterising unidirectional (UD) fibre composites. We compare X-ray CT at different resolutions to optical microscopy (OM) and scanning electron microscopy (SEM), where we characterise fibres by their diameters and positions. In addition to comparing individual fibre diameters, we also model their spatial distribution, and compare the obtained model parameters. Our study shows that X-ray CT is a high precision technique for characterising fibre composites and, with our suggested image analysis method for fibre detection, high precision is also obtained at low resolutions. This has great potential, since it allows larger fields of view to be analysed. Besides analysing representative volumes with high precision, we demonstrate that based on our methodology for individual fibre segmentation it is now possible to study complete bundles at the fibre scale and reveal inhomogeneities in the physical sample.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Statistics and Data Analysis, Department of Wind Energy, Composites and Materials Mechanics
Authors: Emerson, M. J. (Intern), Dahl, V. A. (Intern), Conradsen, K. (Intern), Mikkelsen, L. P. (Intern), Dahl, A. B. (Intern)
Pages: 208-215
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Composites Science and Technology
Volume: 160
ISSN (Print): 0266-3538
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.912 SJR 1.702 CiteScore 5.59
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.37 SJR 1.59 SNIP 2.027
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Streaming Process Discovery and Conformance Checking

Streaming process discovery, streaming conformance checking, and streaming process mining in general (also known as online process mining) are disciplines which analyze event streams to extract a process model or to assess their conformance with respect to a given reference model. The main characteristic of this family of techniques is to analyze events immediately as they are generated (instead of storing them in a log for late processing). This allows to drastically reduce the latency among phases of the BPM lifecycle (cf. Dumas et al (2013)), thus allowing faster process adaptations and better executions.
Structured Bayesian Approximate Inference

This thesis seeks to investigate different facets of the class of Bayesian probabilistic models where the random variables exhibit strong dependencies and simultaneously lack any conditional independence structure, preventing the distribution from being factorized. Without a tractable factorization, a lot of standard inference algorithms become unavailable. We consider the application of variational inference from two different perspectives. In the first scenario we start with an extended model with conditional independence structure, and try to take the auxiliary parameters out of the equation in an optimal manner in a process emulating marginalization. In the second scenario, we tackle the variational problem directly, trying to find an efficient way to represent unfactorized models in an efficient manner, by introducing a separate form of structure to ensure efficiency. For discrete models, we find efficient approximations in the tensor literature that can model structure without sacrificing tractability. Finally, we consider a problem involving Gaussian processes that take random variables as input, leading to an inefficient inference problem. We develop a procedure that allows the stochastic component of the random input to be integrated into the kernel of the Gaussian process.
Svovlbrinte stinker, men dræber uden lugt

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Statistics and Data Analysis
Authors: Hedlund, F. H. (Intern)
Pages: 6-7
Publication date: 2018
Main Research Area: Technical/natural sciences

Svovlsyres fortyndingsvarme
[Dansk sammendrag] Det er god latin, at syrer fortyndes ved at hælde syren i vand, aldrig omvendt. Der udvikles betydelige mængder varme, og kogning kan slynge syre og vand ud af beholderen. Selvom svovlsyre anvendes i enorme mængder, er det overraskende vanskeligt at finde data for fortyndingsvarmen. Det rådes der bod på med denne artikel

[English summary] Although sulfuric acid is one of the most fundamentally important heavy industrial chemicals and produced in very large quantities, there is little practical guidance in open sources on how to estimate the heat of dilution. This article provides a simple method to estimate the increase in temperature upon diluting sulfuric acid with water.simple method to estimate the increase in temperature upon diluting sulfuric acid with water.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Statistics and Data Analysis, Department of Chemical and Biochemical Engineering, PROSYS - Process and Systems Engineering Centre
Authors: Hedlund, F. H. (Intern), Frutiger, J. (Intern), Sin, G. (Intern)
Pages: 16-20
Publication date: 2018
Main Research Area: Technical/natural sciences
Systematic comparison of different techniques to measure hippocampal subfield volumes in ADNI2

Objective: Subfield-specific measurements provide superior information in the early stages of neurodegenerative diseases compared to global hippocampal measurements. The overall goal was to systematically compare the performance of five representative manual and automated T1 and T2 based subfield labeling techniques in a sub-set of the ADNI2 population.

Methods: The high resolution T2 weighted hippocampal images (T2-HighRes) and the corresponding T1 images from 106 ADNI2 subjects (41 controls, 57 MCI, 8 AD) were processed as follows. A. T1-based: 1. Freesurfer + Large-Diffeomorphic-Metric-Mapping in combination with shape analysis. 2. FreeSurfer 5.1 subfields using in-vivo atlas. B. T2-HighRes: 1. Model-based subfield segmentation using ex-vivo atlas (FreeSurfer 6.0). 2. T2-based automated multi-atlas segmentation combined with similarity-weighted voting (ASHS). 3. Manual subfield parcellation. Multiple regression analyses were used to calculate effect sizes (ES) for group, amyloid positivity in controls, and associations with cognitive/memory performance for each approach. Results: Subfield volumetry was better than whole hippocampal volumetry for the detection of the mild atrophy differences between controls and MCI (ES: 0.27 vs 0.11). T2-HighRes approaches outperformed T1 approaches for the detection of early stage atrophy (ES: 0.27 vs 0.10), amyloid positivity (ES: 0.11 vs 0.04), and cognitive associations (ES: 0.22 vs 0.19). Conclusions: T2-HighRes subfield approaches outperformed whole hippocampus and T1 subfield approaches. None of the different T2-HighRes methods tested had a clear advantage over the other methods. Each has strengths and weaknesses that need to be taken into account when deciding which one to use to get the best results from subfield volumetry.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, University of California at San Francisco, University of Pennsylvania, Northwestern University, University College London, VA Medical Center
Pages: 1006-1018
Publication date: 2018
Main Research Area: Technical/natural sciences
Task design for Engineering Mathematics: process, principles and products

General information
State: Accepted/In press
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Københavns Universitet
Authors: Schmidt, K. (Intern), Winsløw, C. (Forskerdatabase)
Number of pages: 10
Publication date: 2018

Host publication information
Title of host publication: Proceedings of INDRUM 2018
Main Research Area: Technical/natural sciences
Conference: Second conference of the International Network for Didactic Research in University Mathematics, Kristiansand, Norway, 05/04/2018 - 05/04/2018
Mathematics for Engineers, Task Design
Electronic versions:
INDRUM2018_SW_rev.pdf

Task-Modulated Cortical Representations of Natural Sound Source Categories
In everyday sound environments, we recognize sound sources and events by attending to relevant aspects of an acoustic input. Evidence about the cortical mechanisms involved in extracting relevant category information from natural sounds is, however, limited to speech. Here, we used functional MRI to measure cortical response patterns while human listeners categorized real-world sounds created by objects of different solid materials (glass, metal, wood) manipulated by different sound-producing actions (striking, rattling, dropping). In different sessions, subjects had to identify either material or action categories in the same sound stimuli. The sound-producing action and the material of the sound source could be decoded from multivoxel activity patterns in auditory cortex, including Heschl's gyrus and planum temporale. Importantly, decoding success depended on task relevance and category discriminability. Action categories were more accurately decoded in auditory cortex when subjects identified action information. Conversely, the material of the same sound sources was decoded with higher accuracy in the inferior frontal cortex during material identification. Representational similarity analyses indicated that both early and higher-order auditory cortex selectively enhanced spectrotemporal features relevant to the target category. Together, the results indicate a cortical selection mechanism that favors task-relevant information in the processing of nonvocal sound categories.

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems, Department of Applied Mathematics and Computer Science, Cognitive Systems, Princeton University, Copenhagen University Hospital
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Number of pages: 12
Pages: 295-306
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Cerebral Cortex
Volume: 128
Issue number: 1
ISSN (Print): 1047-3211
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.633 SJR 3.892 CiteScore 5.87
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.5 SJR 4.103 SNIP 1.614
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 4.929 SNIP 1.872 CiteScore 6.68
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 4.887 SNIP 1.994 CiteScore 6.86
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 5.386 SNIP 1.899 CiteScore 7.26
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 5.077 SNIP 1.916 CiteScore 7.28
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 5.187 SNIP 1.893 CiteScore 7.2
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 5.074 SNIP 1.843
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 5.158 SNIP 1.896
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 4.992 SNIP 1.762
Scopus rating (2005): SJR 4.464 SNIP 1.773
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 4.128 SNIP 1.676
Scopus rating (2003): SJR 4.824 SNIP 1.887
Scopus rating (2002): SJR 4.666 SNIP 1.673
Scopus rating (2001): SJR 3.988 SNIP 1.876
Scopus rating (2000): SJR 3.708 SNIP 2.05
Scopus rating (1999): SJR 3.955 SNIP 2.182
Original language: English
Auditory cortex, Category-based attention, fMR, MVPA, Natural sounds, Object categorization, RSA
Electronic versions:
bhx263.pdf
DOIs:
10.1093/cercor/bhx263
Publication: Research - peer-review › Journal article – Annual report year: 2018

Teaching First-Order Logic with the Natural Deduction Assistant (NaDeA)

The natural deduction proof system is a popular way of teaching logic. It is also important in the philosophy of logic and the foundations of mathematics, in particular for systems of intuitionistic logic and constructive type theory, and it is used in many proof assistants along with automatic proof methods like the tableaux procedure and the resolution calculus. The natural deduction assistant (NaDeA) has been used for teaching first-order logic to hundreds of computer science bachelor students since 2015 [1, 2]. NaDeA runs in a standard browser and is open source software. Upon completion of a natural deduction proof the student obtains a formal proof in the interactive proof assistant Isabelle/HOL [3] of not only the correctness of the student’s natural deduction proof but also of the validity of the formula with respect to the classical semantics of formulas in first-order logic. Our formalization of the syntax, semantics and the inductive definition of the natural deduction proof system extends work by Stefan Berghofer [4] and Melvin Fitting [5] but with a much more detailed soundness proof that can be examined and tested by the students. The corresponding completeness proof is also
available but it is of course quite demanding. We describe the main advantages and disadvantages of using an advanced e-learning tools like NaDeA for teaching logic. Furthermore we briefly survey related and future work. NaDeA can be used with or without installing Isabelle and is available online. URL Address: https://nadea.compute.dtu.dk/.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Technical University of Denmark
Authors: Halkjær From, A. (Ekstern), Hatteland, H. (Ekstern), Villadsen, J. (Intern)
Number of pages: 1
Publication date: 2018
Main Research Area: Technical/natural sciences
Electronic versions:
sls_nadea.pdf

Bibliographical note
Publication: Research - peer-review › Paper – Annual report year: 2018

Technology to provide educational practitioners with the expertise they need

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis
Authors: Porayska-Pomsta, K. (Ekstern), Preston, C. (Ekstern), Weitze, C. L. (Intern), Younie, S. (Ekstern)
Pages: 289-301
Publication date: 2018

Host publication information
Title of host publication: Enhancing Learning and Teaching with Technology - What the Research Says
Editor: Luckin, R.
Chapter: 6.3
Main Research Area: Technical/natural sciences
Electronic versions:
6.3_Developing_innovative_pedagogical_space_and_practice_for_educational_practitioners_Weitze_preprint.pdf
Source: PublicationPreSubmission
Source-ID: 147732760
Publication: Research - peer-review › Book chapter – Annual report year: 2018

The bane of low-dimensionality clustering
In this paper, we give a conditional lower bound of $n^{\omega(k)}$ on running time for the classic $k$-median and $k$-means clustering objectives (where $n$ is the size of the input), even in low-dimensional Euclidean space of dimension four, assuming the Exponential Time Hypothesis (ETH). We also consider $k$-median (and $k$-means) with penalties where each point need not be assigned to a center, in which case it must pay a penalty, and extend our lower bound to at least three-dimensional Euclidean space. This stands in stark contrast to many other geometric problems such as the traveling salesman problem, or computing an independent set of unit spheres. While these problems benefit from the so-called (limited) blessing of dimensionality, as they can be solved in time $n^{O(d)}$ or $2^{n^{1-1/d}}$ in $d$ dimensions, our work shows that widely-used clustering objectives have a lower bound of $n^{\omega(k)}$, even in dimension four. We complete the picture by considering the two-dimensional case: we show that there is no algorithm that solves the penalized version in time less than $\omega(k)$, and provide a matching upper bound of $n^{\omega(k)}$, even in dimension four. The main tool we use to establish these lower bounds is the placement of points on the moment curve, which takes its inspiration from constructions of point sets yielding Delaunay complexes of high complexity.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, University of Copenhagen, Université Grenoble Alpes, Sorbonne Universités
Authors: Cohen-Addad, V. (Ekstern), de Mesmay, A. (Ekstern), Rotenberg, E. (Intern), Roytman, A. (Ekstern)
Pages: 441-456
Publication date: 2018

Host publication information
The Choice Is Yours: The Role of Cognitive Processes for IT-Supported Idea Selection

The selection of good ideas out of hundreds or even thousands has proven to be the next big challenge for organizations that conduct open idea contests for innovation. Cognitive load and attention loss hinder crowds to effectively run their idea selection process. Facilitation techniques for the reduction and clarification of ideas could help with such problems, but have not yet been researched in crowd settings that are prevalent in idea contests. This research-in-progress paper aims to contribute to this research gap by investigating IT-supported selection techniques that differ in terms of selection direction and selection type. A laboratory experiment using eye-tracking will investigate variations in selection type and selection direction. Moreover, the experiment will test the effects on the decision-making process and the number and quality of ideas in a filtered set. Findings will provide explanations why certain mechanisms work for idea selection. Potential implications for theory and practice are discussed.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Software and Process Engineering, University of Innsbruck, University of South Florida
Authors: Seeber, I. (Ekstern), Weber, B. (Intern), Maier, R. (Ekstern), Vreede, G. (Ekstern)
Pages: 17-24
Publication date: 2018

Host publication information
Title of host publication: Information Systems and Neuroscience: Gmunden Retreat on NeuroIS 2017
Volume: 25
Publisher: Springer
Editors: Davis, F. D., Riedl, R., von Brocke, J., Léger, P., Randolph, A. B.
ISBN (Print): 978-3-319-67430-8
ISBN (Electronic): 978-3-319-67431-5

Series: Lecture Notes in Information Systems and Organisation
ISSN: 2195-4968
Main Research Area: Technical/natural sciences
Conference: Gmunden Retreat on NeuroIS, Gmunden, Austria, 12/06/2017 - 12/06/2017
Idea contest, Idea quality, Idea selection, Open innovation, Screening rules
DOIs:
10.1007/978-3-319-67431-5_3
Source: FindIt
Source-ID: 2393011780
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

The Choice of Prior in Bayesian Modeling of the Information Sampling Task

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems
Authors: Axelsen, M. C. (Intern), Jepsen, J. R. M. (Ekstern), Bak, N. (Ekstern)
Number of pages: 2
Pages: E59-E60
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
The flow index and strongly connected orientations

We prove that, for any natural number \( p \), the flow index \( \phi(G) < 2 + \frac{1}{p} \) if and only if \( G \) has a strongly connected modulo \( (2p + 1) \)-orientation. For the case \( p = 1 \) we prove that the flow index of every 8-edge-connected graph is strictly less than 3.

General information

10.1016/j.biopsych.2017.04.021
Source: FindIt
Source-ID: 2371046086
Publication: Research › Letter – Annual report year: 2018
The Generalized Multipole Technique for the Simulation of Low-Loss Electron Energy Loss Spectroscopy

In this study, we demonstrate the use of a Generalized Multipole Technique (GMT) to simulate low-loss Electron Energy Loss Spectroscopy (EELS) spectra of isolated spheriodal nanoparticles. The GMT provides certain properties, such as semi-analytical description of the electromagnetic fields, efficient solution of the underlying electromagnetic model, accurate description of the near field, and flexibility regarding the position and direction of the incident electron beam, that
are advantageous for computation of EELS spectra. Within the chapter, we provide a derivation of the electromagnetic model and its connection to EELS spectra, and comprehensive validation of the implemented GMT regarding electromagnetic scattering and EELS.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Neutrons and X-rays for Materials Physics, University of Bremen
Authors: Kiewidt, L. (Ekstern), Karamehmedovic, M. (Intern)
Pages: 147-167
Publication date: 2018

**Host publication information**
Title of host publication: The Generalized Multipole Technique for Light Scattering
Publisher: Springer
Editors: Wriedt, T., Eremin, Y.
ISBN (Print): 978-3-319-74889-4
Chapter: 7
Series: Springer Series on Atomic, Optical, and Plasma Physics
Volume: 99
ISSN: 1615-5653
Main Research Area: Technical/natural sciences
DOIs: 10.1007/978-3-319-74890-0_7
Source: PublicationPreSubmission
Source-ID: 144960056
Publication: Research - peer-review › Book chapter – Annual report year: 2018

**The Impact of Parametrization on Randomized Search Heuristics**

In this work we present runtime analyses of randomized search heuristics (RSH) in various settings that are determined by parameters of the problems, the algorithms and also exogenous parameters like noise. In the process we provide new techniques for the theoretical analysis of RSH as well as new optimization algorithms. We consider the following topics.

Escaping local optima using local search. We analyze memetic algorithms, i.e. evolutionary algorithms equipped with a local search after mutation. To this end we consider the (1+1) EA equipped with Standard Local Search (SLS) and Variable-Depth Search (VDS) on an artificial test function. We determine features of the fitness landscape that lead to the (1+1) EA using SLS outperforming the (1+1) EA using VDS with an exponential performance gap. Moreover, we present a new local search operator, Opportunistic Local Search (OLS), that can deal with such features in the landscape and show that the (1+1) EA with OLS can efficiently optimize a discretized Rastrigin function. Stochastic fitness functions. We analyze the role of populations in stochastic optimization. We assume that the objective function is subject to noise, introducing stochastic errors in its evaluation. On classical test functions, such noise makes optimization by the simple (1+1) EA hillclimber infeasible even in exponential time. Interestingly, the use of parent and offspring populations of only logarithmic size turns the algorithm into an efficient one. The results are obtained by drift analysis. An asymptotic expansion of the expected runtime of the (1+λ) EA on ONE MAX. We consider the (1+λ) EA with mutation probability c/n, where c > 0 is a constant on ONE MAX. We give an asymptotic expansion for the expected runtime depending on both c and λ. Our results show that c = 1 is the optimal mutation rate for λ = o(logloglogn/logloglogn) and that c only has an impact on the lower-order terms of the expected runtime, i.e. c = 1 is no longer the only optimal mutation rate. Our methods are strongly based on variable drift theorems for upper and lower bounds and a precise analysis of order statistics of the binomial distribution. To the best of our knowledge this is the first tight runtime analysis of a population-based EA, up to lower-order terms. Furthermore, we develop helpful stochastic tools for runtime analyses. Optimal mutation rates for the (1+λ) EA on ONE MAX. We consider the (1+λ) EA with mutation probability c/n on ONE MAX, where c > 0 and λ are constant. We present an improved variable drift theorem that weakens the requirement that no large steps towards the optimum may occur in the process to a stochastic one, reducing the analysis of the expected optimization time to finding an exact expression for the drift. We formalize an exact closed-form expression for the drift and provide small error approximations that are very efficient to compute. Self-adjusting mutation rates for the (1+λ) EA on ONE MAX. We propose a new mechanism to self-adjust the mutation rate in population-based evolutionary algorithms. It consists of creating half the offspring with a higher and the rest with a lower mutation rate. The mutation rate is then adjusted, based on the success of the subpopulations. We show that the (1+λ) EA optimizes ONE MAX in an expected optimization time of O(nλ/logλ + nlogn) which has been shown to be best-possible among all λ-parallel mutation-based unbiased black-box algorithms.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Authors: Gießen, C. (Intern), Witt, C. (Intern)
Number of pages: 156
The importance of liking of appearance, -odour, -taste and -texture in the evaluation of overall liking. A comparison with the evaluation of sensory satisfaction

The response variable of overall liking is often used to measure consumers’ overall hedonic response to food. However, little research is done to understand, if liking of all four sensory modalities; appearance, odour, taste and texture, are reflected in the evaluation of overall liking, or if a single sensory modality stands out and is of most importance. The term sensory satisfaction was recently introduced as an alternative to overall liking and should (at least in theory) be used by consumers as a more holistic response variable than overall liking. The aim of the analyses reported in the present paper were, to study the importance of the sensory modalities (liking of appearance, odour, taste and texture) in consumers’ evaluation of overall liking and compare the findings to the importance of the sensory modalities (liking of appearance, odour, taste and texture) in consumers’ evaluation of sensory satisfaction. The data came from a cross-over consumer case-study on apple-cherry fruit drinks (n = 67). The fruit drinks varied in: type of sweetener used, and addition of aroma and fibre. The modalities driving overall liking and sensory satisfaction were studied through slopes of a regression line relating overall liking and sensory satisfaction, respectively, to liking of the sensory modalities: liking of appearance, -odour, -taste and -texture. Results showed the steepest slope between overall liking and liking of taste, whereas the least steep slope was found for liking of odour. The same pattern between slopes was found for sensory satisfaction and overall liking. Therefore, it was concluded that consumers primarily paid attention to liking of taste (to be understood as flavour) and least attention to liking of odour, when evaluating overall liking and sensory satisfaction, respectively, and that consumers did not use sensory satisfaction as a more holistic response variable than overall liking.
The influence of the perturbation of the wheel rotation speed on the stability of a railway bogie on steady curve sections of a track

Based on the theory of non-linear dynamic systems, the influence of the perturbation of the wheel rotation speed on the quasi-steady curved motions of a two-axle railway bogie system with a realistic wheel/rail contact relation is investigated in this paper. Since the wheel/rail contact relation is non-linear, it is tabulated in a wheel/rail contact table. The bifurcation diagram of the bogie system is constructed with gradually increasing and decreasing speed in the speed range V = 60–100 m/s. A supercritical Hopf bifurcation, where the stable non-trivial stationary solution loses its stability, is found in both models with and without perturbation of the wheel rotation speed. In the model without perturbation of the wheel rotation speed, the first chaotic motions develop at the speed where the wheel flange contact starts. A period-doubling cascade of the bogie system through pitchfork bifurcations, which explains the transition from periodic solutions to chaotic motions of the bogie system, is found. Several jumps happen at higher speeds because of the coexistence of multiple attracting solutions, which should be avoided. A comprehensive investigation of the hysteresis phenomena is made. However, in the model with a perturbation of the wheel rotation speed, no chaotic motions are found.

General information
State: Published
Publication information
Journal: Vehicle System Dynamics
ISSN (Print): 0042-3114

Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 2.015 SJR 1.17 CiteScore 2.86
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.58 SJR 1.042 SNIP 2.354
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.016 SNIP 2.124 CiteScore 2.01
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.022 SNIP 2.638 CiteScore 1.88
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.699 SNIP 2.24 CiteScore 1.57
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.703 SNIP 2.105 CiteScore 1.44
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.732 SNIP 1.989 CiteScore 1.38
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.648 SNIP 2.019
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.554 SNIP 1.242
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.774 SNIP 2.082
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.392 SNIP 0.942
Scopus rating (2006): SJR 0.499 SNIP 1.566
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.407 SNIP 1.363
Scopus rating (2004): SJR 0.609 SNIP 1.934
Scopus rating (2003): SJR 0.602 SNIP 1.639
Scopus rating (2002): SJR 0.508 SNIP 1.16
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.522 SNIP 1.013
Scopus rating (2000): SJR 0.403 SNIP 1.65
Scopus rating (1999): SJR 0.341 SNIP 1.263

Original language: English
Steady curved motion, Railway bogie, Wheel/rail contact relation, Chaotic motions, Hysteresis phenomena
DOIs:
10.1080/00423114.2018.1469778
Source: FindIt
Source-ID: 2434371275
**The Influence of Volume and Anatomic Location of Optic Disc Drusen on the Sensitivity of Autofluorescence**

Optic disc drusen (ODD) are acellular deposits in the optic nerve head. ODD can be diagnosed using different imaging modalities, including enhanced depth imaging optical coherence tomography (EDI-OCT) and autofluorescence (AF). It is unknown which factors determine the sensitivity of AF. The aim of this study was to investigate the effect of volume and anatomic location of ODD on the sensitivity of AF. Cross-sectional study. A total of 38 patients (75 eyes) with ODD were included. In 12 of 75 eyes (16%) and in 11 of 38 patients (29%), EDI-OCT detected ODD that were not detected by AF. In 24 distinctly solitary ODD, both increase in ODD volume ($P = 0.0388$) and a more superficial ODD location ($P < 0.0001$) increased the possibility of AF detection of ODD, when performing a multivariate analysis. EDI-OCT is superior to AF in the diagnosis of ODD. Volume and anatomic location of ODD have a significant impact on the sensitivity of AF.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Statistics and Data Analysis, University of Copenhagen
Authors: Loft, F. C. (Ekstern), Malmqvist, L. (Ekstern), Lindberg, A. W. (Intern), Hamann, S. (Ekstern)
Number of pages: 5
Publication date: 2018
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Journal of Neuro-Ophthalmology
ISSN (Print): 1070-8022
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.781 SJR 0.605 CiteScore 1.31
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.4 SNIP 0.917 SJR 0.745
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.03 SNIP 0.882 SJR 0.611
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.17 SNIP 1.018 SJR 0.794
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 0.89 SNIP 0.781 SJR 0.548
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 0.94 SNIP 0.945 SJR 0.476
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.01 SNIP 0.903 SJR 0.464
BFI (2010): BFI-level 1
Scopus rating (2010): SNIP 0.869 SJR 0.408
BFI (2009): BFI-level 1
Scopus rating (2009): SNIP 0.868 SJR 0.384
BFI (2008): BFI-level 1
Scopus rating (2008): SNIP 0.746 SJR 0.404
Scopus rating (2007): SNIP 1.044 SJR 0.431
Scopus rating (2006): SNIP 1.022 SJR 0.353
Scopus rating (2005): SNIP 0.809 SJR 0.283
Scopus rating (2004): SNIP 0.66 SJR 0.298
Scopus rating (2003): SNIP 0.801 SJR 0.326
Scopus rating (2002): SNIP 0.473 SJR 0.329
Scopus rating (2001): SNIP 0.676 SJR 0.257
Scopus rating (2000): SNIP 0.666 SJR 0.407
Scopus rating (1999): SNIP 0.535 SJR 0.368
Original language: English
DOIs:
The Painleve's Paradox

We consider the problem of a slender rod slipping along a rough surface. Painleve [C. R. Seances Acad. Sci., 121 (1895), pp. 112-115; C. R. Seances Acad. Sci., 141 (1905), pp. 401-405; C. R. Seances Acad. Sci., 141 (1905), pp. 546-552] showed that the governing rigid body equations for this problem can exhibit multiple solutions (the indeterminate case) or no solutions at all (the inconsistent case), provided the coefficient of friction \( \mu \) exceeds a certain critical value \( \mu(p) \).

Subsequently Genot and Brogliato [Eur. J. Mech. A Solids, 18 (1999), pp. 653-677] proved that, from a consistent state, the rod cannot reach an inconsistent state through slipping. Instead the rod will either stop slipping and stick or it will lift off from the surface. Between these two cases is a special solution for \( \mu > \mu(c) > \mu(p) \), where \( \mu(c) \) is a new critical value of the coefficient of friction. Physically, the special solution corresponds to the rod slipping until it reaches a singular "0/0" point \( P \). Even though the rigid body equations cannot describe what happens to the rod beyond the singular point \( P \), it is possible to extend the special solution into the region of indeterminacy. This extended solution is very reminiscent of a canard [E. Benoit et al., Collect. Math., 31-32 (1981), pp. 37-119]. To overcome the inadequacy of the rigid body equations beyond \( P \), the rigid body assumption is relaxed in the neighborhood of the point of contact of the rod with the rough surface. Physically this corresponds to assuming a small compliance there. It is natural to ask what happens to both the point \( P \) and the special solution under this regularization, in the limit of vanishing compliance. In this paper, we prove the existence of a canard orbit in a reduced four-dimensional slow-fast phase space, connecting a two-dimensional focus-type slow manifold with the stable manifold of a two-dimensional saddle-type slow manifold. The proof combines several methods from local dynamical system theory, including blowup. The analysis is not standard, since we only gain ellipticity rather than hyperbolicity with our initial blowup.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics, University of Bristol
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Pages: 859-908
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information

Journal: SIAM Journal on Applied Dynamical Systems
Volume: 17
Issue number: 1
ISSN (Print): 1536-0040
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.226 SJR 1.04 CiteScore 1.75
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.88 SJR 1.289 SNIP 1.268
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.359 SNIP 1.36 CiteScore 1.89
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.1 SNIP 1.201 CiteScore 1.67
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.325 SNIP 1.363 CiteScore 1.85
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.216 SNIP 1.485 CiteScore 1.77
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
The transmission spectrum of sound through a phononic crystal subjected to liquid flow

The influence of liquid-flow up to 7 mm/s is examined on transmission spectra of phononic crystals, revealing a potential use for slow liquid-flow measurement techniques. It is known that transmission of ultrasound through a phononic crystal is determined by its periodicity and depends on the material characteristics of the crystal's constituents. Here, the crystal consists of metal rods with the space in between filled with water. Previous studies have assumed still water in the crystal, and here, we consider flowing liquid. First, the crystal bandgaps are investigated in still water, and the results of transmission experiments are compared with theoretical band structures obtained with the finite element method. Then, changes in transmission spectra are investigated for different speeds of liquid flow. Two situations are investigated: a crystal is placed with a principal symmetry axis in the flow direction (ΓΓX) and then at an angle (ΓΓM). The good stability of the bandgap structure of the transmission spectrum for both directions is observed, which may be of importance for the application of phononic crystals as acoustic filters in an environment of flowing liquid. Minor transmission amplitude changes on the other hand reveal a possibility for slow liquid flow measurements.

Phononic crystals (PCs) are generally formed by a periodic arrangement of materials (scatterers) with elastic properties different from those of the homogeneous matrix in between the scatterers, typically scaled at the wavelengths of interest and giving rise to the emergence of transmission bandgaps. The concept was studied by Yablonovitch1 in optics for a photonic crystal in the ultraviolet microwave regime, where he shows that bandgaps in the spectrum exist as a result of interferences between direct and reverberated paths of waves. A similar behavior of acoustic waves in phononic crystals (PCs) has been observed. Additionally, ultrasonic waves in a periodic structure are used for sensing purposes, such as acoustic waveguides and acoustic lenses, to control, direct, and manipulate sound.2,3 The reported experiments are as
follows: ultrasound is emitted by a transducer, and it travels through the PC, thereby probing its acoustic properties (density, viscosity, speed of sound,…, speed of water flow). A specific transmission spectrum, including bandgaps, emerges, and its specific characteristics are determined by the physical properties of the PC. Over the last decade, PCs have been introduced as a platform for (still) liquid sensing purposes.4–9 based on significant spectral changes induced by composition changes of the liquid mixture.10 Many works discuss the application of PCs for fluid characterization such as viscosity, density, and concentration measurement of liquid solutions. However, no study of possible flow-speed influence on PC filter characteristics has been reported. For the case in which fluid-flow measurements without the presence of a PC is considered, we can cite, for example, Nishimura et al.,11 for measuring the small open channel fluid flow using pulse-echo signals scattered from the particles in a pipe. From the slope of the correlation peak amplitude with the variation in pulse-echo excitation time, the authors estimate the flow-speed of the medium, for speeds much higher than what is studied in the current paper. Here, we study the band structure and its stability and explore minor effects in actual transmission amplitudes to the flow-speed. The low speeds involved are comparable to what one may expect on a large scale in tidal water currents for example. The phononic crystal under study consists of a square lattice arrangement of 169 steel rods, each having a diameter of 1.2mm and a length of 150mm. A photography of the crystal is shown in Fig. 1(a). The rods were aligned using two supporting plates that had been machined to have periodic arrays of holes, and Fig. 1(b) shows the square lattice pattern of the cylinders and the directions of the highest symmetry, referred to as ΓΓX and ΓΓM. The lattice constant, being the distance between the centers of any two adjacent rods, was measured: a = 2.52mm. The crystal made of cylinders is submerged in water, such that the water in between the cylinders acts as the crystal matrix. Assuming a sound speed in water of 1480m/s, incident ultrasound with a wavelength corresponding to the lattice constant would have a frequency on the order of 1MHz. Steel (rods) and water (host medium) were chosen here as the constituent materials of the crystal due to the large contrast in their densities and elastic constants, as this has been shown to be an effective approach for the formation of bandgaps in other studies on phononic crystals.12–14 To study effects of liquid flow on the transmission spectrum, that spectrum was first determined using through-transmission experiments using an emitting and a receiving transducer, namely, two Valpey-Fisher IS0104GP transducers with a nominal center frequency of and a beamwidth of approximately 10mm. Two types of experiments have been performed on the crystal: through-transmission measurements in the ΓΓX direction and in the ΓΓM direction; the results are shown in Fig. 2.
Three Categories of Context-Aware Systems

With regard to context-aware systems: some optimize system-internal processes, based on the context state at hand; others maximize the user-perceived effectiveness of delivered services, by providing different service variants depending on the situation of the user; still others are about offering value-sensitivity when the society demands so. Even though those three perspectives cover a broad range of currently relevant applications there are no widely accepted and commonly used corresponding concepts and terms. This is an obstacle to broadly understand, effectively integrate, and adequately assess such systems. We address this problem, by considering a (component-based) methodological derivation of technical (software) specifications based on underlying enterprise models. That is because context states are about the enterprise environment of a (software) system while the delivery of context-aware services is about technical (software) functionalities; hence, we need a perspective on both. We consider the SDBC (Software Derived from Business Components) approach that brings together enterprise modeling and software specification. On that basis: (a) We deliver a base context-awareness conceptualization; (b) We partially align it to agent technology because adapting behaviors to environments assumes some kind of pro-activity that is only fully covered by agent systems, in our view. We partially illustrate our proposed conceptualization and particularly - the agent technology implications, by means of a case example featuring land border security.
Three Dimensional Polarimetric Neutron Tomography of Magnetic Fields

Through the use of Time-of-Flight Three Dimensional Polarimetric Neutron Tomography (ToF 3DPNT) we have for the first time successfully demonstrated a technique capable of measuring and reconstructing three dimensional magnetic field strengths and directions unobtrusively and non-destructively with the potential to probe the interior of bulk samples which is not amenable otherwise. Using a pioneering polarimetric set-up for ToF neutron instrumentation in combination with a newly developed tailored reconstruction algorithm, the magnetic field generated by a current carrying solenoid has been measured and reconstructed, thereby providing the proof-of-principle of a technique able to reveal hitherto unobtainable information on the magnetic fields in the bulk of materials and devices, due to a high degree of penetration into many materials, including metals, and the sensitivity of neutron polarisation to magnetic fields. The technique puts the potential of the ToF time structure of pulsed neutron sources to full use in order to optimise the recorded information quality and reduce measurement time.
Time and activity sequence prediction of business process instances

The ability to know in advance the trend of running process instances, with respect to different features, such as the expected completion time, would allow business managers to timely counteract to undesired situations, in order to prevent losses. Therefore, the ability to accurately predict future features of running business process instances would be a very helpful aid when managing processes, especially under service level agreement constraints. However, making such accurate forecasts is not easy: many factors may influence the predicted features. Many approaches have been proposed to cope with this problem but, generally, they assume that the underlying process is stationary. However, in real cases this assumption is not always true. In this work we present new methods for predicting the remaining time of running cases. In particular we propose a method, assuming process stationarity, which achieves state-of-the-art performances and two other methods which are able to make predictions even with non-stationary processes. We also describe an approach able to predict the full sequence of activities that a running case is going to take. All these methods are extensively evaluated on different real case studies.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Software and Process Engineering, University of Padua, Eindhoven University of Technology
Authors: Polato, M. (Ekstern), Sperduti, A. (Ekstern), Burattin, A. (Intern), Leoni, M. D. (Ekstern)
Number of pages: 27
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Computing
ISSN (Print): 0010-485X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.393 SJR 0.414 CiteScore 2.01
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Time Prediction on Multi-perspective Declarative Business Processes

Process-aware information systems (PAISs) are increasingly used to provide flexible support for business processes. The support given through a PAIS is greatly enhanced when it is able to provide accurate time predictions which is typically a very challenging task. Predictions should be (1) multi-dimensional and (2) not based on a single process instance. Furthermore, the prediction system should be able to (3) adapt to changing circumstances, and (4) deal with multi-perspective declarative languages (e.g., models which consider time, resource, data and control flow perspectives). In this work, a novel approach for generating time predictions considering the aforementioned characteristics is proposed. For this, first, a multi-perspective constraint-based language is used to model the scenario. Thereafter, an optimized enactment plan (representing a potential execution alternative) is generated from such a model considering the current execution state of the process instances. Finally, predictions are performed by evaluating a desired function over this enactment plan. To evaluate the applicability of our approach in practical settings we apply it to a real process scenario. Despite the high complexity of the considered problems, results indicate that our approach produces a satisfactory number of good predictions in a reasonable time.

General information
State: Submitted
To every manifest domain a CSP expression – a rôle for mereology in computer science

We give an abstract model of parts and part-hood relations, of Stanisław Lesniewski's mereology. Mereology applies to software application domains such as the financial service industry, railway systems, road transport systems, health care, oil pipelines, secure IT systems, etc. We relate this model to axiom systems for mereology, showing satisfiability, and show that for every mereology there corresponds a class of Communicating Sequential Processes, that is: a λ-expression.
Research in fusion energy seeks to develop a green, safe, and sustainable energy source. Nuclear fusion can be achieved by heating a hydrogen gas to temperatures of millions of kelvin. At fusion temperatures, some or all the electrons leave the atomic nucleus of the hydrogen atom. This results in an overall neutral gaseous state of negatively charged free electrons and positively charged ions. This state of matter is called plasma. To achieve and maintain fusion temperatures, the plasma must avoid direct contact with any solid material. Since the plasma consists of charged particles, it can be confined with an appropriate configuration of strong magnetic fields. Toroidal magnetic confinement devices, such as the tokamak, are the most promising designs for a fusion reactor. A tokamak can operate in two distinct modes of operation. These are the low confinement mode (L-mode) and the high confinement mode (H-mode). H-mode is the preferred operating mode for a fusion reactor. The transition from L-mode to H-mode is called the L–H transition. The confinement properties of a plasma are largely determined by the physics near the edge of the confinement region of the plasma. The edge transport of a magnetically confined plasma is predominantly caused by recurring bursts of coherent plasma structures. These structures are in L-mode called blob filaments (blobs) and in H-mode categorized into edge localized mode (ELM) filaments or inter-ELM filaments. To improve the plasma confinement, it is important to understand the evolution of these structures. We apply a dynamical systems approach to quantitatively describe the time evolution of these structures. Three state variables describe blobs in a plasma convection model. A critical point of a variable defines a feature point where that variable is significant. For a range of Rayleigh and Prandtl numbers, we analyze the bifurcations of the critical points of the three variables with time as the main bifurcation parameter. Plasma simulations can be computationally demanding. We apply a Galerkin method to approximate a plasma convection model with a reduced model. The time evolution of the energies of the pressure profile, the turbulent flow, and the zonal flow capture the dynamic behavior of the convection model. Rayleigh decomposition splits the variables of the model into averaged variables and fluctuation variables. We approximate the fluctuation variables by truncated Fourier series and project the equations onto the Fourier basis functions. This results in a computationally simpler model with the spatial dimension reduced by one. Bifurcation diagrams for the energies show consistency between the bifurcation structures of the full and the reduced model.

Finally, we utilize a data-driven modeling approach called SINDy to identify a reduced model from simulation data of a convection model. The reduced model reveals a predator-prey relationship between the zonal flow energy and the turbulent energy. The analytically derived bifurcation diagram for the reduced model has the same structure as the data-based bifurcation diagram for the full model.
Modern mobile devices especially smartphones have rapidly evolved and are widely adopted by people of different ages. Smartphones can assist users in a variety of activities, i.e., from social networking to online shopping, but also have become an attractive target for cyber-criminals due to the stored personal data and sensitive information. The traditional authentication mechanisms like PIN suffer from well-known limitations and drawbacks in the security community; thus, touch behavioral authentication has recently received much attention. Intuitively, authentication based on free touches would be hard to build a stand-alone system. In this work, we advocate that such authentication can consider users’ actions under certain phone applications like web browser, and then propose a touch gesture-based authentication scheme, called TouchWB, with 21 features that can be extracted from web browsing gestures. For evaluation, we implemented the scheme on Android phones and conducted a user study involving 48 participants. Experimental results demonstrated that our approach could reduce the touch behavioral deviation by nearly half and achieve an average error rate of about 2.4% by using a combined classifier of PSO-RBFN.
Toward an Automated Labeling of Event Log Attributes

Process mining aims at exploring the data produced by executable business processes to mine the underlying control-flow and dataflow. Most of the process mining algorithms assume the existence of an event log with a certain maturity level. Unfortunately, the logs provided by process unaware information systems often do not comply with the required maturity level, since they lack the notion of process instance, also referred in process mining as "case id". Without a proper identification of the case id attribute in log files, the outcome of process mining algorithms is unpredictable. This paper proposes a new approach that aims to overcome this challenge by automatically inferring the case id attribute from log files. The approach has been implemented as a ProM plugin and evaluated with several real-world event logs. The results demonstrate a high accuracy in inferring the case id attribute.

Towards Bayesian-based Trust Management for Insider Attacks in Healthcare Software-Defined Networks

The medical industry is increasingly digitalized and Internet-connected (e.g., Internet of Medical Things), and when deployed in an Internet of Medical Things environment, software-defined networks (SDN) allow the decoupling of network control from the data plane. There is no debate among security experts that the security of Internet-enabled medical devices is crucial, and an ongoing threat vector is insider attacks. In this paper, we focus on the identification of insider attacks in healthcare SDNs. Specifically, we survey stakeholders from 12 healthcare organizations (i.e., two hospitals and two clinics in Hong Kong, two hospitals and two clinics in Singapore, and two hospitals and two clinics in China). Based on the survey findings, we develop a trust-based approach based on Bayesian inference to figure out malicious devices in a healthcare environment. Experimental results in either a simulated and a real-world network environment demonstrate the feasibility and effectiveness of our proposed approach regarding the detection of malicious healthcare devices, i.e., our approach could decrease the trust values of malicious devices faster than similar approaches.
Towards Domain-specific Flow-based Languages

Due to the significant growth of the demand for data-intensive computing, in addition to the emergence of new parallel and distributed computing technologies, scientists and domain experts are leveraging languages specialized for their problem domain, i.e., domain-specific languages, to help them describe their problems and solutions, instead of using general purpose programming languages. The goal of these languages is to improve the productivity and efficiency of the development and simulation of concurrent scientific models and systems. Moreover, they help to expose parallelism and to specify the concurrency within a component or across different independent components. In this paper, we introduce the concept of domain-specific flow-based languages which allows domain experts to use flow-based languages adapted to a particular problem domain. Flow-based programming is used to support concurrency, while the domain-specific part of these languages is used to define atomic processes and domain-specific validation rules for composite processes. We propose a modeling language that can be used to develop such domain-specific languages. Since this language allows one to define other languages, we often refer to it as a meta-modeling language.
Towards False Alarm Reduction using Fuzzy If-Then Rules for Medical Cyber Physical Systems

Cyber-Physical Systems (CPS) are integrations of computation, networking and physical processes. Its process control is often referred to as embedded systems. Generally, CPS and Internet of Things (IoT) have the same basic architecture, whereas the former shows a higher combination and coordination between physical and computational elements, i.e., wireless sensor networks (WSNs) can be a vital part of CPS applications. With the rapid development, CPS has been applied to healthcare industry, where a wide range of medical sensors are used within a healthcare organization. However, these sensors may generate a large number of false alarms in practice, which could significantly reduce the system effectiveness. Targeting on this issue, in this work, we attempt to design a Medical Fuzzy Alarm Filter (named MFAFilter) for healthcare environments by means of fuzzy logic, especially fuzzy if-then rules, which could handle the vague and imprecise among data. In the evaluation, we conducted two major experiments to explore the performance of our approach in a simulated and a real network environment, respectively. Experimental results demonstrate that the use of fuzzy if-then rules could achieve a better accuracy as compared to the traditional supervised algorithms, and that our designed filter is effective in the practical environment.
The recognition of coral species based on underwater texture images pose a significant difficulty for machine learning algorithms, due to the three following challenges embedded in the nature of this data: 1) datasets do not include information about the global structure of the coral; 2) several species of coral have very similar characteristics; and 3) defining the spatial borders between classes is difficult as many corals tend to appear together in groups. For this reason, the classification of coral species has always required an aid from a domain expert. The objective of this paper is to develop an accurate classification model for coral texture images. Current datasets contain a large number of imbalanced classes, while the images are subject to inter-class variation. We have analyzed 1) several Convolutional Neural Network (CNN) architectures, 2) data augmentation techniques and 3) transfer learning. We have achieved the state-of-the art accuracies using different variations of ResNet on the two current coral texture datasets, EILAT and RSMAS.

General information
State: Submitted
Organisations: Department of Applied Mathematics and Computer Science , Image Analysis & Computer Graphics, University of Granada, Virginia Commonwealth University
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Number of pages: 22
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Expert Systems with Applications
ISSN (Print): 0957-4174
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 2.449 SJR 1.271 CiteScore 5.22
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.7 SJR 1.343 SNIP 2.463
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.473 SNIP 2.522 CiteScore 4.11
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.476 SNIP 2.564 CiteScore 3.63
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.305 SNIP 2.348 CiteScore 3.31
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.148 SNIP 2.419 CiteScore 3.38
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.113 SNIP 2.541 CiteScore 3.76
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.046 SNIP 1.807
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.922 SNIP 2.543
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.123 SNIP 2.203
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.021 SNIP 1.695
Scopus rating (2006): SJR 0.673 SNIP 1.354
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.683 SNIP 1.655
Scopus rating (2004): SJR 0.563 SNIP 1.79
Towards Interactive Photorealistic Rendering

Interactive rendering applications are becoming more and more prominent in everyday life. In many fields, including manufacturing, product design and entertainment, photorealistic rendering is useful in predicting the appearance of complex materials. However, due to production and time constraints, applications need to be interactive to provide immediate feedback to the user.

In this thesis, we address this challenge by proposing new photorealistic interactive rendering techniques, that leverage the parallel power of graphics processing units (GPUs) in order to effectively create renderings based on the laws of physics. These techniques propose effective caching and filtering schemes in order to efficiently reuse data, either across space or across time.

We provide insights into different areas of computer graphics, including scene reconstruction, material parameter estimation, efficient data structures and physically based rendering models. Our goal is to explore the different compromises and trade-offs that are necessary to achieve accurate photorealistic renderings. More specifically, we contribute with two techniques: the first relates to fast rendering of translucent materials, accounting for directional effects of subsurface scattering. The second technique contributes with a fast reprojection scheme to improve temporal stability in interactive ray tracing, that can be applied on top of existing rendering algorithms. On top of these, we propose an innovative validation pipeline to compare renderings with actual images, with the final purpose of validating existing rendering and reconstruction techniques against a picture of the real world.

With these contributions, we demonstrate how it is possible to use effective caching schemes to effectively improve existing techniques to handle more complex optical effects, maintaining the time constraints of interactive rendering environments.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics
Authors: Dal Corso, A. (Intern)
Number of pages: 173
Publication date: 2018

Publication information

Publisher: DTU Compute
Original language: English

Series: DTU Compute PHD-2018
Volume: 474
ISSN: 0909-3192
Main Research Area: Technical/natural sciences
Electronic versions: thesis_1_.pdf

Relations
Projects:
Towards Interactive Photorealistic Rendering
Publication: Research › Ph.D. thesis – Annual report year: 2018

Uncertainty Management and Sensitivity Analysis

Uncertainty is always there and LCA is no exception to that. The presence of uncertainties of different types and from numerous sources in LCA results is a fact, but managing them allows to quantify and improve the precision of a study and the robustness of its conclusions. LCA practice sometimes suffers from an imbalanced perception of uncertainties, justifying modelling choices and omissions. Identifying prevalent misconceptions around uncertainties in LCA is a central goal of this chapter, aiming to establish a positive approach focusing on the advantages of uncertainty management. The main objectives of this chapter are to learn how to deal with uncertainty in the context of LCA, how to quantify it, interpret
and use it, and how to communicate it. The subject is approached more holistically than just focusing on relevant statistical methods or purely mathematical aspects. This chapter is neither a precise statistical method description, nor a philosophical essay about the concepts of uncertainty, knowledge and truth, although you will find a little bit of both. This chapter contains (1) an introduction of the essential terminology and concepts of relevance for LCA; (2) a discussion of main sources of uncertainty and how to quantify them; (3) a presentation of approaches to calculate uncertainty for the final results (propagation); (4) a discussion of how to use uncertainty information and how to take it into account in the interpretation of the results; and finally (5) a discussion of how to manage, communicate and present uncertainty information together with the LCA results.

Uncovering the fatigue damage initiation and progression in uni-directional non-crimp fabric reinforced polyester composite

The current work studies the fatigue damage initiation and progression in a quasi-unidirectional non-crimp fabric based fibre composite used for wind turbine blades. This is done by combining in situ transilluminated white light imagining (TWLI) with ex-situ X-ray computed tomography (CT) experiments along with tension clamp X-ray CT experiments. TWLI is used to monitor the off-axis cracks in the thin supporting backing fibre bundles present in quasi-UD composites, and a crack counting algorithm is applied to automatically count the cracks in images obtained in situ during fatigue testing. It is found that off-axis cracks not only initiate at the specimen edges but also at isolated locations inside the specimen, which could be related to the microstructural features. In addition, a clear effect of strain level on the measured off-axis crack density is observed. From the X-ray CT experiments, it is found that the UD fibre fractures initiate and progress from regions where the off-axis backing fibre bundles are 'in contact' with a UD fibre bundle. Damage is seen to first initiate at a cross-over region of the backing fibre bundles, and later at a region with only one backing fibre bundle. In addition, applying tension to the specimen during X-ray CT scanning is found to reveal additional UD fibre fractures that are not visible in scans performed the unloaded state. With load applied, a significant number of UD fibre fractures were observed earlier in the fatigue life than expected. Based on the observations of the study a damage progression scheme is presented for quasi-UD fibre composites.
Understandability of Hybrid Process Models Using DCR Graphs

While the understandability of process models has been extensively investigated for different process modeling notations, it has not been yet broadened to cover hybrid models. This paper proposes a new research model to investigate the understandability of hybrid model representations using a variety of psycho-physiological measurements including eye...
tracking and galvanic skin response (GSR) together with verbal data analysis. The aim of this research is to ensure a smooth integration of hybrid modelling technologies in public administrations by investigating the way end-users (i.e., case workers) rely on the different parts of the hybrid process model representation in DCR Graphs, i.e., the graph, the textual annotations describing the law, and the simulation tools to interpret the process model.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Software and Process Engineering, Københavns Universitet, Aarhus Universitet
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Number of pages: 7
Publication date: 2018

**Host publication information**
Title of host publication: Proceedings of 30th International Conference on Advanced Information Systems Engineering
Main Research Area: Technical/natural sciences
Conference: 30th International Conference on Advanced Information Systems Engineering, Tallinn, Estonia, 11/06/2018 - 11/06/2018
Electronic versions: UnderstandabilityPP.pdf

**Bibliographical note**
https://caise2018.ut.ee/sessions/ecoknow-workshop/
Source: PublicationPreSubmission
Source-ID: 149073959
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

**Understanding predictability and exploration in human mobility**
Predictive models for human mobility have important applications in many fields including traffic control, ubiquitous computing, and contextual advertisement. The predictive performance of models in literature varies quite broadly, from over 90% to under 40%. In this work we study which underlying factors - in terms of modeling approaches and spatio-temporal characteristics of the data sources - have resulted in this remarkably broad span of performance reported in the literature. Specifically we investigate which factors influence the accuracy of next-place prediction, using a high-precision location dataset of more than 400 users observed for periods between 3 months and one year. We show that it is much easier to achieve high accuracy when predicting the time-bin location than when predicting the next place. Moreover, we demonstrate how the temporal and spatial resolution of the data have strong influence on the accuracy of prediction. Finally we reveal that the exploration of new locations is an important factor in human mobility, and we measure that on average 20-25% of transitions are to new places, and approx. 70% of locations are visited only once. We discuss how these mechanisms are important factors limiting our ability to predict human mobility.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, Massachusetts Institute of Technology
Authors: Cuttone, A. (Intern), Jørgensen, S. L. (Intern), González, M. C. (Ekstern)
Number of pages: 17
Pages: 1-17
Publication date: 2018
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Epj Data Science
Volume: 7
Issue number: 2
ISSN (Print): 2193-1127
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): SNIP 1.361 SJR 0.943 CiteScore 3.38
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 3.05 SJR 0.912 SNIP 1.186
Scopus rating (2015): SJR 0.98 SNIP 1.424 CiteScore 3.51
Scopus rating (2014): SJR 1.365 SNIP 2.766
In tomographic reconstruction problems it is not uncommon that there are errors in the implementation of the forward projector and/or the backprojector, and hence we encounter a so-called unmatched projector/backprojector pair. Consequently, the matrices that represent the two projectors are not each other’s transpose. Surprisingly, the influence of such errors in algebraic iterative reconstruction methods has received little attention in the literature. The goal of this paper is to perform a rigorous first-order perturbation analysis of the minimization problems underlying the algebraic methods in order to understand the role played by the nonmatch of the matrices. We also study the convergence properties of linear stationary iterations based on unmatched matrix pairs, leading to insight into the behavior of some important row- and column-oriented algebraic iterative methods. We conclude with numerical examples that illustrate the perturbation and convergence results.
Un tanque de levadura excedente falla con consecuencias catastróficas

Un gran tanque de levadura excedente voló por los aires, y solo quedó la placa de base y el contenido del tanque. Aunque el tanque no había sido concebido para sobrepresión, se mantenía a "una sobrepresión muy ligera" para evitar la formación de espuma no deseada. La cervecería no conocía los riesgos relacionados con el aire comprimido.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Statistics and Data Analysis, COWI A/S
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Pages: 76-79
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: BRAUWELT En Español
Volume: 22
Issue number: May
ISSN (Print): 1619-537X
Original language: Spanish
Source: PublicationPreSubmission
Source-ID: 148654698
Publication: Research › Journal article – Annual report year: 2018
Using game design for learning

**General information**
State: Published  
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis  
Authors: Weitze, C. L. (Intern)  
Pages: 54-63  
Publication date: 2018

**Host publication information**
Title of host publication: Enhancing Learning and Teaching with Technology: What the Research Says  
Editor: Luckin, R.  
Chapter: 2.2  
Main Research Area: Technical/natural sciences  
Source: PublicationPreSubmission  
Source-ID: 147732471  
Publication: Research - peer-review › Book chapter – Annual report year: 2018

Validation and optimization of air quality sensor based occupancy detection algorithms
This paper discusses the validation and adjustment of the CO2 based occupancy detection algorithm introduced by Calì et al. (Calì, 2015), based on new data gathered at the E.ON Energy Research Center main building in Aachen in 10 multi-person offices. In addition to the new data basis, further adjustments of the algorithm to the given conditions and possible future improvements are discussed. This paper will also discuss other occupancy detection algorithms, e.g. ones based on VOC, humidity or a combination of different measurements.

**General information**
State: Published  
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, RWTH Aachen University  
Authors: Nienaber, F. (Ekstern), Wesseling, M. (Ekstern), Cali, D. (Intern), Müller, D. (Ekstern)  
Number of pages: 6  
Publication date: 2018

**Host publication information**
Title of host publication: Proceedings of Roomvent & Ventilation 2018  
ISBN (Print): 978-952-5236-48-4  
Main Research Area: Technical/natural sciences  
Conference: Roomvent&Ventilation 2018, Espoo, Finland, 02/06/2018 - 02/06/2018  
CO2, Occupancy detection, Indoor air quality, Occupant behaviour  
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

Very short-term spatio-temporal wind power prediction using a censored Gaussian field
Wind power is a renewable energy resource, that has relatively cheap installation costs and it is highly possible that will become the main energy resource in the near future. Wind power needs to be integrated efficiently into electricity grids, and to optimize the power dispatch, techniques to predict the level of wind power and the associated variability are critical. Ideally, one would like to obtain reliable probability density forecasts for the wind power distributions. We aim at contributing to the literature of wind power prediction by developing and analysing a spatio-temporal methodology for wind power production, that is tested on wind power data from Denmark. We use anisotropic spatio-temporal correlation models to account for the propagation of weather fronts, and a transformed latent Gaussian field model to accommodate the probability masses that occur in wind power distribution due to chains of zeros. We apply the model to generate multi-step ahead probability predictions for wind power generated at both locations where wind farms already exist but also to nearby locations.

**General information**
State: Published  
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, University of Cyprus  
Authors: Baxevani, A. (Ekstern), Lenzi, A. (Intern)  
Pages: 931-948  
Publication date: 2018  
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Stochastic Environmental Research and Risk Assessment
Covariance function, Gaussian transformed model, Kriging equations, Spatio-temporal model, Wind power, Electric power generation, Energy resources, Forecasting, Gaussian distribution, Probability, Probability density function, Probability distributions, Renewable energy resources, Weather forecasting, Gaussians, Kriging, Probability densities, Spatio-temporal models, Spatiotemporal correlation, Wind power distribution, Wind power predictions, Electric load dispatching, Environment, Earth Sciences, general, Probability Theory and Stochastic Processes, Statistics for Engineering, Physics, Computer Science, Chemistry and Earth Sciences, Computational Intelligence, Waste Water Technology / Water Pollution Control / Water Management / Aquatic Pollution

DOI: 10.1007/s00477-017-1435-7
Visual Human-Computer Interaction
In the recent years, technologies such as Virtual and Augmented Reality has gained massive popularity. Simultaneously, computer vision systems and computation power have reached a point, where it is possible to acquire and process geometric and appearance data to produce photorealistic renderings that can appear indistinguishable from real photographs. This enables new ways for Human-Computer Interaction (HCI) methods and applications, that needs to be evaluated to explore their full potential. This thesis addresses a set of vision based challenges concerning HCI. The presented contributions fall into the overall themes of geometric acquisition and handling of refractive objects, photorealistic rendering for computer graphics applications, and systems for advanced and realistic complex applications for HCI. Accordingly, the work of this thesis is presented in a four-element taxonomy: Geometry and appearance acquisition, tracking, visualization and interaction, and datasets. The work contributes to state of the art methods and prepares the ground for future research within the above-mentioned topics. All in all this thesis contributes to improving the eld of visual HCI.

Vitamin D vitamers affect vitamin D status differently in young healthy males
Dietary intake of vitamin D includes vitamin D3 (vitD3), 25-hydroxyvitamin D3 (25OH-D3), and vitamin D2 (vitD2). However, the bioactivity of the different species has not been scientifically established. The hypothesis in this study was that vitD3, 25OH-D3, and vitD2 have an equal effect on 25-hydroxyvitamin D in serum (vitamin D status). To test our hypothesis, we performed a randomized, crossover study. Twelve young males consumed 10 µg/day vitD3 during a four-week run-in period, followed by 3 × 6 weeks of 10 µg/day vitD3, 10 µg/day 25OH-D3, and 10 µg/day vitD2. The content of vitD3, vitD2, 25OH-D3, and 25-hydroxyvitamin D2 (25OH-D2) in serum was quantified by liquid chromatography-tandem mass spectrometry (LC-MS/MS). The hypothesis that the three sources of vitamin D affect vitamin D status equally was rejected. Based on the assumption that 1 µg vitD3/day will show an increase in vitamin D status of 1.96 nmol/L, the results showed that 23 µg vitD2 and 6.8 µg 25OH-D3 was similar to 10 µg vitD3. These results demonstrate that further investigations are necessary to determine how to quantify the total vitamin D activity based on chemical quantification of the individual vitamin D metabolites to replace the total vitamin D activity assessed in biological rat models.
In this article we explicitly determine the structure of the Weierstrass semigroups $H(P)$ for any point $P$ of the Giulietti–Korchmáros curve $X$. We show that as the point varies, exactly three possibilities arise: one for the $\mathbb{F}_{q^2}$-rational points (already known in the literature), one for the $\mathbb{F}_{q^6} \setminus \mathbb{F}_{q^2}$-rational points, and one for all remaining points. As a result, we prove a conjecture concerning the structure of $H(P)$ in case $P$ is an $\mathbb{F}_{q^6} \setminus \mathbb{F}_{q^2}$-rational point.
When Intrusion Detection Meets Blockchain Technology: A Review

With the purpose of identifying cyber threats and possible incidents, intrusion detection systems (IDSs) are widely deployed in various computer networks. In order to enhance the detection capability of a single IDS, collaborative intrusion detection networks (or collaborative IDSs) have been developed, which allow IDS nodes to exchange data with each other. However, data and trust management still remain two challenges for current detection architectures, which may degrade the effectiveness of such detection systems. In recent years, blockchain technology has shown its adaptability in many fields such as supply chain management, international payment, interbanking and so on. As blockchain can protect the integrity of data storage and ensure process transparency, it has a potential to be applied to intrusion detection domain. Motivated by this, this work provides a review regarding the intersection of IDSs and blockchains. In particular, we introduce the background of intrusion detection and blockchain, discuss the applicability of blockchain to intrusion detection, and identify open challenges in this direction.

Who is behind the Model? Classifying Modelers based on Pragmatic Model Features

Process modeling tools typically aid end users in generic, non-personalized ways. However, it is well conceivable that different types of end users may profit from different types of modeling support. In this paper, we propose an approach based on machine learning that is able to classify modelers regarding their expertise while they are creating a process model. To do so, it takes into account pragmatic features of the model under development. The proposed approach is fully automatic, unobtrusive, tool independent, and based on objective measures. An evaluation based on two data sets resulted in a prediction performance of around 90%. Our results further show that all features can be efficiently calculated, which makes the approach applicable to online settings like adaptive modeling environments. In this way, this work contributes to improving the performance of process modelers.
Wind Power Forecasting Based on Echo State Networks and Long Short-Term Memory

Wind power generation has presented an important development around the world. However, its integration into electrical systems presents numerous challenges due to the variable nature of the wind. Therefore, to maintain an economical and reliable electricity supply, it is necessary to accurately predict wind generation. The Wind Power Prediction Tool (WPPT) has been proposed to solve this task using the power curve associated with a wind farm. Recurrent Neural Networks (RNNs) model complex non-linear relationships without requiring explicit mathematical expressions that relate the variables involved. In particular, two types of RNN, Long Short-Term Memory (LSTM) and Echo State Network (ESN), have shown good results in time series forecasting. In this work, we present an LSTM+ESN architecture that combines the characteristics of both networks. An architecture similar to an ESN is proposed, but using LSTM blocks as units in the hidden layer. The training process of this network has two key stages: (i) the hidden layer is trained with a descending gradient method online using one epoch; (ii) the output layer is adjusted with a regularized regression. In particular, the case is proposed where Step (i) is used as a target for the input signal, in order to extract characteristics automatically as the autoencoder approach; and in the second stage (ii), a quantile regression is used in order to obtain a robust estimate of the expected target. The experimental results show that LSTM+ESN using the autoencoder and quantile regression outperforms the WPPT model in all global metrics used.
WinProGen: A Markov-Chain-based stochastic window status profile generator for the simulation of realistic energy performance in buildings

New and retrofitted buildings often do not perform as expected. In fact, the real energy performance of a building depends on deterministic characteristics (e.g. building's structure and HVAC), and on stochastic elements (e.g. occupants' behavior). Probabilistic models of occupant behavior in the simulation of buildings' energy performance can help to bridge the gap between prediction and real energy consumption. With this aim, a stochastic window status profile generator (WinProGen) is introduced, validated (using the Markov chain Monte Carlo technique) through observations from field tests, and tested through dynamic building simulations. In WinProGen, we implemented three models for the generation of window state profiles, based on field test data, with a time resolution of 1min. The profiles generated from model 1 depend on the time of the day and the daily average ambient temperature. The profiles generated from model 2 depend on the time of the day, on the daily average ambient temperature and on the day of the week (working day or weekend day). The profiles generated from model 3 depend on the time of the day, on the daily average ambient temperature of the actual day and on the daily average ambient temperature of the past day. The generated profiles can be used as an input to simulate dynamic building energy performance. Moreover, users can include in WinProGen their own field test data to generate own state profiles. The dynamic simulation of two demonstrator buildings with the generated window state profiles offers reliable predictions of buildings' energy performance.
Journal: Building and Environment
Volume: 136
ISSN (Print): 0360-1323
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 5.22 SJR 2.169 SNIP 2.534
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.51 SJR 1.998 SNIP 2.215
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.067 SNIP 2.463 CiteScore 4.37
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.887 SNIP 2.742 CiteScore 4.14
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.547 SNIP 2.551 CiteScore 3.57
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.293 SNIP 2.857 CiteScore 3.06
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.127 SNIP 2.279 CiteScore 2.76
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.245 SNIP 2.058
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.025 SNIP 1.889
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.938 SNIP 1.413
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.826 SNIP 1.771
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.016 SNIP 1.716
Scopus rating (2005): SJR 0.933 SNIP 1.296
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.572 SNIP 1.259
Scopus rating (2003): SJR 0.898 SNIP 0.963
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.216 SNIP 1.436
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.809 SNIP 1.065
Scopus rating (2000): SJR 0.585 SNIP 1.086
Scopus rating (1999): SJR 0.54 SNIP 1.137
Original language: English
Occupant behavior, Markov chain, Natural ventilation, Buildings' energy performance, Building simulation, Window opening and closing
Work Package 2 Report - Cyber resilience for the shipping industry

This report describes the current state of the research performed as a part of the CyberShip project for its Work Package 2. This work package aims at defining a CyberShip model and KPIs for cyber resilience. This is a project funded by the Danish Maritime Fund (DMF) with the objective of proposing a framework for improving the resilience of the shipping industry.

General information
State: Published
Organisations: Department of Management Engineering, Management Science, Transport DTU, Operations Management, Department of Applied Mathematics and Computer Science, Cyber Security
Authors: Sahay, R. (Intern), Sepúlveda Estay, D. A. (Intern)
Number of pages: 25
Publication date: 2018

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
180404_cybership_report_WP2.pdf

Relations
Projects:
Work Package 2 Report - Cyber resilience for the shipping industry
Source: PublicationPreSubmission
Source-ID: 149384338
Publication: Research › Report – Annual report year: 2018

X-ray tomography based finite element modelling of non-crimp fabric based fibre composite

The current study presents a workflow to import a fibre bundle structure of a non-crimp fabric based fibre composite obtained by X-ray CT to a solvable 3D model in the finite element software ABAQUS. The considered fibre composite is similar to that used for the load carrying parts of wind turbine blades, and each layer of the non-crimp fabric contains fibre bundles oriented in the 0º, 90º, and 45º directions. The 3D fibre bundle geometry is first segmented in the software AVIZO and then imported to Geomagic Wrap where the geometry is smoothened and converted into a nurbs surface that can be imported into ABAQUS. The resulting stress distribution is qualitatively compared to previous experimental observations and discussed.

General information
State: Published
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Authors: Jespersen, K. M. (Intern), Asp, L. E. (Ekstern), Hosoi, A. (Ekstern), Kawada, H. (Ekstern), Mikkelsen, L. P. (Intern)
Number of pages: 8
Publication date: 2018
Main Research Area: Technical/natural sciences
Electronic versions:
ECCM18_7_.pdf
Publication: Research - peer-review › Paper – Annual report year: 2018

How to target inter-regional phase synchronization with dual-site Transcranial Alternating Current Stimulation

Large-scale synchronization of neural oscillations is a key mechanism for functional information exchange among brain areas. Dual-site Transcranial Alternating Current Stimulation (ds-TACS) has been recently introduced as non-invasive technique to manipulate the temporal phase relationship of local oscillations in two connected cortical areas. While the frequency of ds-TACS is matched, the phase of stimulation is either identical (in-phase stimulation) or opposite (anti-phase stimulation) in the two cortical target areas. In-phase stimulation is thought to synchronize the endogenous oscillations and hereby to improve behavioral performance. Conversely, anti-phase stimulation is thought to desynchronize neural oscillations in the two areas, which is expected to decrease performance. Critically, in- and anti-phase ds-TACS should
only differ with respect to temporal phase, while all other stimulation parameters such as focality and stimulation intensity should be matched to enable an unambiguous interpretation of the behavioral effects. Using electric field simulations based on a realistic head geometry, we tested how well this goal has been met in studies, which have employed ds-TACS up to now. Separating the induced electrical fields in their spatial and temporal components, we investigated how the chosen electrode montages determined the spatial field distribution and the generation of phase variations in the injected electric fields. Considering the basic physical mechanisms, we derived recommendations for an optimized stimulation montage. The latter allows for a principled design of in- and anti-phase ds-TACS conditions with matched spatial distributions of the electric field. This knowledge will help cognitive neuroscientists to design optimal ds-TACS configurations, which are suited to probe unambiguously the causal contribution of phase coupling to specific cognitive processes in the human brain.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, Center for Magnetic Resonance, Department of Electrical Engineering, Danish Research Centre for Magnetic Resonance, Technical University of Denmark, University of Copenhagen
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Pages: 68-80
Publication date: 1 Dec 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: NeuroImage
Volume: 163
ISSN (Print): 1053-8119
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 6.15 SJR 3.679 SNIP 1.806
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 6.31 SJR 3.967 SNIP 1.759
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 4.583 SNIP 1.852 CiteScore 6.71
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 4.323 SNIP 2.03 CiteScore 6.9
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 4.489 SNIP 2.028 CiteScore 7.06
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 4.026 SNIP 1.972 CiteScore 6.86
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.728 SNIP 1.818 CiteScore 6.31
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 3.654 SNIP 1.869
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 3.954 SNIP 1.899
Web of Science (2009): Indexed yes
Corticomescular coherence in the acute and subacute phase after stroke

Objective Stroke is one of the leading causes of physical disability due to damage of the motor cortex or the corticospinal tract. In the present study we set out to investigate the role of adaptations in the corticospinal pathway for motor recovery during the subacute phase after stroke. Methods We examined 19 patients with clinically diagnosed stroke and 18 controls. The patients had unilateral mild to moderate weakness of the hand. Each patient attended two sessions at approximately 3 days (acute) and 38 days post stroke (subacute). Task-related changes in the communication between motor cortex and muscles were evaluated from coupling in the frequency domain between EEG and EMG during movement of the paretic hand. Results Corticomuscular coherence (CMC) and intermuscular coherence (IMC) were reduced in patients as compared to controls. Paretic hand motor performance improved within 4–6 weeks after stroke, but no change was observed in CMC or IMC. Conclusions CMC and IMC were reduced in patients in the early phase after stroke. However, changes in coherence do not appear to be an efficient marker for early recovery of hand function following stroke. Significance This is the first study to demonstrate sustained reduced coherence in acute and subacute stroke.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, University of Copenhagen
Authors: Larsen, L. H. (Ekstern), Zibrandtsen, I. C. (Ekstern), Wienecke, T. (Ekstern), Kjaer, T. W. (Ekstern), Christensen, M. S. (Intern), Nielsen, J. B. (Ekstern), Langberg, H. (Ekstern)
Pages: 2217-2226
Publication date: 1 Nov 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Clinical Neurophysiology
Volume: 128
Issue number: 11
ISSN (Print): 1388-2457
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Online short-term forecast of greenhouse heat load using a weather forecast service

In some district heating systems, greenhouses represent a significant share of the total load, and can lead to operational challenges. Short term load forecast of such consumers has a strong potential to contribute to the improvement of the overall system efficiency. This work investigates the performance of recursive least squares for predicting the heat load of individual greenhouses in an online manner. Predictor inputs (weekly curves terms and weather forecast inputs) are selected in an automated manner using a forward selection approach. Historical load measurements from 5 Danish greenhouses with different operational characteristics were used, together with weather measurements and a weather forecast service. It was found that these predictors of reduced complexity and computational load performed well at capturing recurring load profiles, but not fast frequency random changes. Overall, the root mean square error of the prediction was within 8–20% of the peak load for the set of consumers over the 8 months period considered.
Dynamic Relative Compression, Dynamic Partial Sums, and Substring Concatenation

Given a static reference string $R$ and a source string $S$, a relative compression of $S$ with respect to $R$ is an encoding of $S$ as a sequence of references to substrings of $R$. Relative compression schemes are a classic model of compression and have recently proved very successful for compressing highly-repetitive massive data sets such as genomes and web-data.

We initiate the study of relative compression in a dynamic setting where the compressed source string $S$ is subject to edit operations. The goal is to maintain the compressed representation compactly, while supporting edits and allowing efficient random access to the (uncompressed) source string. We present new data structures that achieve optimal time for updates and queries while using space linear in the size of the optimal relative compression, for nearly all combinations of parameters. We also present solutions for restricted and extended sets of updates. To achieve these results, we revisit the dynamic partial sums problem and the substring concatenation problem. We present new optimal or near optimal bounds for these problems. Plugging in our new results we also immediately obtain new bounds for the string indexing for patterns with wildcards problem and the dynamic text and static pattern matching problem.

**General information**

State: E-pub ahead of print
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Number of pages: 18
Publication date: 16 Oct 2017
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Algorithmica
ISSN (Print): 0178-4617
Ratings:

BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 1.27 SJR 0.56 SNIP 1.354
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.11 SJR 0.648 SNIP 1.184
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.739 SNIP 1.16 CiteScore 1.15
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.854 SNIP 1.197 CiteScore 1.2
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.952 SNIP 1.395 CiteScore 1.26
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.836 SNIP 1.204 CiteScore 0.99
ISI indexed (2012): ISI indexed yes
Robotic system and method for manufacturing of objects

The present disclosure relates to a method and a system for manufacturing a mould (17) for creation of complex objects, such as concrete objects, by controlling and moving two end effectors (1) of a robotic system, the two end effectors (1) having a flexible cutting element (3) attached to and extending between the two end effectors (1), the method comprising the steps of: defining at least one surface (8) representing the inner surface of the mould (17); dividing the surface (8) into a number of segments represented by planar curves (9, 11, 12) on the surface (8); for each planar curve, calculating at least one elastic curve representing the planar curve; for each calculated elastic curve, calculating a set of data corresponding to placement and direction of the two end effectors (1) for configuring the flexible cutting element to a shape corresponding to the calculated elastic curve; sequentially positioning the end effectors (1) according to each set of data.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics
Authors: Gravesen, J. (Intern), Brander, D. (Intern), Bærentzen, J. A. (Ekstern), Markvorsen, S. (Intern), Bjerge Nørbjerg, T. (Intern), Hornbak Steenstrup, K. (Intern)
Publication date: 21 Sep 2017

Publication information

IPC: G06T 17/30 A1
Patent number: WO2017157917
Date: 21/09/2017
Priority date: 14/03/2016
Priority number: EP20160160088
Original language: English
Electronic versions:
WO2017157917A1.pdf
Supporting smartphone-based behavioral activation: A simulation study

Behavioral activation has shown to be a simple yet effective therapy for depressive patients. The method relies on extensive collection of patient reported activity data on an hourly basis. We are currently in the process of designing a smartphone-based behavioral activation system for depressive disorders. However, it is an open question to what degree patients would use this approach given the high demand for user input. In order to investigate this question, we collected paper-based behavioral activation forms from 5 patients, covering in total 18 weeks, 115 days, and 1,614 hours of self-reported activity data. In this paper we present an analysis of this data and discuss the implications for the design of a smartphone-based system for behavioral activation.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, University of Copenhagen
Authors: Bardram, J. E. (Intern), Rohani, D. A. (Intern), Tuxen, N. (Ekstern), Faurholt-Jepsen, M. (Ekstern), Kessing, L. V. (Ekstern)
Number of pages: 14
Pages: 830-843
Publication date: 11 Sep 2017

Host publication information
Publisher: Association for Computing Machinery
ISBN (Electronic): 9781450351904
Main Research Area: Technical/natural sciences
Behavioral activation, Depression, Mental health, Smartphone
Electronic versions:
8189ad45f50f77135208f50b793e7f159f35.pdf
DOI:s:
10.1145/3123024.3125617
Source: Scopus
Source-ID: 85030870866
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Contracting a planar graph efficiently

We present a data structure that can maintain a simple planar graph under edge contractions in linear total time. The data structure supports adjacency queries and provides access to neighbor lists in O(1) time. Moreover, it can report all the arising self-loops and parallel edges. By applying the data structure, we can achieve optimal running times for decremental bridge detection, 2-edge connectivity, maximal 3-edge connected components, and the problem of finding a unique perfect matching for a static planar graph. Furthermore, we improve the running times of algorithms for several planar graph problems, including decremental 2-vertex and 3-edge connectivity, and we show that using our data structure in a black-box manner, one obtains conceptually simple optimal algorithms for computing MST and 5-coloring in planar graphs.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, University of Rome Tor Vergata, University of Warsaw, Google Inc., University of Copenhagen
Authors: Holm, J. (Ekstern), Italiano, G. F. (Ekstern), Karczmarz, A. (Ekstern), Łacki, J. (Ekstern), Rotenberg, E. (Intern), Sankowski, P. (Ekstern)
Publication date: 1 Sep 2017

Host publication information
Title of host publication: 25th European Symposium on Algorithms, ESA 2017
Volume: 87
Publisher: Schloss Dagstuhl-Leibniz-Zentrum fur Informatik GmbH, Dagstuhl Publishing
Determination of thermal characteristics of standard and improved hollow concrete blocks using different measurement techniques

The lighter weight, improved thermal properties and better acoustic insulation of hollow-core concrete blocks are few of the characteristics that one encounters when comparing them to traditional Maltese globigerina limestone solid blocks. As a result, hollow concrete blocks have recently been in greater demand. However, their transmittance, or U-value, is still quite high and does not meet the minimum energy requirements for constructing new buildings. This paper is focused on the investigation of the thermal properties of a new building block, developed as part of a nationally-funded research project ThermHCB, with the aim of improving the U-value of such blocks without changing their compressive strength, physical dimensions or manufacturing process. Measurement techniques were applied to obtain comparative values of the thermal transmittance for standard and improved HCBs, using different EN and draft standards. Compressive testing was carried out concurrently in order to ensure that the minimum benchmark compressive strength was reached. The comparison between these results provides information on the reliability of the methodologies used to determine the thermal properties of building elements in-situ, without having to conduct such tests in a laboratory hot box setup.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, University of Malta, Galea Curmi Engineering Services Ltd.
Authors: Caruana, C. (Ekstern), Yousif, C. (Ekstern), Bacher, P. (Intern), Buhagiar, S. (Ekstern), Grima, C. (Ekstern)
Pages: 336-346
Publication date: 1 Sep 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Building Engineering
Volume: 13
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): CiteScore 2.8 SJR 0.753 SNIP 1.862
Scopus rating (2016): CiteScore 2 SJR 0.571 SNIP 1.088
Original language: English
Building envelope, Heat flow, Hollow-core concrete block, Infrared, Insitu, Malta
Source: Scopus
Source-ID: 85029520499
Publication: Research - peer-review › Journal article – Annual report year: 2017

Evaluation of pharmacokinetic model designs for subcutaneous infusion of insulin aspart
Effective mathematical modelling of continuous subcutaneous infusion pharmacokinetics should aid understanding and control in insulin therapy. Thorough analysis of candidate model performance is important for selecting the appropriate models. Eight candidate models for insulin pharmacokinetics included a range of modelled behaviours, parameters and complexity. The models were compared using clinical data from subjects with type 1 diabetes with continuous subcutaneous insulin infusion. Performance of the models was compared through several analyses: R^2 for goodness of fit; the Akaike Information Criterion; a bootstrap analysis for practical identifiability; a simulation exercise for predictability. The simplest model fit poorly to the data (R^2 = 0.53), had the highest Akaike score, and worst prediction. Goodness of fit improved with increasing model complexity (R^2 = 0.85–0.92) but Akaike scores were similar for these models. Complexity increased practical non-identifiability, where small changes in the dataset caused large variation (CV > 10%) in identified parameters in the most complex models. Best prediction was achieved in a relatively simple model. Some model complexity was necessary to achieve good data fit but further complexity introduced practical non-identifiability and worsened prediction capability. The best model used two linear subcutaneous compartments, an interstitial and plasma compartment, and two identified variables for interstitial clearance and subcutaneous transfer rate. This model had optimal performance trade-off with reasonable fit (R^2 = 0.86) and parameterisation, and best prediction and practical identifiability.
Fast computation of the roots of polynomials over the ring of power series

We give an algorithm for computing all roots of polynomials over a univariate power series ring over an exact field $K$. More precisely, given a precision $d$, and a polynomial $Q$ whose coefficients are power series in $x$, the algorithm computes a representation of all power series $f(x)$ such that $Q(f(x)) = 0 \mod x^d$. The algorithm works unconditionally, in particular also with multiple roots, where Newton iteration fails. Our main motivation comes from coding theory where instances of this problem arise and multiple roots must be handled. The cost bound for our algorithm matches the worst-case input and output size $d \deg(Q)$, up to logarithmic factors. This improves upon previous algorithms which were quadratic in at least one of $d$ and $\deg(Q)$. Our algorithm is a refinement of a divide & conquer algorithm by Alekhnovich (2005), where the cost of recursive steps is better controlled via the computation of a factor of $Q$ which has a smaller degree while preserving the roots.
SCANNING AND TRACKING MONITORING APPARATUS AND METHOD

Disclosed is a scanning monitoring apparatus for medical imaging, the scanning monitoring apparatus comprising a controller unit and a display, wherein the controller unit during a scanning session is configured to obtain tracking data (102) of a subject in a medical scanner, obtain scanner data indicative of operating parameters of the medical scanner (104); determine an output of a verification function based on the tracking data and the scanner data (106); and control the scanning monitoring apparatus according to the output of the verification function (108). A notification signal may be provided if the output is indicative of an erroneous scanning.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics
Authors: Olesen, O. V. (Intern), Benjaminsen, C. (Intern)
Publication date: 22 Jun 2017

Condition monitoring of a rotor arrangement in particular a wind turbine

The present invention relates to a method of determining the condition of a device comprising a rotor arrangement. The rotor arrangement comprises a rotational shaft and a number rotor blades each connected at the root to the rotational shaft and extending radially from the rotational shaft. Sensors are arranged to measure for each rotor blade corresponding values of one or more of the following parameters: azimuth angle (Φ) (or a parameter related to the azimuth angle), root bending moment(s) (q), such as the edgewise and/or flapwise root bending moments. The method comprises, while the rotor arrangement rotates, recording corresponding values of azimuth angle and edgewise and flapwise root bending moments for a plurality of rotations of rotor arrangement, transforming by use of e.g. a multi blade coordinate transformation, a Park's transformation or similar transformation the recorded edgewise and flapwise root bending moments (qf). The method further comprising identifying periodicity in each of the transformed root bending moments, determining the condition of the rotor arrangement to be faulty, in case the one or more periodicities are identified in the transformed root bending moments.
Best laid plans of lions and men

We answer the following question dating back to J. E. Littlewood (1885-1977): Can two lions catch a man in a bounded area with rectifiable lakes? The lions and the man are all assumed to be points moving with at most unit speed. That the lakes are rectifiable means that their boundaries are finitely long. This requirement is to avoid pathological examples where the man survives forever because any path to the lions is infinitely long. We show that the answer to the question is not always “yes” by giving an example of a region R in the plane where the man has a strategy to survive forever. R is a polygonal region with holes and the exterior and interior boundaries are pairwise disjoint, simple polygons. Our construction is the first truly two-dimensional example where the man can survive. Next, we consider the following game played on the entire plane instead of a bounded area: There is any finite number of unit speed lions and one fast man who can run with speed 1 + ε for some value ε > 0. Can the man always survive? We answer the question in the affirmative for any constant ε > 0.

Fingerprints in compressed strings

In this paper we show how to construct a data structure for a string S of size N compressed into a context-free grammar of size n that supports efficient Karp–Rabin fingerprint queries to any substring of S. That is, given indices i and j, the answer to a query is the fingerprint of the substring S[i,j]. We present the first O(n) space data structures that answer fingerprint queries without decompressing any characters. For Straight Line Programs (SLP) we get O(logN) query time, and for Linear SLPs (an SLP derivative that captures LZ78 compression and its variations) we get O(loglogN) query time. We extend the result to solve the longest common extension problem in query time O(logNlogr) and O(logrloglogr+loglogN) for
SLPs and Linear SLPs, respectively. Here, ℓ denotes the length of the LCE.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, University of Bristol
Authors: Bille, P. (Intern), Gørtz, I. L. (Intern), Cording, P. H. (Intern), Sach, B. (Ekstern), Vildhøj, H. W. (Intern), Vind, S. (Intern)
Pages: 171-180
Publication date: 1 Jun 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Computer and System Sciences
Volume: 86
ISSN (Print): 0022-0000
Ratings:
- BFI (2018): BFI-level 2
- BFI (2017): BFI-level 2
- BFI (2016): BFI-level 2
- BFI (2015): BFI-level 2
- BFI (2014): BFI-level 2
- BFI (2013): BFI-level 2
- BFI (2012): BFI-level 2
- BFI (2011): BFI-level 2
- BFI (2010): BFI-level 2
- BFI (2009): BFI-level 2
- BFI (2008): BFI-level 2
Original language: English
Grammar compressed string, Karp–Rabin fingerprints, Longest common extensions
Electronic versions:
- 1305.2777.pdf
DOIs:
- 10.1016/j.jcss.2017.01.002
Source: Scopus
Source-ID: 85009813096
Publication: Research - peer-review → Journal article – Annual report year: 2017

Cauchy Noise Removal by Nonconvex ADMM with Convergence Guarantees
Image restoration is one of the essential tasks in image processing. In order to restore images from blurs and noise while also preserving their edges, one often applies total variation (TV) minimization. Cauchy noise, which frequently appears in engineering applications, is a kind of impulsive and non-Gaussian noise. Removing Cauchy noise can be achieved by solving a nonconvex TV minimization problem, which is difficult due to its nonconvexity and nonsmoothness. In this paper, we adapt recent results in the literature and develop a specific alternating direction method of multiplier to solve this problem. Theoretically, we establish the convergence of our method to a stationary point. Experimental results demonstrate that the proposed method is competitive with other methods in visual and quantitative measures. In particular, our method achieves higher PSNRs for 0.5 dB on average.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, University of Electronic Science and Technology of China, University of California at Los Angeles
Authors: Mei, J. J. (Ekstern), Dong, Y. (Intern), Huang, T. Z. (Ekstern), Yin, W. (Ekstern)
Number of pages: 24
Pages: 1-24
Publication date: 30 May 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Scientific Computing
ISSN (Print): 0885-7474
Ratings:
- BFI (2018): BFI-level 2
Image quality transfer and applications in diffusion MRI
This paper introduces a new computational imaging technique called image quality transfer (IQT). IQT uses machine learning to transfer the rich information available from one-off experimental medical imaging devices to the abundant but lower-quality data from routine acquisitions. The procedure uses matched pairs to learn mappings from low-quality to
corresponding high-quality images. Once learned, these mappings then augment unseen low quality images, for example by enhancing image resolution or information content. Here, we demonstrate IQT using a simple patch-regression implementation and the uniquely rich diffusion MRI data set from the human connectome project (HCP). Results highlight potential benefits of IQT in both brain connectivity mapping and microstructure imaging. In brain connectivity mapping, IQT reveals, from standard data sets, thin connection pathways that tractography normally requires specialised data to reconstruct. In microstructure imaging, IQT shows potential in estimating, from standard “single-shell” data (one non-zero b-value), maps of microstructural parameters that normally require specialised multi-shell data. Further experiments show strong generalisability, highlighting IQT’s benefits even when the training set does not directly represent the application domain. The concept extends naturally to many other imaging modalities and reconstruction problems.

**General information**

State: Published  
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, University College London, Microsoft USA, University of Oxford, University of Nottingham  
Authors: Alexander, D. C. (Ekstern), Zikic, D. (Ekstern), Ghosh, A. (Ekstern), Tanno, R. (Ekstern), Wottschel, V. (Ekstern), Zhang, J. (Ekstern), Kaden, E. (Ekstern), Dyrby, T. B. (Intern), Sotiropoulos, S. N. (Ekstern), Zhang, H. (Ekstern), Criminisi, A. (Ekstern)  
Number of pages: 16  
Pages: 283-298  
Publication date: 15 May 2017  
Main Research Area: Technical/natural sciences

**Publication Information**

Journal: NeuroImage  
Volume: 152  
ISSN (Print): 1053-8119  
Ratings:  
  BFI (2018): BFI-level 2  
  Web of Science (2018): Indexed yes  
  BFI (2017): BFI-level 2  
  Scopus rating (2017): CiteScore 6.15 SJR 3.679 SNIP 1.806  
  Web of Science (2017): Indexed Yes  
  BFI (2016): BFI-level 2  
  Scopus rating (2016): CiteScore 6.31 SJR 3.967 SNIP 1.759  
  Web of Science (2016): Indexed yes  
  BFI (2015): BFI-level 2  
  Scopus rating (2015): SJR 4.583 SNIP 1.852 CiteScore 6.71  
  Web of Science (2015): Indexed yes  
  BFI (2014): BFI-level 2  
  Scopus rating (2014): SJR 4.323 SNIP 2.03 CiteScore 6.9  
  Web of Science (2014): Indexed yes  
  BFI (2013): BFI-level 2  
  Scopus rating (2013): SJR 4.489 SNIP 2.028 CiteScore 7.06  
  ISI indexed (2013): ISI indexed yes  
  Web of Science (2013): Indexed yes  
  BFI (2012): BFI-level 2  
  Scopus rating (2012): SJR 4.026 SNIP 1.972 CiteScore 6.86  
  ISI indexed (2012): ISI indexed yes  
  Web of Science (2012): Indexed yes  
  BFI (2011): BFI-level 2  
  Scopus rating (2011): SJR 3.728 SNIP 1.818 CiteScore 6.31  
  ISI indexed (2011): ISI indexed yes  
  Web of Science (2011): Indexed yes  
  BFI (2010): BFI-level 2  
  Scopus rating (2010): SJR 3.654 SNIP 1.869  
  Web of Science (2010): Indexed yes  
  BFI (2009): BFI-level 2  
  Scopus rating (2009): SJR 3.954 SNIP 1.899
Flexible non-linear predictive models for large-scale wind turbine diagnostics

We demonstrate how flexible non-linear models can provide accurate and robust predictions on turbine component temperature sensor data using data-driven principles and only a minimum of system modeling. The merits of different model architectures are evaluated using data from a large set of turbines operating under diverse conditions. We then go on to test the predictive models in a diagnostic setting, where the output of the models are used to detect mechanical faults in rotor bearings. Using retrospective data from 22 actual rotor bearing failures, the fault detection performance of the models are quantified using a structured framework that provides the metrics required for evaluating the performance in a fleet wide monitoring setup. It is demonstrated that faults are identified with high accuracy up to 45 days before a warning from the hard-threshold warning system.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, Department of Applied Electronics, Department of Informatics and Mathematical Modeling, Siemens Diagnostic Center
Authors: Bach-Andersen, M. (Intern), Rømer-Odgaard, B. (Ekstern), Winther, O. (Intern)
Number of pages: 12
Pages: 753-764
Publication date: 1 May 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Wind Energy
Volume: 20
Issue number: 5
ISSN (Print): 1095-4244
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.18 SJR 1.051 SNIP 1.834
PET/MRI in the presence of metal implants: Completion of the attenuation map from PET emission data

We present a novel technique for accurate whole-body attenuation correction in the presence of metallic endoprosthesis, on integrated non-time-of-flight (non-TOF) PET/MRI scanners. The proposed implant PET-based attenuation map completion (IPAC) method performs a joint reconstruction of radioactivity and attenuation from the emission data to determine the position, shape, and linear attenuation coefficient (LAC) of metallic implants. Methods: The initial estimate of
the attenuation map was obtained using the MR Dixon method currently available on the Siemens Biograph mMR scanner. The attenuation coefficients in the area of the MR image subjected to metal susceptibility artifacts are then reconstructed from the PET emission data using the IPAC algorithm. The method was tested on 11 subjects presenting 13 different metallic implants, who underwent CT and PET/MR scans. Relative mean LACs and Dice similarity coefficients were calculated to determine the accuracy of the reconstructed attenuation values and the shape of the metal implant, respectively. The reconstructed PET images were compared with those obtained using the reference CT-based approach and the Dixon-based method. Absolute relative change (aRC) images were generated in each case, and voxel-based analyses were performed. Results: The error in implant LAC estimation, using the proposed IPAC algorithm, was 15.7% ± 7.6%, which was significantly smaller than the Dixon- (100%) and CT-(39%) derived values. A mean Dice similarity coefficient of 73% ± 9% was obtained when comparing the IPAC- with the CT-derived implant shape. The voxel-based analysis of the reconstructed PET images revealed quantification errors (aRC) of 13.2% ± 22.1% for the IPAC with respect to CT-corrected images. The Dixon-based method performed substantially worse, with a mean aRC of 23.1% ± 38.4%.

Conclusion: We have presented a non-TOF emission-based approach for estimating the attenuation map in the presence of metallic implants, to be used for whole-body attenuation correction in integrated PET/MR scanners. The Graphics Processing Unit implementation of the algorithm will be included in the open-source reconstruction toolbox Occiput.io.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Harvard University, IRCCS Fondazione SDN, Università degli Studi di Napoli Parthenope, Siemens
Number of pages: 6
Pages: 840-845
Publication date: 1 May 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Nuclear Medicine
Volume: 58
Issue number: 5
ISSN (Print): 0161-5505
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.705 SJR 2.307 CiteScore 5.12
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.06 SJR 2.313 SNIP 1.843
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.511 SNIP 1.887 CiteScore 4.83
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.461 SNIP 1.978 CiteScore 4.9
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.315 SNIP 1.982 CiteScore 4.66
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.787 SNIP 2.16 CiteScore 5
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.642 SNIP 2.092 CiteScore 5.08
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Subsequence automata with default transitions

Let $S$ be a string of length $n$ with characters from an alphabet of size $\sigma$. The subsequence automaton of $S$ (often called the directed acyclic subsequence graph) is the minimal deterministic finite automaton accepting all subsequences of $S$. A straightforward construction shows that the size (number of states and transitions) of the subsequence automaton is $O(n\sigma)$ and that this bound is asymptotically optimal. In this paper, we consider subsequence automata with default transitions, that is, special transitions to be taken only if none of the regular transitions match the current character, and which do not consume the current character. We show that with default transitions, much smaller subsequence automata are possible, and provide a full trade-off between the size of the automaton and the delay, i.e., the maximum number of consecutive default transitions followed before consuming a character. Specifically, given any integer parameter $k$, $1 < k \leq \sigma$, we present a subsequence automaton with default transitions of size $O(nk \log_k \sigma)$ and delay $O(\log_k \sigma)$. Hence, with $k=2$ we obtain an automaton of size $O(n \log \sigma)$ and delay $O(\log \sigma)$. At the other extreme, with $k=\sigma$, we obtain an automaton of size $O(n\sigma)$ and delay $O(1)$, thus matching the bound for the standard subsequence automaton construction. Finally, we generalize the result to multiple strings. The key component of our result is a novel hierarchical automata construction of independent interest.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Technical University of Denmark
Authors: Bille, P. (Intern), Gørtz, I. L. (Intern), Skjoldjensen, F. R. (Ekstern)
Number of pages: 8
Pages: 48-55
Publication date: 1 May 2017
Main Research Area: Technical/natural sciences

Publication information

Journal: Journal of Discrete Algorithms
Volume: 44
ISSN (Print): 1570-8667
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.156 SJR 0.549 CiteScore 0.97
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.76 SJR 0.472 SNIP 0.843
BFI (2015): BFI-level 1
Pin-count reduction for continuous flow microfluidic biochips

Microfluidic biochips are replacing the conventional biochemical analyzers integrating the necessary functions on-chip. We are interested in flow-based biochips, where a continuous flow of liquid is manipulated using integrated microvalves, controlled from external pressure sources via off-chip control pins. Recent research has addressed the physical design of such biochips. However, such research has so far ignored the pin-count, which rises with the increase in the number of microvalves. Given a biochip architecture and a biochemical application, we propose an algorithm for reducing the number of control pins required to run the application. The proposed algorithm has been evaluated on several biochips, including the AquaFlux biochip from Microfluidic Innovations LLC.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering
Authors: Schneider, A. (Intern), Pop, P. (Intern), Madsen, J. (Intern)
Number of pages: 12
Pages: 1-12
Publication date: 6 Apr 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Microsystem Technologies
ISSN (Print): 0946-7076
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.803 SJR 0.346 CiteScore 1.34
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.96 SJR 0.35 SNIP 0.756
BFI (2015): BFI-level 1
It has been predicted that electric vehicles will play a crucial role in incorporating a large renewable component in the energy sector. If electric vehicles are integrated in a naive way, they may exacerbate issues related to peak demand and transmission capacity limits while not reducing polluting emissions. Optimizing the charging of electric vehicles is paramount for their successful integration. This paper presents a model to describe the driving patterns of electric vehicles in order to provide primary input information to any mathematical programming model for optimal charging. Specifically, an inhomogeneous Markov model that captures the diurnal variation in the use of a vehicle is presented. The model is defined by the time-varying probabilities of starting and ending a trip, and is justified due to the uncertainty associated with the use of the vehicle. The model is fitted to data collected from the actual utilization of a vehicle. Inhomogeneous Markov models imply a large number of parameters. The number of parameters in the proposed model is reduced using B-splines.

**Inhomogeneous Markov Models for Describing Driving Patterns**
It has been predicted that electric vehicles will play a crucial role in incorporating a large renewable component in the energy sector. If electric vehicles are integrated in a naive way, they may exacerbate issues related to peak demand and transmission capacity limits while not reducing polluting emissions. Optimizing the charging of electric vehicles is paramount for their successful integration. This paper presents a model to describe the driving patterns of electric vehicles in order to provide primary input information to any mathematical programming model for optimal charging. Specifically, an inhomogeneous Markov model that captures the diurnal variation in the use of a vehicle is presented. The model is defined by the time-varying probabilities of starting and ending a trip, and is justified due to the uncertainty associated with the use of the vehicle. The model is fitted to data collected from the actual utilization of a vehicle. Inhomogeneous Markov models imply a large number of parameters. The number of parameters in the proposed model is reduced using B-splines.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems
Authors: Iversen, E. B. (Intern), Møller, J. K. (Intern), Morales, J. M. (Intern), Madsen, H. (Intern)
Pages: 581-588
Publication date: 1 Mar 2017
Main Research Area: Technical/natural sciences
We show that manifest domains, an understanding of which are a prerequisite for software requirements prescriptions, can be precisely described: narrated and formalised. We show that such manifest domains can be understood as a collection of endurant, that is, basically spatial entities: parts, components and materials, and perdurant, that is, basically temporal entities: actions, events and behaviours. We show that parts can be modeled in terms of external qualities: actions, events and behaviours. We show that the manifest domain analysis endeavour can be supported by a calculus of manifest domain analysis prompts: is_entity, is_endurant, is_perdurant, is_part, is_component, is_material, is_atomic, is_composite, has_components, has_materials, has_concrete_type, attribute_names, is_stationary, etcetera; and show how the manifest domain description endeavour can be supported by a calculus of manifest domain description prompts: observe_part_sorts, observe_part_type, observe_components, observe_materials, observe_unique_identifier, observe_mereology, observe_attributes. We show how to model attributes, essentially following Michael Jackson (Software requirements & specifications: a lexicon of practice, principles and prejudices. ACM Press, Addison-Wesley, Reading, 1995), but with a twist: The attribute model introduces the attribute analysis prompts: is_static_attribute, is_dynamic_attribute, is_inert_attribute, is_reactive_attribute, is_active_attribute, is_autonomous_attribute, is_biddable_attribute and is_programmable_attribute. The twist suggests ways of modeling "access" to the values of these kinds of attributes: the static attributes by simply "copying" them, once, the reactive and programmable attributes by "carrying" them as function parameters whose values are kept always updated, and the remaining, the external_attributes, by inquiring, when needed, as to their value, as if they were always offered on CSP-like channels (Hoare, Communicating sequential processes. C.A.R. Hoare series in computer science. Prentice-Hall International, London, 2004). We show how to model essential aspects of perdurants in terms of their signatures based on the concepts of endurants. And we show...
how one can “compile” descriptions of endurant parts into descriptions of perdurant behaviours. We do not show prompt calculi for perdurants. The above contributions express a method with principles, techniques and tools for constructing domain descriptions. It is important to realise that we do not wish to nor claim that the method can describe all that it is interesting to know about domains.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science
Authors: Bjørner, D. (Intern)
Number of pages: 51
Pages: 175-225
Publication date: 1 Mar 2017
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Formal Aspects of Computing
Volume: 29
Issue number: 2
ISSN (Print): 0934-5043
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.281 SJR 0.377 CiteScore 1.35
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.1 SJR 0.411 SNIP 1.329
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.421 SNIP 1.037 CiteScore 0.95
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.69 SNIP 2.099 CiteScore 1.72
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.739 SNIP 1.432 CiteScore 1.39
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.449 SNIP 1.135 CiteScore 1.09
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.506 SNIP 1.062 CiteScore 1.06
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.638 SNIP 1.437
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 0.94 SNIP 1.655
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.886 SNIP 1.359
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.539 SNIP 1.183
Scopus rating (2006): SJR 0.463 SNIP 1.038
Scopus rating (2005): SJR 0.532 SNIP 1.233
Scopus rating (2004): SJR 0.571 SNIP 1.153
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.583 SNIP 1.089
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.443 SNIP 1.536
Scopus rating (2001): SJR 0.46 SNIP 1.043
Content dependent information flow control

Information flow control extends access control by not only regulating who is allowed to access what data but also the subsequent use of the data. Applications within communications systems require such information flow control to be dependent on the actual contents of the data. We develop a combined Hoare logic and type system for enforcing content dependent information flow policies dealing with both integrity and confidentiality. We establish the soundness of the Hoare logic with respect to an instrumented operational semantics and illustrate the development on a running example. We also argue that a well-established approach to non-interference fails to distinguish between integrity and confidentiality. The development is performed for programs written in a concurrent language with synchronous communication and separate data domains.

22q11.2 Deletion Syndrome Is Associated With Impaired Auditory Steady-State Gamma Response

The 22q11.2 deletion syndrome confers a markedly increased risk for schizophrenia. 22q11.2 deletion carriers without manifest psychotic disorder offer the possibility to identify functional abnormalities that precede clinical onset. Since schizophrenia is associated with a reduced cortical gamma response to auditory stimulation at 40 Hz, we hypothesized that the 40 Hz auditory steady-state response (ASSR) may be attenuated in nonpsychotic individuals with a 22q11.2 deletion. Eighteen young nonpsychotic 22q11.2 deletion carriers and a control group of 27 noncarriers with comparable age range (12-25 years) and sex ratio underwent 128-channel EEG. We recorded the cortical ASSR to a 40 Hz train of clicks, given either at a regular inter-stimulus interval of 25 ms or at irregular intervals jittered between 11 and 37 ms. Healthy noncarriers expressed a stable ASSR to regular but not in the irregular 40 Hz click stimulation. Both gamma power and inter-trial phase coherence of the ASSR were markedly reduced in the 22q11.2 deletion group. The ability to phase lock cortical gamma activity to regular auditory 40 Hz stimulation correlated with the individual expression of negative symptoms in deletion carriers (ρ = -0.487, P = .041). Nonpsychotic 22q11.2 deletion carriers lack efficient phase locking of evoked gamma activity to regular 40 Hz auditory stimulation. This abnormality indicates a dysfunction of fast intracortical oscillatory processing in the gamma-band. Since ASSR was attenuated in nonpsychotic deletion carriers,
ASSR deficiency may constitute a premorbid risk marker of schizophrenia.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, University of Copenhagen, H. Lundbeck A/S
Number of pages: 10
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Schizophrenia Bulletin
Article number: sbx058
ISSN (Print): 0586-7614
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.989 SJR 4.039 CiteScore 5.95
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 6.53 SJR 4.122 SNIP 1.964
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 4.166 SNIP 2.254 CiteScore 7.25
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 3.95 SNIP 2.465 CiteScore 6.96
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 4.327 SNIP 2.606 CiteScore 7.3
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 4.801 SNIP 2.795 CiteScore 7.39
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 4.674 SNIP 2.846 CiteScore 7.62
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 4.22 SNIP 2.404
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 3.691 SNIP 2.185
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 3.736 SNIP 2.027
Scopus rating (2007): SJR 2.729 SNIP 1.97
Scopus rating (2006): SJR 1.956 SNIP 1.643
Scopus rating (2005): SJR 1.691 SNIP 1.305
Scopus rating (2004): SJR 1.876 SNIP 1.437
Scopus rating (2003): SJR 2.403 SNIP 2.117
Scopus rating (2002): SJR 3.256 SNIP 2.09
Scopus rating (2001): SJR 3.207 SNIP 2.719
Scopus rating (2000): SJR 2.955 SNIP 2.739
Scopus rating (1999): SJR 3.013 SNIP 2.992
Original language: English

22q11.2 deletion syndrome, Gamma band, EEG, Oscillations, Schizophrenia

Electronic versions:
sbx058.pdf
2nd International Workshop on Mental Health and Well-being: Sensing and Intervention: sensing and intervention
Mental health issues affect a significant portion of the world's population and can result in debilitating and life-threatening outcomes. To address this increasingly pressing healthcare challenge, there is a need to research novel approaches for early detection and prevention. In particular, ubiquitous systems can play a central role in revealing and tracking clinically relevant behaviors, contexts, and symptoms. Further, such systems can passively detect relapse onset and enable the opportune delivery of effective intervention strategies. However, despite their clear potential, the uptake of ubiquitous technologies into clinical mental healthcare is rare, and a number of challenges still face the overall efficacy of such technology-based solutions. The goal of this workshop is to bring together researchers interested in identifying, articulating, and addressing such issues and opportunities. Following the success of last year's inaugural workshop, we aim to continue facilitating the UbiComp community in developing a holistic approach for sensing and intervention in the context of mental health.

3d Finite Element Modelling of Non-Crimp Fabric Based Fibre Composite Based on X-Ray Ct Data
Due to the high number of fatigue load cycles during the life of a wind turbine blade, fatigue is one of the main design concerns. However, it is still not possible to realistically predict the fatigue life of the non-crimp fabric based fibre composites commonly used for the main load carrying parts of wind turbine blades. Existing modelling attempts generally consider the fibre bundle structure as a perfect pattern, however recent experimental X-ray CT studies [1,2] have shown that the local variations in the fibre bundle structure have a large influence on the observed fatigue damage initiation and progression in the material. In the current study, the real bundle structure inside a non-crimp fabric based fibre composite is extracted from 3D X-ray CT images and imported into ABAQUS for numerical modelling. The local stress concentrations when loaded in tension caused by the fibre bundle structure are examined and compared to experimental observations of the fatigue damage. In the current study the bundle structure is manually segmented, however the possibility of automatic segmentation in the future is also discussed. The study shows the potential of X-ray CT based modelling for increased understanding of the fatigue damage mechanisms, but also sets the stage for modelling across scales including the variations caused by manufacturing process.
A bayesian inference-based detection mechanism to defend medical smartphone networks against insider attacks

With the increasing digitization of the healthcare industry, a wide range of devices (including traditionally non-networked medical devices) are Internet- and inter-connected. Mobile devices (e.g. smartphones) are one common device used in the healthcare industry to improve the quality of service and experience for both patients and healthcare workers, and the underlying network architecture to support such devices is also referred to as medical smartphone networks (MSNs). MSNs, similar to other networks, are subject to a wide range of attacks (e.g. leakage of sensitive patient information by a malicious insider). In this work, we focus on MSNs and present a compact but efficient trust-based approach using Bayesian inference to identify malicious nodes in such an environment. We then demonstrate the effectiveness of our approach in detecting malicious nodes by evaluating the deployment of our proposed approach in a real-world environment with two healthcare organizations.
A brief comparison of Simon and Simeck

SIMECK is a new lightweight block cipher design based on combining the design principles of the SIMON and Speck block cipher. While the design allows a smaller and more efficient hardware implementation, its security margins are not well understood. The lack of design rationals of its predecessors further leaves some uncertainty on the security of SIMECK. In this work we give a short analysis of the impact of the design changes by comparing the upper bounds on the probability of differential and linear trails with SIMON. We also give a comparison of the effort of finding those bounds, which surprisingly is significantly lower for SIMECK while covering a larger number of rounds at the same time.

Furthermore, we provide new differentials for SIMECK which can cover more rounds compared to previous results on SIMON and study how to choose good differentials for attacks and show that one can find better differentials by building them from a larger set of trail with initially lower probability. We also provide experimental results for the differentials for SIMON32 and SIMECK32 which show that there exist keys for which the probability of the differential is significantly higher than expected. Based on this we mount key recovery attacks on 19/26/33 rounds of SIMECK32/48/64, which also give insights on the reduced key guessing effort due to the different set of rotation constants.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cyber Security
Authors: Kölbl, S. (Intern), Roy, A. (Intern)
Pages: 69-88
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information

Journal: Lecture Notes in Computer Science
Volume: 10098
ISSN (Print): 0302-9743
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 0.9 SJR 0.295 SNIP 0.655
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.67 SJR 0.339 SNIP 0.642
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.369 SNIP 0.684 CiteScore 0.37
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.354 SNIP 0.743 CiteScore 0.42
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.36 SNIP 0.761 CiteScore 0.49
In this paper, a comprehensive analysis is presented to investigate a codimension two bifurcation that exists in a nonlinear railway bogie dynamic system combining theoretical analysis with numerical investigation. By using the running velocity $V$ and the primary longitudinal stiffness $K$ as bifurcation parameters the first and second Lyapunov coefficients are calculated to determine which kind of Hopf bifurcation can happen and how the system states change with the variance of the bifurcation parameters. It is found that multiple solution branches both stable and unstable coexist in a range of the bifurcation parameters which can lead to jumps in the lateral oscillation amplitude of the railway bogie system. Furthermore, reduce the values of the bifurcation parameters gradually. Firstly, the supercritical Hopf bifurcation turns into a subcritical one with multiple limit cycles both stable and unstable near the Hopf bifurcation point. With a further reduction in the bifurcation parameters two saddle-node bifurcation points emerge, resulting in the loss of the stable limit cycle between these two bifurcation points.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Southwest Jiaotong University
Authors: Zhang, T. (Ekstern), True, H. (Intern), Dai, H. (Ekstern)
Number of pages: 14
Pages: 1-14
Publication date: 2017
Mechanical Engineering, Codimension two bifurcation, Hopf bifurcation, Limit cycles, Railway bogie, Stability analysis, Bifurcation (mathematics), Bogies (railroad rolling stock), Railroads, Transportation, Hopf bifurcation point, Limit-cycle, Numerical investigations, Saddle node bifurcation point, Supercritical Hopf bifurcation

DOIs:
10.1007/s00419-017-1314-1

Source: FindIt

Source-ID: 2392077201

Publication: Research - peer-review → Journal article – Annual report year: 2017
A combined experimental and simulation based approach to model the flow-front dynamics in the vacuum assisted resin transfer moulding process.

With more emphasis on the use of green energy, the size of the turbines and blades in the wind turbines is continuously increasing. With increasing blade size, the casting process becomes more complicated and the risk of faults increases. Production of such blades, made of fibre reinforced polymer composites, without the possibility of visual inspection of the infusion process calls for a sensor system (possibly virtual) for monitoring the process. This paper proposes a two-step modelling methodology to identify the parameters related to the flow-front that are essential for determining the current state of infusion process.

**General information**

State: Published  
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, National Institute of Aquatic Resources, Siemens Gamesa Renewable Energy  
Pages: 28-35  
Publication date: 2017

**Host publication information**

Title of host publication: Proceedings of LIMAS 2017  
Main Research Area: Technical/natural sciences  
Source: PublicationPreSubmission  
Source-ID: 143900347  
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

A comparison of reflectance properties on polymer micro-structured functional surface

In this study, a functional micro-structure surface [1] has been developed as a combination of arrays of micro ridges. The scope of the surface is to achieve specific directional optical properties: that is, under constrained lighting, maximizing the reflectance from a certain viewing direction, and minimizing it from the corresponding horizontally orthogonal position, i.e. maximize the contrast between two horizontally orthogonal view positions at the same inclination (Figure 1). The sample is composed of 12 different anisotropic surfaces, that are designed as a combination of ridges defined by their pitch distance and their angle in respect to the surface (Figure 2). The geometry was obtained by precision milling of a tool steel bar and replicated through silicone replica technology [2], and by hot embossing using Acrylonitrile Butadiene Styrene (ABS). A digital microscope has been used as a gonioreflectometer to determine the directional surface reflectance of each surface to varying light and camera positions. The presented results show that the replication processes and the polymeric material have a strong impact on the contrast under constrained lightening. More specifically, the reflectance properties are strongly influenced by the geometry of the structure and by the colour.

**General information**

State: Published  
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Danish Meteorological Institute  
Authors: Regi, F. (Intern), Li, D. (Intern), Nielsen, J. B. (Intern), Zhang, Y. (Intern), Tosello, G. (Intern), Madsen, M. H. (Ekstern), Frisvad, J. R. (Intern), Aanæs, H. (Intern)  
Number of pages: 1  
Publication date: 2017  
Event: Poster session presented at 17th euspen International Conference & Exhibition, Hannover, Germany.  
Main Research Area: Technical/natural sciences  
Electronic versions:  
poster_euspen_faregi_final_1.pdf  
Publication: Research - peer-review › Poster – Annual report year: 2017

A complete characterization of Galois subfields of the generalized Giulietti–Korchmáros function field

We give a complete characterization of all Galois subfields of the generalized Giulietti–Korchmáros function fields $\mathbb{F}_{q^n}$ for $n \geq 5$. Calculating the genera of the corresponding fixed fields, we find new additions to the list of known genera of maximal function fields.

**General information**

State: Published  
Organisations: Department of Applied Mathematics and Computer Science, Mathematics, Bogazici University  
Authors: Anbar, N. (Intern), Bassa, A. (Ekstern), Beelen, P. (Intern)
A Controller for Dynamic Partial Reconfiguration in FPGA-Based Real-Time Systems
In real-time systems, the use of hardware accelerators can lead to a worst-case execution-time speed-up, to a simplification of its analysis, and to a reduction of its pessimism. When using FPGA technology, dynamic partial reconfiguration (DPR) can be used to minimize the area, by only loading those accelerators that are needed at any given point in time. The DPR controllers provided by the FPGA vendors satisfy a wide range of requirements and rely on software to manage the reconfiguration. This approach may lead to slow reconfiguration and unpredictable timing. This paper presents an open-source DPR controller specially developed for hard real-time systems and prototyped in connection with the open-source multi-core platform for real-time applications T-CREST. The controller enables a processor to perform reconfiguration in a time-predictable manner and supports different operating modes. The paper also presents a software tool for bitstream conversion, compression, and for reconfiguration time analysis. The DPR controller is evaluated in terms of hardware cost, operating frequency, speed, and bitstream compression ratio vs. reconfiguration time trade-off. A simple application example is also presented with the scope of showing the reconfiguration features of the controller.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering
Authors: Pezzarossa, L. (Intern), Schoeberl, M. (Intern), Sparsø, J. (Intern)
Pages: 92-100
Publication date: 2017

Host publication information
Title of host publication: 2017 IEEE 20th International Symposium on Real-Time Distributed Computing
Publisher: IEEE
ISSN: 2375-5261
Main Research Area: Technical/natural sciences
Conference: 2017 IEEE 20th International Symposium on Real-Time Distributed Computing, Toronto, Canada, 16/05/2017 - 16/05/2017
Logic circuits, Logic and switching circuits, Field programmable gate arrays, Real-time systems, Dynamic partial reconfiguration, FPGA-based real-time systems, Open-source DPR controller, Open-source multicores platform, Software tool, Hardware, Process control, Computer architecture, Software, Random access memory, Reconfiguration controller, Reconfiguration time analysis, T-CREST multi-cores platform, Reconfiguration application example
DOIs: 10.1109/ISORC.2017.3
Source: FindIt
Source-ID: 2372243783
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

A coordination language for databases
We present a coordination language for the modeling of distributed database applications. The language, baptized Klaim-DB, borrows the concepts of localities and nets of the coordination language Klaim but re-incarnates the tuple spaces of Klaim as databases. It provides high-level abstractions and primitives for the access and manipulation of structured data, with integrity and atomicity considerations. We present the formal semantics of Klaim-DB and develop a type system that avoids potential runtime errors such as certain evaluation errors and mismatches of data format in tables, which are monitored in the semantics. The use of the language is illustrated in a scenario where the sales from different branches of a chain of department stores are aggregated from their local databases. Raising the abstraction level and encapsulating integrity checks in the language primitives have benefited the modeling task considerably.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Formal Methods, University of Queensland
Authors: Li, X. (Intern), Wu, X. (Ekstern), Lluch Lafuente, A. (Intern), Nielson, F. (Intern), Nielson, H. R. (Intern)
Number of pages: 52
Publication date: 2017
Main Research Area: Technical/natural sciences
A critical period of corticomuscular and EMG-EMG coherence detection in healthy infants aged 9-25 weeks: Corticomuscular and EMG-EMG coherence during early development

The early postnatal development of functional corticospinal connections in human infants is not fully clarified. We used EEG and EMG to investigate the development of corticomuscular and intramuscular coherence as indicators of functional corticospinal connectivity in healthy infants aged 1-66 weeks. EEG was recorded over leg and hand area of motor cortex. EMG recordings were made from right ankle dorsiflexor and right wrist extensor muscles. Quantification of the amount of corticomuscular coherence in the 20-40 Hz frequency band showed a significantly larger coherence for infants aged 9-25 weeks compared to younger and older infants. Coherence between paired EMG recordings from tibialis anterior muscle in the 20-40 Hz frequency band was also significantly larger for the 9-25 week age group. A low-amplitude, broad-duration (40-50 ms) central peak of EMG-EMG synchronization was observed for infants younger than 9 weeks, whereas a short-lasting (10-20 ms) central peak was observed for EMG-EMG synchronization in older infants. This peak was largest for infants aged 9-25 weeks. These data suggest that the corticospinal drive to lower and upper limb muscles shows significant developmental changes with an increase in functional coupling in infants aged 9-25 weeks, a period which coincides partly with the developmental period of normal fidgety movements. We propose that these neurophysiological findings may reflect the existence of a sensitive period where the functional connections between corticospinal tract fibres
and spinal motoneurones undergo activity-dependent reorganization. This may be relevant for the timing of early therapy interventions in infants with pre- and perinatal brain injury.
A cross-sectional field study on potential associations between feed quality measures and usage of antimicrobials in commercial mink (Neovison vison)

Feed quality is generally assumed to affect health status in animal production. In previous studies, the feed producer has been found to affect the occurrence of gastrointestinal disease and antimicrobial use in Mink (Neovison vison). Mink are fed with moist, freshly produced feed, based on perishable ingredients. The objective of this study was to investigate the potential effect of specific feed parameters on antimicrobial use on herd level. The study was cross-sectional, including 1472 mink herds, responsible for 97% of oral antimicrobials prescribed for Danish mink during the study period, 2012-2014. Data were obtained from the national veterinary prescription database (VetStat), Kopenhagen Fur database, and the Voluntary Feed Control (Mink producers Organization). All feed batches subject to feed control were included. A multivariable variance analysis was carried out analysing the effect of the feed parameters total volatile nitrogen, dry matter, crude protein and fat; total bacterial count (21 °C), and counts of sulphite producing bacteria (21 °C), Clostridium spp., faecal cocci (FC) (44 °C), yeast, and mould; presence of Salmonella spp. and Clostridium perfringens (dichotome). Three outcome variables were applied: prescription of oral antimicrobial on herd level within time slots of 3, 5 or 7 days after feeding. Two binomial models were developed, adjusting for significant effects (p < 0.0001) of Ps. aeruginosa infection, herd size, month (season) and year. Antimicrobial prescription was significantly (p < 0.0001) associated with FC (all time slots, both models). A negative association (p < 0.0001) with crude protein on antimicrobial prescription within a 7 day slot suggested an association between low content of crude protein and antimicrobial use. The associations need to be confirmed in controlled studies, and ideally, potential causalities should be investigated. The perspective of such findings could be the development of tests for control of feed ingredients prior to use in the feed production.
We describe a case study with the participation of a Danish veteran suffering from post-traumatic stress disorder (PTSD). As part of psychotherapeutic treatment the participant and therapist have used our novel technique for instrumenting self-tracking of select aspects of subjective experience using a one-button wearable device. The instrumentation system is described along with the specific self-tracking protocol which defined the participant’s self-tracking of a single symptom, namely the occurrences of a bodily experienced precursor to hyperarousal. Results from the case study demonstrate how self-tracking data on a single symptom collected by a patient can provide valuable input to the therapeutic process. Specifically, it facilitated identification of crucial details otherwise unavailable from the clinical assessment and even became decisive in disentangling different symptoms and their causes.
Active vibration-based structural health monitoring system for wind turbine blade: Demonstration on an operating Vestas V27 wind turbine

This study presents a structural health monitoring system that is able to detect structural defects of wind turbine blade such as cracks, leading/trailing-edge opening, or delamination. It is shown that even small defects of at least 15 cm size can be detected remotely without stopping the wind turbine. The structural health monitoring system presented is vibration-based: mechanical energy is artificially introduced by means of an electromechanical actuator, whose plunger periodically hits the blade. The induced vibrations propagate along the blade and are picked up by accelerometers mounted along the blade. The vibrations in mid-range frequencies are utilized: this range is above the frequencies excited by blade–wind interaction, ensuring a good signal-to-noise ratio. At the same time, the corresponding wavelength is short enough to deliver required damage detection resolution and long enough to be able to propagate the entire blade length. This article demonstrates the system on a Vestas V27 wind turbine. One blade of the wind turbine was equipped with the system, and a 3.5-month monitoring campaign was conducted while the turbine was operating normally. During the campaign, a defect—a trailing-edge opening—was artificially introduced into the blade and its size was gradually increased from the original 15 to 45 cm. Using a semi-supervised learning algorithm, the system was able to detect even the smallest amount of damage while the wind turbine was operating under different weather conditions. This article provides detailed information about the instrumentation and the measurement campaign and explains the damage detection algorithm.
Activity-Based Collaboration for Interactive Spaces

Activity-based computing (ABC) is a conceptual and technological framework for designing interactive systems that offers a better mapping between the activities people conduct and the digital entities they use. In ABC, rather than interacting directly with lower-level technical entities like files, folder, documents, etc., users are able to interact with ‘activities’ which encapsulate files and other low-level resources. In ABC an ‘activity’ can be shared between collaborating users and can be accessed on different devices. As such, ABC is a framework that suits the requirements of designing interactive spaces. This chapter provides an overview of ABC with a special focus on its support for collaboration (‘Activity Sharing’) and multiple devices (‘Activity Roaming’). These ABC concepts are illustrated as implemented in two different interactive spaces technologies; ReticularSpaces [1] and the eLabBench [2, 3]. The chapter discusses the benefits of activity-based collaboration support for these interactive spaces, while also discussing limitations and challenges to be addressed in further research.

General information
State: Published
Organisations: Copenhagen Center for Health Technology, Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, Centre National de la Recherche Scientifique, IT University of Copenhagen
Authors: Bardram, J. E. (Intern), Esbensen, M. (Forskerdatabase), Tabard, A. (Forskerdatabase)
Pages: 233-257
Publication date: 2017

Host publication information
Title of host publication: Collaboration Meets Interactive Spaces
Publisher: Springer
Editors: Anslow, C., Campos, P., Jorge, J.
ISBN (Print): 978-3-319-45852-6
ISBN (Electronic): 978-3-319-45853-3
Chapter: 11
Main Research Area: Technical/natural sciences
DOIs: 10.1007/978-3-319-45853-3_11
Publication: Research - peer-review › Book chapter – Annual report year: 2017

A Cycle of Maximum Order in a Graph of High Minimum Degree has a Chord
A well-known conjecture of Thomassen states that every cycle of maximum order in a 33-connected graph contains a chord. While many partial results towards this conjecture have been obtained, the conjecture itself remains unsolved. In
In this paper, we prove a stronger result without a connectivity assumption for graphs of high minimum degree, which shows Thomassen's conjecture holds in that case. This result is within a constant factor of best possible. In the process of proving this, we prove a more general result showing that large minimum degree forces a large difference between the order of the largest cycle and the order of the largest chordless cycle.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Authors: Harvey, D. J. (Intern)
Number of pages: 8
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**
Journal: The Electronic Journal of Combinatorics
Volume: 24
Issue number: 4
Article number: P4.33
ISSN (Print): 1097-1440
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.06 SJR 0.961 CiteScore 0.65
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.53 SNIP 0.902 SJR 0.734
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 0.52 SNIP 1.064 SJR 0.867
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 0.52 SNIP 0.938 SJR 0.851
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 0.61 SNIP 1.037 SJR 0.852
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 0.53 SNIP 1.067 SJR 0.661
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 0.65 SNIP 1.173 SJR 0.965
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
Scopus rating (2010): SNIP 1.014 SJR 1.045
Scopus rating (2009): SNIP 0.976 SJR 0.862
BFI (2008): BFI-level 1
Scopus rating (2008): SNIP 0.909 SJR 0.801
Scopus rating (2007): SNIP 0.807 SJR 0.695
Scopus rating (2006): SNIP 1.122 SJR 0.908
Scopus rating (2005): SNIP 1.001 SJR 0.829
Scopus rating (2004): SNIP 0.691 SJR 0.819
Scopus rating (2003): SNIP 0.856 SJR 0.842
Scopus rating (2002): SNIP 1.005 SJR 1.008
Scopus rating (2001): SNIP 0.999 SJR 1.141
Scopus rating (2000): SNIP 1.099 SJR 1.178
Scopus rating (1999): SNIP 0.926 SJR 1.075
Original language: English
Electronic versions: 7152_22782_1_PB.pdf
Adaptive control in an artificial pancreas for people with type 1 diabetes

In this paper, we discuss overnight blood glucose stabilization in patients with type 1 diabetes using a Model Predictive Controller (MPC). We compute the model parameters in the MPC using a simple and systematic method based on a priori available patient information. We describe and compare 3 different model structures. The first model structure is an autoregressive integrated moving average with exogenous input (ARIMAX) structure. The second model structure is an autoregressive moving average with exogenous input (ARMAX) model, i.e. a model without an integrator. The third model structure is an adaptive ARMAX model in which we use a recursive extended least squares (RELS) method to estimate parameters of the stochastic part. In addition, we describe some safety layers in the control algorithm that improve the controller robustness and reduce the risk of hypoglycemia. We test and compare our control strategies using a virtual clinic of 100 randomly generated patients with a representative inter-subject variability. This virtual clinic is based on the Hovorka model. We consider the case where only half of the meal bolus is administered at mealtime, and the case where the insulin sensitivity increases during the night. The numerical results suggest that the use of an integrator leads to higher occurrence of hypoglycemia than for the controllers without the integrator. Compared to other control strategies, the adaptive MPC reduces both the time spent in hypoglycemia and the time spent in hyperglycemia.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Dynamical Systems, Copenhagen Center for Health Technology, Center for Energy Resources Engineering, Copenhagen University Hospital
Number of pages: 11
Pages: 332–342
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Control Engineering Practice
Volume: 58
ISSN (Print): 0967-0661
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.876 SJR 1.069 CiteScore 3.42
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.42 SJR 1.076 SNIP 2.117
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.116 SNIP 2.067 CiteScore 3.05
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.205 SNIP 2.502 CiteScore 3.26
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.339 SNIP 3.154 CiteScore 3.5
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.164 SNIP 3.054 CiteScore 3.02
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.405 SNIP 2.865 CiteScore 2.96
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Adaptive Laboratory Evolution of Antibiotic Resistance Using Different Selection Regimes Lead to Similar Phenotypes and Genotypes

Antibiotic resistance is a global threat to human health, wherefore it is crucial to study the mechanisms of antibiotic resistance as well as its emergence and dissemination. One way to analyze the acquisition of de novo mutations conferring antibiotic resistance is adaptive laboratory evolution. However, various evolution methods exist that utilize different population sizes, selection strengths, and bottlenecks. While evolution in increasing drug gradients guarantees high-level antibiotic resistance promising to identify the most potent resistance conferring mutations, other selection regimes are simpler to implement and therefore allow higher throughput. The specific regimen of adaptive evolution may have a profound impact on the adapted cell state. Indeed, substantial effects of the selection regime on the resulting geno- and phenotypes have been reported in the literature. In this study we compare the geno- and phenotypes of Escherichia coli after evolution to Amikacin, Piperacillin, and Tetracycline under four different selection regimes. Interestingly, key mutations that confer antibiotic resistance as well as phenotypic changes like collateral sensitivity and cross-resistance emerge independently of the selection regime. Yet, lineages that underwent evolution under mild selection displayed a growth advantage independently of the acquired level of antibiotic resistance compared to lineages adapted under maximal selection in a drug gradient. Our data suggests that even though different selection regimens result in subtle genotypic and phenotypic differences key adaptations appear independently of the selection regime.

General information
State: Published
Organisations: Novo Nordisk Foundation Center for Biosustainability, Bacterial Synthetic Biology, Department of Applied Mathematics and Computer Science, Research Groups
Authors: Jahn, L. J. (Intern), Munck, C. (Intern), Ellabaan, M. M. H. (Intern), Sommer, M. O. A. (Intern)
Number of pages: 14
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Frontiers in Microbiology
Volume: 8
Article number: 816
ISSN (Print): 1664-302X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Adaptive Smoothing in fMRI Data Processing Neural Networks

Functional Magnetic Resonance Imaging (fMRI) relies on multi-step data processing pipelines to accurately determine brain activity; among them, the crucial step of spatial smoothing. These pipelines are commonly suboptimal, given the local optimisation strategy they use, treating each step in isolation. With the advent of new tools for deep learning, recent work has proposed to turn these pipelines into end-to-end learning networks. This change of paradigm offers new avenues to improvement as it allows for a global optimisation. The current work aims at benefitting from this paradigm shift by defining a smoothing step as a layer in these networks able to adaptively modulate the degree of smoothing required by each brain volume to better accomplish a given data analysis task. The viability is evaluated on real fMRI data where subjects did alternate between left and right finger tapping tasks.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, Copenhagen Center for Health Technology, Danish Research Centre for Magnetic Resonance
Authors: Vilamala, A. (Intern), Madsen, K. H. (Ekstern), Hansen, L. K. (Intern)
Number of pages: 4
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 2017 International Workshop on Pattern Recognition in Neuroimaging
Publisher: IEEE
Main Research Area: Technical/natural sciences
Conference: 2017 International Workshop on Pattern Recognition in Neuroimaging, Toronto, Canada, 21/06/2017 - 21/06/2017
DOIs: 10.1109/PRNI.2017.7981499
Source: FindIt
Source-ID: 2372484806
Publication: Research › Article in proceedings – Annual report year: 2018
Adaptive Unscented Kalman Filter using Maximum Likelihood Estimation

The purpose of this study is to develop an adaptive unscented Kalman filter (UKF) by tuning the measurement noise covariance. We use the maximum likelihood estimation (MLE) and the covariance matching (CM) method to estimate the noise covariance. The multi-step prediction errors generated by the UKF are used for covariance estimation by MLE and CM. Then we apply the two covariance estimation methods on an example application. In the example, we identify the covariance of the measurement noise for a continuous glucose monitoring (CGM) sensor. The sensor measures the subcutaneous glucose concentration for a type 1 diabetes patient. The root-mean square (RMS) error and the computation time are used to compare the performance of the two covariance estimation methods. The results indicate that as the prediction horizon expands, the RMS error for the MLE declines, while the error remains relatively large for the CM method. For larger prediction horizons, the MLE provides an estimate of the noise covariance that is less biased than the estimate by the CM method. The CM method is computationally less expensive though.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Dynamical Systems
Authors: Mahmoudi, Z. (Intern), Poulsen, N. K. (Intern), Madsen, H. (Intern), Jørgensen, J. B. (Intern)
Number of pages: 6
Pages: 3859-3864
Publication date: 2017
Conference: 20th IFAC World Congress 2017, Toulouse, France, 09/07/2017 - 09/07/2017
Main Research Area: Technical/natural sciences

Publication information
Journal: IFAC-PapersOnLine
Volume: 50
Issue number: 1
ISSN (Print): 2405-8963
Ratings:
Scopus rating (2017): CiteScore 0.68 SJR 0.26 SNIP 0.434
Scopus rating (2016): CiteScore 0.45 SJR 0.234 SNIP 0.328
Scopus rating (2015): SJR 0.298 SNIP 0.39
Scopus rating (2014): SJR 0.298 SNIP 0.383
Scopus rating (2013): SJR 0.326 SNIP 0.41
Scopus rating (2012): SJR 0.265 SNIP 0.331
Scopus rating (2011): SJR 0.257 SNIP 0.324
Scopus rating (2010): SJR 0.197 SNIP 0.276
Scopus rating (2009): SJR 0.211 SNIP 0.29
Scopus rating (2008): SJR 0.172 SNIP 0.239
Scopus rating (2007): SJR 0.195 SNIP 0.271
Scopus rating (2006): SJR 0.21 SNIP 0.284
Scopus rating (2005): SJR 0.192 SNIP 0.445
Scopus rating (2004): SJR 0.245 SNIP 0.419
Scopus rating (2003): SJR 0.26 SNIP 0.403
Original language: English
Control and Systems Engineering, Adaptive filtering, Continuous glucose monitors, Covariance estimation, Covariance matching technique, Maximum likelihood estimation, Unscented Kalman filter

Electronic versions:
1_s2.0_S2405896317306882_main.pdf
DOIs:
10.1016/j.ifacol.2017.08.356
Source: FindIt
Source-ID: 2392251563
Publication: Research - peer-review › Conference article – Annual report year: 2017

A deep learning approach to adherence detection for type 2 diabetics

Diabetes has become one of the biggest health problems in the world. In this context, adherence to insulin treatment is essential in order to avoid life-threatening complications. In this pilot study, a novel adherence detection algorithm using Deep Learning (DL) approaches was developed for type 2 diabetes (T2D) patients, based on simulated Continuous Glucose Monitoring (CGM) signals. A large and diverse amount of CGM signals were simulated for T2D patients using a T2D adapted version of the Medtronic Virtual Patient (MVP) model for T1D. By using these signals, different classification algorithms were compared using a comprehensive grid search. We contrast a standard logistic regression baseline to
Multi-Layer Perceptrons (MLPs) and Convolutional Neural Networks (CNNs). The best classification performance with an average accuracy of 77.5% was achieved with CNN. Hence, this indicates the potential of DL, when considering adherence detection systems for T2D patients.

**A Disentangled Recognition and Nonlinear Dynamics Model for Unsupervised Learning**

This paper takes a step towards temporal reasoning in a dynamically changing video, not in the pixel space that constitutes its frames, but in a latent space that describes the non-linear dynamics of the objects in its world. We introduce the Kalman variational auto-encoder, a framework for unsupervised learning of sequential data that disentangles two latent representations: an object's representation, coming from a recognition model, and a latent state describing its...
dynamics. As a result, the evolution of the world can be imagined and missing data imputed, both without the need to generate high dimensional frames at each time step. The model is trained end-to-end on videos of a variety of simulated physical systems, and outperforms competing methods in generative and missing data imputation tasks.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, Google Deepmind
Authors: Fraccaro, M. (Intern), Kamronn, S. D. (Intern), Paquet, U. (Ekstern), Winther, O. (Intern)
Number of pages: 13
Publication date: 2017

Host publication information
Title of host publication: Proceedings of 31st Conference on Neural Information Processing Systems
BFI conference series: Neural Information Processing Systems (5000199)
Main Research Area: Technical/natural sciences
Conference: 31st Conference on Neural Information Processing Systems, Long Beach, United States, 04/12/2017 - 04/12/2017
Source: PublicationPreSubmission
Source-ID: 140142797
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

A Domain-Specific Language for Generic Interlocking Models and Their Properties
State-of-the-art railway interlocking systems typically adhere to the product line paradigm, where each individual system is obtained by instantiating a generic system with configuration data. In this paper, we present a domain-specific language, IDL, for specifying generic behavioural models and generic properties of interlocking systems. An IDL specification of a generic model consists of generic variable declarations and generic transition rules, and generic properties are generic state invariants. Generic models and generic properties can be instantiated with configuration data. This results in concrete models and concrete properties that can be used as input for a model checker to formally verify that the system model satisfies desired state invariants. The language and a configuration data instantiator based on the semantics have been implemented as components of the RobustRailS tool set for formal specification and verification of interlocking systems. They have successfully been applied to (1) define a generic model and generic safety properties for the new Danish interlocking systems and to (2) instantiate these generic artefacts for real-world stations and lines in Denmark. A novelty of this work is to provide a domain-specific language for generic models and an instantiator tool taking not only configuration data but also a generic model as input instead of using a hard-coded generator for instantiating only one fixed generic model and its properties with configuration data.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Software and Process Engineering, University of Bremen
Authors: Vu, L. H. (Intern), Haxthausen, A. E. (Intern), Peleska, J. (Ekstern)
Pages: 99-115
Publication date: 2017

Host publication information
Title of host publication: Reliability, Safety, and Security of Railway Systems. Modelling, Analysis, Verification, and Certification
Volume: 10598
Publisher: Springer
Series: Lecture Notes in Computer Science
Volume: 10598
ISSN: 0302-9743
Main Research Area: Technical/natural sciences
Conference: RSSRail 2017, Pistoia, Italy, 14/11/2017 - 14/11/2017
Science, Railway interlocking systems, Domain-specific languages, Formal methods, Formal models, Formal verification
DOIs: 10.1007/978-3-319-68499-4_7
Source: FindIt
Source-ID: 2392780400
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

A Dynamic Characterization of Energy Flexibility

General information
A Framework for Online Conformance Checking

Conformance checking – a branch of process mining – focuses on establishing to what extent actual executions of a process are in line with the expected behavior of a reference model. Current conformance checking techniques only allow for a-posteriori analysis: the amount of (non-)conformant behavior is quantified after the completion of the process instance. In this paper we propose a framework for online conformance checking: not only do we quantify (non-)conformant behavior as the execution is running, we also restrict the computation to constant time complexity per event analyzed, thus enabling the online analysis of a stream of events. The framework is instantiated with ideas coming from the theory of regions, and state similarity. An implementation is available in ProM and promising results have been obtained.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Software and Process Engineering, Universitat Politècnica de Catalunya
Authors: Burattin, A. (Intern), Carmona, J. (Ekstern)
Pages: 165-177
Publication date: 2017

Host publication information
Publisher: Springer
Editors: Teniente, E., Weidlich, M.
ISBN (Print): 978-3-319-74029-4
ISBN (Electronic): 978-3-319-74030-0
Series: Lecture Notes in Business Information Processing
Volume: 308
ISSN: 1865-1348
Main Research Area: Technical/natural sciences
Conference: 13th International Workshop on Business Process Intelligence, Barcelona, Spain, 10/09/2017 - 10/09/2017
Online process mining, Conformance checking, Event stream
Electronic versions:
2017_online_conformance.pdf
DOIs:
10.1007/978-3-319-74030-0_12
Source: PublicationPreSubmission
Source-ID: 137907909
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

A Framework for Organization-Aware Agents

Open systems are characterized by the presence of a diversity of heterogeneous and autonomous agents that act according to private goals. Organizations, such as those used in real-life to structure human activities such as task allocation, coordination and supervision, can regulate the agents’ behavior space and describe the expected behavior of the agents. Assuming an open environment, where agents are developed independently of the Organizational structures, agents need to be able to reason about the structure, so that they can deliberate about their actions and act within the expected boundaries and work towards the objectives of the organization. In this paper, we present the AORTA reasoning framework and show how it can be integrated into typical BDI-agents. We provide operational semantics that enables agents to make organizational decisions in order to coordinate and cooperate without explicit coordination mechanisms.
within the agents. The organizational model is independent of that of the agents, and the approach is not tied to a specific organizational model, but uses an organizational metamodel. We show how AORTA helps agents work together in a system with an organization for choosing the best tender for a building project.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Delft University of Technology
Authors: Jensen, A. S. (Intern), Dignum, V. (Ekstern), Villadsen, J. (Intern)
Pages: 387–422
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Autonomous Agents and Multi-Agent Systems
Volume: 31
Issue number: 3
ISSN (Print): 1387-2532
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.53 SJR 0.429 CiteScore 2.3
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): SJR 0.531 SNIP 1.595 CiteScore 2.19
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.731 SNIP 1.831 CiteScore 2.17
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.837 SNIP 2.5 CiteScore 2.44
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.846 SNIP 2.754 CiteScore 2.7
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.742 SNIP 3.396 CiteScore 2.21
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.9 SNIP 3.528 CiteScore 3.33
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.162 SNIP 3.24
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.237 SNIP 4.082
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.295 SNIP 4.124
Scopus rating (2007): SJR 1.419 SNIP 4.056
Scopus rating (2006): SJR 1.252 SNIP 4.38
Scopus rating (2005): SJR 1.668 SNIP 4.883
Scopus rating (2004): SJR 0.794 SNIP 3.406
Scopus rating (2003): SJR 1.733 SNIP 6.119
Scopus rating (2002): SJR 2.165 SNIP 3.789
Scopus rating (2001): SJR 2.477 SNIP 5.549
Scopus rating (2000): SJR 0.214 SNIP 5.472
Scopus rating (1999): SJR 0.663 SNIP 7.023
Original language: English
Operational semantics, Organization-aware agents, Organizational reasoning

Electronic versions:
A framework of DYNAMIC data structures for string processing
In this paper we present DYNAMIC, an open-source C++ library implementing dynamic compressed data structures for string manipulation. Our framework includes useful tools such as searchable partial sums, succinct/gap-encoded bitvectors, and entropy/run-length compressed strings and FM indexes. We prove close-to-optimal theoretical bounds for the resources used by our structures, and show that our theoretical predictions are empirically tightly verified in practice. To conclude, we turn our attention to applications. We compare the performance of five recently-published compression algorithms implemented using DYNAMIC with those of state-of-the-art tools performing the same task. Our experiments show that algorithms making use of dynamic compressed data structures can be up to three orders of magnitude more space-efficient (albeit slower) than classical ones performing the same tasks.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Authors: Prezza, N. (Intern)
Number of pages: 15
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Leibniz International Proceedings in Informatics
Volume: 75
ISSN (Print): 1868-8969
Ratings:
Scopus rating (2017): CiteScore 0.85 SJR 0.363 SNIP 0.77
Scopus rating (2016): CiteScore 0.73 SNIP 0.862 SJR 0.613
Scopus rating (2015): SJR 0.607 SNIP 0.892
Scopus rating (2014): SJR 0.656 SNIP 0.918
Scopus rating (2013): SJR 0.845 SNIP 0.915
ISI indexed (2013): ISI indexed no
Scopus rating (2012): SJR 0.872 SNIP 1.073
ISI indexed (2012): ISI indexed no
Scopus rating (2011): SJR 0.734 SNIP 1.033
ISI indexed (2011): ISI indexed no
Scopus rating (2010): SJR 0.681 SNIP 1.25
Scopus rating (2009): SJR 0.12 SNIP 0.136
Original language: English
Electronic versions:
LIPIcs_SEA_2017_11.pdf
DOIs:
10.4230/LIPIcs.SEA.2017.11
Source: FindIt
Source-ID: 2384991062
Publication: Research - peer-review › Journal article – Annual report year: 2017

A generalization of Gale's lemma
In this work, we present a generalization of Gale's lemma. Using this generalization, we introduce two sharp combinatorial lower bounds for $\text{coind}(B_0(G)) + 1$ and $\text{coind}(B(G)) + 2$, the two classic topological lower bounds for the chromatic number of a graph $G$.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Shahrood University of Technology
Authors: Alishahi, M. (Ekstern), Hajiabolhassan, H. (Intern)
Pages: 337-346
Publication information
Journal: Journal of Graph Theory
Volume: 88
Issue number: 2
ISSN (Print): 0364-9024
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.45 SJR 1.104 CiteScore 0.82
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 0.71 SJR 1.105 SNIP 1.362
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.469 SNIP 1.598 CiteScore 0.85
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.281 SNIP 1.136 CiteScore 0.73
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.477 SNIP 1.698 CiteScore 0.9
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.37 SNIP 1.446 CiteScore 0.79
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.139 SNIP 1.235 CiteScore 0.76
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.273 SNIP 1.205
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.748 SNIP 1.512
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.615 SNIP 1.884
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.49 SNIP 1.496
Scopus rating (2006): SJR 1.24 SNIP 1.16
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.625 SNIP 0.786
Scopus rating (2004): SJR 1.057 SNIP 1.625
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.598 SNIP 1.157
Scopus rating (2002): SJR 0.882 SNIP 1.433
Scopus rating (2001): SJR 1.967 SNIP 1.598
Scopus rating (2000): SJR 1.699 SNIP 1.224
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 1.45 SNIP 1.12
Original language: English
Box complex, Chromatic number of graphs, Gale’s lemma
DOIs:
10.1002/jgt.22215
Source: FindIt
Source-ID: 2393323745
Publication: Research - peer-review › Journal article – Annual report year: 2018
A gentle introduction to epistemic planning: The DEL approach

Epistemic planning can be used for decision making in multi-agent situations with distributed knowledge and capabilities. Dynamic Epistemic Logic (DEL) has been shown to provide a very natural and expressive framework for epistemic planning. In this paper, we aim to give an accessible introduction to DEL-based epistemic planning. The paper starts with the most classical framework for planning, STRIPS, and then moves towards epistemic planning in a number of smaller steps, where each step is motivated by the need to be able to model more complex planning scenarios.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Authors: Bolander, T. (Intern)
Pages: 1-22
Publication date: 2017
Conference: 9th Workshop on Methods for Modalities, Kanpur, India, 08/01/2017 - 08/01/2017
BFI conference series: International Workshop on Methods for Modalities (5010598)
Main Research Area: Technical/natural sciences

Publication information
Journal: Electronic Proceedings in Theoretical Computer Science
Volume: 243
ISSN (Print): 2075-2180
Ratings:
Web of Science (2018): Indexed yes
Web of Science (2017): Indexed yes
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: English
Software, Multi agent systems, Distributed knowledge, Dynamic epistemic logic, Epistemic planning, Multi agent, Decision making, Management, cs.AI, cs.LO, cs.MA
Electronic versions:
1703.02192.pdf
DOIs:
10.4204/EPTCS.243.1
Source: FindIt
Source-ID: 2355416908
Publication: Research - peer-review › Conference article – Annual report year: 2017

Aggregation model for curtailable generation and sheddable loads

This study shows modelling developed during the first year of the SmartNet project. In particular, it presents a mathematical model for aggregation of curtailable generation and sheddable loads. The model determines the quantity and the cost of the flexibility provided by the flexible resources based on their physical and dynamic behaviours. The model also proposes a bidding strategy in order to translate the aggregated behaviour into market bids.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, SINTEF, University of Strathclyde
Authors: Marthinsen, H. (Ekstern), Morch, A. Z. (Ekstern), Plećaš, M. (Ekstern), Kockar, I. (Ekstern), Džamarija, M. (Intern)
Pages: 1562-1566
Publication date: 2017
Conference: 24th International Conference on Electricity Distribution, Glasgow, United Kingdom, 12/06/2017 - 12/06/2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Cired - Open Access Proceedings Journal
Volume: 2017
Issue number: 1
ISSN (Print): 2515-0855
Original language: English
Electronic versions:
OAP_CIRED.2017.0994.pdf
Agile Processes in Software Engineering and Extreme Programming
The volume constitutes the proceedings of the 18th International Conference on Agile Software Development, XP 2017, held in Cologne, Germany, in May 2017. The 14 full and 6 short papers presented in this volume were carefully reviewed and selected from 46 submissions. They were organized in topical sections named: improving agile processes; agile in organization; and safety critical software. In addition, the volume contains 3 doctoral symposium papers (from 4 papers submitted).

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Software and Process Engineering
Number of pages: 306
Publication date: 2017

Publication information
Publisher: Springer
ISBN (Print): 978-3-319-57632-9
Original language: English
Series: Lecture Notes in Business Information Processing
Volume: 283
ISSN: 1865-1348
Main Research Area: Technical/natural sciences
Electronic versions: 9783319576329_p1_1_.pdf
DOIs: 10.1007/978-3-319-57633-6
Publication: Research › Book – Annual report year: 2018

A high-performance Riccati based solver for tree-structured quadratic programs
Robust multi-stage Model Predictive Control (MPC) is an increasingly popular approach to handle model uncertainties due to the simplicity of its problem formulation and other attractive properties. However, the exponential growth of the problem dimensions with respect to the robust horizon renders the online solution of such problems challenging and the development of tailored solvers crucial. In this paper, an interior point method is presented that can solve Quadratic Programs (QPs) arising in multi-stage MPC efficiently by means of a tree-structured Riccati recursion and a high-performance linear algebra library. A performance comparison with code-generated and general purpose sparse QP solvers shows that the computation times can be significantly reduced for all problem sizes that are practically relevant in embedded MPC applications. The presented implementation is freely available as part of the open-source software HPMPC.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, University of Freiburg
Authors: Frison, G. (Intern), Kouzoupis, D. (Ekstern), Diehl, M. (Ekstern), Jørgensen, J. B. (Intern)
Pages: 14399-14405
Publication date: 2017
Conference: 20th IFAC World Congress 2017, Toulouse, France, 09/07/2017 - 09/07/2017
Main Research Area: Technical/natural sciences

Publication information
Journal: IFAC-PapersOnLine
Volume: 50
Issue number: 1
ISSN (Print): 2405-8963
AIR Tools II: algebraic iterative reconstruction methods, improved implementation

We present a MATLAB software package with efficient, robust, and flexible implementations of algebraic iterative reconstruction (AIR) methods for computing regularized solutions to discretizations of inverse problems. These methods are of particular interest in computed tomography and similar problems where they easily adapt to the particular geometry of the problem. All our methods are equipped with stopping rules as well as heuristics for computing a good relaxation parameter, and we also provide several test problems from tomography. The package is intended for users who want to experiment with algebraic iterative methods and their convergence properties. The present software is a much expanded and improved version of the package AIR Tools from 2012, based on a new modular design. In addition to improved performance and memory use, we provide more flexible iterative methods, a column-action method, new test problems, new demo functions, and perhaps most important the ability to use function handles instead of (sparse) matrices, allowing larger problems to be handled.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, University of Manchester
Authors: Hansen, P. C. (Intern), Jørgensen, J. S. (Ekstern)
Number of pages: 31
Pages: 1-31
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Numerical Algorithms
ISSN (Print): 1017-1398
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.274 SJR 0.981 CiteScore 1.49
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.4 SJR 1.096 SNIP 1.281
A language-based approach to modelling and analysis of Twitter interactions

More than a personal microblogging site, Twitter has been transformed by common use to an information publishing venue, which public characters, media channels and common people daily rely on for, e.g., news reporting and consumption, marketing, and social messaging. The use of Twitter in a cooperative and interactive setting calls for the precise awareness of the dynamics regulating message spreading. In this paper, we describe Twitlang, a language for modelling the interactions among Twitter accounts. The associated operational semantics allows users to precisely determine the effects of their actions on Twitter, such as post, reply-to or delete tweets. The language is implemented in the form of a Maude interpreter, Twitlanger, which takes a language term as an input and explores the computations arising from the term. By combining the strength of Twitlanger and the Maude model checker, it is possible to automatically verify communication properties of Twitter accounts. We illustrate the benefits of our executable formalisation by means of an application scenario inspired from real life. While the scenario highlights the benefits of adopting Twitter for a cooperative use in the everyday life, our analysis shows that appropriate settings are essential for a proper usage of the platform, in respect of fulfilling those communication properties expected within collaborative and interactive contexts.
A least squares approach for efficient and reliable short-term versus long-term optimization

The uncertainties related to long-term forecasts of oil prices impose significant financial risk on ventures of oil production. To minimize risk, oil companies are inclined to maximize profit over short-term horizons ranging from months to a few years. In contrast, conventional production optimization maximizes long-term profits over horizons that span more than a decade. To address this challenge, the oil literature has introduced short-term versus long-term optimization. Ideally, this problem is solved by a posteriori multi-objective optimization methods that generate an approximation to the Pareto front of optimal short-term and long-term trade-offs. However, such methods rely on a large number of reservoir simulations and scale poorly with the number of objectives subject to optimization. Consequently, the large-scale nature of production optimization severely limits applications to real-life scenarios. More practical alternatives include ad hoc hierarchical switching schemes. As a drawback, such methods lack robustness due to unclear convergence properties and do not naturally generalize to cases of more than two objectives. Also, as this paper shows, the hierarchical formulation may skew the balance between the objectives, leaving an unfulfilled potential to increase profits. To promote efficient and reliable short-term versus long-term optimization, this paper introduces a natural way to characterize desirable Pareto points and proposes a novel least squares (LS) method. Unlike hierarchical approaches, the method is guaranteed to converge to a Pareto optimal point. Also, the LS method is designed to properly balance multiple objectives, independently of Pareto front’s shape. As such, the method poses a practical alternative to posteriori methods in situations where the frontier is intractable to generate.
Algorithms for Zero-Dimensional Ideals Using Linear Recurrent Sequences

Inspired by Faugére and Mou’s sparse FGLM algorithm, we show how using linear recurrent multi-dimensional sequences can allow one to perform operations such as the primary decomposition of an ideal, by computing the annihilator of one or several such sequences.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics, University of Waterloo
Authors: Neiger, V. (Intern), Rahkooy, H. (Ekstern), Schost, É. (Ekstern)
Pages: 313-328
Publication date: 2017

Host publication information
Title of host publication: 19th International Workshop on Computer Algebra in Scientific Computing
Publisher: Springer
ISBN (Print): 9783319663197
Series: Lecture Notes in Computer Science
Volume: 10490
ISSN: 0302-9743
Main Research Area: Technical/natural sciences
Conference: 19th International Workshop on Computer Algebra in Scientific Computing, Beijing, China, 18/09/2017 - 18/09/2017
DOIs:
10.1007/978-3-319-66320-3_23
Source: FindIt
Source-ID: 2390990637
Publication: Research - peer-review › Book chapter – Annual report year: 2017

Alterations in the brain's connectome during recovery from severe traumatic brain injury: Protocol for a longitudinal prospective study

Introduction Traumatic brain injury (TBI) is considered one of the most pervasive causes of disability in people under the age of 45. TBI often results in disorders of consciousness, and clinical assessment of the state of consciousness in these patients is challenging due to the lack of behavioural responsiveness. Functional neuroimaging offers a means to assess these patients without the need for behavioural signs, indicating that brain connectivity plays a major role in consciousness emergence and maintenance. However, little is known regarding how changes in connectivity during recovery from TBI accompany changes in the level of consciousness. Here, we aim to combine cutting-edge neuroimaging techniques to follow changes in brain connectivity in patients recovering from severe TBI. Methods and analysis A multimodal, longitudinal assessment of 30 patients in the subacute stage after severe TBI will be made comprising an MRI session combined with electroencephalography (EEG), a positron emission tomography session and a transcranial magnetic stimulation (TMS) combined with EEG (TMS/EEG) session. A group of 20 healthy participants will be included for comparison. Four sessions for patients and two sessions for healthy participants will be planned. Data analysis techniques will focus on whole-brain, both data-driven and hypothesis-driven, connectivity measures that will be specific to the imaging modality. Ethics and dissemination The project has received ethical approval by the local ethics committee of the Capital Region of Denmark and by the Danish Data Protection. Results will be published as original research articles in peer-reviewed journals and disseminated in international conferences. None of the measurements will have any direct clinical impact on the patients included in the study but may benefit future patients through a better understanding of the mechanisms underlying the recovery process after TBI. Trial registration number: NCT02424656; Pre-results.
A machine learning method for fast and accurate characterization of depth-of-interaction gamma cameras: Paper

Measuring the depth-of-interaction (DOI) of gamma photons enables increasing the resolution of emission imaging systems. Several design variants of DOI-sensitive detectors have been recently introduced to improve the performance of scanners for positron emission tomography (PET). However, the accurate characterization of the response of DOI detectors, necessary to accurately measure the DOI, remains an unsolved problem. Numerical simulations are, at the state of the art, imprecise, while measuring directly the characteristics of DOI detectors experimentally is hindered by the impossibility to impose the depth-of-interaction in an experimental set-up. In this article we introduce a machine learning approach for extracting accurate forward models of gamma imaging devices from simple pencil-beam measurements, using a nonlinear dimensionality reduction technique in combination with a finite mixture model. The method is purely data-driven, not requiring simulations, and is applicable to a wide range of detector types. The proposed method was evaluated both in a simulation study and with data acquired using a monolithic gamma camera designed for PET (the cMiCE detector), demonstrating the accurate recovery of the DOI characteristics. The combination of the proposed calibration technique with maximum-a posteriori estimation of the coordinates of interaction provided a depth resolution of approximate to 1.14 mm for the simulated PET detector and approximate to 1.74 mm for the cMiCE detector. The software and experimental data are made available at http://occiput.mgh.harvard.edu/depthembedding/.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Harvard Medical School, University of Washington
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Number of pages: 26
Pages: 8376-8401
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Physics in Medicine and Biology
Volume: 62
Issue number: 21
ISSN (Print): 0031-9155
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Amalgams and $\chi$-Boundedness

A class of graphs is hereditary if it is closed under isomorphism and induced subgraphs. A class $G$ of graphs is $\chi$-bounded if there exists a function $f : N \to N$ such that for all graphs $G \leq G$, and all induced subgraphs $H$ of $G$, we have that $\chi(H) \leq f(\omega(H))$. We prove that proper homogeneous sets, clique-cutsets, and amalgams together preserve $\chi$-boundedness. More precisely, we show that if $G$ and $G^*$ are hereditary classes of graphs such that $G$ is $\chi$-bounded, and such that every graph in $G^*$ either belongs to $G$ or admits a proper homogeneous set, a clique-cutset, or an amalgam, then the class $G^*$ is $\chi$-bounded. This generalizes a result of [J Combin Theory Ser B 103(5) (2013), 567–586], which states that proper
homogeneous sets and clique-cutsets together preserve \( \chi \)-boundedness, as well as a result of [European J Combin 33(4) (2012), 679–683], which states that 1-joins preserve \( \chi \)-boundedness. The house is the complement of the four-edge path. As an application of our result and of the decomposition theorem for “cap-free” graphs from [J Graph Theory 30(4) (1999), 289–308], we obtain that if \( G \) is a graph that does not contain any subdivision of the house as an induced subgraph, then \( \chi(G) \leq 3\omega(G)-1 \).

**General information**
- **State**: Published
- **Organisations**: Department of Applied Mathematics and Computer Science, Algorithms and Logic
- **Authors**: Penev, I. (Intern)
- **Pages**: 57–92
- **Publication date**: 2017
- **Main Research Area**: Technical/natural sciences

**Publication information**
- **Journal**: Journal of Graph Theory
- **Volume**: 84
- **Issue number**: 1
- **ISSN (Print)**: 0364-9024
- **Ratings**:
  - BFI (2018): BFI-level 2
  - Web of Science (2018): Indexed yes
  - BFI (2017): BFI-level 2
  - Scopus rating (2017): SNIP 1.45 SJR 1.104 CiteScore 0.82
  - Web of Science (2017): Indexed yes
  - BFI (2016): BFI-level 2
  - Scopus rating (2016): CiteScore 0.71 SJR 1.105 SNIP 1.362
  - BFI (2015): BFI-level 2
  - Scopus rating (2015): SJR 1.469 SNIP 1.598 CiteScore 0.85
  - BFI (2014): BFI-level 2
  - Scopus rating (2014): SJR 1.281 SNIP 1.136 CiteScore 0.73
  - BFI (2013): BFI-level 2
  - Scopus rating (2013): SJR 1.477 SNIP 1.698 CiteScore 0.9
  - ISI indexed (2013): ISI indexed yes
  - BFI (2012): BFI-level 2
  - Scopus rating (2012): SJR 1.37 SNIP 1.446 CiteScore 0.79
  - ISI indexed (2012): ISI indexed yes
  - BFI (2011): BFI-level 2
  - Scopus rating (2011): SJR 1.139 SNIP 1.235 CiteScore 0.76
  - ISI indexed (2011): ISI indexed yes
  - BFI (2010): BFI-level 2
  - Scopus rating (2010): SJR 1.273 SNIP 1.205
  - BFI (2009): BFI-level 1
  - Scopus rating (2009): SJR 1.748 SNIP 1.512
  - BFI (2008): BFI-level 1
  - Scopus rating (2008): SJR 1.615 SNIP 1.884
  - Web of Science (2008): Indexed yes
  - Scopus rating (2007): SJR 1.49 SNIP 1.496
  - Scopus rating (2006): SJR 1.24 SNIP 1.16
  - Web of Science (2006): Indexed yes
  - Scopus rating (2005): SJR 0.625 SNIP 0.786
  - Scopus rating (2004): SJR 1.057 SNIP 1.625
  - Web of Science (2004): Indexed yes
  - Scopus rating (2003): SJR 1.598 SNIP 1.157
  - Scopus rating (2002): SJR 0.882 SNIP 1.433
  - Scopus rating (2001): SJR 1.967 SNIP 1.598
  - Scopus rating (2000): SJR 1.699 SNIP 1.224
A method to characterize the roughness of 2-D line features: recrystallization boundaries

A method is presented, which allows quantification of the roughness of nonplanar boundaries of objects for which the neutral plane is not known. The method provides quantitative descriptions of both the local and global characteristics. How the method can be used to estimate the sizes of rough features and local curvatures is also presented. The potential of the method is illustrated by quantification of the roughness of two recrystallization boundaries in a pure Al specimen characterized by scanning electron microscopy.

General information
State: Published
Organisations: Department of Wind Energy, Materials science and characterization, Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics
Pages: 313–321
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Microscopy
Volume: 265
Issue number: 3
ISSN (Print): 0022-2720
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.94 SJR 0.728 CiteScore 1.85
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.9 SJR 0.746 SNIP 0.841
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.962 SNIP 1.095 CiteScore 2.37
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.067 SNIP 1.339 CiteScore 2.41
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.749 SNIP 1.051 CiteScore 1.96
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.764 SNIP 1.276 CiteScore 1.84
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.873 SNIP 0.918 CiteScore 1.67
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
A modular interpretation of various cubic towers

In this article we give a Drinfeld modular interpretation for various towers of function fields meeting Zink's bound.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics, Bosphorus University
Authors: Anbar Meidl, N. (Intern), Bassa, A. (Ekstern), Beelen, P. (Intern)
Pages: 341-357
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Number Theory
Volume: 171
ISSN (Print): 0022-314X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.375 SJR 1.275 CiteScore 0.82
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.7 SJR 1.095 SNIP 1.183
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.865 SNIP 1.164 CiteScore 0.59
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.086 SNIP 1.307 CiteScore 0.68
A Monte Carlo simulation of scattering reduction in spectral x-ray computed tomography

In X-ray computed tomography (CT), scattered radiation plays an important role in the accurate reconstruction of the inspected object, leading to a loss of contrast between the different materials in the reconstruction volume and cupping artifacts in the images. We present a Monte Carlo simulation tool for spectral X-ray CT to predict the scattered radiation generated by complex samples. An experimental setup is presented to isolate the energy distribution of scattered radiation. Spectral CT is a novel technique implementing photon-counting detectors able to discriminate the energy of incoming photons, enabling spectral analysis of X-ray images. This technique is useful to extract efficiently more information on energy dependent quantities (e.g. mass attenuation coefficients) and study matter interactions (e.g. X-ray scattering, photoelectric absorption, etc...). Having a good knowledge of the spectral distribution of the scattered X-rays is fundamental to establish methods attempting to correct for it. The simulations are validated by real measurements using a CdTe spectral resolving detector (Multix ME-100). We observed the effect of the scattered radiation on the image reconstruction, becoming relevant in the energy range where the Compton events are dominant (i.e. above 50keV).

Bibliographical note

General information
State: Published
Organisations: Department of Physics, Neutrons and X-rays for Materials Physics, Department of Applied Mathematics and Computer Science , Image Analysis & Computer Graphics, National Space Institute, Niels Bohr Institute
Number of pages: 9
A Multi-Format Floating-Point Multiplier for Power-Efficient Operations

In this work, we present a radix-16 multi-format multiplier to multiply 64-bit unsigned integer operands, double-precision and single-precision operands. The multiplier is sectioned in two lanes such that two single-precision multiplications can be computed in parallel. Radix-16 is chosen for the reduced number of partial products and the resulting power savings. The experimental results show that high power efficiency is obtained by issuing two single-precision multiplications per cycle. Moreover, by converting the double-precision numbers which fit to single-precision, further energy can be saved.

An Adaptive Nonlinear Basal-Bolus Calculator for Patients With Type 1 Diabetes

Background: Bolus calculators help patients with type 1 diabetes to mitigate the effect of meals on their blood glucose by administering a large amount of insulin at mealtime. Intraindividual changes in patients physiology and nonlinearity in insulin-glucose dynamics pose a challenge to the accuracy of such calculators.

Method: We propose a method based on a continuous-discrete unscented Kalman filter to continuously track the postprandial glucose dynamics and the insulin sensitivity. We augment the Medtronic Virtual Patient (MVP) model to simulate noise-corrupted data from a continuous glucose monitor (CGM). The basal rate is determined by calculating the steady state of the model and is adjusted once a day before breakfast. The bolus size is determined by optimizing the postprandial glucose values based on an estimate of the insulin sensitivity and states, as well as the announced meal size. Following meal announcements, the meal compartment and the meal time constant are estimated, otherwise insulin sensitivity is estimated.

Results: We compare the performance of a conventional linear bolus calculator with the proposed bolus calculator. The proposed basal-bolus calculator significantly improves the time spent in glucose target (P < .01) compared to the conventional bolus calculator.
Conclusion: An adaptive nonlinear basal-bolus calculator can efficiently compensate for physiological changes. Further clinical studies will be needed to validate the results.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Dynamical Systems, Copenhagen University Hospital
Authors: Boiroux, D. (Intern), Aradóttir, T. B. (Intern), Nørgaard, K. (Ekstern), Poulsen, N. K. (Intern), Madsen, H. (Intern), Jørgensen, J. B. (Intern)
Number of pages: 8
Pages: 29-36
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Diabetes Science and Technology
Volume: 11
Issue number: 1
ISSN (Print): 1932-2968
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.109 SJR 1.256 CiteScore 2.48
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.14 SJR 0.875 SNIP 1.078
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.934 SNIP 0.971 CiteScore 1.99
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.882 SNIP 0.955 CiteScore 1.84
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.785 SNIP 0.921 CiteScore 2.19
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.711 SNIP 0.976 CiteScore 1.33
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.691 SNIP 0.904 CiteScore 0.6
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.463 SNIP 0.669
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.242 SNIP 0.534
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.229 SNIP 0.406
Original language: English
Bolus calculator, Diabetes technology, Type 1 diabetes, Unscented Kalman filter
DOIs:
10.1177/1932296816666295
Links:
Source: PublicationPreSubmission
Source-ID: 126153779
Publication: Research - peer-review › Journal article – Annual report year: 2016

An Aerial Robot for Rice Farm Quality Inspection With Type-2 Fuzzy Neural Networks Tuned by Particle Swarm Optimization-Sliding Mode Control Hybrid Algorithm
Agricultural robots, or agrobots, have been increasingly adopted in every aspect of farming from surveillance to fruit harvesting in order to improve the overall productivity over the last few decades. Motivated by compelling growth of
agricultural robots in modern farms, in this work, an autonomous quality inspection over rice farms is proposed by employing quadcopters. Real-time control of these vehicles, however, is still challenging as they exhibit highly nonlinear behavior especially for agile maneuvers. What is more, these vehicles have to operate under uncertain working conditions such as wind and gust disturbances as well as positioning errors caused by inertial measurement units and global positioning system. To handle these difficulties, as a model-free and learning control algorithm, type-2 fuzzy neural networks (T2-FNNs) are designed for the control of quadcopter. The novel particle swarm optimization-sliding mode control (PSO-SMC) theory-based hybrid algorithm is proposed for the training of T2-FNNs. In particular, continuous version of PSO is adopted for the identification of the antecedent part of T2-FNNs while SMC-based update rules are utilized for online learning of the consequent part during control. In the virtual environment, the quadcopter is expected to perform an autonomous flight including agile maneuvers such as steep turning and sudden altitude changes over a rice terrace farm in Longsheng, China. The simulation results for T2-FNNs are compared with the outcome of conventional proportional-derivative (PD) controllers for different case studies. The results show that our method decreases trajectory tracking integral squared error by %26 over PD controllers in the ideal case, while this ratio goes up to %95 under uncertain working conditions.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Nanyang Technological University
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Number of pages: 8
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Swarm and Evolutionary Computation
ISSN (Print): 2210-6502
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): SNIP 2.691 SJR 1.053 CiteScore 5.44
Scopus rating (2016): CiteScore 5.54 SJR 1.365 SNIP 2.801
Scopus rating (2015): CiteScore 5.25 SNIP 2.885 SJR 1.714
Scopus rating (2014): CiteScore 9.83 SNIP 5.331 SJR 2.944
Scopus rating (2013): CiteScore 12.33 SNIP 8.403 SJR 4.015
Scopus rating (2012): CiteScore 9.05 SNIP 5.222 SJR 1.743
Original language: English
Type-2 fuzzy neural networks, Particle swarm optimization, Sliding mode control, Unmanned aerial vehicle, System identification, Control
DOIs: 10.1016/j.swevo.2017.10.003
Source: PublicationPreSubmission
Source-ID: 140582385
Publication: Research - peer-review → Journal article – Annual report year: 2018

Analysis of aggregated functional data from mixed populations with application to energy consumption
Understanding energy consumption patterns of different types of consumers is essential in any planning of energy distribution. However, obtaining individual-level consumption information is often either not possible or too expensive. Therefore, we consider data from aggregations of energy use, that is, from sums of individuals' energy use, where each individual falls into one of C consumer classes. Unfortunately, the exact number of individuals of each class may be unknown due to inaccuracies in consumer registration or irregularities in consumption patterns. We develop a methodology to estimate both the expected energy use of each class as a function of time and the true number of consumers in each class. To accomplish this, we use B-splines to model both the expected consumption and the individual-level random effects. We treat the reported numbers of consumers in each category as random variables with distribution depending on the true number of consumers in each class and on the probabilities of a consumer in one class reporting as another class. We obtain maximum likelihood estimates of all parameters via a maximization algorithm. We introduce a special numerical trick for calculating the maximum likelihood estimates of the true number of consumers in each class. We apply our method to a data set and study our method via simulation.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, University of British Columbia, University of Campinas
Authors: Lenzi, A. (Intern), de Souza, C. P. E. (Ekstern), Dias, R. (Ekstern), Garcia, N. L. (Ekstern), Heckman, N. E. (Ekstern)
Analysis of DDoS-capable IoT malwares
The Internet of Things (IoT) revolution promises to make our lives easier by providing cheap and always connected smart embedded devices, which can interact on the Internet and create added values for human needs. But all that glitters is not gold. Indeed, the other side of the coin is that, from a security perspective, this IoT revolution represents a potential disaster. This plethora of IoT devices that flooded the market were very badly protected, thus an easy prey for several families of malwares that can enslave and incorporate them in very large botnets. This, eventually, brought back to the top Distributed Denial of Service (DDoS) attacks, making them more powerful and easier to achieve than ever. This paper aims at provide an up-to-date picture of DDoS attacks in the specific subject of the IoT, studying how these attacks work and considering the most common families in the IoT context, in terms of their nature and evolution through the years. It also explores the additional offensive capabilities that this arsenal of IoT malwares has available, to mine the security of Internet users and systems. We think that this up-to-date picture will be a valuable reference to the scientific community in order to take a first crucial step to tackle this urgent security issue.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, Copenhagen Center for Health Technology, Technical University of Denmark, Örebro University
Authors: De Donno, M. (Intern), Dragoni, N. (Intern), Giaretta, A. (Ekstern), Spognardi, A. (Intern)
Number of pages: 10
Pages: 807-816
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the Federated Conference on Computer Science and Information Systems
Volume: 11
Publisher: IEEE
Series: Annals of Computer Science and Information Systems
Volume: 11
ISSN: 2300-5963
Main Research Area: Technical/natural sciences
Conference: Federated Conference on Computer Science and Information Systems, Prague, Czech Republic, 04/09/2017 - 04/09/2017
DOIs: 10.15439/2017F288
Source: FindIt
Source-ID: 2392985081
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Analysis of the Data Using the R Package sensR

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis
Authors: Brockhoff, P. B. (Intern), Linander, C. B. (Intern)
Pages: 303-344
Publication date: 2017

Host publication information
Title of host publication: Discrimination Testing in Sensory Science
Publisher: Woodhead Publishing
Chapter: 15

Series: Woodhead Publishing Series in Food Science, Technology and Nutrition
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
Source-ID: 140538643
Publication: Research - peer-review › Book chapter – Annual report year: 2017
Analysis of trait-based models in marine ecosystems.
The overarching theme for this thesis is spatial and temporal variations in ecosystems. The focus is on describing mechanisms that are responsible for generating the spatial and temporal patterns. The thesis contains two separate projects, each exploring a possible mechanism for pattern formation. In both projects, the model formulations result in partial integro-differential equations. The first project in the thesis considers temporal patterns in a size structured population. Size structure is relevant for species that goes through significant changes through their lifetime. The population’s response to regular temporal variations in the environment is investigated by introducing a periodic forcing in the system. This can for instance represent seasonal changes. The effect of an imposed forcing is explored both when the underlying unforced system has a stable equilibrium and when it has stable oscillatory dynamics. The numerical solutions show regular cycles where the period is equal to, or an integer multiple of, the forcing period and where the population can have one or more pulses of reproduction in each cycle. Additionally, the numerical results indicate quasi-periodic or chaotic solutions, period doubling bifurcations and coexisting attractors. The bifurcation structure is similar to results for comparable unstructured population models in the literature. This indicates that size structure does not affect the response to periodic forcing. The next project in the thesis considers spatio-temporal pattern formation in a predator–prey system where animals move towards higher fitness. Reaction-diffusion systems have been used extensively to describe spatio-temporal patterns in a variety of systems. However, animals rarely move completely at random, as expressed by diffusion. This has lead to models with taxis terms, describing individuals moving in the direction of an attractant. An example is chemotaxis models, where bacteria are attracted to a chemical substance. From an evolutionary perspective, it is expected that animals act to optimize their fitness. Based on this principle, a predator–prey system with fitness taxis and diffusion is proposed. Here, fitness taxis refer to animals moving towards higher values of fitness, and the specific growth rates of the populations are used as a measure of the fitness values. To determine the conditions for pattern formation, a linear stability analysis is conducted. The analysis reveals that the fitness taxis leads to mechanisms for pattern formation, which are based on the prey gathering together. It turns out, that in some cases the problem is not well-posed and an ultraviolet catastrophe occurs, i.e., perturbations with infinitely short wavelength grow infinitely fast. To prevent this, the population dynamics are revised with a spatial feeding kernel, that defines a spatial range wherein a predator consumes prey. A linear stability analysis for the revised system reveals the ultraviolet catastrophe is avoided and the basic mechanisms for pattern formation are unchanged. Numerical solutions to the revised system are computed to visualize the patterns. The solutions encompass stationary spatial patterns in addition to traveling waves, standing waves and irregular solutions that might be spatio-temporal chaos. The modeling approach of fitness taxis presents a general way to express movement and it is concluded that the model provides a useful framework for describing generic mechanisms for pattern formation.
An Approach for Hospital Planning with Multi-Agent Organizations

A Natural Logic for Natural-language Knowledge Bases

We describe a natural logic for computational reasoning with a regimented fragment of natural language. The natural logic comes with intuitive inference rules enabling deductions and with an internal graph representation facilitating conceptual path finding between pairs of terms as an approach to semantic querying. Our core natural logic proposal covers formal ontologies and generative extensions thereof. It further provides means of expressing general relationships between classes in an application. We discuss extensions of the core natural logic with various conservative as well as non-conservative constructs in order to approach scientific use of natural language. Finally, we outline a prototype system addressing life science for the natural logic knowledge base setup being under continuous development.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Pages: 1-26
Publication date: 2017

Host publication information
Title of host publication: Preproceedings of the 29th Benelux Conference on Artificial Intelligence
ISBN (Print): 978-94-034-0299-4
BFI conference series: Benelux Conference on Artificial Intelligence (5010262)
Main Research Area: Technical/natural sciences
Conference: 29th Benelux Conference on Artificial Intelligence, Groningen, Netherlands, 08/11/2017 - 08/11/2017
Source: PublicationPreSubmission
Source-ID: 139212683
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017
An efficient and rigorous thermodynamic library and optimal-control of a cryogenic air separation unit.

Cryogenic air separation (CAS) is the leading technology for large scale production of pure N2, O2 and Ar. This process is very electric-energy intensive; thus it is a likely candidate for load balancing of power stations in a smart grid. This type of intermittent operation of CAS, requires a non-linear model based control to achieve optimal techno-economic performance. Accordingly, this work presents a computationally efficient and novel approach for solving a tray-by-tray equilibrium model and its implementation for open-loop optimal-control of a cryogenic distillation column. Here, the optimisation objective is to reduce the cost of compression in a volatile electricity market while meeting the production requirements, i.e. product flow rate and purity. This model is implemented in Matlab and uses the ThermoLib rigorous thermodynamic library. The present work represents a first step towards plant-wide dynamic modelling and smart control of a cryogenic distillation plant.

An Efficient Robust Solution to the Two-Stage Stochastic Unit Commitment Problem

This paper proposes a reformulation of the scenario-based two-stage unitcommitment problem under uncertainty that allows finding unit-commitment plans that perform reasonably well both in expectation and for the worst caserealization of the uncertainties. The proposed reformulation is based on partitioning the sample space of the uncertain factors by clustering thescenarios that approximate their probability distributions. It is, furthermore,very amenable to decomposition and parallelization using acolumn-and-constraint generation procedure.
Stochastic and robust unit commitment, Columnand- constraint generation, Parallel computing, Clustering, Scenario reduction

Electronic versions:
AnEfficientRobustSolutiontotheTwoStageStochasticUnitCommitmentProblem_Blanco_Morales_postprint.pdf
An Error Analysis of Structured Light Scanning of Biological Tissue
This paper presents an error analysis and correction model for four structured light methods applied to three common types of biological tissue: skin, fat and muscle. Despite its many advantages, structured light is based on the assumption of direct reflection at the object surface only. This assumption is violated by most biological material e.g. human skin, which exhibits subsurface scattering. In this study, we find that in general, structured light scans of biological tissue deviate significantly from the ground truth. We show that a large portion of this error can be predicted with a simple, statistical linear model based on the scan geometry. As such, scans can be corrected without introducing any specially designed pattern strategy or hardware. We can effectively reduce the error in a structured light scanner applied to biological tissue by as much as factor of two or three.

A New Structural-Differential Property of 5-Round AES
AES is probably the most widely studied and used block cipher. Also versions with a reduced number of rounds are used as a building block in many cryptographic schemes, e.g. several candidates of the SHA-3 and CAESAR competition are based on it. So far, non-random properties which are independent of the secret key are known for up to 4 rounds of AES. These include differential, impossible differential, and integral properties. In this paper we describe a new structural property for up to 5 rounds of AES, differential in nature and which is independent of the secret key, of the details of the MixColumns matrix (with the exception that the branch number must be maximal) and of the SubBytes operation. It is very simple: By appropriate choices of difference for a number of input pairs it is possible to make sure that the number of times that the difference of the resulting output pairs lie in a particular subspace is always a multiple of 8. We not only observe this property experimentally (using a small-scale version of AES), we also give a detailed proof as to why it has to exist. As a first application of this property, we describe a way to distinguish the 5-round AES permutation (or its inverse) from a random permutation with only 2 32 chosen texts that has a computational cost of 2(35.6) look-ups into memory of size 2 36 bytes which has a success probability greater than 99%.
Block cipher, Permutation, AES, Secret-key distinguisher
A new tower with good p-rank meeting Zink's bound
In this article we investigate the asymptotic p-rank of a new tower of function fields defined over cubic finite fields. Its limit meets Zink's bound, but the new feature of this tower is that its asymptotic p-rank for small cubic finite fields is much smaller than that of other cubic towers for which the asymptotic p-rank is known. This is of independent interest, but also makes this new tower more interesting for theoretical applications in cryptography.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics
Authors: Anbar Meidl, N. (Intern), Beelen, P. (Intern), Nguyen, N. (Intern)
Number of pages: 28
Pages: 347-374
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Acta Arithmetica
Volume: 177
Issue number: 4
ISSN (Print): 0065-1036
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 0.55 SJR 0.68 SNIP 1.04
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.49 SJR 0.775 SNIP 0.926
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.733 SNIP 1.113 CiteScore 0.54
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.934 SNIP 1.082 CiteScore 0.56
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.848 SNIP 0.96 CiteScore 0.5
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.829 SNIP 1.002 CiteScore 0.49
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.75 SNIP 1.077 CiteScore 0.48
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.981 SNIP 1.157
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.811 SNIP 1.093
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.956 SNIP 1.023
Scopus rating (2007): SJR 0.79 SNIP 0.96
An experimentally validated simulation model for a four-stage spray dryer

In this paper, we develop a dynamic model of an industrial-type medium size four-stage spray dryer. The purpose of the model is to enable simulations of the spray dryer at different operating points, such that the model facilitates development and comparison of control strategies. The dryer is divided into four consecutive stages: a primary spray drying stage, two heated fluid bed stages, and a cooling fluid bed stage. Each of these stages in the model is assumed ideally mixed and the dynamics are described by mass- and energy balances. These balance equations are coupled with constitutive equations such as a thermodynamic model, the water evaporation rate, the heat transfer rates, and an equation for the stickiness of the powder (glass transition temperature). Laboratory data is used to model the equilibrium moisture content and the glass transition temperature of the powder. The resulting mathematical model is an index-1 differential algebraic equation (DAE) model with 12 states, 9 inputs, 8 disturbances, and 30 parameters. The parameters in the model are identified from well-excited experimental data obtained from the industrial-type spray dryer. The simulated outputs of the model are validated using independent well-excited experimental data from the same spray dryer. The simulated temperatures, humidities, and residual moistures in the spray dryer compare well to the validation data. The model also provides the profit of operation, the production rate, the energy consumption, and the energy efficiency. In addition, it computes stickiness of the powder in different stages of the spray dryer. These facilities make the model well suited as a simulation model for comparison of the process economics associated to different control strategies.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Department of Electrical Engineering, Automation and Control, Scientific Computing, GEA Process Engineering A/S
Authors: Petersen, L. N. (Intern), Poulsen, N. K. (Intern), Niemann, H. H. (Intern), Utzen, C. (Ekstern), Jørgensen, J. B. (Intern)
Pages: 50–65
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Process Control
Volume: 57
ISSN (Print): 0959-1524
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.85 SJR 1.108 SNIP 1.971
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.41 SJR 1.037 SNIP 2.138
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
An image-based method for objectively assessing injection moulded plastic quality

In high volume productions based on casting processes, like high-pressure die casting (HPDC) or injection moulding, there is a wide range of variables that affect the end quality of produced parts. These variables include production parameters (temperature, pressure, mixture), and external factors (humidity, temperature, etc.). With this many variables it is a challenge to maintain a stable output quality, wherefore massive amounts of resources are spent on quality assurance (QA) of produced parts. Currently, this QA is done manually through visual inspection. We demonstrate how a multispectral imaging system can be used to automatically rate the quality of a produced part using an autocorrelation and a Fourier-based method. These methods are compared with human rankings and achieve good correlations on a variety of samples.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Budapest University of Technology and Economics
Authors: Hannemose, M. (Intern), Nielsen, J. B. (Intern), Zsíros, L. (Ekstern), Aanæs, H. (Intern)
Pages: 426-437
An Improved Direction of Gradient-type Method for Large Scale Unconstrained Optimization

In this paper, a new modification of diagonal-gradient-type method for large scale unconstrained optimization is proposed. We utilize information from the proceeding iteration and consider some corrections for the difference of iterates to improve the current Hessian approximation in diagonal form. Also, the global convergence, under mild conditions is established. Finally, we report some numerical results to show the efficiency of our proposed method.

General information

State: Accepted/In press
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Islamic Azad University
Authors: Mahboube, F. (Intern), Malekmohammadi, N. (Ekstern)
Number of pages: 10
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information

Journal: Journal of Advanced Mathematics and Applications
ISSN (Print): 2156-7565
Ratings:
Web of Science (2018): Indexed yes
Web of Science (2017): Indexed yes
Original language: English
Gradient-type methods, Diagonal updating, Quasi-Newton method, Large-scale unconstrained optimization
Electronic versions:
JAMA_700216_FaridM.pdf
Publication: Research - peer-review › Journal article – Annual report year: 2017

An introduction to Deep learning on biological sequence data - Examples and solutions

Deep neural network architectures such as convolutional and long short-term memory networks have become increasingly popular as machine learning tools during the recent years. The availability of greater computational resources, more data, new algorithms for training deep models and easy to use libraries for implementation and training of neural networks are the drivers of this development. The use of deep learning has been especially successful in image recognition; and the development of tools, applications and code examples are in most cases centered within this field rather than within biology. Here, we aim to further the development of deep learning methods within biology by providing application examples and ready to apply and adapt code templates. Given such examples, we illustrate how architectures consisting of convolutional and long short-term memory neural networks can relatively easily be designed and trained to state-of-the-art performance on three biological sequence problems: prediction of subcellular localization, protein secondary structure and the binding of peptides to MHC Class II molecules. All implementations and datasets are available online to the scientific community at https://github.com/vanessajurtz/lasagne4bio. Supplementary data are available at Bioinformatics online.

General information

State: Published
Organisations: Department of Bio and Health Informatics, Immuninformatics and Machine Learning, Department of Applied Mathematics and Computer Science, Department of Electrical Engineering, Disease Intelligence and Molecular...
An Introduction to Malware

These notes, intended for use in DTU course 02233 on Network Security, give a short introduction to the topic of malware. The most important types of malware are described, together with their basic principles of operation and dissemination, and defenses against malware are discussed.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering
Authors: Sharp, R. (Intern)
Number of pages: 35
Publication date: 2017

An Investigation of Methods for CT Synthesis in MR-only Radiotherapy

In recent years, the interest in using magnetic resonance (MR) imaging in radiotherapy (RT) has increased. This is because MR has a superior soft tissue contrast compared to computed tomography (CT), which makes it a better modality for delineating the target volume (tumor) and possible organs at risk (OARs). In an MR/CT work-flow, independent MR and CT scans are acquired. The target and possible OARs are delineated on the MR and then transferred to CT by aligning the data using a registration. This introduces the risk of systematic registration errors especially in non-rigid body structures, the consequence being a systematic miss of target or increased dose to healthy tissue.

Radiotherapy based on MR as the only modality removes this uncertainty and simplifies the clinical work-flow. However, the information on electron density which is usually contained in the CT must now be derived from the MR. A way to achieve this is to computationally estimate a so-called synthetic CT (sCT) from the MR data, which can then act as a substitute for the CT. This is a challenging task, since no unique relationship between MR and electron density exists.

The goal of this thesis is to develop and investigate the right combination of MR acquisition protocols and computational models for accurate MR-based CT synthesis for use in RT. We investigate different categories of methods for CT synthesis and validate them using clinically relevant quality measures. Specifically, we implement a patch-based multi-atlas method in the brain, which compares favorably to state-of-the-art methods. In our next effort, we substantially improve the speed of the method and apply it in the pelvis, again with promising results. Our final contribution is a voxel-based method, which is developed to be registration-free and broadly applicable. In initial results, the performance of this method is close to the patch-based.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics
Authors: Andreason, D. (Intern), Van Leemput, K. (Intern)
Number of pages: 72
Publication date: 2017

Publication information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Original language: English

Series: DTU Compute PHD-2016
Number: 428
ISSN: 0909-3192
Main Research Area: Technical/natural sciences
Electronic versions: phd428_Andreason_D.pdf
Annex 67: Energy Flexible Buildings - Energy Flexibility as a key asset in a smart building future

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Department of Civil Engineering, Section for Building Energy, New University of Lisbon, Vienna University of Technology, Norwegian Water Resources and Energy Directorate, Ecole Polytechnique de Montreal, Belgian Building Research Institute, Delft University of Technology, EURAC Research, Teknologisk Institut, Aalborg Universitet København
Authors: Jensen, S. Ø. (Ekstern), Madsen, H. (Intern), Lopes, R. (Ekstern), Junker, R. G. (Intern), Aelenei, D. (Ekstern), Li, R. (Intern), Metzger, S. (Ekstern), Lindberg, K. B. (Ekstern), Marszal, A. J. (Forskerdatabase), Kummert, M. (Ekstern), Bayles, B. (Ekstern), Mlecnik, E. (Ekstern), Lollini, R. (Ekstern), Pasut, W. (Ekstern)
Number of pages: 16
Publication date: 2017

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Untitled.pdf

Bibliographical note
Contribution of Annex 67 to the European Smart Building Initiatives
Source: PublicationPreSubmission
Source-ID: 146845969
Publication: Research › Report – Annual report year: 2018

A Note on a Tower by Bassa, Garcia and Stichtenoth
In this note, we prove that the tower given by Bassa, Garcia and Stichtenoth in [4] is a subtower of the one given by Anbar, Beelen and Nguyen in [2]. This completes the study initiated in [16, 2] to relate all known towers over cubic finite fields meeting Zink’s bound with each other.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics
Authors: Anbar Meidl, N. (Intern), Beelen, P. (Intern)
Number of pages: 13
Pages: 47-60
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Functiones et Approximatio Commentarii Mathematici
Volume: 57
Issue number: 1
ISSN (Print): 0208-6573
Ratings:
Scopus rating (2017): CiteScore 0.38 SJR 0.368 SNIP 0.755
Scopus rating (2016): CiteScore 0.24 SJR 0.429 SNIP 0.41
Web of Science (2016): Indexed yes
Scopus rating (2015): SJR 0.215 SNIP 0.371 CiteScore 0.21
Scopus rating (2014): SJR 0.439 SNIP 0.693 CiteScore 0.06
Scopus rating (2013): SJR 0.442 SNIP 0.869
Scopus rating (2012): SJR 0.243 SNIP 0.475
Scopus rating (2011): SJR 0.431 SNIP 0.576
Scopus rating (2010): SJR 0.48 SNIP 0.65
Scopus rating (2009): SJR 0.267 SNIP 0.4
Scopus rating (2008): SJR 0.18 SNIP 0.221
A note on circulatory systems: Old and new results: Circulatory systems

It is astonishing that after more than half a century intensive research in the area of non-conservative systems of second order differential equations still new interesting results appear, see [4]. In that paper an old stability criterion by Metelitsyn [8] and Frik [9] was reinvented. We shortly repeat this result in order to emphasize that the criterion is sufficient but not necessary for stability. Afterwards we concentrate on circulatory systems with purely imaginary eigenvalues and investigate the influence of indefinite damping. Finally the possibility of stabilizing circulatory systems by gyroscopic forces will be commented. Examples will demonstrate the developed theory.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science
Authors: Kliem, W. (Intern), Pommer, C. (Intern)
Pages: 92–97
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Zeitschrift fuer Angewandte Mathematik und Mechanik
Volume: 97
Issue number: 1
ISSN (Print): 0044-2267
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.085 SJR 0.604 CiteScore 1.6
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.23 SJR 0.593 SNIP 0.908
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.629 SNIP 1.206 CiteScore 1.06
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.62 SNIP 1.155 CiteScore 1.01
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.685 SNIP 1.177 CiteScore 1
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.653 SNIP 0.989 CiteScore 0.91
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.524 SNIP 0.992 CiteScore 0.84
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.439 SNIP 0.825
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.645 SNIP 1.197
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.496 SNIP 0.891
A Novel Approach for Risk Minimization in Life-Cycle Oil Production Optimization

The oil research community has invested much effort into computer aided optimization to enhance oil recovery. While simulation studies have demonstrated the potential of model-based technology to improve industrial standards, the largely unknown geology of subsurface reservoirs limits applications to commercial oil fields. In particular, uncertain model descriptions lead to risks of profit loss. To address the challenges of geological uncertainty, this paper proposes offset risk minimization. As opposed to existing methodologies of the oil literature, the offset approach minimizes risk of profit loss relative to industrial standards. A numerical case study compares the offset approach to a representative selection of current state-of-the-art methodologies. The results show that the offset approach offers the overall lowest risk of profit loss relative to industrial best practices. This suggests that it may be more relevant to consider offset risk minimization than conventional ensemble-based methods for the purpose of life-cycle production optimization.
Anthropometry, DXA and leptin reflect subcutaneous but not visceral abdominal adipose tissue by MRI in 197 healthy adolescents

Background Abdominal fat distribution is associated with the development of cardio-metabolic disease independently of body mass index (BMI). We assessed anthropometry, serum adipokines, and DXA as markers of abdominal subcutaneous adipose tissue (SAT) and visceral adipose tissue (VAT) using magnetic resonance imaging (MRI). Methods We performed a cross-sectional study that included 197 healthy adolescents (114 boys) aged 10–15 years nested within a longitudinal population-based cohort. Clinical examination, blood sampling, DXA, and abdominal MRI were performed. SAT% and VAT% were adjusted to total abdominal volume. Results Girls had a higher SAT% than did boys in early and late puberty (16 vs. 13%, P<0.01 and 20 vs. 15%, P=0.001, respectively), whereas VAT% was comparable (7% in both genders, independently of puberty). DXA android fat% (standard deviation score (SDS)), suprailiac skinfold thickness (SDS), leptin, BMI (SDS), waist-to-height ratio (WHtR), and waist circumference (SDS) correlated strongly with SAT% (descending order: r=0.90–0.55, all P<0.001) but weakly with VAT% (r=0.49–0.06). Suprailiac skinfold was the best anthropometric marker of SAT% (girls: R2=48.6%, boys: R2=65%, P<0.001) and VAT% in boys (R2=16.4%, P<0.001). WHtR was the best marker of VAT% in girls (R2=7.6%, P=0.007). Conclusions Healthy girls have a higher SAT% than do boys, whereas VAT% is comparable, independently of puberty. Anthropometry and circulating leptin are valid markers of SAT%, but not of VAT%.
A Numerical Framework for Sobolev Metrics on the Space of Curves

Statistical shape analysis can be done in a Riemannian framework by endowing the set of shapes with a Riemannian metric. Sobolev metrics of order two and higher on shape spaces of parametrized or unparametrized curves have several desirable properties not present in lower order metrics, but their discretization is still largely missing. In this paper, we present algorithms to numerically solve the geodesic initial and boundary value problems for these metrics. The combination of these algorithms enables one to compute Karcher means in a Riemannian gradient-based optimization scheme and perform principal component analysis and clustering. Our framework is sufficiently general to be applicable to a wide class of metrics. We demonstrate the effectiveness of our approach by analyzing a collection of shapes representing HeLa cell nuclei.
A performance assessment of a 2 axis scanning mirror galvanometer for powder bed fusion

Additive Manufacturing by powder bed fusion allows production of high strength parts with complex features, not possible through conventional manufacturing. To experiment and test current theory within laser processing of metal powder, an open and customizable laser scanner platform is developed and constructed. The platform seeks to fully support and enable the laser driven process of selective consolidation metal powder, as most industrially available powder bed fusion machine tools are closed and proprietary systems. This allows the machine tool manufacturer to strictly control how the system is used and therefore maintain stability through limiting the operator to use proprietary software hardware and process materials but unfortunately limits to an equally wide extent how such machine tools can be applied for research purposes as it renders the scientist to become a mere operator of the machine tool. A galvanometer based laser scanning system is here presented. The system was designed to meet a theoretical resolution of 0.009 mm. From inspiration of the use of optomechanical hole plates as reference artefacts for coordinate metrology a test was conducted to verify the accuracy of the laser scanning system. The system was found to perform excellent for relative positioning. Absolute positioning of the laser beam did not conform with design specifications, as the test deviated by 0.12 mm with respect to the nominal test value, yet this is expected in the future to be met from the implementation of a better galvanometer control system.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics
Number of pages: 3
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the Joint Special Interest Group meeting between euspen and ASPE: Dimensional Accuracy and Surface Finish in Additive Manufacturing
A Pilot Study of Multiple Password Interference Between Text and Map-Based Passwords

Today’s computer users have to remember several passwords for each of their accounts. It is easily noticed that people may have difficulty in remembering multiple passwords, which result in a weak password selection. Previous studies have shown that recall success rates are not statistically dissimilar between textual passwords and graphical passwords. With the advent of map-based graphical passwords, this paper focuses on multiple password interference and presents a pilot study consisting of 60 participants to study the recall of multiple passwords between text passwords and map-based passwords under various account scenarios. Each participant has to create six distinct passwords for different account scenarios. It is found that participants in the map-based graphical password scheme could perform better than the textual password scheme in both short-term (one-hour session) and long term (after two weeks) password memorability tests (i.e., they made higher success rates). Our effort attempts to complement existing studies and stimulate more research on this issue.

Applied 3D Vision: An Empirical Study

General information
State: Submitted
Organisations: Department of Applied Mathematics and Computer Science
Authors: Jensen, S. H. N. (Intern), Aanæs, H. (Intern)
Number of pages: 142
Publication date: 2017

Publication information
Original language: English
Series: DTU Compute PHD-2017
Number: 467
ISSN: 0909-3192
Main Research Area: Technical/natural sciences
Publication: Research › Ph.D. thesis – Annual report year: 2018
Applying LCA in decision making- the need and the future perspective

General information
State: Published
Organisations: Department of Management Engineering, Quantitative Sustainability Assessment, Department of Civil Engineering, Centre for oil and gas – DTU, Transport DTU, Transport Modelling, Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Department of Environmental Engineering, Urban Water Systems, National Food Institute, Research Group for Genomic Epidemiology, Section for Structural Engineering
Authors: Dong, Y. (Intern), Miraglia, S. (Intern), Manzo, S. (Intern), Georgiadis, S. (Intern), Sørup, H. J. D. (Intern), Boriani, E. (Intern), Hald, T. (Intern), Thøns, S. (Intern), Hauschild, M. Z. (Intern)
Number of pages: 1
Publication date: 2017
Main Research Area: Technical/natural sciences
Electronic versions: Applying_LCA_in_decision_making_Final

A predator-2 prey fast-slow dynamical system for rapid predator evolution
We consider adaptive change of diet of a predator population that switches its feeding between two prey populations. We develop a novel 1 fast-3 slow dynamical system to describe the dynamics of the three populations amidst continuous but rapid evolution of the predator's diet choice. The two extremes at which the predator's diet is composed solely of one prey correspond to two branches of the three-branch critical manifold of the fast slow system. By calculating the points at which there is a fast transition between these two feeding choices (i.e., branches of the critical manifold), we prove that the system has a two-parameter family of periodic orbits for sufficiently large separation of the time scales between the evolutionary and ecological dynamics. Using numerical simulations, we show that these periodic orbits exist, and that their phase difference and oscillation patterns persist, when ecological and evolutionary interactions occur on comparable time scales. Our model also exhibits periodic orbits that agree qualitatively with oscillation patterns observed in experimental studies of the coupling between rapid evolution and ecological interactions.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, National Institute of Aquatic Resources, Centre for Ocean Life, University of Michigan, University of Oxford
Authors: Piltz, S. H. (Intern), Veerman, F. (Ekstern), Maini, P. K. (Ekstern), Porter, M. A. (Ekstern)
Pages: 54-90
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: SIAM Journal on Applied Dynamical Systems
Volume: 16
Issue number: 1
ISSN (Print): 1536-0040
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.226 SJR 1.04 CiteScore 1.75
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.88 SJR 1.289 SNIP 1.268
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.359 SNIP 1.36 CiteScore 1.89
Web of Science (2015): Indexed yes
A Privacy-Preserving Framework for Collaborative Intrusion Detection Networks Through Fog Computing

Nowadays, cyber threats (e.g., intrusions) are distributed across various networks with the dispersed networking resources. Intrusion detection systems (IDSs) have already become an essential solution to defend against a large amount of attacks. With the development of cloud computing, a modern IDS is able to implement more complicated detection algorithms by offloading the expensive operations such as the process of signature matching to the cloud (i.e., utilizing computing resources from the cloud). However, during the detection process, no party wants to disclose their own data especially sensitive information to others for privacy concerns, even to the cloud side. For this sake, privacy-preserving technology has been applied to IDSs, while it still lacks of proper solutions for a collaborative intrusion detection network (CIDN) due to geographical distribution. A CIDN enables a set of dispersed IDS nodes to exchange required information. With the advent of fog computing, in this paper, we propose a privacy-preserving framework for collaborative networks based on fog devices. Our study shows that the proposed framework can help reduce the workload on cloud’s side.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science , Cyber Security, Guangzhou University, City University of Hong Kong, Technical University of Denmark
Authors: Wang, Y. (Ekstern), Xie, L. (Ekstern), Li, W. (Ekstern), Meng, W. (Intern), Li, J. (Ekstern)
A probabilistic approach to urban flooding from sea surges in Copenhagen

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Department of Environmental Engineering, Urban Water Systems
Authors: Georgiadis, S. (Intern), Sørup, H. J. D. (Intern), Nielsen, B. F. (Intern), Arnbjerg-Nielsen, K. (Intern)
Pages: 658-662
Publication date: 2017

Host publication information
Title of host publication: Proceedings of 14th IWA/IAHR International Conference on Urban Drainage 2017
Publisher: IWA Publishing
Main Research Area: Technical/natural sciences
Conference: 14th IWA/IAHR International Conference on Urban Drainage 2017, Prague, Czech Republic, 10/09/2017 - 10/09/2017
Source: PublicationPreSubmission
Source-ID: 137138916
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

A Probabilistic Framework for Curve Evolution

In this work, we propose a nonparametric probabilistic framework for image segmentation using deformable models. We estimate an underlying probability distributions of image features from regions defined by a deformable curve. We then evolve the curve such that the distance between the distributions is increasing. The resulting active contour resembles a well studied piecewise constant Mumford-Shah model, but in a probabilistic setting. An important property of our framework is that it does not require a particular type of distributions in different image regions. Additional advantages of our approach include ability to handle textured images, simple generalization to multiple regions, and efficiency in computation. We test our probabilistic framework in combination with parametric (snakes) and geometric (level-sets) curves. The experimental results on composed and natural images demonstrate excellent properties of our framework.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Image Analysis & Computer Graphics
Authors: Dahl, V. A. (Intern), Dahl, A. B. (ed.) (Intern)
Pages: 421-32
Publication date: 2017

Host publication information
Title of host publication: Scale Space and Variational Methods in Computer Vision
Publisher: Springer
ISBN (Print): 9783319587707
A procedure for grouping food consumption data for use in food allergen risk assessment

Food allergic subjects need to avoid the allergenic food that triggers their allergy. However, foods can also contain unintended allergens. Food manufacturers or authorities need to perform a risk assessment to be able to decide if unintended allergen presence constitutes a risk to food allergic consumers. One of the input parameters in risk assessment is the amount of a given food consumed in a meal. There has been little emphasis on how food consumption data can be used in food allergen risk assessment. The aim of the study was to organize the complex datasets from National Food Consumption Surveys from different countries (France, Netherlands and Denmark) to be manageable in food allergen risk assessment. To do this, a two-step method was developed. First, based on initial groups of similar food items, the homogeneity of consumption was evaluated using a customized clustering method. Then, the risk was calculated for each initial food group and its subgroups to verify if it also represents a relevant difference in risk. Forty-eight food groups were designated in Denmark (53 in the Netherlands, 54 in France). Finally, summary statistics and names for each food group for the Danish data illustrate the results when applying the procedure.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, National Food Institute, Research Group for Gut Microbiology and Immunology, Division of Risk Assessment and Nutrition, The Netherlands Organization for Applied Scientific Research, ANSES - French Agency for Food, Environmental and Occupational Health & Safety
Authors: Birot, S. (Intern), Madsen, C. B. (Intern), Kruizinga, A. G. (Ekstern), Christensen, T. (Intern), Crépet, A. (Ekstern), Brockhoff, P. B. (Intern)
Pages: 111-123
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Food Composition and Analysis
Volume: 59
ISSN (Print): 0889-1575
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.402 SJR 1.054 CiteScore 3.12
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.15 SJR 1.095 SNIP 1.481
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.123 SNIP 1.613 CiteScore 2.99
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.164 SNIP 1.755 CiteScore 2.71
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.252 SNIP 1.684 CiteScore 2.8
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
A proof of the Barát-Thomassen conjecture

The Barát-Thomassen conjecture asserts that for every tree $T$ on $m$ edges, there exists a constant $k_T$ such that every $k_T$-edge-connected graph with size divisible by $m$ can be edge-decomposed into copies of $T$. So far this conjecture has only been verified when $T$ is a path or when $T$ has diameter at most 4. Here we prove the full statement of the conjecture.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Université Toulouse III - Paul Sabatier, École Normale Supérieure de Lyon
Authors: Bensmail, J. (Intern), Harutyunyan, A. (Ekstern), Le, T. N. (Ekstern), Merker, M. (Intern), Thomassé, S. (Ekstern)
Pages: 39-55
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information

Journal: Journal of Combinatorial Theory. Series B
Volume: 124
ISSN (Print): 0095-8956
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes

Food allergy, National Food Consumption Surveys, Food groups, Probabilistic risk assessment, Food analysis, Food composition, Automatic procedure, Allergen contamination

DOIs:
10.1016/j.jfca.2017.01.008
Source: FindIt
Source-ID: 2351238088
Publication: Research - peer-review › Journal article – Annual report year: 2017
A pseudo-Voigt component model for high-resolution recovery of constituent spectra in Raman spectroscopy

Raman spectroscopy is a well-known analytical technique for identifying and analyzing chemical species. Since Raman scattering is a weak effect, surface-enhanced Raman spectroscopy (SERS) is often employed to amplify the signal. SERS signal surface mapping is a common method for detecting trace amounts of target molecules. Since the method produces large amounts of data and, in the case of very low concentrations, low signal-to-noise (SNR) ratio, ability to extract relevant spectral features is crucial. We propose a pseudo-Voigt model as a constrained source separation model, that is able to directly and reliably identify the Raman modes, with overall performance similar to the state of the art non-negative matrix factorization approach. However, the model provides better interpretation and is a step towards enabling the use of SERS in detection of trace amounts of molecules in real-life settings.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, Department of Micro- and Nanotechnology, Nanoprobes, Center for Intelligent Drug Delivery and Sensing Using Microcontainers and Nanomechanics
Authors: Alstrøm, T. S. (Intern), Schmidt, M. N. (Intern), Rindzevicius, T. (Intern), Boisen, A. (Intern), Larsen, J. (Intern)
Pages: 2317-21
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 42nd IEEE International Conference on Acoustics, Speech and Signal Processing
Publisher: IEEE
ISBN (Print): 9781509041169
Main Research Area: Technical/natural sciences
Conference: 42nd IEEE International Conference on Acoustics, Speech and Signal Processing, New Orleans, United States, 05/03/2017 - 05/03/2017
Electronic versions: Untitled.pdf
DOIs: 10.1109/ICASSP.2017.7952570
Source: PublicationPreSubmission
Source-ID: 128987321
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Architecturally Significant Requirements identification, Classification and Change Management for Multi-tenant Cloud-Based Systems

Involvement of numerous stakeholders in cloud-based systems’ design and usage with varying degrees of nonfunctional requirements makes Architecturally Significant Requirements (ASRs) identification and management a challenge undertaking. The aim of the research presented in this chapter is to identify different types of design-time and run-time ASRs of the cloud-based systems, provide an ASRs classification scheme and present a framework to manage the requirements’ variability during life cycle of the cloud-based systems. We have used a multifaceted research approach to address the ASRs identification, classification, and change management challenges. We have explored findings from systematic as well as structured reviews of the literature on quality requirements of the cloud-based systems including but not limited to security, availability, scalability, privacy, and multi-tenancy. We have presented a framework for requirements classification and change management focusing on distributed Platform as a Service (PaaS) and Software as a Service (SaaS) systems as well as complex software ecosystems that are built using PaaS and SaaS, such as Tools as a Service (TaaS). We have demonstrated applicability of the framework on a selected set of the requirements for the cloud-based systems. The results of the research presented in this chapter show that key quality requirements of the cloud-based systems, for example, multi-tenancy and security, have a significant impact on how other quality requirements (such as scalability, reliability, and interoperability) are handled in the overall architecture design of a cloud-based system. It is important to distinguish tenant-specific run-time architecturally significant quality requirements and corresponding cloud-based systems’ components so that run-time status of the tenant-specific architecture quality requirements can be monitored and system configurations can be adjusted accordingly. For the systems that can be used by multiple tenants, the requirements change management framework should consider if the addition or modification (triggered by a specific tenant) of a quality requirement can impact quality requirements of other tenants, and whether or not a trade-off point should be introduced in the architecture (corresponding to the requirements). The trade-off point can also be referred as a variability point, that is, a compromise has to be made among the number of quality requirements and only some of the requirements can be satisfied. System analysts and software architects can use the proposed taxonomy and the management framework for identifying relevant quality requirements for multi-tenant cloud-based systems, for analyzing impact of changes in the requirements on the overall system architecture, and for managing variability of the architecturally significant requirements.
This paper presents a resource-efficient time-division multiplexing network interface of a network-on-chip intended for use in a multicore platform for hard real-time systems. The network-on-chip provides virtual circuits to move data between core-local on-chip memories. In such a platform, a change of the application’s operating mode may require reconfiguration of virtual circuits that are setup by the network-on-chip. A unique feature of our network interface is the instantaneous reconfiguration between different time-division multiplexing schedules, containing sets of virtual circuits, without affecting virtual circuits that persist across the reconfiguration. The results show that the worst-case latency from triggering a reconfiguration until the new schedule is executing is in the range of 300 clock cycles. Experiments show that new schedules can be transmitted from a single master to all slave nodes for a 16-core platform in between 500 and 3500 clock cycles. The results also show that the hardware cost for an FPGA implementation of our architecture is considerably smaller than other network-on-chips with similar reconfiguration functionalities, and that the worst-case time for a reconfiguration is smaller than that seen in functionally equivalent architectures.
A Riccati-Based Interior Point Method for Efficient Model Predictive Control of SISO Systems

This paper presents an algorithm for Model Predictive Control of SISO systems. Based on a quadratic objective in addition to (hard) input constraints it features soft upper as well as lower constraints on the output and an input rate-of-change penalty term. It keeps the deterministic and stochastic model parts separate. The controller is designed based on the deterministic model, while the Kalman filter results from the stochastic part. The controller is implemented as a primal-dual interior point (IP) method using Riccati recursion and the computational savings possible for SISO systems. In particular the computational complexity scales linearly with the control horizon. No warm-start strategies are considered. Numerical examples are included illustrating applications to Artificial Pancreas technology. We provide typical execution times for a single iteration of the IP algorithm and the number of iterations required for convergence in different situations.
A Robust Statistical Model to Predict the Future Value of the Milk Production of Dairy Cows Using Herd Recording Data

The future value of an individual dairy cow depends greatly on its projected milk yield. In developed countries with developed dairy industry infrastructures, facilities exist to record individual cow production and reproduction outcomes consistently and accurately. Accurate prediction of the future value of a dairy cow requires further detailed knowledge of the costs associated with feed, management practices, production systems, and disease. Here, we present a method to predict the future value of the milk production of a dairy cow based on herd recording data only. The method consists of several steps to evaluate lifetime milk production and individual cow somatic cell counts and to finally predict the average production for each day that the cow is alive. Herd recording data from 610 Danish Holstein herds were used to train and test a model predicting milk production (including factors associated with milk yield, somatic cell count, and the survival of individual cows). All estimated parameters were either herd- or cow-specific. The model prediction deviated, on average, less than 0.5 kg from the future average milk production of dairy cows in multiple herds after adjusting for the effect of somatic cell count. We conclude that estimates of future average production can be used on a day-to-day basis to rank cows for culling, or can be implemented in simulation models of within-herd disease spread to make operational decisions, such as culling versus treatment. An advantage of the approach presented in this paper is that it requires no specific knowledge of disease status or any other information beyond herd recorded milk yields, somatic cell counts, and reproductive status.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, National Veterinary Institute, Epidemiology, Dynamical Systems, University of Copenhagen
Authors: Græsbøll, K. (Intern), Kirkeby, C. T. (Intern), Nielsen, S. S. (Ekstern), Hisham Beshara Halasa, T. (Intern), Toft, N. (Intern), Christiansen, L. E. (Intern)
Number of pages: 9
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information

Journal: Frontiers in Veterinary Science
Volume: 4
Article number: 13
ISSN (Print): 2297-1769
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Artifacts and Visible Singularities in Limited Data X-Ray Tomography

We describe a principle to determine which features of an object will be easy to reconstruct from limited X-ray CT data and which will be difficult. The principle depends on the geometry of the data set, and it applies to any limited data set. We also describe a characterization of Fröken and the author explaining artifacts that can be added to limited angle reconstructions, and we provide an easy-to-implement method to decrease them. These ideas are justified using microlocal analysis, deep mathematics that involves Fourier theory. Reconstructions from simulated and real limited data are given to illustrate our ideas.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing
Authors: Quinto, T. (Intern)
Number of pages: 14
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Sensing and Imaging
Volume: 18
Issue number: 1
ISSN (Print): 1557-2064
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.581 SJR 0.255 CiteScore 0.95
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.236 SNIP 0.723 CiteScore 0.72
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.182 SNIP 0.945 CiteScore 0.59
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.178 SNIP 1.046 CiteScore 1.09
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.182 SNIP 0.583 CiteScore 0.59
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.164 SNIP 0.563 CiteScore 0.79
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.111 SNIP 0.417 CiteScore 0.47
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.429 SNIP 1.287
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.37 SNIP 1.123
BFI (2008): BFI-level 1
A simple island model with $N$ islands and migration occurring after every $m$ iterations is studied on the dynamic fitness function Maze. This model is equivalent to a parallel EA if $m = 1$, i.e., migration occurs during every iteration. It is proved that even for an increased offspring population size up to $N$, the parallel EA is still not able to track the optimum of Maze. If the migration interval is chosen carefully, the algorithm is able to track the optimum even for logarithmic $m$. The relationship of $m$ and the ability of the island model to track the optimum is then investigated more closely. Finally, experiments are performed to supplement the asymptotic results, and investigate the impact of the migration topology.
A Shared Scratchpad Memory with Synchronization Support

Multicore processors usually communicate via shared memory, which is backed up by a shared level 2 cache and a cache coherence protocol. However, this solution is not a good fit for real-time systems, where we need to provide tight guarantees on execution and memory access times. In this paper, we propose a shared scratchpad memory as a time-predictable communication and synchronization structure, instead of the level 2 cache. The shared on-chip memory is accessed via a time division multiplexing arbiter, isolating the execution time of load and store instructions between processing cores. Furthermore, the arbiter supports an extended time slot where an atomic load and store instruction can be executed to implement synchronization primitives. In the evaluation we show that a shared scratchpad memory is an efficient communication structure for a small number of processors; in our setup, 9 cores. Furthermore, we evaluate the efficiency of the synchronization support for implementation of classic locks.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, Technical University of Denmark
Authors: Hansen, H. E. (Ekstern), Maroun, E. J. (Ekstern), Kristensen, A. T. (Ekstern), Schoeberl, M. (Intern), Marquart, J. (Ekstern)
Number of pages: 6
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the IEEE NorCAS 2017
Publisher: IEEE
ISBN (Print): 978-1-5386-2844-7
Main Research Area: Technical/natural sciences
Conference: Nordic Circuits and Systems Conference (NORCAS): NORCHIP and International Symposium of System-on-Chip (SoC), Linköping, Sweden, 23/10/2017 - 23/10/2017
Electronic versions:
A Simulation-based Markov Decision Process for the Scheduling of Operating Theatres

General information
State: Published
Organisations: Department of Management Engineering, Management Science, Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Aalborg University
Authors: Andersen, A. R. (Intern), Nielsen, B. F. (Intern), Stidsen, T. J. R. (Intern), Reinhardt, L. B. (Ekstern)
Number of pages: 1
Publication date: 2017
Event: Abstract from European Conference on Stochastic Optimization 2017, Rom, Italy.
Main Research Area: Technical/natural sciences
Electronic versions: Abstract.pdf

Relations
Activities:
A Simulation-based Markov Decision Process for the Scheduling of Operating Theatres
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

A Stochastic Method to Manage Delay and Missing Values for In-Situ Sensors in an Alternating Activated Sludge Process
In the alternating activated sludge process with rule-based control, online N-measurements are of great importance for maintaining good control. These measurements can be delayed due to sensor processing time, turbulence at the location in the aeration tank where the sensor is placed, etc. The measurements may also be temporarily unavailable because of recalibration, communication faults or other errors. Here we present a method that handles such delay and missing observations. The model is based on zero order hold stochastic differential equations which use binary signals for influent flow and aeration to determine the state of the alternating process. It also uses measured ammonium and nitrate concentrations, which are shifted to account for delay. The method is developed and tested with data from a WWTP located in Kolding, Denmark. Results indicate that even though the model is simple, the model residuals and parameters are uncorrelated and the model predictions are 60% closer to the true values (measurements shifted to account for delay) than the delayed measurements are.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Department of Environmental Engineering, Urban Water Systems, Krüger A/S
Authors: Stentoft, P. A. (Intern), Munk-Nielsen, T. (Ekstern), Mikkelsen, P. S. (Intern), Madsen, H. (Intern)
Number of pages: 10
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 12th IWA Specialized Conference on Instrumentation, Control & Automation
Main Research Area: Technical/natural sciences
Conference: 12th IWA Specialized Conference on Instrumentation, Control & Automation, Québec, Canada, 11/06/2017 - 11/06/2017
Grey box, WWTP, Stochastic, Sensor delay, Alternating, ASP, Online control, In-situ sensor, Rule-based control
Source: PublicationPreSubmission
Source-ID: 140797706
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

A Study on Text-Score Disagreement in Online Reviews
In this paper, we focus on online reviews and employ artificial intelligence tools, taken from the cognitive computing field, to help understand the relationships between the textual part of the review and the assigned numerical score. We move from the intuitions that (1) a set of textual reviews expressing different sentiments may feature the same score (and vice-versa), and (2) detecting and analyzing the mismatches between the review content and the actual score may benefit both service providers and consumers, by highlighting specific factors of satisfaction (and dissatisfaction) in texts. To prove the intuitions, we adopt sentiment analysis techniques and we concentrate on hotel reviews, to find polarity mismatches therein. In particular, we first train a text classifier with a set of annotated hotel reviews, taken from the Booking website. Then, we analyze a large dataset, with around 160k hotel reviews collected from TripAdvisor, with the aim of detecting a polarity mismatch, indicating if the textual content of the review is in line, or not, with the associated score. Using well-
established artificial intelligence techniques and analyzing in depth the reviews featuring a mismatch between the text polarity and the score, we find that-on a scale of five stars-those reviews ranked with middle scores include a mixture of positive and negative aspects. The approach proposed here, beside acting as a polarity detector, provides an effective selection of reviews-on an initial very large dataset-that may allow both consumers and providers to focus directly on the review subset featuring a text/score disagreement, which conveniently convey to the user a summary of positive and negative features of the review target.

General information
State: Published
Organisations: Embedded Systems Engineering, Department of Applied Mathematics and Computer Science, Istituto di Informatica e Telematica, University of Padua
Authors: Fazzolari, M. (Ekstern), Cozza, V. (Ekstern), Petrocchi, M. (Ekstern), Spognardi, A. (Intern)
Pages: 689-701
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Cognitive Computation
Volume: 9
Issue number: 5
ISSN (Print): 1866-9956
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): CiteScore 3.77 SJR 0.906 SNIP 1.72
Web of Science (2017): Indexed Yes
Scopus rating (2016): CiteScore 2.98 SJR 0.854 SNIP 1.564
Scopus rating (2015): SJR 0.593 SNIP 0.984 CiteScore 1.86
Scopus rating (2014): SJR 0.462 SNIP 1.227 CiteScore 1.88
Scopus rating (2013): SJR 0.503 SNIP 1.025 CiteScore 1.5
ISI indexed (2013): ISI indexed yes
Scopus rating (2012): SJR 0.443 SNIP 1.093 CiteScore 1.44
ISI indexed (2012): ISI indexed no
Scopus rating (2011): SJR 0.396 SNIP 2.106 CiteScore 1.63
ISI indexed (2011): ISI indexed no
Scopus rating (2010): SJR 0.454 SNIP 1.283
Original language: English
Online Reviews, Natural Language Processing, Artificial Intelligence, Data Mining, Social Science Methods or Tools, Polarity Detection
DOIs:
10.1007/s12559-017-9496-y
Source: FindIt
Source-ID: 2372437861
Publication: Research - peer-review › Journal article – Annual report year: 2017

Asynchronous Distributed Execution of Fixpoint-Based Computational Fields
Coordination is essential for dynamic distributed systems whose components exhibit interactive and autonomous behaviors. Spatially distributed, locally interacting, propagating computational fields are particularly appealing for allowing components to join and leave with little or no overhead. Computational fields are a key ingredient of aggregate programming, a promising software engineering methodology particularly relevant for the Internet of Things. In our approach, space topology is represented by a fixed graph-shaped field, namely a network with attributes on both nodes and arcs, where arcs represent interaction capabilities between nodes. We propose a SMuC calculus where μ-calculus-like modal formulas represent how the values stored in neighbor nodes should be combined to update the present node. Fixpoint operations can be understood globally as recursive definitions, or locally as asynchronous converging propagation processes. We present a distributed implementation of our calculus. The translation is first done mapping SMuC programs into normal form, purely iterative programs and then into distributed programs. Some key results are presented that show convergence of fixpoint computations under fair asynchrony and under reinitialization of nodes. The first result allows nodes to proceed at different speeds, while the second one provides robustness against certain kinds of failure. We illustrate our approach with a case study based on a disaster recovery scenario, implemented in a prototype simulator that we use to evaluate the performance of a recovery strategy.

General information
State: Published
A systematic and practical method for selecting systems engineering tools

The complexity of many types of systems has grown considerably over the last decades. Using appropriate systems engineering tools therefore becomes increasingly important. Starting the tool selection process can be intimidating because organizations often only have a vague idea about what they need. The tremendous number of available tools
makes it difficult to get an overview and identify the best choice. Selecting wrong tools due to inappropriate analysis can have severe impact on the success of the company. This paper presents a systematic method for selecting systems engineering tools based on thorough analyses of the actual needs and the available tools. Grouping needs into categories, allow us to obtain a comprehensive set of requirements for the tools. The entire model-based systems engineering discipline was categorized for a modeling tool case to enable development of a tool specification. Correlating requirements and tool capabilities, enables us to identify the best tool for singletool scenarios or the best set of tools for multi-tool scenarios. In both scenarios, we use gap analysis to prevent selection of infeasible tools. We used the method to select a traceability tool that has been in successful operation since 2013 at GN Hearing. We further utilized the method to select a set of tools that we used on pilot cases at GN Hearing for modeling, simulating and formally verifying embedded systems.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, Copenhagen Center for Health Technology
Authors: Munck, A. (Intern), Madsen, J. (Intern)
Number of pages: 8
Pages: 201-208
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the Systems Conference (SysCon), 2017 Annual IEEE International
Publisher: IEEE
Main Research Area: Technical/natural sciences
Conference: 11th Annual IEEE International Systems Conference (SysCon) 2017, Montreal, Canada, 24/04/2017 - 24/04/2017
Intelligence
DOIs: 10.1109/SYSCON.2017.7934729
Source: FindIt
Source-ID: 2371000477
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

A taxonomy of distributed denial of service attacks
The Internet of Things revolution promises to make our lives much easier by providing us cheap and convenient smart devices, but all that glitters is not gold. This plethora of devices that flooded the market, generally poorly designed with respect to security aspects, brought back to the top Distributed Denial of Service (DDoS) attacks which are now even more powerful and easier to achieve than the past. Understanding how these attacks work, in all their different forms, represents a first crucial step to tackle this urgent issue. To this end, in this paper we propose a new up-to-date taxonomy and a comprehensive classification of current DDoS attacks.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, Örebro University
Authors: De Donno, M. (Intern), Giaretta, A. (Ekstern), Dragoni, N. (Intern), Spognardi, A. (Intern)
Pages: 100-7
Publication date: 2017

Host publication information
Title of host publication: Proceedings of 2017 International Conference on Information Society (i-Society)
Publisher: IEEE
ISBN (Print): 978-1-908320/86/5
Main Research Area: Technical/natural sciences
Conference: 2017 International Conference on Information Society, Dublin, Ireland, 17/07/2017 - 17/07/2017
DOIs: 10.23919/i-Society.2017.8354681
Source: FindIt
Source-ID: 2434426965
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

A Thermodynamic Library for Simulation and Optimization of Dynamic Processes
Process system tools, such as simulation and optimization of dynamic systems, are widely used in the process industries for development of operational strategies and control for process systems. These tools rely on thermodynamic models and
many thermodynamic models have been developed for different compounds and mixtures. However, rigorous thermodynamic models are generally computationally intensive and not available as open-source libraries for process simulation and optimization. In this paper, we describe the application of a novel open-source rigorous thermodynamic library, ThermoLib, which is designed for dynamic simulation and optimization of vapor-liquid processes. ThermoLib is implemented in Matlab and C and uses cubic equations of state to compute vapor and liquid phase thermodynamic properties. The novelty of ThermoLib is that it provides analytical first and second order derivatives. These derivatives are needed for efficient dynamic simulation and optimization. The analytical derivatives improve the computational performance by a factor between 12 and 35 as compared to finite difference approximations. We present two examples that use ThermoLib routines in their implementations: (1) simulation of a vapor-compression cycle, and (2) optimal control of an isoenergetic-isochoric flash separation process. The ThermoLib software used in this paper is distributed as open-source software at www.psetools.org.

General information
State: Published
Organisations: Center for Energy Resources Engineering, Department of Applied Mathematics and Computer Science, Scientific Computing
Authors: Ritschel, T. K. S. (Intern), Gaspar, J. (Intern), Jørgensen, J. B. (Intern)
Pages: 3542-3547
Publication date: 2017
Conference: 20th IFAC World Congress 2017, Toulouse, France, 09/07/2017 - 09/07/2017
Main Research Area: Technical/natural sciences

Publication information
Journal: IFAC-PapersOnLine
Volume: 50
Issue number: 1
ISSN (Print): 2405-8963
Ratings:
Scopus rating (2017): CiteScore 0.68 SJR 0.26 SNIP 0.434
Scopus rating (2016): CiteScore 0.45 SJR 0.234 SNIP 0.328
Scopus rating (2015): SJR 0.298 SNIP 0.39
Scopus rating (2014): SJR 0.298 SNIP 0.383
Scopus rating (2013): SJR 0.326 SNIP 0.41
Scopus rating (2012): SJR 0.265 SNIP 0.331
Scopus rating (2011): SJR 0.257 SNIP 0.324
Scopus rating (2010): SJR 0.197 SNIP 0.276
Scopus rating (2009): SJR 0.211 SNIP 0.29
Scopus rating (2008): SJR 0.172 SNIP 0.239
Scopus rating (2007): SJR 0.195 SNIP 0.271
Scopus rating (2006): SJR 0.21 SNIP 0.284
Scopus rating (2005): SJR 0.192 SNIP 0.445
Scopus rating (2004): SJR 0.245 SNIP 0.419
Scopus rating (2003): SJR 0.26 SNIP 0.403
Original language: English
Control and Systems Engineering, Dynamic optimization, Flash separation, Process simulation, Thermodynamic library, Vapor compression cycle, Vapor-liquid equilibrium
Electronic versions:
1_s2.0_S2405896317314234_main.pdf
DOIs:
10.1016/j.ifacol.2017.08.951
Source: FindIt
Source-ID: 2392249388
Publication: Research - peer-review › Conference article – Annual report year: 2017

Atomistic Galois insertions for flow sensitive integrity
Several program verification techniques assist in showing that software adheres to the required security policies. Such policies may be sensitive to the flow of execution and the verification may be supported by combinations of type systems and Hoare logics. However, this requires user assistance and to obtain full automation we shall explore the over-approximating nature of static analysis. We demonstrate that the use of atomistic Galois insertions constitutes a stable framework in which to obtain sound and fully automatic enforcement of flow sensitive integrity. The framework is illustrated on a concurrent language with local storage and polyadic synchronous communication.
A Top-down Approach to Genetic Circuit Synthesis and Optimized Technology Mapping

Genetic logic circuits are becoming popular as an emerging field of technology. They are composed of genetic parts of DNA and work inside a living cell to perform a dedicated boolean function triggered by the presence or absence of certain proteins or other species.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering
Authors: Baig, H. (Intern), Madsen, J. (Intern)
Number of pages: 2
Publication date: 2017

Host publication information
Title of host publication: Proceedings of 9th International Workshop on Bio-Design Automation
Main Research Area: Technical/natural sciences
Conference: 9th International Workshop on Bio-Design Automation, Pittsburgh, United States, 08/08/2017 - 08/08/2017
Electronic versions:
IWBDA_HB_JM.pdf
Source: PublicationPreSubmission
Source-ID: 134658523
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Augmented Reality Interfaces for Additive Manufacturing

This paper explores potential use cases for using augmented reality (AR) as a tool to operate industrial machines. As a baseline we use an additive manufacturing system, more commonly known as a 3D printer. We implement novel augmented interfaces and controls using readily available open source frameworks and low cost hardware. Our results show that the technology enables richer and more intuitive printer control and performance monitoring than currently available on the market. Therefore, there is a great deal of potential for these types of technologies in future digital factories.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Department of Mechanical Engineering, Manufacturing Engineering, Technical University of Denmark, MIT Media Lab
Pages: 515-525
Publication date: 2017

Host publication information
Title of host publication: Scandinavian Conference on Image Analysis
Publisher: Springer
Series: Lecture Notes in Computer Science
Volume: 10269
ISSN: 0302-9743
Main Research Area: Technical/natural sciences
Conference: 20th Scandinavian Conference on Image Analysis, Tromsø, Norway, 12/06/2017 - 12/06/2017
3D Printing, Additive manufacturing, Augmented reality
Electronic versions:
ar_for_am.pdf
DOIs:
10.1007/978-3-319-59126-1_43
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Authentication for E-Government in Developing Countries - With special focus on the North Africa Countries

Recently, many countries include both developed countries as well as developing countries have transformed paper based systems into electronic systems using ICT technologies in order to improve service delivery and reduce cost. Several researches and International Organizations in the field of e-Government reports that many countries over the world have not achieved transaction stages of government e-services and most of those countries are from developing...
countries. One of the main issues challenge government e-service inclusion is digital divide which barriers achieving principle of equal access and benefit of government e-service. Therefore, This thesis aims to investigate digital divide and IDM issues challenge government e-service in developing countries such as North Africa Countries (NAC) from achieving the principle of equal access in a secure manner. To achieve this aim we, developed a framework that consists of two components include digital divide variables and a simple IDM model in order to assess the current state of government e-service in NAC. Moreover, we analyzed the existing IDM protocol's concept to understand whether those concepts consider disadvantaged user's needs. Based on the identified challenges in NAC using the developed framework and the analysis of IDM protocol's concept we identify the requirements to be satisfied in order to allow large portion of citizens access and benefit of government e-service in equal and secure manner. One possible solution to improve e-Government inclusion is to consider vulnerable group needs such as the case in which users (citizens) do not have the ability either to read or write and as a result are excluded from e-services. Thus, a solution should enable such users to benefit from e-services. Introducing vulnerable group such as illiterate individuals might introduce new risks which have not existed in citizens-government face to face interaction. Thus, considering security property include confidentiality, integrity, non-repudiation and accountability for a proposed solution is needed. User authentication based on social relationship protocol is proposed in order to bridge digital divide. We formalized the proposed protocol as well as IDM protocol's concept using Open Source Fixed Point Model Checker tool (OFMC) To verify security properties include secrecy of exchanged information and authenticity of communication parties of the target protocols. OFMC is an automatic protocol security verification tool to identify the strengths of the verified protocol. Based on the verification result of OFMC tool, an attack is found against the existing IDM protocol's concept when considering vulnerable users while the proposed protocol has achieved the specified goals without an attack at least in one session. We also, performed a simple usability comparison between the proposed protocol and public kiosk service delivery channel and the proposed protocol shows its effectiveness as well as efficient.

General information
State: Submitted
Organisations: Cyber Security, Department of Applied Mathematics and Computer Science
Authors: Elaswad, O. (Intern), Jensen, C. D. (Intern)
Number of pages: 130
Publication date: 2017

Publication information
Publisher: DTU Compute
Original language: English

Series: DTU Compute PHD-2017
Volume: 455
ISSN: 0909-3192
Main Research Area: Technical/natural sciences

Relations
Projects:
Authentication for E-Government in Developing Countries - With special focus on the North Africa Countries
Publication: Research › Ph.D. thesis – Annual report year: 2017

Automated angular and translational tomographic alignment and application to phase-contrast imaging
X-ray computerized tomography (CT) is a 3D imaging technique that makes use of x-ray illumination and image reconstruction techniques to reproduce the internal cross-sections of a sample. Tomographic projection data usually require an initial relative alignment or knowledge of the exact object position and orientation with respect to the detector. As tomographic imaging reaches increasingly better resolution, thermal drifts, mechanical instabilities, and equipment limitations are becoming the main dominant factors contributing to sample positioning uncertainties that will further introduce reconstruction artifacts and limit the attained resolution in the final tomographic reconstruction. Alignment algorithms that require manual interaction impede data analysis with ever-increasing data acquisition rates, supplied by more brilliant sources. We present in this paper an iterative reconstruction algorithm for wrapped phase projection data and an alignment algorithm that automatically takes 5 degrees of freedom, including the possible linear and angular motion errors, into consideration. The presented concepts are applied to simulated and real measured phase-contrast data, exhibiting a possible improvement in the reconstruction resolution. A MATLAB implementation is made publicly available and will allow robust analysis of large volumes of phase-contrast tomography data.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Department of Energy Conversion and Storage, Imaging and Structural Analysis
Authors: Cunha Ramos, T. J. (Intern), Jørgensen, J. S. (Intern), Andreasen, J. W. (Intern)
Pages: 1830-1843
Publication date: 2017
Main Research Area: Technical/natural sciences
Automated specification and verification of Web-based applications

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Formal Methods, Consiglio Nazionale delle Ricerche
Authors: ter Beek, M. H. (Ekstern), Lluch Lafuente, A. (Intern)
Pages: 51-51
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Logical and Algebraic Methods in Programming
Volume: 87
Ratings:
Automated Segmentation of Abdominal Fat in MRI-Scans, Using Graph-Cuts and Image Derived Energies

For many clinical studies, changes in the abdominal distribution of fat are an important measure. However, the segmentation of abdominal fat in MRI scans is both difficult and time-consuming using manual methods. We present here an automatic and flexible software package, that performs both bias field correction and segmentation of the fat into superficial and deep subcutaneous fat as well as visceral fat with the spinal compartment removed. Assessment when comparing to the gold standard - CT-scans - shows a correlation and bias comparable to manual segmentation. The method is flexible by tuning the image-derived energies used for the segmentation, allowing the method to be applied to other body parts, such as the thighs.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Rector’s office, Statistics and Data Analysis, University of Copenhagen
Authors: Christensen, A. N. (Intern), Larsen, C. T. (Intern), Mandrup Jensen, C. M. (Ekstern), Petersen, M. B. (Ekstern), Larsen, R. (Intern), Conradsen, K. (Intern), Dahl, V. A. (Intern)
Pages: 109-120
Publication date: 2017

A Variational Study on BRDF Reconstruction in a Structured Light Scanner

Time-efficient acquisition of reflectance behavior together with surface geometry is a challenging problem. In this study, we investigate the impact of system parameter uncertainties when incorporating a data-driven BRDF reconstruction approach into the standard pipeline of a structured light scanning system. The parameters investigated include geometric detail of scanned objects; vertex positions and normals; and position and intensity of light sources. To have full control of uncertainties, experiments are carried out in a simulated environment, mimicking an actual structured light scanning setup. Results show that while uncertainties in vertex positions and normals have a high impact on the quality of reconstructed BRDFs, object geometry and light source properties have very little influence on the reconstructed BRDFs. With this analysis, practitioners now have insight in the tolerances required for accurate BRDF acquisition to work.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics
Authors: Nielsen, J. B. (Intern), Stets, J. D. (Intern), Lyngby, R. A. (Intern), Aanæs, H. (Intern), Dahl, A. B. (Intern), Frisvad, J. R. (Intern)
Number of pages: 10
Bayesian inference for spatio-temporal spike-and-slab priors

In this work, we address the problem of solving a series of underdetermined linear inverse problems subject to a sparsity constraint. We generalize the spike-and-slab prior distribution to encode a priori correlation of the support of the solution in both space and time by imposing a transformed Gaussian process on the spike-and-slab probabilities. An expectation propagation (EP) algorithm for posterior inference under the proposed model is derived. For large scale problems, the standard EP algorithm can be prohibitively slow. We therefore introduce three different approximation schemes to reduce the computational complexity. Finally, we demonstrate the proposed model using numerical experiments based on both synthetic and real data sets.
Bayesian Modelling of Functional Whole Brain Connectivity

This thesis deals with parcellation of whole-brain functional magnetic resonance imaging (fMRI) using Bayesian inference with mixture models tailored to the fMRI data. In the three included papers and manuscripts, we analyze two different approaches to modeling fMRI signal; either we accept the prevalent strategy of standardizing fMRI time series and model data using directional statistics or we model the variability in the signal across the brain and across multiple subjects. In either case, we use Bayesian nonparametric modeling to automatically learn from the fMRI data the number of functional units, i.e. parcels. We benchmark the proposed mixture models against state of the art methods of brain parcellation, both probabilistic and non-probabilistic.

The time series of each voxel are most often standardized using z-scoring which projects the time series data onto a hypersphere. This underlying manifold is often ignored and the data is modeled using Gaussian distributions. In one contribution, we show that using a mixture model based on the directional distribution, the von Mises-Fisher distribution, increase the reliability of inferred parcellations.

We develop a mixture model for modeling time-series using a Gaussian Process as a prior that is informed of the temporal dynamics of the data expected from the blood oxygenation level dependent (BOLD) signal. In two contributions, we explore the potential of this modeling framework. In the first, we show that this mixture model can delineate regions of task activation that can then be identified unsupervised. This forms a promising framework for unsupervised identification of task activated when the task design is unknown. In the final contribution, we evaluate the performance of the mixture model on the problem of clustering whole-brain fMRI. Based on both simulations on synthetic data and analysis of two fMRI datasets, we show that the model provides improved reliability of clustering compared to traditional clustering methods. Furthermore, the inferred parcellations provide the foundation for a method for increasing the reliability and sensitivity in analyses of task activation and for determining the networks of functionally connectivity in fMRI.

The proposed mixture models form promising tools for brain parcellation and we hope the methods can provide a nudge towards using probabilistic models for fMRI parcellation.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems
Authors: Røge, R. (Intern), Mørup, M. (Intern), Schmidt, M. N. (Intern)
Number of pages: 163
Publication date: 2017

Publication information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Original language: English
Bayesian state prediction of wind turbine bearing failure

A statistical approach to abstract and predict turbine states in an online manner has been developed. Online inference is performed on temperature measurement residuals to predict the failure state δn steps ahead of time. In this framework a case study is performed showing the ability to predict bearing failure 33 days, on average, ahead of time. The approach is based on the separability of the sufficient statistics and a hidden variable, namely the state length. The predictive probability is conditioned on the data available, as well as the state variables. It is shown that the predictive probability can be calculated by a model for the samples and a hazard function describing the probability for undergoing a state transition. This study is concerned with the prior training of the model, for which run-to-failure time series of bearing measurements are used. For the sample model prediction is conditioned on prior information and predict the next δn samples from a feature space spanned by the prior samples. By assuming that the feature space can be described by a multivariate Gaussian distribution, the prediction is treated as a Gaussian process over the feature space.
Bayesian inference, Classification, Data driven, Fault prediction, Machine learning, Wind turbines

Behavioural Profiling in Cyber-Social Systems

Computer systems have evolved from standalone systems, over networked systems, to cyber-physical systems. In all stages, human operators have been essential for the functioning of the system and for understanding system messages. Recent trends make human actors an even more central part of computer systems, resulting in what we call "cyber-social systems". In cyber-social systems, human actors and their interaction with a system are essential for the state of the system and its functioning. Both the system's operation and the human's operating it are based on an assumption of each other's behaviour. Consequently, an assessment of the state of a system must take the human actors and these interactions into account. However, human behaviour is difficult to model at best. While socio-technical system models promise the inclusion of human actors into a basis for system assessment, they lack the modelling mechanisms for human behaviour. Existing behavioural models, on the other side, mostly aim at explaining actions after an event. In this paper we discuss, how behavioural models can be used to profile actor behaviour either online or in simulations to understand the potential motivation and to test hypotheses.
Bent and bent(4) spectra of Boolean functions over finite fields

For c is an element of F(2)n, a c-bent4 function f from the finite field F(2)n to F-2 is a function with a flat spectrum with respect to the unitary transform V-f(c), which is designed to describe the component functions of modified planar functions. For c = 0 the transform V-f(c) reduces to the conventional Walsh transform, and hence a 0-bent4 function is bent. In this article we generalize the concept of partially bent functions to the transforms V-f(c). We show that every quadratic function is partially bent, and hence it is plateaued with respect to any of the transforms V-f(c). In detail we analyse two quadratic monomials. The first has values as small as possible in its spectra with respect to all transforms V-f(c), and the second has a flat spectrum for a large number of c. Moreover, we show that every quadratic function is c-bent4 for at least three distinct c. In the last part we analyse a cubic monomial. We show that it is c-bent(4) only for c = 1, the function is then called negabent, which shows that non-quadratic functions exhibit a different behaviour. (C) 2017 Elsevier Inc. All rights reserved.
Beskedent overtryk gav spektakulære følger
For at undertrykke generende opskumning blev en tank sat under et såkaldt "meget beskedent overtryk". Pludselig svigtede samlingen i bunden. Tanken nåede en højde på 30 m og faldt ned og knuste en varevogn. Uheldet viser, at et stort volumen af gas under lavt tryk indeholder en ikke uvæsentlig mængde energi.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science , Dynamical Systems, Statistics and Data Analysis
Authors: Hedlund, F. H. (Intern)
Pages: 16-18
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Kjemi
Volume: 77
Issue number: 1
ISSN (Print): 0023-1983
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Best practice for caching of single-path code
Single-path code has some unique properties that make it interesting to explore different caching and prefetching alternatives for the stream of instructions. In this paper, we explore different cache organizations and how they perform with single-path code.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, Vienna University of Technology
Authors: Schoeberl, M. (Intern), Cilku, B. (Ekstern), Prokesch, D. (Ekstern), Puschner, P. (Ekstern)
Number of pages: 10
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Open Access Series in Informatics
Volume: 57
ISSN (Print): 2190-6807
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: English
Method cache, Prefetching, Single-path code
Electronic versions:
OASIcs_WCET_2017_2.pdf
DOIs:
10.4230/OASIcs.WCET.2017.2
Source: Findit
Source-ID: 2394653551
Publication: Research - peer-review › Journal article – Annual report year: 2017

Best Practice for Caching of Single-Path Code
Single-path code has some unique properties that make it interesting to explore different caching and prefetching alternatives for the stream of instructions. In this paper, we explore different cache organizations and how they perform with single-path code.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, Vienna University of Technology
Authors: Schoeberl, M. (Intern), Cilku, B. (Ekstern), Prokesch, D. (Ekstern), Puschner, P. (Ekstern)
Number of pages: 10
Publication date: 2017
Main Research Area: Technical/natural sciences

Host publication information
Title of host publication: Proceedings of 17th International Workshop on Worst-Case Execution Time Analysis
Publisher: Schloss Dagstuhl - Leibniz-Zentrum fuer Informatik GmbH
ISBN (Electronic): 978-3-95977-057-6
BFI conference series: Worst-Case Execution Time Analysis (5010559)
Main Research Area: Technical/natural sciences
Conference: 17th International Workshop on Worst-Case Execution Time Analysis, Dubrovnik, Croatia, 27/06/2017 - 27/06/2017
Single-path, Method cache, Prefetching
Electronic versions:
WCET_2017_paper_2.pdf
Beyond Brainstorming: Exploring Convergence in Teams

Collaborative brainstorming is often followed by a convergence activity where teams extract the most promising ideas on a useful level of detail from the brainstorming results. Contrary to the wealth of research on electronic brainstorming, there is a dearth of research on convergence. We used experimental methods for an in-depth exploration of two facilitation-based interventions in a convergence activity: attention guidance (focusing participants on procedures to execute a convergence task) and discussion encouragement (engaging participants in conversations to combine knowledge on ideas). Our findings show that both attention guidance and discussion encouragement are correlated with higher convergence quality. We argue that attention guidance’s contribution is in its support of coordination, information processing, and goal specification. Similar, we argue that discussion encouragement’s contribution is in its stimulation of idea clarification and idea combination. Contrary to past research, our findings further show that satisfaction was higher after convergence than after brainstorming.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Software and Process Engineering, University of Innsbruck, University of South Florida
Authors: Seeber, I. (Ekstern), de Vreede, G. (Ekstern), Maier, R. (Ekstern), Weber, B. (Intern)
Number of pages: 31
Pages: 939-969
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Management Information Systems
Volume: 34
Issue number: 4
ISSN (Print): 0742-1222
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.459 SJR 2.489 CiteScore 3.22
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.08 SNIP 2.15 SJR 2.824
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.31 SNIP 2.408 SJR 2.661
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.8 SNIP 1.957 SJR 2.096
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 3.33 SNIP 1.741 SJR 1.688
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.67 SNIP 1.816 SJR 1.408
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 3.29 SNIP 2.392 SJR 1.883
BFI (2010): BFI-level 2
Scopus rating (2010): SNIP 2.502 SJR 2.596
BFI (2009): BFI-level 2
Scopus rating (2009): SNIP 2.21 SJR 2.05
BFI (2008): BFI-level 2
Scopus rating (2008): SNIP 2.13 SJR 2.053
Scopus rating (2007): SNIP 1.991 SJR 2.737
Scopus rating (2006): SNIP 2.325 SJR 2.044
Scopus rating (2005): SNIP 2.177 SJR 1.763
Big Data Analytics for Industrial Process Control

Today, in modern factories, each step in manufacturing produces a bulk of valuable as well as highly precise information. This provides a great opportunity for understanding the hidden statistical dependencies in the process. Systematic analysis and utilization of advanced analytical methods can lead towards more informed decisions. In this article we discuss some of the challenges related to big data analysis in manufacturing and relevant solutions to some of these challenges.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Aalborg University
Authors: Khan, A. R. (Ekstern), Schioler, H. (Ekstern), Kulahci, M. (Intern), Knudsen, T. S. (Ekstern)
Number of pages: 8
Publication date: 2017

Host publication information
Title of host publication: International Conference on Emerging Technologies and Factory Automation (etfa)
Publisher: IEEE
ISBN (Print): 9781509065059
Series: Emerging Technologies and Factory Automation (etfa), International Conference on
ISSN: 1946-0759
Main Research Area: Technical/natural sciences
Conference: 22nd IEEE International Conference on
Emerging Technologies And Factory Automation, Limassol, Cyprus, 12/09/2017 - 12/09/2017
Big data analytics for industrial process, Cloud Computing, Data Mining, Genetic Algorithm
Source: FindIt
Source-ID: 2399115274
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

Big Data hvor N=1
Forskningen vedrørende anvendelsen af ’big data’ indenfor sundhed er kun lige begyndt, og kan på sigt blive en stor hjælp i forhold til at tilrettelægge en mere personlig og helhedsorienteret sundhedsindsats for multisyrge. Personlig sundhedsstekologi, som kort præsenteres i dette kapitel, rummer et stor potentiale for at gennemføre ’big data’ analyser for den enkelte person, det vil sige hvor N=1. Der er store teknologiske udfordringer i at få lavet teknologier og metoder til at indsamle og håndtere personlige data, som kan deles, på tværs på en standardiseret, forsvarlig, robust, sikker og ikke mindst anonym faco.
Big data - modelling of midges in Europe using machine learning techniques and satellite imagery

Biting midges (Diptera, Ceratopogonidae) of the genus Culicoides are important vectors of pathogens causing diseases in free living and production animals and can lead to large economic losses in many European countries. In Europe, Culicoides imicola and the Obsoletus group are considered to be the main vectors of bluetongue virus that mostly affects ruminants such as cattle and sheep. Spatio-temporal modelling of vector distribution and abundance allows us to identify high risk areas for virus transmission and can aid in applying effective surveillance and control measures.

We used presence-absence and monthly abundance data of Culicoides from 1005 sites across 9 countries (Spain, France, Denmark, Poland, Switzerland, Austria, Poland, Sweden, Norway) collected between the years 2007 and 2013. The dataset included information on the vector species abundance (number of specimens caught per night), GPS coordinates of each trap, start and end dates of trapping. We used 120 environmental predictor variables together with Random Forest machine learning algorithms to predict the overall species distribution (probability of occurrence) and monthly abundance in Europe. We generated maps for every month of the year, to visualize the abundance of C. imicola and Obsoletus group in Europe as well as distribution maps showing the probability of occurrence.

We were able to create predictive maps of both Culicoides sp. occurrence and abundance using Random Forest models, and although the variance was large, the predicted abundance values for each site had a positive correlation with the observed abundance. We found relatively large spatial variations in probability of occurrence and abundance for both C. imicola and the Obsoletus group. For C. imicola probability of occurrence and abundance was higher in southern Spain, where as the Obsoletus group had higher probability of occurrence and abundance in central and northern Europe such as France and Germany. Temporal variation was also observed with higher abundance occurring during summer months and low or no abundance during winter months for both C. imicula and the Obsoletus group, although abundance was generally higher for a longer period of time for C. imicula than for the Obsoletus group.

Using machine learning techniques, we were able to model the spatial distribution in Europe for C. imicola and the Obsoletus group in terms of abundance and suitability (probability of occurrence). Our maps corresponded well with the previously reported distribution for C. imicola and the Obsoletus group. The observed seasonal variation was also consistent with reported population dynamics for Culicoides, as it depends on environmental factors such as temperature and rainfall. Longer seasonal abundance for C. imicula compared to the Obsoletus group can be explained by the species distribution, as C. imicula is limited to the southern parts of Europe where the warm season lasts longer, whereas the Obsoletus group is found further north. The outputs obtained here will be used as input for epidemiological models and can be helpful for determining high risk areas for disease transmission.

General information
State: Published
Organisations: National Veterinary Institute, Epidemiology, Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Universidad de Zaragoza, University of the Balearic Islands, Avia-GIS, Aarhus University, Roskilde University, National Veterinary Institute Sweden, Bernhard Nocht Institute for Tropical Medicine, National Veterinary Research Institute, Norwegian Veterinary Institute, Institute for Veterinary Public Health, Centre de cooperation Internationale en Recherche Agronomique pour le Développement, Université de Strasbourg, EID Méditerranée, University of Zurich
Number of pages: 2
Publication date: 2017
Biomass accident investigations – missed opportunities for learning and accident prevention
The past decade has seen a major increase in the production of energy from biomass. The growth has been mirrored in an increase of serious biomass related accidents involving fires, gas explosions, combustible dust explosions and the release of toxic gasses. There are indications that the number of bioenergy related accidents is growing faster than the energy production. This paper argues that biomass accidents, if properly investigated and lessons shared widely, provide ample opportunities for improving general hazard awareness and safety performance of the biomass industry. The paper examines selected serious accidents involving biogas and wood pellets in Denmark and argues that such opportunities for learning were missed because accident investigations were superficial, follow-up incomplete and information sharing absent. In one particularly distressing case, a facility saw a repeat accident, this time with fatal outcome, still without any learning taking place. The paper presents some information on other biomass accidents in Denmark, mostly involving biogas from anaerobic digestion. Details are lacking however, precisely because the accidents were insufficiently investigated and results not communicated. The biomass industry needs to pay more attention to safety. Utmost care should be taken to avoid so-called mediashifting i.e. that the resolution of a problem within one domain, the environmental, creates a new problem in another, the workplace safety domain.

Biomass Supply Planning for Combined Heat and Power Plants using Stochastic Programming
During the last years, the consumption of biomass to produce power and heat has increased due to the new carbon neutral policies. Nowadays, many district heating systems operate their combined heat and power (CHP) plants using different types of biomass instead of fossil fuel, especially to produce heat. Since biomass is transported from the supplier to the consumption sites and the contracts with the suppliers are negotiated months in advance, the negotiation process involves many uncertainties from the energy producer’s side. The demand for biomass is uncertain at the time of negotiation, and heat demand and electricity prices vary drastically during the planning period. Furthermore, the optimal operation of combined heat and power plants has to consider the existing synergies between the power and heating systems while always fulfilling the heat demand of the system. We propose a solution method using stochastic optimization to support the biomass supply planning for combined heat and power plants. Our two-phase approach combines mid-term decisions about biomass supply contracts with the short-term decisions regarding the optimal market participation of the producer to ensure profitability and feasibility. The risk of major deficits in biomass supply is reduced by including appropriate risk measures to the models. We present numerical results and an economic analysis based on a realistic test case.
Block factorization of step response model predictive control problems

By introducing a stage-wise prediction formulation that enables the use of highly efficient quadratic programming (QP) solution methods, this paper expands the computational toolbox for solving step response MPC problems. We propose a novel MPC scheme that is able to incorporate step response data in a traditional manner and use the computationally efficient block factorization facilities in QP solution methods. In order to solve the MPC problem efficiently, both tailored Riccati recursion and condensing algorithms are proposed and embedded into an interior-point method. The proposed algorithms were implemented in the HPMPC framework, and the performance is evaluated through simulation studies. The results confirm that a computationally fast controller is achieved, compared to the traditional step response MPC scheme that relies on an explicit prediction formulation. Moreover, the tailored condensing algorithm exhibits superior performance and produces solution times comparable to that achieved when using a condensing scheme for an equivalent (but much smaller) state-space model derived from first-principles. Implementation aspects necessary for high performance on embedded platforms are discussed, and results using a programmable logic controller are presented.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Department of Wind Energy, Norwegian University of Science and Technology
Authors: Kufoalor, D. K. (Ekstern), Frison, G. (Intern), Imsland, L. (Ekstern), Johansen, T. A. (Ekstern), Jørgensen, J. B. (Intern)
Number of pages: 14
Publications: 1-14
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Process Control
Volume: 53
ISSN (Print): 0959-1524
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.85 SJR 1.108 SNIP 1.971
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.41 SJR 1.037 SNIP 2.138
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.346 SNIP 2.028 CiteScore 3.35
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.397 SNIP 2.642 CiteScore 3.92
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.421 SNIP 2.537 CiteScore 3.47
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.435 SNIP 2.883 CiteScore 3.39
ISI indexed (2012): ISI indexed yes
Blowup for flat slow manifolds: Paper

In this paper, we present a way of extending the blowup method, in the formulation of Krupa and Szmolyan, to flat slow manifolds that lose hyperbolicity beyond any algebraic order. Although these manifolds have infinite co-dimensions, they do appear naturally in certain settings; for example, in (a) the regularization of piecewise smooth systems by tanh, (b) a particular aircraft landing dynamics model, and finally (c) in a model of earthquake faulting. We demonstrate the approach using a simple model system and the examples (a) and (b).
Blygsamt övertryck fick spektakulära följder
För att minska besvärande skumning sattes en tank under ”mycket blygsamt” övertryck. Plötsligt brast botten. Tanken för 30 meter upp i luften, föll ned och krossade en varubil. Olyckan visar att en stor gasvolym under lågt tryck innehåller en väsentlig mängd energi
Boganmeldelse: Pascal - Matematik og mirakler

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems
Authors: Hansen, V. L. (Intern)
Number of pages: 1
Pages: 44
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication Information
Journal: Aktuel Naturvidenskab
Volume: 2017
Issue number: 6
ISSN (Print): 1399-2309
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: English
Carl Henrik Koch
Electronic versions:
Anmeldelse_Pascal.pdf

Bibliographical note
Anmeldelse af bogen "Pascal - Matematik og mirakler" skrevet af Carl Henrik Koch.
Source: PublicationPreSubmission
Source-ID: 141012488
Publication: Communication › Literature review – Annual report year: 2017

Bounds on the stably recoverable information for the Helmholtz equation in $\mathbb{R}^2$

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Neutrons and X-rays for Materials Physics
Authors: Karamehmedovic, M. (Intern)
Number of pages: 1
Pages: 236-236
Publication date: 2017

Host publication information
Title of host publication: Applied Inverse Problems 2017
Article number: CT-2.3
Main Research Area: Technical/natural sciences
Conference: Applied Inverse Problems, Hangzhou, China, 29/05/2017 - 29/05/2017
Electronic versions:
Sider_fra_AIP_Abstract.pdf
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

BProVe: A formal verification framework for business process models

Business Process Modelling has acquired increasing relevance in software development. Available notations, such as BPMN, permit to describe activities of complex organisations. On the one hand, this shortens the communication gap between domain experts and IT specialists. On the other hand, this permits to clarify the characteristics of software systems introduced to provide automatic support for such activities. Nevertheless, the lack of formal semantics hinders the
automatic verification of relevant properties. This paper presents a novel verification framework for BPMN 2.0, called BProVe. It is based on an operational semantics, implemented using MAUDE, devised to make the verification general and effective. A complete tool chain, based on the Eclipse modelling environment, allows for rigorous modelling and analysis of Business Processes. The approach has been validated using more than one thousand models available on a publicly accessible repository. Besides showing the performance of BProVe, this validation demonstrates its practical benefits in identifying correctness issues in real models.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Formal Methods, University of Camerino
Authors: Corradini, F. (Ekstern), Fornari, F. (Ekstern), Polini, A. (Ekstern), Re, B. (Ekstern), Tiezzi, F. (Ekstern), Vandin, A. (Intern)
Number of pages: 12
Pages: 217-228
Publication date: 2017

Host publication information
Title of host publication: Proceedings of 2017 32nd IEEE/ACM International Conference on Automated Software Engineering (ASE)
Publisher: IEEE
ISBN (Print): 978-1-5386-3976-4
Main Research Area: Technical/natural sciences
Conference: 2017 32nd IEEE/ACM International Conference on Automated Software Engineering (ASE), Illinois, United States, 30/10/2017 - 30/10/2017
Electronic versions: 08115635.pdf
DOIs: 10.1109/ASE.2017.8115635
Source: FindIt
Source-ID: 2393789458
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

BProVe: Tool support for business process verification
This demo introduces BProVe, a tool supporting automated verification of Business Process models. BProVe analysis is based on a formal operational semantics defined for the BPMN 2.0 modelling language, and is provided as a freely accessible service that uses open standard formats as input data. Furthermore a plug-in for the Eclipse platform has been developed making available a tool chain supporting users in modelling and visualising, in a friendly manner, the results of the verification. Finally we have conducted a validation through more than one thousand models, showing the effectiveness of our verification tool in practice. (Demo video: https://youtu.be/iF5OM7vKtDA)

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Formal Methods, University of Camerino
Authors: Corradini, F. (Ekstern), Fornari, F. (Ekstern), Polini, A. (Ekstern), Re, B. (Ekstern), Tiezzi, F. (Ekstern), Vandin, A. (Intern)
Number of pages: 6
Pages: 937-942
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 2017 32nd IEEE/ACM International Conference on Automated Software Engineering (ASE)
Publisher: IEEE
ISBN (Print): 978-1-5386-3976-4
Main Research Area: Technical/natural sciences
Conference: 2017 32nd IEEE/ACM International Conference on Automated Software Engineering (ASE), Illinois, United States, 30/10/2017 - 30/10/2017
Electronic versions: 08115708.pdf
DOIs: 10.1109/ASE.2017.8115708
Source: FindIt
Source-ID: 2393789341
Brugen af R² i gymnasiet

Der lader til at være en vis forvirring blandt og uenighed mellem forskellige faggrupper omkring R²-værdien, også kaldet "forklaringsgraden" eller "determinationskoefficienten". Uenigheden omkring brugen og nytten af R² som et mål til at bekrive en statistisk model optøger ikke kun i gymnasiet; globalt set skaber brugen af R² tilsvarende gnidninger. Den anvendes rigtig meget i visse miljøer. Man kan imidlertid finde en del fagstatistikere, der vil tænde advarselslampen overfor forskellige over- og fejlfortolkninger af R²-værdien, som det er let at lade sig besnære af, og som mange miljøer uden tvivl gør sig skyldige i engang imellem.

For en fagstatistiker kan det derfor være fristende simpelthen at fraråde brugen af R² i det hele taget for at undgå, at folk fejlfortolker resultatet og/eller misbruger størrelsen. Med dette indspark håber vi at kunne bidrage til den fælles forståelse for hvad R² kan og ikke kan gøre for os, og pege på et alternativ, der i mange faglige sammenhænge kunne være en mere direkte størrelse at beregne.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Københavns Universitet
Authors: Brockhoff, P. B. (Intern), Hansen, E. (Ekstern), Ekstrøm, C. T. (Ekstern)
Number of pages: 5
Pages: 22-31
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: LMFK-Bladet
Volume: 2017
Issue number: 2
ISSN (Print): 0906-0855
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: English
Electronic versions:
LMFK2017_paper2.pdf

Bibliographical note
Artikal i LMFK-Bladet (non-review paper)
Source: PublicationPreSubmission
Source-ID: 140538853
Publication: Communication › Journal article – Annual report year: 2017

Brugen af R² i gymnasiet

Der lader til at være en vis forvirring blandt og uenighed mellem forskellige faggrupper omkring R²-værdien, også kaldet "forklaringsgraden" eller "determinationskoefficienten". Uenigheden omkring brugen og nytten af R² som et mål til at bekrive en statistisk model optøger ikke kun i gymnasiet; globalt set skaber brugen af R² tilsvarende gnidninger. Den anvendes rigtig meget i visse miljøer. Man kan imidlertid finde en del fagstatistikere, der vil tænde advarselslampen overfor forskellige over- og fejlfortolkninger af R²-værdien, som det er let at lade sig besnære af, og som mange miljøer uden tvivl gør sig skyldige i engang imellem. For en fagstatistiker kan det derfor være fristende simpelthen at fraråde brugen af R² i det hele taget for at undgå, at folk fejlfortolker resultatet og/eller misbruger størrelsen. Med dette indspark håber vi at kunne bidrage til den fælles forståelse for hvad R² kan og ikke kan gøre for os, og pege på et alternativ, der i mange faglige sammenhænge kunne være en mere direkte størrelse at beregne.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Københavns Universitet
Authors: Brockhoff, P. B. (Intern), Hansen, E. (Ekstern), Ekstrøm, C. T. (Ekstern)
Publication date: 2017
B-Spline Approximations of the Gaussian, their Gabor Frame Properties, and Approximately Dual Frames

We prove that Gabor systems generated by certain scaled B-splines can be considered as perturbations of the Gabor systems generated by the Gaussian, with a deviation within an arbitrary small tolerance whenever the order N of the B-spline is sufficiently large. As a consequence we show that for any choice of translation/modulation parameters (Formula presented.) with (Formula presented.), the scaled version of (Formula presented.) generates Gabor frames for N sufficiently large. Considering the Gabor frame decomposition generated by the Gaussian and a dual window, the results lead to estimates of the deviation from perfect reconstruction that arise when the Gaussian is replaced by a scaled B-spline, or when the dual window of the Gaussian is replaced by certain explicitly given and compactly supported linear combinations of the B-splines. In particular, this leads to a family of approximate dual windows of a very simple form, leading to almost perfect reconstruction within any desired error tolerance whenever the product ab is sufficiently small. In contrast, the known (exact) dual windows have a very complicated form. A similar analysis is sketched with the scaled B-splines replaced by certain truncations of the Gaussian. As a consequence of the approach we prove (mostly known) convergence results for the considered scaled B-splines to the Gaussian in the (Formula presented.)-spaces, as well in the time-domain as in the frequency domain.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics, Ulsan National Institute of Science and Technology, Yeungnam University
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Pages: 1-22
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Fourier Analysis and Applications
ISSN (Print): 1069-5869
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.537 SJR 1.024 CiteScore 1.27
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.09 SJR 0.753 SNIP 1.083
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.036 SNIP 1.351 CiteScore 1.42
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.11 SNIP 1.479 CiteScore 1.21
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.221 SNIP 1.512 CiteScore 1.23
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.993 SNIP 1.517 CiteScore 1.25
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.037 SNIP 2.424 CiteScore 2.7
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.232 SNIP 1.556
This paper proposes the cache-mesh, a dynamic mesh data structure in 3D that allows modifications of stored topological relations effortlessly. The cache-mesh can adapt to arbitrary problems and provide fast retrieval to the most-referred-to topological relations. This adaptation requires trivial extra effort in implementation with the cache-mesh, whereas it may require tremendous effort using traditional meshes. The cache-mesh also gives a further boost to the performance with parallel mesh processing by caching the partition of the mesh into independent sets. This is an additional advantage of the cache-mesh, and the extra work for caching is also trivial. Though it appears that it takes effort for initial implementation, building the cache-mesh is comparable to a traditional mesh in terms of implementation.
Cache timing attacks on recent microarchitectures

Cache timing attacks have been known for a long time, however since the rise of cloud computing and shared hardware resources, such attacks found new potentially devastating applications. One prominent example is S$\text{A}$ (presented by Irazoqui et al at S&P 2015) which is a cache timing attack against AES or similar algorithms in virtualized environments. This paper applies variants of this cache timing attack to Intel's latest generation of microprocessors. It enables a spy-process to recover cryptographic keys, interacting with the victim processes only over TCP. The threat model is a logically separated but CPU co-located attacker with root privileges. We report successful and practically verified applications of this attack against a wide range of microarchitectures, from a two-core Nehalem processor (i5-650) to two-core Haswell (i7-4600M) and four-core Skylake processors (i7-6700). The attack results in full key recovery. Compared to earlier processor generations, the attacks are more involved, but still of practical complexity, requiring between $2^{19}$ and $2^{21}$ encryptions. For the last two processors, the cache slice selection algorithm (CSSA) was not known before and had to be reverse engineered as part of this work. This is the first time CSSAs for the Skylake architecture are reported. Our attacks demonstrate that cryptographic applications in cloud computing environments using key-dependent tables for acceleration are still vulnerable even on recent architectures, including Skylake. Our reverse engineering of the CSSAs of these processors will also be beneficial for developers in many other contexts, for instance for implementing page colouring in modern operating systems.

Canards in stiction: on solutions of a friction oscillator by regularization

We study the solutions of a friction oscillator subject to stiction. This discontinuous model is nonFilippov, and the concept of Filippov solution cannot be used. Furthermore some Carathéodory solutions are unphysical. Therefore we introduce the concept of stiction solutions: these are the Carathéodory solutions that are physically relevant, i.e. the ones that follow the stiction law. However, we find that some of the stiction solutions are forward non-unique in subregions of the slip onset. We call these solutions singular, in contrast to the regular stiction solutions that are forward unique. In order to further the understanding of the non-unique dynamics, we introduce a regularization of the model. This gives a singularly perturbed problem that captures the main features of the original discontinuous problem. We identify a repelling slow manifold that separates the forward slipping to forward sticking solutions, leading to a high sensitivity to the initial conditions. On this slow manifold we find canard trajectories, that have the physical interpretation of delaying the slip onset. We show with numerics that the regularized problem has a family of periodic orbits interacting with the canards. We observe that this family has a saddle stability and that it connects, in the rigid body limit, the two regular, slip-stick branches of the discontinuous problem, that were otherwise disconnected.
**Canonical analysis of sentinel-1 radar and sentinel-2 optical data**

This paper gives results from joint analyses of dual polarimetry synthetic aperture radar data from the Sentinel-1 mission and optical data from the Sentinel-2 mission. The analyses are carried out by means of traditional canonical correlation analysis (CCA) and canonical information analysis (CIA). Where CCA is based on maximising correlation between linear combinations of the two data sets, CIA maximises mutual information between the two. CIA is a conceptually more pleasing method for the analysis of data with very different modalities such as radar and optical data. Although a little inconclusive as far as the change detection aspect is concerned, results show that CIA analysis gives conspicuously less noisy appearing images of canonical variates (CVs) than CCA. Also, the 2D histogram of the mutual information based leading CVs clearly reveals much more structure than the correlation based one. This gives promise for potentially better change detection results with CIA than can be obtained by means of CCA.

**General information**

State: Published  
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics  
Authors: Nielsen, A. A. (Intern), Larsen, R. (Intern)  
Pages: 147-158  
Publication date: 2017

**Host publication information**

Title of host publication: Image Analysis  
Volume: 10270  
Publisher: IEEE  
ISBN (Print): 9783319591285  
Series: Lecture Notes in Computer Science  
Volume: 10270  
ISSN: 0302-9743  
Main Research Area: Technical/natural sciences  
Conference: 20th Scandinavian Conference on Image Analysis, Tromsø, Norway, 12/06/2017 - 12/06/2017  
Theoretical Computer Science, Computer Science (all), Canonical correlation analysis, Canonical information analysis, Correlation methods, Information analysis, Radar, Synthetic aperture radar, 2-D histograms, Analysis of data, Canonical analysis, Change detection, Joint analysis, Linear combinations, Mutual informations, Image analysis  
Electronic versions: SCIA2017.pdf  
DOIs: 10.1007/978-3-319-59129-2_13  
Source: FindIt  
Source-ID: 2371747216  
Publication date: 2017

**Can Real-Time Systems Benefit from Dynamic Partial Reconfiguration?**

In real-time systems, a solution where hardware accelerators are used to implement computationally intensive tasks can be easier to analyze, in terms of worst-case execution time (WCET), than a pure software solution. However, when using FPGAs, the amount and the complexity of the hardware accelerators are limited by the resources available. Dynamic partial reconfiguration (DPR) of FPGAs can be used to overcome this limitation by replacing the accelerators that are only required for limited amounts of time with new ones. This paper investigates the potential benefits of using DPR to implement hardware accelerators in real-time systems and presents an experimental analysis of the trade-offs between hardware utilization and WCET increase due to the reconfiguration time overhead of DPR. We also investigate the trade-off between the use of multiple specialized accelerators combined with DPR instead of the use of a more general accelerator. The results show that, for computationally intensive tasks, the use of DPR can lead to a more efficient use of the FPGA, while maintaining comparable computational performance.

**General information**

State: Published  
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, Technical University of Denmark  
Authors: Pezzarossa, L. (Intern), Kristensen, A. T. (Ekstern), Schoeberl, M. (Intern), Sparse, J. (Intern)  
Number of pages: 6  
Publication date: 2017
Can smartphone-based electronic markers discriminate between patients with bipolar disorder, healthy first-degree relatives and healthy control individuals

General information
State: Published
Organisations: Copenhagen Center for Health Technology, Department of Applied Mathematics and Computer Science, Cognitive Systems, Center for Energy Resources Engineering, Embedded Systems Engineering
Authors: Stanislaus, S. (Ekstern), Faurholt-Jepsen, M. (Ekstern), Vinberg, M. (Ekstern), Winther, O. (Intern), Frost, M. G. (Intern), Bardram, J. E. (Intern), Kessing, L. (Ekstern)
Number of pages: 1
Pages: 128-128
Publication date: 2017
Conference: 19th Annual Conference of the International Society for Bipolar Disorders, Washington DC, United States, 04/05/2017 - 04/05/2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Bipolar Disorders (English Edition, Online)
Volume: 19
ISSN (Print): 1399-5618
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): SNIP 1.355 SJR 2.354 CiteScore 4.1
Web of Science (2017): Indexed Yes
Scopus rating (2016): CiteScore 4.35 SJR 2.481 SNIP 1.325
Scopus rating (2015): SJR 2.558 SNIP 1.488 CiteScore 4.68
Web of Science (2015): Indexed yes
Scopus rating (2014): SJR 3.286 SNIP 1.732 CiteScore 4.94
Scopus rating (2013): SJR 2.618 SNIP 1.509 CiteScore 4.8
Scopus rating (2012): SJR 3.084 SNIP 1.753 CiteScore 5.42
Scopus rating (2011): SJR 2.743 SNIP 1.625 CiteScore 4.84
Scopus rating (2010): SJR 2.711 SNIP 1.474
Scopus rating (2009): SJR 3.041 SNIP 1.566
Scopus rating (2008): SJR 2.764 SNIP 1.218
Scopus rating (2007): SJR 2.834 SNIP 1.368
Scopus rating (2006): SJR 2.228 SNIP 1.328
Scopus rating (2005): SJR 2.283 SNIP 1.128
Scopus rating (2004): SJR 2.23 SNIP 1.262
Scopus rating (2003): SJR 2.197 SNIP 0.988
Scopus rating (2002): SJR 2.48 SNIP 0.836
Scopus rating (2001): SJR 0.789 SNIP 0.653
Scopus rating (2000): SJR 1.096 SNIP 0.91
Original language: English
Source: FindIt
Source-ID: 2372727252
Caries affected by calcium and fluoride in drinking water and family income

Water quality and socioeconomics influence caries in populations. This study broadens previous studies on how caries is associated with fluoride and calcium in drinking water and with family income by quantifying the combined effect of the three independent variables. The effects of calcium and fluoride can be described as independent effects of the two ions or, alternatively, in the form of saturation with respect to fluorite (CaF$_2$). A general linear model describes this relationship with high significance and the model confirms the important protective effect of calcium and fluoride, independently against caries. From the model, the relative importance of fluoride and calcium to protect against caries is quantified. The relationship between caries and family income is also highly significant. It is illustrated how the linear model can be applied in planning and analyzing drinking water softening in relation to caries.
C code generation applied to nonlinear model predictive control for an artificial pancreas
This paper presents a method to generate C code from MATLAB code applied to a nonlinear model predictive control (NMPC) algorithm. The C code generation uses the MATLAB Coder Toolbox. It can drastically reduce the time required for development compared to a manual porting of code from MATLAB to C, while ensuring a reliable and fairly optimized code. We present an application of code generation to the numerical solution of nonlinear optimal control problems (OCP). The OCP uses a sequential quadratic programming algorithm with multiple shooting and sensitivity computation. We consider the problem of glucose regulation for people with type 1 diabetes as a case study. The average computation time when using generated C code is 0.21 s (MATLAB: 1.5 s), and the maximum computation time when using generated C code is 0.97 s (MATLAB: 5.7 s). Compared to the MATLAB implementation, generated C code can run in average more than 7 times faster.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing
Authors: Boiroux, D. (Intern), Jørgensen, J. B. (Intern)
Pages: 327-332
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 2017 21st International Conference on Process Control
Publisher: IEEE
ISBN (Print): 978-1-5386-4011-1
Series: 2017 21st International Conference on Process Control (pc)
Main Research Area: Technical/natural sciences
Conference: 2017 21st International Conference on Process Control, Štrbské Pleso, Slovakia, 06/06/2017 - 06/06/2017
MATLAB, Sensitivity, Optimization, Diabetes, Sugar, Approximation algorithms, Mathematical model
DOIs:
10.1109/PC.2017.7976235
Source: FindIt
Source-ID: 2372401149
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Cellular shear stiffness reflects progression of arsenic-induced transformation during G1
Cancer cells consistently exhibit decreased stiffness, however the onset and progression of this change has not been characterized. To study the development of cell stiffness changes we evaluated the shear stiffness of populations of cells during transformation to a carcinogenic state. Bronchial epithelial cells were exposed to sodium arsenite to initiate early stages of transformation. Exposed cells were cultured in soft agar to further transformation and select for clonal populations exhibiting anchorage independent growth. Shear stiffness of various cell populations in G1 was assessed using a novel non-invasive assay that applies shear stress with fluid flow and evaluates nano-scale deformation using quantitative phase imaging (QPI). Arsenic treated cells exhibited reduced stiffness relative to control cells, while arsenic clonal lines, selected by growth in soft agar, were found to have reduced stiffness relative to control clonal lines, which were cultured in soft agar but did not receive arsenic treatment. The relative standard deviation of the stiffness of Arsenic clones was reduced compared to control clones, as well as to the arsenic exposed cell population. Cell stiffness at the population level exhibits potential to be a novel and sensitive framework for identifying the development of cancerous cells.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, New York University School of Medicine, Duke University, University of Copenhagen
Authors: Muñoz, A. (Ekstern), Eldridge, W. J. (Ekstern), Jakobsen, N. M. (Intern), Sørensen, H. (Ekstern), Wax, A. (Ekstern), Costa, M. (Ekstern)
Pages: 109-117
Certified Soundness of Simplest Known Formulation of First-Order Logic

In 1965, Donald Monk published a paper about an axiomatic system for first-order predicate logic that he described as “the simplest known formulation of ordinary logic”. In this paper we show work in progress on certifying soundness of this system in the interactive proof assistant Isabelle. Through this work we demonstrate the usefulness of using proof assistants for validating mathematical results. This work also establishes an outline for future work such as a certified completeness proof of the axiomatic system in Isabelle.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Authors: Larsen, J. B. (Intern)
Pages: 25-36
Publication date: 2017

Change detection in a series of Sentinel-1 SAR data

Based on an omnibus likelihood ratio test statistic for the equality of several variance-covariance matrices following the complex Wishart distribution with an associated p-value and a factorization of this test statistic, change analysis in a time series of seven multilook, dual polarization Sentinel-1 SAR data in the covariance matrix representation (with diagonal elements only) is carried out. The omnibus test statistic and its factorization detect if and when change occurs. http://www.imm.dtu.dk/pubdb/p.php?6982.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, National Space Institute, Microwaves and Remote Sensing, Research Center Jülich GmbH
Authors: Nielsen, A. A. (Intern), Conradsen, K. (Intern), Skriver, H. (Intern), Canty, M. J. (Ekstern)
Number of pages: 3
Publication date: 2017

Change detection in multi-temporal dual polarization Sentinel-1 data

Based on an omnibus likelihood ratio test statistic for the equality of several variance-covariance matrices following the complex Wishart distribution with an associated p-value and a factorization of this test statistic, change analysis in a time series of 19 multilook, dual polarization Sentinel-1 SAR data in the covariance matrix representation (with diagonal elements only) is carried out. The omnibus test statistic and its factorization detect if and when change occurs.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, National Space Institute, Microwaves and Remote Sensing, Research Center Jülich GmbH
Authors: Nielsen, A. A. (Intern), Conradsen, K. (Intern), Skriver, H. (Intern), Canty, M. J. (Ekstern)
Number of pages: 3
Publication date: 2017
Characterisations of Partition of Unities Generated by Entire Functions in $C^d$

Collections of functions forming a partition of unity play an important role in analysis. In this paper we characterise for any $N \in \mathbb{N}$ the entire functions $P$ for which the partition of unity condition $\sum_{n \in \mathbb{Z}^d} P(x+n)\chi_{[0,N]^d}(x+n) = 1$ holds for all $x \in \mathbb{R}^d$. The general characterisation leads to various easy ways of constructing such entire functions as well. We demonstrate the flexibility of the approach by showing that additional properties like continuity or differentiability of the functions $(P \chi_{[0,N]^d})(\cdot+n)$ can be controlled. In particular, this leads to easy ways of constructing entire functions $P$ such that the functions in the partition of unity belong to the Feichtinger algebra.
Characterization of absorption enhancers for orally administered therapeutic peptides in tablet formulations - Applying statistical learning

To develop a successful oral formulation of insulin for treatment of type-2 diabetes patients would be a great milestone in terms of convenience. Besides protecting insulin from enzymatic cleavage in the small intestine, the formulation must overcome the intestinal epithelial barrier. Absorption enhancers are needed to ensure even a few percent of insulin are taken up. In thesis article 1, various methods to measure the effect of absorption enhancement and enzyme stability of insulin were applied. The major class of absorption enhancers is surfactant-like enhancers and is thought to promote absorption by mildly perturbing the epithelial membranes of the small intestine. The Caco-2 (Carcinoma Colon) cells can grow an artificial epithelial layer, and are used to test the potency of new absorption enhancers. This project was aimed to identify new absorption enhancers, that are both potent and sufficiently soluble. Quantitative structural activity relationship (QSAR) modeling is an empiric approach to learn relationships between molecular formulas and the biochemical properties using statistical models. A public data set testing the potency of absorption enhancers in Caco-2 was used to build a QSAR model to screen for new potent permeation enhancers. Thesis article 2 contains likely the first QSAR model to predict absorption enhancement. The model was verified by predicting molecules not tested before in Caco-2. The Caco-2 model overestimates the clinical effect of lipophilic permeation enhancers. In the Caco-2 model all reagents are pre-dissolved, and therefore the assay cannot predict critical solubility issues and bile salt interactions in the final tablet formulation. A QSAR solubility model was built to foresee and avoid slow tablet dissolution. Due to enzyme kinetics, slow tablet dissolution will allow most insulin to be deactivated by intestinal enzymes. The combined predictions of potency and solubility, will likely provide a more useful in-silico screening of potential permeation enhancers.

Random forest was used to learn relationships between molecular descriptors and potency or solubility. However, unlike multiple linear regression, the explicitly stated random forest model is complex, and therefore difficult to interpret and communicate. Any supervised regression model can be understood as a high dimensional surface connecting any possible combination of molecular properties with a given prediction. This high dimensional surface is also difficult to comprehend, but for random forests, it was discovered that a method, feature contributions, was especially useful to decompose and visualize model structures. The visualization technique was named forest floor and could replace the otherwise widely use technique partial dependence plots, especially in terms of discovering interactions in the model structure. Thesis article 3 describes the forest floor method. An R package forestFloor was developed to compute feature contributions and visualize these according to the ideas of thesis article 3. Better interpretation of random forest models is an exciting interdisciplinary field, as it allows investigators of many backgrounds to find fairly complicated relationships in data sets without in advance specifying what parameters to estimate. Forest floor was used to explain how potency and solubility were predicted by random forest models.
Characterization of the glucagon-like peptide-1 receptor in male mouse brain using a novel antibody and in situ hybridization

Glucagon-like peptide-1 (GLP-1) is a physiological regulator of appetite and long-acting GLP-1 receptor agonists (GLP-1RA) lower food intake and bodyweight in both human and animal studies. The effects are mediated through brain GLP-1Rs, and several brain nuclei expressing the GLP-1R may be involved. To date, mapping the complete location of GLP-1R protein in the brain has been challenged by lack of good antibodies and the discrepancy between mRNA and protein especially relevant in neuronal axonal processes. Here, we present a novel and specific monoclonal GLP-1R antibody for immunohistochemistry with murine tissue and show detailed distribution of GLP-1R expression as well as mapping of GLP-1R mRNA by non-radioactive in situ hybridization. Semi-automated image analysis was performed to map the GLP-1R distribution to atlas plates from the Allen Institute of Brain Science (AIBS). The GLP-1R was abundantly expressed in numerous regions including the septal nucleus, the hypothalamus and the brain stem. GLP-1R protein expression was also observed on neuronal projections in brain regions devoid of any mRNA which has not been observed in earlier reports. Taken together, these findings provide new knowledge on GLP-1R expression in neuronal cell bodies and neuronal projections.
Characterizing graphs of maximum matching width at most 2

The maximum matching width is a width-parameter that is defined on a branch-decomposition over the vertex set of a graph. The size of a maximum matching in the bipartite graph is used as a cut-function. In this paper, we characterize the graphs of maximum matching width at most 2 using the minor obstruction set. Also, we compute the exact value of the maximum matching width of a grid.

General information
State: Accepted/In press
Organisations: Department of Applied Mathematics and Computer Science, Korea Advanced Institute of Science & Technology
Authors: Jeong, J. (Ekstern), Ok, S. (Intern), Suh, G. (Ekstern)
Number of pages: 12
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Discrete Applied Mathematics
ISSN (Print): 0166-218X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
In this paper, we consider the notion of special treewidth, recently introduced by Courcelle (2012). In a special tree decomposition, for each vertex \( v \) in a given graph, the bags containing \( v \) form a rooted path. We show that the class of graphs of special treewidth at most two is closed under taking minors, and give the complete list of the six minor obstructions. As an intermediate result, we prove that every connected graph of special treewidth at most two can be constructed by arranging blocks of special treewidth at most two in a specific tree-like fashion. Inspired by the notion of special treewidth, we introduce three natural variants of treewidth, namely spaghetti treewidth, strongly chordal treewidth and directed spaghetti treewidth. All these parameters lie between pathwidth and treewidth, and we provide common structural properties on these parameters. For each parameter, we prove that the class of graphs having the parameter at
most two is minor closed, and we characterize those classes in terms of a tree of cycles with additional conditions. Finally, we show that for each $k \geq 3$, the class of graphs with special treewidth, spaghetti treewidth, directed spaghetti treewidth, or strongly chordal treewidth, respectively at most $k$, is not closed under taking minors.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, University of Bonn, Utrecht University, Eindhoven University of Technology, Maastricht University, Korea Advanced Institute of Science & Technology
Authors: Bodlaender, H. L. (Ekstern), Kratsch, S. (Ekstern), Kreuzen, V. J. (Ekstern), Kwon, O. (Ekstern), Ok, S. (Intern)
Number of pages: 18
Pages: 29–46
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Discrete Applied Mathematics
Volume: 216
Issue number: 1
ISSN (Print): 0166-218X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.216 SJR 0.785 CiteScore 1.05
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1 SJR 0.863 SNIP 1.244
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.804 SNIP 1.162 CiteScore 0.89
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.845 SNIP 1.353 CiteScore 0.99
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.751 SNIP 1.435 CiteScore 1.03
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.745 SNIP 1.304 CiteScore 1
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.79 SNIP 1.18 CiteScore 1.01
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.762 SNIP 1.133
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.764 SNIP 1.347
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.843 SNIP 1.506
Scopus rating (2007): SJR 0.786 SNIP 1.118
Scopus rating (2006): SJR 0.706 SNIP 1.15
Scopus rating (2005): SJR 0.708 SNIP 1.261
Scopus rating (2004): SJR 0.647 SNIP 1.205
Cheetah Experimental Platform Web 1.0: Cleaning Pupillary Data

Recently, researchers started using cognitive load in various settings, e.g., educational psychology, cognitive load theory, or human–computer interaction. Cognitive load characterizes a task's demand on the limited information processing capacity of the brain. The widespread adoption of eye-tracking devices led to increased attention for objectively measuring cognitive load via pupil dilation. However, this approach requires a standardized data processing routine to reliably measure cognitive load. This technical report presents CEP–Web, an open source platform to providing state of the art data processing routines for cleaning pupillary data combined with a graphical user interface, enabling the management of studies and subjects. Future developments will include the support for analyzing the cleaned data as well as support for Task–Evoked Pupillary Response (TEPR) studies.

Chords in longest cycles

If a graph G is 3-connected and has minimum degree at least 4, then some longest cycle in G has a chord. If G is 2-connected and cubic, then every longest cycle in G has a chord.
Choreographing Cyber-Physical Distributed Control Systems for the Energy Sector

Energy Systems are facing a significant change in the way their management and control is conceived. With the introduction of distributed and renewable energy based resources, a shift to a more distributed operation paradigm is emerging, overturning the conventional top-down design and operation principles. This shift creates a demand for distributed control systems (DCS) to facilitate a more adaptive and efficient operation of power networks. One key challenge here is to ensure the required reliability of distributed control systems. Whereas proven strategies exist for reliable control for coordination of physical actions, with increasing distribution of such control, the reliability and degradation properties in response to communications issues become more important. We build on the notion of Quality Choreographies, a formal model for the development of failure-aware distributed systems, and discuss how quality choreographies respond to the needs presented by DCS. We demonstrate their applicability by modelling the Bully Algorithm, one of the de-facto election algorithms used in coordination of DCS.

Chromatic number via Turán number

For a graph G and a family of graphs F, the general Kneser graph KG(G, F) is a graph with the vertex set consisting of all subgraphs of G isomorphic to some member of F and two vertices are adjacent if their corresponding subgraphs are edge disjoint. In this paper, we introduce some generalizations of Turán number of graphs. In view of these generalizations, we give some lower and upper bounds for the chromatic number of general Kneser graphs KG(G, F). Using these bounds, we determine the chromatic number of some family of general Kneser graphs KG(G, F) in terms of generalized Turán number of graphs. In particular, we determine the chromatic number of every Kneser multigraph KG(G, F) where G is a multigraph each of whose edges has the multiplicity at least 2 and F is an arbitrary family of simple graphs. Moreover, the chromatic number of general Kneser graph KG(G, F) is exactly determined where G is a dense graph and F = \{K1,2\}.
Chromatic number, General Kneser graph, Generalized Turán number

DOIs:
10.1016/j.disc.2017.05.010

Links:
http://arxiv.org/pdf/1401.0138
Class attendance, peer similarity, and academic performance in a large field study

Identifying the factors that determine academic performance is an essential part of educational research. Existing research indicates that class attendance is a useful predictor of subsequent course achievements. The majority of the literature is, however, based on surveys and self-reports, methods which have well-known systematic biases that lead to limitations on conclusions and generalizability as well as being costly to implement. Here we propose a novel method for measuring class attendance that overcomes these limitations by using location and Bluetooth data collected from smartphone sensors. Based on measured attendance data of nearly 1,000 undergraduate students, we demonstrate that early and consistent class attendance strongly correlates with academic performance. In addition, our novel dataset allows us to determine that attendance among social peers was substantially correlated (>0.5), suggesting either an important peer effect or homophily with respect to attendance.
CloudScan - A Configuration-Free Invoice Analysis System Using Recurrent Neural Networks

We present CloudScan; an invoice analysis system that requires zero configuration or upfront annotation. In contrast to previous work, CloudScan does not rely on templates of invoice layout, instead it learns a single global model of invoices that naturally generalizes to unseen invoice layouts. The model is trained using data automatically extracted from end-user provided feedback. This automatic training data extraction removes the requirement for users to annotate the data precisely. We describe a recurrent neural network model that can capture long range context and compare it to a baseline logistic regression model corresponding to the current CloudScan production system. We train and evaluate the system on 8 important fields using a dataset of 326,471 invoices. The recurrent neural network and baseline model achieve 0.891 and 0.887 average F1 scores respectively on seen invoice layouts. For the harder task of unseen invoice layouts, the recurrent neural network model outperforms the baseline with 0.840 average F1 compared to 0.788.

Cloud-shadow removal for Unmanned Aerial System multispectral imagery based on tensor decomposition methods
Cloud-shadow removal for Unmanned Aerial System multispectral imagery based on tensor decomposition methods

Multispectral images acquired on board of Unmanned Aerial Systems (UAS) provide unprecedented opportunities to monitor vegetation status and functioning at spatial scales compatible with field instrumentation and field management. UAS such as hexacopters acquire overlapping images that are mosaicked into larger images to produce ortho-photomaps. Frequently, especially in northern latitudes, the images to be mosaicked have been acquired under varying irradiance conditions due to moving clouds that create artifacts in the detected signal unrelated to physical changes in vegetation properties. In order to exploit the full potential of UAS, correction methods should be developed to provide ortho-rectified images that can provide robust estimates of vegetation properties. We applied a Tucker tensor decomposition method to reconstruct images using a four-way factorization scheme. By doing so, this study succeeded to remove the cloud shadow effects and image noise in UAS imagery providing normalized reflectance. The comparison between the corrected and un-corrected images shows a significant improvement for reflectance estimation in the shadow areas. Further, analysis of vegetation indices e.g. normalized difference vegetation index derived from the corrected and un-corrected images also showed improvement. This method could also have the ability to resolve artifacts, such as temporary objects (e.g. humans, tractors etc.) from the vegetation background.

Collaborative Affordances of Medical Records

This article proposes the concept of Collaborative Affordances to describe physical and digital properties (i.e., affordances) of an artifact, which affords coordination and collaboration in work. Collaborative Affordances build directly on Gibson (1977)’s affordance concept and extends the work by Sellen and Harper (2003) on the affordances of physical paper. Sellen and Harper describe how the physical properties of paper affords easy reading, navigation, mark-up, and writing, but focuses, we argue, mainly on individual use of paper and digital technology. As an extension to this, Collaborative Affordances focusses on the properties of physical and digital artifacts that affords collaborative activities. We apply the concept of Collaborative Affordances to the study of paper-based and electronic patient records in hospitals and detail how they afford collaboration through four types of Collaborative Affordances; being portable across patient wards and the entire hospital, by providing collocated access, by providing a shared overview of medical data, and by giving clinicians ways to maintain mutual awareness. We then discuss how the concept of Collaborative Affordances can be used in the design of new technology by providing a design study of a ‘Hybrid Patient Record’ (HyPR), which is designed to seamlessly blend and integrate paper-based with electronic patient records.
Combined shape and topology optimization for minimization of maximal von Mises stress

This work shows that a combined shape and topology optimization method can produce optimal 2D designs with minimal stress subject to a volume constraint. The method represents the surface explicitly and discretizes the domain into a simplicial complex which adapts both structural shape and topology. By performing repeated topology and shape optimizations and adaptive mesh updates, we can minimize the maximum von Mises stress using the p-norm stress measure with p-values as high as 30, provided that the stress is calculated with sufficient accuracy.
Company-University Collaboration Types As A Determinant For Knowledge Transfer
This paper develops a framework for a novel measurement of outcomes of different types of company-university collaboration. We test whether the level of formalization and the type of interaction influences the outcomes, in particular knowledge transfer. We extend the existing research by applying novel statistical computational methods form the field of natural language processing to identify the knowledge transfer. We investigate how the level of formalization of collaboration affects the knowledge transfer between universities and companies. Preliminary results indicate that we are able to identify additional forms of knowledge transfer and give companies insights into their potential benefits from different types of relationships. We propose a new perspective that enables companies to shape and adapt their external knowledge search as effective as possible.

Comparing chemical reaction networks: A categorical and algorithmic perspective
We study chemical reaction networks (CRNs) as a kernel model of concurrency provided with semantics based on ordinary differential equations. We investigate the problem of comparing two CRNs, i.e., to decide whether the solutions of a source and of a target CRN can be matched for an appropriate choice of initial conditions. Using a categorical framework, we extend and unify model-comparison approaches based on dynamical (semantic) and structural (syntactic) properties of CRNs. Then, we provide an algorithm to compare CRNs, running linearly in time with respect to the cardinality of all possible comparisons. Finally, using a prototype implementation, CAGE, we apply our results to biological models from the literature.
Publication information
Journal: Theoretical Computer Science
ISSN (Print): 0304-3975
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SJR 0.488 SNIP 0.996 CiteScore 1.08
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 0.97 SJR 0.547 SNIP 0.996
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.592 SNIP 1.123 CiteScore 1
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.669 SNIP 1.148 CiteScore 1.08
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.717 SNIP 1.297 CiteScore 1.17
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.78 SNIP 1.21 CiteScore 1.16
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.747 SNIP 1.246 CiteScore 1.17
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.839 SNIP 1.278
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 0.876 SNIP 1.434
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.098 SNIP 1.587
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.931 SNIP 1.576
Scopus rating (2006): SJR 0.834 SNIP 1.457
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.747 SNIP 1.438
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.717 SNIP 1.324
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.848 SNIP 1.494
Scopus rating (2002): SJR 0.729 SNIP 1.32
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.856 SNIP 1.473
Scopus rating (2000): SJR 0.492 SNIP 1.26
Scopus rating (1999): SJR 0.472 SNIP 1.115
Original language: English
Bisimulation, Chemical reaction networks, Model comparison, Ordinary differential equations
DOIs:
10.1016/j.tcs.2017.12.018
Comparison of Different Classification Algorithms for the Detection of User's Interaction with Windows in Office Buildings

Occupant behavior in terms of interactions with windows and heating systems is seen as one of the main sources of discrepancy between predicted and measured heating, ventilation and air conditioning (HVAC) building energy consumption. Thus, this work analyzes the performance of several classification algorithms for detecting occupant's interactions with windows, while taking the imbalanced properties of the available data set into account. The tested methods include support vector machines (SVM), random forests, and their combination with dynamic Bayesian networks (DBN). The results will show that random forests outperform all alternative approaches for identifying the window status in office buildings.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, RWTH Aachen University
Authors: Markovic, R. (Ekstern), Wolf, S. (Intern), Cao, J. (Ekstern), Spinnraker, E. (Ekstern), Wolki, D. (Ekstern), Frisch, J. (Ekstern), van Treeck, C. (Ekstern)
Number of pages: 6
Pages: 337-342
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Energy Procedia
Volume: 122
ISSN (Print): 1876-6102
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.44 SJR 0.495 SNIP 0.799
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.16 SJR 0.464 SNIP 0.598
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.359 SNIP 0.562 CiteScore 0.92
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.429 SNIP 0.807 CiteScore 1.09
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.42 SNIP 0.778 CiteScore 1.02
ISI indexed (2013): ISI indexed no
Web of Science (2013): Indexed yes
Scopus rating (2012): SJR 0.411 SNIP 0.55 CiteScore 1.08
ISI indexed (2012): ISI indexed no
Web of Science (2012): Indexed yes
Scopus rating (2011): SJR 0.877 SNIP 1.45 CiteScore 2.42
ISI indexed (2011): ISI indexed no
Scopus rating (2010): SJR 0.416 SNIP 0.91
Web of Science (2009): Indexed yes
Original language: English
Occupant behavior, Office buildings, Random forest, SVMs, Window opening
Electronic versions:
1_s2.0_S1876610217329375_main.pdf
DOIs:
10.1016/j.egypro.2017.07.333
Source: FindIt
Source-ID: 2390897793
Publication: Research - peer-review › Conference article – Annual report year: 2017
Comparison of three control strategies for optimization of spray dryer operation

Spray drying is the preferred process to reduce the water content of many chemicals, pharmaceuticals, and foodstuffs. A significant amount of energy is used in spray drying to remove water and produce a free flowing powder product. In this paper, we present and compare the performance of three controllers for operation of a four-stage spray dryer. The three controllers are a proportional-integral (PI) controller that is used in industrial practice for spray dryer operation, a linear model predictive controller with real-time optimization (MPC with RTO, MPC-RTO), and an economically optimizing nonlinear model predictive controller (E-NMPC). The MPC with RTO is based on the same linear state space model in the MPC and the RTO layer. The E-NMPC consists of a single optimization layer that uses a nonlinear system of ordinary differential equations for its predictions. The PI control strategy has a fixed target that is independent of the disturbances, while the MPC-RTO and the E-NMPC adapt the operating point to the disturbances. The goal of spray dryer operation is to optimize the profit of operation in the presence of feed composition and ambient air humidity variations; i.e. to maximize the production rate, while minimizing the energy consumption, keeping the residual moisture content of the powder below a maximum limit, and avoiding that the powder sticks to the chamber walls. We use an industrially recorded disturbance scenario in order to produce realistic simulations and conclusions. The key performance indicators such as the profit of operation, the product flow rate, the specific energy consumption, the energy efficiency, and the residual moisture content of the produced powder are computed and compared for the three controllers. In this simulation study, we find that the economic performance of the MPC with RTO as well as the E-NMPC is considerably improved compared to the PI control strategy used in industrial practice. The MPC with RTO improves the profit of operation by 8.61%, and the E-NMPC improve.

General Information
State: Published
Organisations: Scientific Computing, Department of Applied Mathematics and Computer Science, Dynamical Systems, Department of Electrical Engineering, Automation and Control, GEA Process Engineering A/S
Authors: Petersen, L. N. (Intern), Poulsen, N. K. (Intern), Niemann, H. H. (Intern), Utzen, C. (Ekstern), Jørgensen, J. B. (Intern)
Pages: 1-14
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Process Control
Volume: 57
ISSN (Print): 0959-1524
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.85 SJR 1.108 SNIP 1.971
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.41 SJR 1.037 SNIP 2.138
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.346 SNIP 2.028 CiteScore 3.35
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.397 SNIP 2.642 CiteScore 3.92
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.421 SNIP 2.537 CiteScore 3.47
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.435 SNIP 2.883 CiteScore 3.39
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.236 SNIP 2.535 CiteScore 2.9
Compensation for geometric modeling errors by positioning of electrodes in electrical impedance tomography: Paper

Electrical impedance tomography aims at reconstructing the conductivity inside a physical body from boundary measurements of current and voltage at a finite number of contact electrodes. In many practical applications, the shape of the imaged object is subject to considerable uncertainties that render reconstructing the internal conductivity impossible if they are not taken into account. This work numerically demonstrates that one can compensate for inaccurate modeling of the object boundary in two spatial dimensions by finding compatible locations and sizes for the electrodes as a part of a reconstruction algorithm. The numerical studies, which are based on both simulated and experimental data, are complemented by proving that the employed complete electrode model is approximately conformally invariant, which suggests that the obtained reconstructions in mismodeled domains reflect conformal images of the true targets. The numerical experiments also confirm that a similar approach does not, in general, lead to a functional algorithm in three dimensions.
Compositional Model Checking of Interlocking Systems for Lines with Multiple Stations

In the railway domain safety is guaranteed by an interlocking system which translates operational decisions into commands leading to field operations. Such a system is safety critical and demands thorough formal verification during its development process. Within this context, our work has focused on the extension of a compositional model checking approach to formally verify interlocking system models for lines with multiple stations. The idea of the approach is to decompose a model of the interlocking system by applying cuts at the network modelling level. The paper introduces an alternative cut (the linear cut) to a previously proposed cut (border cut). Powered with the linear cut, the model checking approach is then applied to the verification of an interlocking system controlling a real-world multiple station line.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Software and Process Engineering
Railway interlocking systems are responsible to grant exclusive access to a route, that is a sequence of track elements, through a station or a network. Formal verification that basic safety rules regarding exclusive access to routes are satisfied by an implementation is still a challenge for networks of large size due to the exponential computation time and resources needed. Some recent attempts to address this challenge adopt a compositional approach, targeted to track layouts that are easily decomposable into sub-networks such that a route is almost fully contained in a sub-network: in this way granting the access to a route is essentially a decision local to the sub-network, and the interfaces with the rest of the network easily abstract away less interesting details related to the external world. Following up on previous work, where we defined a compositional verification method that started considering routes that overlap between sub-networks in interlocking systems governing a multi-station line, we attack the verification of large networks, which are typically those in main stations of major cities, and where routes are very intertwined and can hardly be separated into sub-networks that are independent at some degree. At this regard, we study how the division of a complex network into sub-networks, using stub elements to abstract all the routes that are common between sub-networks, may still guarantee compositional safety properties.

Compositional Verification of Interlocking Systems for Large Stations

Railway interlocking systems are responsible to grant exclusive access to a route, that is a sequence of track elements, through a station or a network. Formal verification that basic safety rules regarding exclusive access to routes are satisfied by an implementation is still a challenge for networks of large size due to the exponential computation time and resources needed. Some recent attempts to address this challenge adopt a compositional approach, targeted to track layouts that are easily decomposable into sub-networks such that a route is almost fully contained in a sub-network: in this way granting the access to a route is essentially a decision local to the sub-network, and the interfaces with the rest of the network easily abstract away less interesting details related to the external world. Following up on previous work, where we defined a compositional verification method that started considering routes that overlap between sub-networks in interlocking systems governing a multi-station line, we attack the verification of large networks, which are typically those in main stations of major cities, and where routes are very intertwined and can hardly be separated into sub-networks that are independent at some degree. At this regard, we study how the division of a complex network into sub-networks, using stub elements to abstract all the routes that are common between sub-networks, may still guarantee compositional safety properties.
Compressed Subsequence Matching and Packed Tree Coloring

We present a new algorithm for subsequence matching in grammar compressed strings. Given a grammar of size \(n\) compressing a string of size \(N\) and a pattern string of size \(m\) over an alphabet of size \(\sigma\), our algorithm uses \(O(n+\frac{n\sigma}{w})\) space and \(O(n+\frac{n\sigma}{w}+m\log N\log w+\log \text{occ})\) time. Here \(w\) is the word size and \(\text{occ}\) is the number of minimal occurrences of the pattern. Our algorithm uses less space than previous algorithms and is also faster for \(\text{occ}=o(\frac{n}{\log N})\) occurrences. The algorithm uses a new data structure that allows us to efficiently find the next occurrence of a given character after a given position in a compressed string. This data structure in turn is based on a new data structure for the tree color problem, where the node colors are packed in bit strings.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science , Algorithms and Logic
Authors: Bille, P. (Intern), Cording, P. H. (Intern), Gørtz, I. L. (Intern)
Pages: 336–348
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information

Journal: Algorithmica
Volume: 77
Issue number: 2
ISSN (Print): 0178-4617
Ratings:
  - BFI (2018): BFI-level 2
  - Web of Science (2018): Indexed yes
  - BFI (2017): BFI-level 2
  - Scopus rating (2017): CiteScore 1.27 SJR 0.56 SNIP 1.354
  - Web of Science (2017): Indexed Yes
  - BFI (2016): BFI-level 2
  - Scopus rating (2016): CiteScore 1.11 SJR 0.646 SNIP 1.184
  - Web of Science (2016): Indexed yes
  - BFI (2015): BFI-level 2
  - Scopus rating (2015): SJR 0.739 SNIP 1.16 CiteScore 1.15
  - Web of Science (2015): Indexed yes
  - BFI (2014): BFI-level 2
  - Scopus rating (2014): SJR 0.854 SNIP 1.197 CiteScore 1.2
  - Web of Science (2014): Indexed yes
  - BFI (2013): BFI-level 2
  - Scopus rating (2013): SJR 0.952 SNIP 1.395 CiteScore 1.26
  - ISI indexed (2013): ISI indexed yes
  - BFI (2012): BFI-level 2
  - Scopus rating (2012): SJR 0.836 SNIP 1.204 CiteScore 0.99
  - ISI indexed (2012): ISI indexed yes
  - Web of Science (2012): Indexed yes
  - BFI (2011): BFI-level 2
  - Scopus rating (2011): SJR 0.848 SNIP 1.184 CiteScore 0.91
  - ISI indexed (2011): ISI indexed yes
  - Web of Science (2011): Indexed yes
  - BFI (2010): BFI-level 2
  - Scopus rating (2010): SJR 0.904 SNIP 1.317
  - BFI (2009): BFI-level 2
  - Scopus rating (2009): SJR 0.95 SNIP 1.351
  - BFI (2008): BFI-level 1
  - Scopus rating (2008): SJR 1.129 SNIP 1.218
  - Scopus rating (2007): SJR 0.99 SNIP 1.43
Computer-aided radiation therapy planning is an essential tool in the treatment of brain tumors. The aim is to deliver the optimal radiation dose to the targeted tumor while minimizing the dose to sensitive healthy structures called organs-at-risk (OARs). This process involves delineating the tumor and OARs on medical images of the patient's head to optimize the radiation dose plan.

Traditionally, this process is performed manually, which is time-consuming and poorly reproducible. There is a need for automated methods that can segment both brain tumors and OARs simultaneously. However, current methods struggle to handle the variability in tumor size, shape, and location, as well as the deformation and mass effect caused by the tumor.

The goal of this PhD-project was to develop automated segmentation methods that can handle both brain tumors and OARs. In the first part of the project, a model for tumor shape was developed and used in a fully automated generative method for brain tumor segmentation. This method performed favorably compared to state-of-the-art methods. In the second part, a probabilistic atlas-based model was developed to handle various OARs. This model was integrated into the previously used modeling framework, allowing for simultaneous segmentation of brain tumors and OARs, and adaptation to different imaging sequences.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics
Authors: Agn, M. (Intern), Van Leemput, K. (Intern), Larsen, R. (Intern)
Number of pages: 60
Publication date: 2017

Publication information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Original language: English
Series: DTU Compute PHD-2016
Number: 442
ISSN: 0909-3192
Main Research Area: Technical/natural sciences
Electronic versions: phd442_Agn_M.pdf

Relations
Projects:
Computational Modeling of Medical Images of Brain Tumor Patients for Optimized Radiation Therapy Planning
Publication: Research › Ph.D. thesis – Annual report year: 2017
Computational and analytical studies of degradation of wind turbine blade materials at the macro-, micro-, and nanoscale carried out by the modelling team of the Section Composites and Materials Mechanics, Department of Wind Energy, DTU, are reviewed. Examples of the analysis of the microstructural effects on the strength and fatigue life of composites are shown. Computational studies of degradation mechanisms of wind blade composites under tensile and compressive loading are presented. The effect of hybrid and nanoengineered structures on the performance of the composite was studied in computational experiments as well.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Department of Wind Energy, Composites and Materials Mechanics
Authors: Mikkelsen, L. P. (Intern), Mishnaevsky, L. (Intern)
Number of pages: 15
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Materials
Volume: 10
Issue number: 11
Article number: 1278
ISSN (Print): 1996-1944
Ratings:
- Web of Science (2018): Indexed yes
- Scopus rating (2017): CiteScore 3.02 SJR 0.732 SNIP 1.285
- Web of Science (2017): Indexed Yes
- Scopus rating (2016): CiteScore 3.26 SJR 0.838 SNIP 1.495
- Web of Science (2016): Indexed yes
- Scopus rating (2015): SJR 0.83 SNIP 1.457 CiteScore 3.11
- Scopus rating (2014): SJR 0.767 SNIP 1.229 CiteScore 2.69
- Web of Science (2014): Indexed yes
- Scopus rating (2013): SJR 1.001 SNIP 1.631 CiteScore 3.12
- ISI indexed (2013): ISI indexed yes
- Scopus rating (2012): SJR 0.841 SNIP 1.465
- ISI indexed (2012): ISI indexed no
- Scopus rating (2011): SJR 0.651 SNIP 1.212
- ISI indexed (2011): ISI indexed no
- Web of Science (2011): Indexed yes
- Scopus rating (2010): SJR 0.392 SNIP 0.981
Original language: English
Electronic versions:
- materials_10_01278_v2.pdf
DOIs: 10.3390/ma10111278
Source: PublicationPreSubmission
Source-ID: 139437169
Publication: Research - peer-review › Journal article – Annual report year: 2017

Computation of Phase Equilibrium and Phase Envelopes
In this technical report, we describe the computation of phase equilibrium and phase envelopes based on expressions for the fugacity coefficients. We derive those expressions from the residual Gibbs energy. We consider 1) ideal gases and liquids modeled with correlations from the DIPPR database and 2) nonideal gases and liquids modeled with cubic equations of state. Next, we derive the equilibrium conditions for an isothermal-isobaric (constant temperature, constant pressure) vapor-liquid equilibrium process (PT flash), and we present a method for the computation of phase envelopes. We formulate the involved equations in terms of the fugacity coefficients. We present expressions for the first-order derivatives. Such derivatives are necessary in computationally efficient gradient-based methods for solving the vapor-liquid equilibrium equations and for computing phase envelopes. Finally, we describe a Matlab program that computes the phase envelope of a mixture. We present the source code and discuss practical details of the implementation.

General information
Computer Vision for Additive Manufacturing.

Ever since the commercialization of additive manufacturing in the late 80’s, it has been clear what enormous potential the technology could have, potentially disrupting several industries. However, we have yet to see the technology fully adopted by the manufacturing industry. One of the issues that has prevented widespread adoption of 3D printing for use within manufacturing is the apparent lack of quality control during and after the printing process. This thesis demonstrates how computer vision may be applied in beneficial ways within additive manufacturing. The main contributions aim at solving part of the challenges required for the technology to reach its full envisioned potential, and to reach widespread industry adoption as a de-facto manufacturing modality. Quality control has been a major milestone to overcome in this regard. As a result, a core part of the contributions revolves around this central topic. The work is separated into three main categories: The first two concerning process and quality control of appearance and geometry. The third category concerns machine interaction paradigms within additive manufacturing. Here, challenges are addressed within the 3D ecosystem, aiming towards facilitating a fluid integration of additive manufacturing within the factory of tomorrow.
Contact activity and dynamics of the social core
Humans interact through numerous communication channels to build and maintain social connections: they meet face-to-face, make phone calls or send text messages, and interact via social media. Although it is known that the network of physical contacts, for example, is distinct from the network arising from communication events via phone calls and instant messages, the extent to which these networks differ is not clear. We show here that the network structure of these channels show large structural variations. The various channels account for diverse relationships between pairs of individuals and the corresponding interaction patterns across channels differ to an extent that social ties cannot easily be reduced to a single layer. Each network of interactions, however, contains both central and peripheral individuals: central members are characterized by higher connectivity and can reach a large fraction of the network within a low number of steps, in contrast to the nodes on the periphery. The origin and purpose of each communication network also determine the role of their respective central members: highly connected individuals in the person-to-person networks interact with their environment in a regular manner, while members central in the social communication networks display irregular behavior with respect to their physical contacts and are more active through irregular social events. Our results suggest that due to the inherently different functions of communication channels, each one favors different social behaviors and different strategies for interacting with the environment. These findings can facilitate the understanding of the varying roles and impact individuals have on the population, which can further shed light on the prediction and prevention of epidemic outbreaks, or information propagation.

Convergence of Crowdsourcing Ideas: A Cognitive Load perspective
Many organizations use crowdsourcing for problem solving, innovation, and consultation. In open innovation and community crowdsourcing initiatives the volume of generated ideas may prevent a careful evaluation if each individual contribution. To overcome this challenge, crowd workers can perform a convergence activity. Convergence involves reducing a large set of ideas to a focused subset of ideas that are worthy of further consideration. While convergence is a critical process for situations were large volumes of ideas must be processed, little is known what affects convergence quality and satisfaction with the convergence process and outcomes. We propose an experimental study that adopts Cognitive Load Theory as its theoretical lens to investigate the effects of task complexity, idea presentation, and instructional guidance on convergence quality and satisfaction. This study has the potential to further our understanding of convergence processes in crowdsourcing and inform the design and guidance of crowdsourcing initiatives.
Convergence on Self-Generated vs. Crowdsourced Ideas in Crisis Response: Comparing Social Exchange Processes and Satisfaction with Process

Social media allow crowds to generate many ideas to swiftly respond to events like crises, public policy discourse, or online town hall meetings. This allows organizations and governments to harness the innovative power of the crowd. As part of this setting, teams that process crowd ideas must engage in social exchange processes to converge on a few promising ideas. Traditionally, teams work on self-generated ideas. However, in a crowdsourcing scenario, such as public participation in crisis response, teams may have to process crowd-generated ideas. To better understand this new practice, it is important to investigate how converging on crowdsourced ideas affects the social exchange processes of teams and resulting outcomes. We conducted a laboratory experiment in which small teams working in a crisis response setting converged on self-generated or crowdsourced ideas in an emergency response context. Our findings suggest that teams converging on self-generated ideas have better social exchange processes in terms of dominance and coordination. We found support that evaluation and coordination positively affect team member satisfaction under both experimental conditions. Implications for research and practice are discussed.

Cooperative epistemic multi-agent planning for implicit coordination

Epistemic planning can be used for decision making in multi-agent situations with distributed knowledge and capabilities. Recently, Dynamic Epistemic Logic (DEL) has been shown to provide a very natural and expressive framework for epistemic planning. We extend the DEL-based epistemic planning framework to include perspective shifts, allowing us to define new notions of sequential and conditional planning with implicit coordination. With these, it is possible to solve planning tasks with joint goals in a decentralized manner without the agents having to negotiate about and commit to a joint policy at plan time. First we define the central planning notions and sketch the implementation of a planning system built on those notions. Afterwards we provide some case studies in order to evaluate the planner empirically and to show that the concept is useful for multi-agent systems in practice.
General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Albert Ludwigs Universität Freiburg
Authors: Engesser, T. (Ekstern), Bolander, T. (Intern), Mattmüller, R. (Ekstern), Nebel, B. (Ekstern)
Pages: 75-90
Publication date: 2017
Conference: 9th Workshop on Methods for Modalities, Kanpur, India, 08/01/2017 - 08/01/2017
BFI conference series: International Workshop on Methods for Modalities (5010598)
Main Research Area: Technical/natural sciences

Publication information
Journal: Electronic Proceedings in Theoretical Computer Science
Volume: 243
ISSN (Print): 2075-2180

Ratings:
Web of Science (2018): Indexed yes
Web of Science (2017): Indexed yes
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no

Original language: English
Software, Decision making, Central planning, Conditional planning, Distributed knowledge, Dynamic epistemic logic, Epistemic planning, Multi-agent planning, Planning systems, Planning tasks, Multi agent systems, Management, cs.AI, cs.LO, cs.MA

Electronic versions:
1703.02196.pdf
DOIs:
10.4204/EPTCS.243.6
Source: Findit
Source-ID: 2355416916
Publication: Research - peer-review › Conference article – Annual report year: 2017

Corrections to "Change Detection in Full and Dual Polarization, Single- and Multi-Frequency SAR Data"
When the covariance matrix formulation is used for multi-look polarimetric synthetic aperture radar (SAR) data, the complex Wishart distribution applies. Based on this distribution a test statistic for equality of two complex variance-covariance matrices and an associated asymptotic probability of obtaining a smaller value of the test statistic are given. In a case study airborne EMISAR C- and L-band SAR images from the spring of 1998 covering agricultural fields and wooded areas near Foulum, Denmark, are used in single- and bi-frequency, bi-temporal change detection with full and dual polarimetry data.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, National Space Institute, Microwaves and Remote Sensing
Authors: Nielsen, A. A. (Intern), Conradsen, K. (Intern), Skriver, H. (Intern)
Pages: 5143-5144
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Volume: 10
Issue number: 11
ISSN (Print): 1939-1404

Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.598 SJR 1.547 CiteScore 3.61
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Correlations between human mobility and social interaction reveal general activity patterns

A day in the life of a person involves a broad range of activities which are common across many people. Going beyond diurnal cycles, a central question is: to what extent do individuals act according to patterns shared across an entire population? Here we investigate the interplay between different activity types, namely communication, motion, and physical proximity by analyzing data collected from smartphones distributed among 638 individuals. We explore two central questions: Which underlying principles govern the formation of the activity patterns? Are the patterns specific to each individual or shared across the entire population? We find that statistics of the entire population allows us to successfully predict 71% of the activity and 85% of the inactivity involved in communication, mobility, and physical proximity. Surprisingly, individual level statistics only result in marginally better predictions, indicating that a majority of activity patterns are shared across our sample population. Finally, we predict short-term activity patterns using a generalized linear model, which suggests that a simple linear description might be sufficient to explain a wide range of actions, whether they be of social or of physical character.
Cyber-Physical Systems (CPS) are integrations of computation and physical processes, with distributed embedded computation units, connected by network, controlling and monitoring a physical plant. The development of physical...
components is essentially different from the object-oriented software of the computation units. A major challenge developing CPS, is the nonlinear interaction between the discrete domain of the computational units and the continuous domain of the physical process. Model based development of both discrete and continuous systems has significantly benefited from specialized modelling and simulation tools in each domain. However, to realize the full potential of CPS, the abstraction-level of models and simulation has to unify both computation and physical dynamics. A solution to this, is a so-called co-simulation where the coupled problem is divided into sub-systems where each constituent model can be solved by its optimum tool/solver in a distributed manner. This enables domain expert to work in domain specific tools while being able to simulate the complete CPS in a holistic manner. This dissertation provides a solution for doing co-simulation of CPS with distributed embedded control. This research has been conducted in collaboration with MAN Diesel & Turbo (MD&T) using their CPS, consisting of a two-stroke low speed engine with a distributed engine control system, as case study. Adapting a distributed control system to enable co-simulation is not trivial. How the lower layers of the embedded system software has been adapted to enable a deterministic and temporally controlled simulation will be presented. This includes how multiple controllers are compiled to dynamic link libraries that can be executed in parallel by a main process. A method for controlling execution and time progression on each controller has been developed along with a scheduling and network communication solution. To enable co-simulation with tools for modelling physical dynamics, the Functional Mockup Interface (FMI) standard for co-simulation has been implemented in the control system simulation. The solutions presented are validated through a set co-simulation experiments using the MD&T engine control system and different physical dynamic modelling tools. During the research new applications and requirements to the co-simulation environment was discovered. In large organizations like MD&T, tools, platforms and architecture used by different departments often deviate, making co-simulation and model exchange difficult. In collaboration with the EU Horizon 2020 project; Integrated Tool-chain for the model based design of Cyber-Physical Systems (INTO-CPS), a distributed co-simulation was made possible, that was able to co-simulate sub-systems of any architecture (32/64bit) and platform (Windows/Linux). Furthermore, when developing safety critical CPS that include a Human Machine Interface (HMI), the human interaction and cognitive assessment is of great importance. However, it is often difficult to obtain quantitative and evidence based data on the human in the loop. With an extension to the co-simulation environment it is possible to connect the control system simulation with the HMI in a hybrid co-simulation. In the hybrid co-simulation scenarios requiring human interaction can be formulated and tracked. The collected data can be used for analyzing the system applicability and intuitiveness, insuring correct and secure operation of MD&T engines. Validation and verification on hardware and engine test-benches is a major part of the development cost at MD&T. With the possibility of simulating the complete distributed control system, engineers are able to verify more of the component design before moving to the hardware test-benches. Furthermore, by introducing co-simulation, engineers can investigate and validate the holistic system dynamics during development before moving to the Engine test-bench and do model sharing between departments, reducing redundant modelling efforts. This research provides a solution for doing co-simulation of CPS with distributed control and proves that co-simulation can improve the development process, by reducing the amount of design and test loops during the design phase, thereby reducing the overall verification and validation cost.

**General information**

State: Submitted  
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering  
Authors: Pedersen, N. (Intern), Madsen, J. (Intern)  
Number of pages: 136  
Publication date: 2017

**Publication information**

Publisher: DTU Compute  
Original language: English  
Main Research Area: Technical/natural sciences

**Relations**

Projects:  
Co-Simulation of Cyber-Physical System with Distributed Embedded Control  
Publication: Research > Ph.D. thesis – Annual report year: 2017

**Cost-effective evolution of research prototypes into end-user tools: The MACH case study**

Much of Software Engineering research needs to provide an implementation as proof-of-concept. Often such implementations are created as exploratory prototypes without polished user interfaces, making it difficult to (1) run user studies to validate the tool's contribution, (2) validate the author's claim by fellow scientists, and (3) demonstrate the utility and value of the research contribution to any interested parties. However, turning an exploratory prototype into a “proper” tool for end-users often entails great effort. Heavyweight mainstream frameworks such as Eclipse do not address this issue; their steep learning curves constitute substantial entry barriers to such ecosystems.

In this paper, we present the Model Analyzer/Checker (MACH), a stand-alone tool with a command-line interpreter. MACH integrates a set of research prototypes for analyzing UML models. By choosing a simple command line interpreter rather than (costly) graphical user interface, we achieved the core goal of quickly deploying research results to a broader audience while keeping the required effort to an absolute minimum. We analyze MACH as a case study of how requirements and constraints in an academic environment influence design decisions in software tool development. We argue that our approach while perhaps unconventional, serves its purpose with a remarkable cost-benefit ratio.
In this article we count the number of \([n, k]\) generalized Reed–Solomon (GRS) codes, including the codes coming from a non-degenerate conic plus nucleus. We compare our results with known formulae for the number of \([n, 3]\) MDS codes with \(n = 6, 7, 8, 9\).

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics, Flinders University, Indian Institute of Science Education and Research Pune
Authors: Beelen, P. (Intern), Glynn, D. (Ekstern), Høholdt, T. (Intern), Kaipa, K. (Ekstern)
Pages: 777--790
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Advances in Mathematics of Communication
Volume: 11
Issue number: 4
ISSN (Print): 1930-5346
Ratings:
- BFI (2018): BFI-level 1
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Scopus rating (2017): SNIP 0.839 SJR 0.421 CiteScore 0.62
- Web of Science (2017): Indexed Yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 0.65 SJR 0.417 SNIP 0.845
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 0.512 SNIP 1.024 CiteScore 0.72
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 0.69 SNIP 1.273 CiteScore 0.84
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 0.675 SNIP 1.045 CiteScore 0.82
- ISI indexed (2013): ISI indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 0.456 SNIP 0.948 CiteScore 0.71
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 0.536 SNIP 0.913 CiteScore 0.66
- ISI indexed (2011): ISI indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 0.397 SNIP 0.976
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 0.289 SNIP 0.95
- BFI (2008): BFI-level 1
- Original language: English

Electronic versions:
BeelenGlynnHoeholdtKaipa_Copy.pdf
Creating Ultra Dense Point Correspondence Over the Entire Human Head

While the acquisition and analysis of 3D faces has been an active area of research for decades, it is still a complex and demanding task to accurately model the entire head and ears. Having accurate models would for example enable virtual design of hearing devices. In this paper, we describe a complete framework for surface registration of complete human heads where the result is point correspondence with a very high number of points. The method is based on a volumetric and multi-scale non-rigid registration of signed distance fields. The method is evaluated on a set of 30 human heads and the results are convincing. The output can for example be used to compute statistical shape models. The accuracy of predicted anatomical landmarks is on the level of experienced human operators.

Cross-Validation of a Glucose-Insulin-Glucagon Pharmacodynamics Model for Simulation using Data from Patients with Type 1 Diabetes

Background:
Currently, no consensus exists on a model describing endogenous glucose production (EGP) as a function of glucagon concentrations. Reliable simulations to determine the glucagon dose preventing or treating hypoglycemia or to tune a dual-hormone artificial pancreas control algorithm need a validated glucoregulatory model including the effect of glucagon.

Methods:
Eight type 1 diabetes (T1D) patients each received a subcutaneous (SC) bolus of insulin on four study days to induce mild hypoglycemia followed by a SC bolus of saline or 100, 200, or 300 µg of glucagon. Blood samples were analyzed for concentrations of glucagon, insulin, and glucose. We fitted pharmacokinetic (PK) models to insulin and glucagon data using maximum likelihood and maximum a posteriori estimation methods. Similarly, we fitted a pharmacodynamic (PD) model to glucose data. The PD model included multiplicative effects of insulin and glucagon on EGP. Bias and precision of PD model test fits were assessed by mean predictive error (MPE) and mean absolute predictive error (MAPE).

Results:
Assuming constant variables in a subject across nonoutlier visits and using thresholds of ±15% MPE and 20% MAPE, we accepted at least one and at most three PD model test fits in each of the seven subjects. Thus, we successfully validated the PD model by leave-one-out cross-validation in seven out of eight T1D patients.

Conclusions:
The PD model accurately simulates glucose excursions based on plasma insulin and glucagon concentrations. The
reported PK/PD model including equations and fitted parameters allows for in silico experiments that may help improve diabetes treatment involving glucagon for prevention of hypoglycemia.

### General information

**State:** Published  
**Organisations:** Department of Applied Mathematics and Computer Science, Scientific Computing, Dynamical Systems, Copenhagen Center for Health Technology, Center for Energy Resources Engineering, Copenhagen University Hospital, Zealand Pharma A/S  
**Authors:** Wendt, S. L. (Intern), Ranjan, A. (Forskerdatabase), Møller, J. K. (Intern), Schmidt, S. (Ekstern), Boye Knudsen, C. (Ekstern), Holst, J. J. (Ekstern), Madsbad, S. (Ekstern), Madsbad, S. (Ekstern), Madsen, H. (Intern), Nørgaard, K. (Ekstern), Jørgensen, J. B. (Intern)  
**Pages:** 1101-1111  
**Publication date:** 2017  
**Main Research Area:** Technical/natural sciences

### Publication information

**Journal:** Journal of Diabetes Science and Technology  
**Volume:** 11  
**Issue number:** 6  
**ISSN (Print):** 1932-2968  
**Web of Science (2018):** Indexed yes  
**BFI (2018):** BFI-level 1  
**Scopus rating (2017):** SNIP 1.109 SJR 1.256 CiteScore 2.48  
**Web of Science (2017):** Indexed yes  
**BFI (2016):** BFI-level 1  
**Scopus rating (2016):** CiteScore 2.14 SJR 0.875 SNIP 1.078  
**BFI (2015):** BFI-level 1  
**Scopus rating (2015):** SJR 0.934 SNIP 0.971 CiteScore 1.99  
**BFI (2014):** BFI-level 1  
**Scopus rating (2014):** SJR 0.882 SNIP 0.955 CiteScore 1.84  
**BFI (2013):** BFI-level 1  
**Scopus rating (2013):** SJR 0.785 SNIP 0.921 CiteScore 2.19  
**ISI indexed (2013):** ISI indexed no  
**BFI (2012):** BFI-level 1  
**Scopus rating (2012):** SJR 0.711 SNIP 0.976 CiteScore 1.33  
**ISI indexed (2012):** ISI indexed no  
**BFI (2011):** BFI-level 1  
**Scopus rating (2011):** SJR 0.691 SNIP 0.904 CiteScore 0.6  
**ISI indexed (2011):** ISI indexed no  
**BFI (2010):** BFI-level 1  
**Scopus rating (2010):** SJR 0.463 SNIP 0.669  
**BFI (2009):** BFI-level 1  
**Scopus rating (2009):** SJR 0.242 SNIP 0.534  
**BFI (2008):** BFI-level 1  
**Scopus rating (2008):** SJR 0.229 SNIP 0.406  
**Original language:** English  
**Cross-validation, Glucagon, Glucoregulatory model, Parameter Estimation, Simulation model, Type 1 diabetes**

### Cycles through all finite vertex sets in infinite graphs

A closed curve in the Freudenthal compactification $|G|$ of an infinite locally finite graph $G$ is called a Hamiltonian curve if it meets every vertex of $G$ exactly once (and hence it meets every end at least once). We prove that $|G|$ has a Hamiltonian
curve if and only if every finite vertex set of G is contained in a cycle of G. We apply this to extend a number of results and conjectures on finite graphs to Hamiltonian curves in infinite locally finite graphs. For example, Barnette’s conjecture (that every finite planar cubic 3-connected bipartite graph is Hamiltonian) is equivalent to the statement that every one-ended planar cubic 3-connected bipartite graph has a Hamiltonian curve. It is also equivalent to the statement that every planar cubic 3-connected bipartite graph with a nowhere-zero 3-flow (with no restriction on the number of ends) has a Hamiltonian curve. However, there are 7-ended planar cubic 3-connected bipartite graphs that do not have a Hamiltonian curve.

General information
State: Published
Organisations: Algorithms and Logic, Department of Applied Mathematics and Computer Science, Northwestern Polytechnical University
Authors: Kundgen, A. (Intern), Li, B. (Ekstern), Thomassen, C. (Intern)
Pages: 259–275
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: European Journal of Combinatorics
Volume: 65
ISSN (Print): 0195-6698
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.503 SJR 1.38 CiteScore 0.99
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.75 SJR 1.029 SNIP 1.154
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.051 SNIP 1.089 CiteScore 0.68
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.014 SNIP 1.155 CiteScore 0.75
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.066 SNIP 1.423 CiteScore 0.85
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.104 SNIP 1.38 CiteScore 0.77
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.192 SNIP 1.218 CiteScore 0.78
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.235 SNIP 1.094
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.223 SNIP 1.229
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.186 SNIP 1.359
Scopus rating (2007): SJR 1.312 SNIP 1.476
Scopus rating (2006): SJR 1.321 SNIP 1.26
Scopus rating (2005): SJR 0.866 SNIP 0.945
Scopus rating (2004): SJR 0.767 SNIP 1.021
Scopus rating (2003): SJR 1.118 SNIP 0.913
Scopus rating (2002): SJR 0.71 SNIP 1.267
Scopus rating (2001): SJR 0.893 SNIP 0.751
Scopus rating (2000): SJR 1.107 SNIP 0.895
Scopus rating (1999): SJR 1.115 SNIP 0.888
Original language: English
DOIs:
10.1016/j.ejc.2017.06.006
Data Descriptor: A multiscale imaging and modelling dataset of the human inner ear

Understanding the human inner ear anatomy and its internal structures is paramount to advance hearing implant technology. While the emergence of imaging devices allowed researchers to improve understanding of intracochlear structures, the difficulties to collect appropriate data has resulted in studies conducted with few samples. To assist the cochlear research community, a large collection of human temporal bone images is being made available. This data descriptor, therefore, describes a rich set of image volumes acquired using cone beam computed tomography and micro-CT modalities, accompanied by manual delineations of the cochlea and sub-compartments, a statistical shape model encoding its anatomical variability, and data for electrode insertion and electrical simulations. This data makes an important asset for future studies in need of high-resolution data and related statistical data objects of the cochlea used to leverage scientific hypotheses. It is of relevance to anatomists, audiologists, computer scientists in the different domains of image analysis, computer simulations, imaging formation, and for biomedical engineers designing new strategies for cochlear implantations, electrode design, and others.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Scientific Computing, University of Bern, Alma IT Systems, Scanco Medical AG, MED-EL GMBH, Universitat Pompeu Fabra, University Hospital of Bern, Catalan Institution for Research and Advanced Studies, Technical University of Munich
Number of pages: 12
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Scientific Data
Volume: 4
Article number: 170132
ISSN (Print): 2052-4463
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): CiteScore 6.08 SJR 3.026 SNIP 2.291
Scopus rating (2016): CiteScore 4.8 SJR 3.261 SNIP 2.059
Scopus rating (2015): SNIP 1.373 SJR 2.187
Original language: English
Electronic versions:
sdata2017132.pdf
DOIs:
10.1038/sdata.2017.132
Source: FindIt
Source-ID: 2390770382
Publication: Research - peer-review › Journal article – Annual report year: 2017

Data Mining and Visualization of Large Human Behavior Data Sets

Traditional methods for studying human behavior such as surveys and manual collection are expensive, time-consuming and therefore cannot be easily applied at large scale. In recent years an explosive amount of digital traces of human activity – for example social network interactions, emails and credit card transactions – have provided us new sources for studying our behavior. In particular smartphones have emerged as new tools for collecting data about human activity, thanks to their sensing capabilities and their ubiquity. This thesis investigates the question of what we can learn about human behavior from this rich and pervasive mobile sensing data. In the first part, we describe a large-scale data collection deployment collecting high-resolution data for over 800 students at the Technical University of Denmark using smartphones, including location, social proximity, calls and SMS. We provide an overview of the technical infrastructure, the experimental design, and the privacy measures. The second part investigates the usage of this mobile sensing data for understanding personal behavior. We describe two large-scale user studies on the deployment of self-tracking apps, in order to understand the patterns of usage and non-usage. Moreover we provide some design guidelines for facilitating reflection in self-tracking systems. Finally we propose a model for inferring sleep patterns from smartphone interactions.

In the third part, we focus on a specific aspect of collective behavior: human mobility. We perform an experiment to verify the feasibility of inferring places from location traces using mobile sensing data. We develop a hierarchical model for
human mobility, which is able to measure mobility properties at multiple scales. We perform a study on the factors influencing the accuracy of nextplace prediction models. Finally we present an open-source tool for creating geographical visualizations.

**General information**

State: Published  
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems  
Authors: Cuttone, A. (Intern), Larsen, J. E. (Intern), Jørgensen, S. L. (Intern)  
Number of pages: 255  
Publication date: 2017

**Publication Information**

Place of publication: Kgs. Lyngby  
Publisher: Technical University of Denmark (DTU)  
Original language: English  
Series: DTU Compute PHD-2016  
Number: 422  
ISSN: 0909-3192  
Main Research Area: Technical/natural sciences  
Electronic versions: phd422_Cuttone_A.pdf

**Relations**

Projects:  
Data Mining and Visualization of Large Human Behavior Data Sets  
Publication: Research › Ph.D. thesis – Annual report year: 2017

**Decoding Interleaved Gabidulin Codes using Alekhnovich's Algorithm**

We prove that Alekhnovich's algorithm can be used for row reduction of skew polynomial matrices. This yields an \(O(3n(\omega+1)/2\log(n))\) decoding algorithm for \(t\)-Interleaved Gabidulin codes of length \(n\), where \(\omega\) is the matrix multiplication exponent.

**General information**

State: Published  
Organisations: Department of Applied Mathematics and Computer Science, Mathematics, University of Ulm  
Authors: Puchinger, S. (Ekstern), Müelich, S. (Ekstern), Mödinger, D. (Ekstern), Rosenkilde, J. S. H. (Intern), Bossert, M. (Ekstern)  
Pages: 175–180  
Publication date: 2017  
Main Research Area: Technical/natural sciences

**Publication Information**

Journal: Electronic Notes in Discrete Mathematics  
Volume: 57  
ISSN (Print): 1571-0653  
Ratings:  
BFI (2018): BFI-level 1  
BFI (2017): BFI-level 1  
Scopus rating (2017): SNIP 0.401 SJR 0.262 CiteScore 0.34  
Web of Science (2017): Indexed yes  
BFI (2016): BFI-level 1  
Scopus rating (2016): CiteScore 0.32 SJR 0.276 SNIP 0.386  
BFI (2015): BFI-level 1  
Scopus rating (2015): SJR 0.304 SNIP 0.405 CiteScore 0.35  
BFI (2014): BFI-level 1  
Scopus rating (2014): SJR 0.222 SNIP 0.262 CiteScore 0.26  
BFI (2013): BFI-level 1  
Scopus rating (2013): SJR 0.379 SNIP 0.485 CiteScore 0.43  
ISI indexed (2013): ISI indexed no  
BFI (2012): BFI-level 1
Decoding of interleaved Reed-Solomon codes using improved power decoding

We propose a new partial decoding algorithm for m-interleaved Reed-Solomon (IRS) codes that can decode, with high probability, a random error of relative weight $1 - \frac{Rm}{m+1}$ at all code rates $R$, in time polynomial in the code length $n$. For $m > 2$, this is an asymptotic improvement over the previous state-of-the-art for all rates, and the first improvement for $R > 1/3$ in the last 20 years. The method combines collaborative decoding of IRS codes with power decoding up to the Johnson radius.

Deep convolutional neural networks for interpretable analysis of EEG sleep stage scoring

Sleep studies are important for diagnosing sleep disorders such as insomnia, narcolepsy or sleep apnea. They rely on manual scoring of sleep stages from raw polysomnography signals, which is a tedious visual task requiring the workload of highly trained professionals. Consequently, research efforts to pursue for an automatic stage scoring based on machine learning techniques have been carried out over the last years. In this work, we resort to multitaper spectral analysis to
create visually interpretable images of sleep patterns from EEG signals as inputs to a deep convolutional network trained to solve visual recognition tasks. As a working example of transfer learning, a system able to accurately classify sleep stages in new unseen patients is presented. Evaluations in a widely-used publicly available dataset favourably compare to state-of-the-art results, while providing a framework for visual interpretation of outcomes.

**DeepLoc: prediction of protein subcellular localization using deep learning**

The prediction of eukaryotic protein subcellular localization is a well-studied topic in bioinformatics due to its relevance in proteomics research. Many machine learning methods have been successfully applied in this task, but in most of them, predictions rely on annotation of homologues from knowledge databases. For novel proteins where no annotated homologues exist, and for predicting the effects of sequence variants, it is desirable to have methods for predicting protein properties from sequence information only. Here, we present a prediction algorithm using deep neural networks to predict protein subcellular localization relying only on sequence information. At its core, the prediction model uses a recurrent neural network that processes the entire protein sequence and an attention mechanism identifying protein regions important for the subcellular localization. The model was trained and tested on a protein dataset extracted from one of the latest UniProt releases, in which experimentally annotated proteins follow more stringent criteria than previously. We demonstrate that our model achieves a good accuracy (78% for 10 categories; 92% for membrane-bound or soluble), outperforming current state-of-the-art algorithms, including those relying on homology information. The method is available as a web server at http://www.cbs.dtu.dk/services/DeepLoc. Example code is available at https://github.com/JJAlmagro/subcellular_localization. The dataset is available at http://www.cbs.dtu.dk/services/DeepLoc/data.php. jjalma@dtu.dk.
Deep recurrent conditional random field network for protein secondary prediction

Deep learning has become the state-of-the-art method for predicting protein secondary structure from only its amino acid residues and sequence profile. Building upon these results, we propose to combine a bi-directional recurrent neural network (biRNN) with a conditional random field (CRF), which we call the biRNN-CRF. The biRNN-CRF may be seen as an improved alternative to an autoregressive uni-directional RNN where predictions are performed sequentially conditioning on the prediction in the previous timestep. The CRF is instead nearest neighbor-aware and models for the joint distribution of the labels for all time-steps. We condition the CRF on the output of biRNN, which learns a distributed representation based on the entire sequence. The biRNN-CRF is therefore close to ideally suited for the secondary structure task because a high degree of cross-talk between neighboring elements can be expected. We validate the model on several benchmark datasets. For example, on CB513, a model with 1.7 million parameters, achieves a Q8 accuracy of 69.4 for single model and 70.9 for ensemble, which to our knowledge is state-of-the-art. 1

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Copenhagen Center for Health Technology, Cognitive Systems, University of Copenhagen
Density of Real Zeros of the Tutte Polynomial

The Tutte polynomial of a graph is a two-variable polynomial whose zeros and evaluations encode many interesting properties of the graph. In this article we investigate the real zeros of the Tutte polynomials of graphs, and show that they form a dense subset of certain regions of the plane. This is the first density result for the real zeros of the Tutte polynomial in a region of positive volume. Our result almost confirms a conjecture of Jackson and Sokal except for one region which is related to an open problem on flow polynomials.

General information

State: Published
Organisations: Algorithms and Logic, Department of Applied Mathematics and Computer Science, Korea Advanced Institute of Science & Technology
Authors: Ok, S. (Ekstern), Perrett, T. (Intern)
Number of pages: 6
Pages: 941-946
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Electronic Notes in Discrete Mathematics
Volume: 61
ISSN (Print): 1571-0653
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.401 SJR 0.262 CiteScore 0.34
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.32 SJR 0.276 SNIP 0.386
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.304 SNIP 0.405 CiteScore 0.35
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.222 SNIP 0.262 CiteScore 0.26
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.379 SNIP 0.485 CiteScore 0.43
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.334 SNIP 0.399 CiteScore 0.26
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.305 SNIP 0.365 CiteScore 0.25
Design and analysis of cryptographic algorithms
In today's world computers are ubiquitous. They can be found in virtually any industry and most households own at least one personal computer or have a mobile phone. Apart from these fairly large and complex devices, we also see computers on a much smaller scale appear in everyday objects in the form of micro-controllers and RFID chips.

What truly transformed our society are large scale networks, like the Internet or mobile telephone networks, which can link billions of devices. Our ways of communicating and conducting business have severely changed over the last decades due to this development. However, most of this communication happens over inherently insecure channels requiring methods to protect our communication. A further issue is the vast amount of data generated, which raises serious privacy concerns.

Cryptography provides the key components for protecting our communication. From securing our passwords and personal data to protecting mobile communication from eavesdroppers and our electronic bank transactions from manipulation. These applications would be impossible without cryptography.

The main topic of this thesis is the design and security analysis of the most fundamental algorithms used in cryptography, namely block ciphers and cryptographic hash functions. These algorithms are the building blocks for a vast amount of applications and play a vital role in providing both confidentiality and integrity for our communication.

This work is organized in two parts. First, an introduction to block ciphers and cryptographic hash functions is given to provide an overview over the state-of-the-art, the terminology, and how we can evaluate the security of an algorithm. The second part is a collection of scientific publications that have been written during the PhD studies and published.

In the first publication we analyze the security of cryptographic hash functions based on the AES and demonstrate practical attacks on reduced-round versions of these algorithms. The second publication provides cryptanalysis of the lightweight block cipher SIMON in particular how resistant this type of block ciphers are against differential and linear cryptanalysis. In the fourth publication we present a short-input hash function utilizing AES-specific instructions on modern CPUs in order to improve the performance of hashbased signature schemes. The last publication deals with the design of the tweakable lightweight block cipher Skinny which provides strong security bounds against differential and linear attacks while also competing with the performance of SIMON.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cyber Security
Authors: Kölbl, S. (Intern), Rechberger, C. (Intern), Knudsen, L. R. (Intern)
Number of pages: 272
Publication date: 2017

Publication information
Design, economics and parameter uncertainty in dynamic operation of post-combustion CO₂ capture using piperazine (PZ) and MEA

Post-combustion capture is a promising solution to mitigate the anthropogenic CO₂ emission rate and reduce global warming. However, to make it economically attractive, the techno-economic performance of this process needs to be improved. This includes steady-state but also dynamic operation of the plant. Flexibility is particularly crucial from an economic and operational point of view since plants must balance the power production and the electricity demand on a daily basis.

This work shows the impact of design decisions and uncertainties on the dynamic operation and economics of a CO₂ capture plant using piperazine (PZ), compared to the benchmark MEA solvent. This is exemplified through dynamic model calculations. The results show that the capacity of the buffer tank is a key parameter for the flexibility of the plant. A small tank corresponds to lower capital cost but it leads to increased operation cost and also to flexibility/controllability issues. Both, the PZ and MEA plants present inverse response for small tanks. These plants are challenging to control.
Designing Visual Decision Making Support with the Help of Eye-tracking

Data visualizations are helpful tools to cognitively access large amounts of data and make complex relationships in data understandable. This paper shows how results from neuro-physiological measurements, more specifically eye-tracking, can support justified design decisions about improving existing data visualizations for exploring process execution data. This is achieved by gaining insight into how visualizations are used for decision-making. The presented examination is embedded in the domain of process modeling behavior analysis, and the analyses are performed on the background of representative analytical questions from the domain of process model behavior analysis. We present initial findings on one out of three visualization types we have examined, which is the Rhythm-Eye visualization.

Detecting Malicious Nodes in Medical Smartphone Networks Through Euclidean Distance-Based Behavioral Profiling

With the increasing digitization of the healthcare industry, a wide range of medical devices are Internet- and inter-connected. Mobile devices (e.g., smartphones) are one common facility used in the healthcare industry to improve the quality of service and experience for both patients and healthcare personnel. The underlying network architecture to support such devices is also referred to as medical smartphone networks (MSNs). Similar to other networks, MSNs also suffer from various attacks like insider attacks (e.g., leakage of sensitive patient information by a malicious insider). In this work, we focus on MSNs and design a trust-based intrusion detection approach through Euclidean distance-based behavioral profiling to detect malicious devices (or called nodes). In the evaluation, we collaborate with healthcare organizations and implement our approach in a real simulated MSN environment. Experimental results demonstrate that our approach is promising in effectively identifying malicious MSN nodes.
Detection and quantification of flow consistency in business process models

Business process models abstract complex business processes by representing them as graphical models. Their layout, as determined by the modeler, may have an effect when these models are used. However, this effect is currently not fully understood. In order to systematically study this effect, a basic set of measurable key visual features is proposed, depicting the layout properties that are meaningful to the human user. The aim of this research is thus twofold: first, to empirically identify key visual features of business process models which are perceived as meaningful to the user and second, to show how such features can be quantified into computational metrics, which are applicable to business process models. We focus on one particular feature, consistency of flow direction, and show the challenges that arise when transforming it into a precise metric. We propose three different metrics addressing these challenges, each following a different view of flow consistency. We then report the results of an empirical evaluation, which indicates which metric is more effective in predicting the human perception of this feature. Moreover, two other automatic evaluations describing the performance and the computational capabilities of our metrics are reported as well.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Software and Process Engineering, University of Innsbruck, University of Haifa
Authors: Burattin, A. (Intern), Bernstein, V. (Ekstern), Neurauter, M. (Ekstern), Soffer, P. (Ekstern), Weber, B. (Intern)
Number of pages: 22
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information

Journal: Software and Systems Modeling
ISSN (Print): 1619-1366
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 1.98 SJR 0.476 SNIP 1.807
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.65 SJR 0.598 SNIP 1.712
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.564 SNIP 1.613 CiteScore 1.53
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.555 SNIP 1.648 CiteScore 1.41
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Deterministic indexing for packed strings

Given a string $S$ of length $n$, the classic string indexing problem is to preprocess $S$ into a compact data structure that supports efficient subsequent pattern queries. In the deterministic variant the goal is to solve the string indexing problem without any randomization (at preprocessing time or query time). In the packed variant the strings are stored with several character in a single word, giving us the opportunity to read multiple characters simultaneously. Our main result is a new string index in the deterministic and packed setting. Given a packed string $S$ of length $n$ over an alphabet $\sigma$, we show how to preprocess $S$ in $O(n)$ (deterministic) time and space $O(n)$ such that given a packed pattern string of length $m$ we can support queries in (deterministic) time $O(m/\alpha + \log m + \log \log \sigma)$, where $\alpha = w/\log \sigma$ is the number of characters packed in a word of size $w = \Theta(\log n)$. Our query time is always at least as good as the previous best known bounds and whenever several characters are packed in a word, i.e., $\log \sigma$
Developing advanced fingerprint attacks on challenge-based collaborative intrusion detection networks

Traditionally, an isolated intrusion detection system (IDS) is vulnerable to various types of attacks. In order to enhance IDS performance, collaborative intrusion detection networks (CIDNs) are developed through enabling a set of IDS nodes to communicate with each other. Due to the distributed network architecture, insider attacks are one of the major threats. In the literature, challenge-based trust mechanisms have been built to identify malicious nodes by evaluating the satisfaction levels between challenges and responses. However, such mechanisms rely on two major assumptions, which may result in a weak threat model. In this case, CIDNs may be still vulnerable to advanced insider attacks in real-world deployment.

In this paper, we propose a novel collusion attack, called passive message fingerprint attack (PMFA), which can collect messages and identify normal requests in a passive way. In the evaluation, we explore the attack performance under both simulated and real network environments. Experimental results demonstrate that our attack can help malicious nodes send malicious responses to normal requests, while maintaining their trust values.
Developing a simulation framework for safe and optimal trajectories considering drivers' driving style

Advanced driving assistance systems (ADAS) have huge potential for improving road safety and travel times. However, their take-up in the market is very slow; and these systems should consider driver's preferences to increase adoption rates. The aim of this study is to develop a model providing drivers with the optimal trajectory considering the motorist's driving style in real time. Travel duration and safety are the main parameters used to find the optimal trajectory. A simulation framework to determine the optimal trajectory was developed in which the ego car travels in a highway environment scenario, using an agent-oriented approach. The performance of the algorithm was compared against optimal trajectories computed offline with the hybrid A* algorithm. The new framework provides trajectories close to the optimal trajectory and is computationally achievable. The agents were shown to follow safe and fast trajectories in three tests scenarios: emergency braking, overtaking and a complex situation with multiple vehicles around the ego vehicle. Different driver profiles were then tested in the complex scenario, showing that the proposed approach can adapt to driver preferences and provide a solution close to the optimal solution given the defined safety constraints.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Queensland University of Technology
Authors: Gruber, T. (Ekstern), Larue, G. S. (Ekstern), Rakotonirainy, A. (Ekstern), Poulsen, N. K. (Intern)
Pages: 624-31
Publication date: 2017
Conference: 23rd World Congress on Intelligent Transport Systems, world congress, Melbourne, Australia, 10/10/2016 - 10/10/2016
Main Research Area: Technical/natural sciences

Publication information

Journal: I E T Intelligent Transport Systems
Volume: 11
Issue number: 10
ISSN (Print): 1751-956X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.066 SJR 0.436 CiteScore 1.84
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.62 SJR 0.452 SNIP 1.018
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.445 SNIP 1.204 CiteScore 1.48
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.459 SNIP 1.441 CiteScore 1.52
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.671 SNIP 1.656 CiteScore 1.98
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.513 SNIP 1.944 CiteScore 1.74
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.453 SNIP 1.372 CiteScore 1.19
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.298 SNIP 0.871
Development of a New Fractal Algorithm to Predict Quality Traits of MRI Loins

Traditionally, the quality traits of meat products have been estimated by means of physico-chemical methods. Computer vision algorithms on MRI have also been presented as an alternative to these destructive methods since MRI is non-destructive, non-ionizing and innocuous. The use of fractals to analyze MRI could be another possibility for this purpose. In this paper, a new fractal algorithm is developed, to obtain features from MRI based on fractal characteristics. This algorithm is called OPFTA (One Point Fractal Texture Algorithm). Three fractal algorithms were tested in this study: CFA (Classical fractal algorithm), FTA (Fractal texture algorithm) and OPFTA. The results obtained by means of these three fractal algorithms were correlated to the results obtained by means of physico-chemical methods. OPFTA and FTA achieved correlation coefficients higher than 0.75 and CFA reached low relationship for the quality parameters of loins. The best results were achieved for OPFTA as fractal algorithm (0.837 for lipid content, 0.909 for salt content and 0.911 for moisture). These high correlation coefficients confirm the new algorithm as an alternative to the classical computational approaches (texture algorithms) in order to compute the quality parameters of meat products in a non-destructive and efficient way.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Statistics and Data Analysis, University of Extremadura, University of Copenhagen
Authors: Caballero, D. (Ekstern), Caro, A. (Ekstern), Amigo, J. M. (Ekstern), Dahl, A. B. (Intern), Ersbøll, B. K. (Intern), Pérez-Palacios, T. (Ekstern)
Number of pages: 11
Pages: 208-218
Publication date: 2017

Host publication information

Title of host publication: Computer Analysis of Images and Patterns
Volume: 10424
Publisher: Springer
ISBN (Print): 97833199646893

Series: Lecture Notes in Computer Science
Volume: 10424
ISSN: 0302-9743
Main Research Area: Technical/natural sciences
Conference: 17th international Conference on Computer Analysis of Images and Patterns, Ystad, Sweden, 22/08/2017 - 22/08/2017

Difference-of-Convex optimization for variational kl-corrected inference in dirichlet process mixtures

Variational methods for approximate inference in Bayesian models optimise a lower bound on the marginal likelihood, but the optimization problem often suffers from being nonconvex and high-dimensional. This can be alleviated by working in a collapsed domain where a part of the parameter space is marginalized. We consider the KL-corrected collapsed variational bound and apply it to Dirichlet process mixture models, allowing us to reduce the optimization space considerably. We find that the variational bound exhibits consistent and exploitable structure, allowing the application of difference-of-convex optimization algorithms. We show how this yields an interpretable fixed-point update algorithm in the
collapsed setting for the Dirichlet process mixture model. We connect this update formula to classical coordinate ascent updates, illustrating that the proposed improvement surprisingly reduces to the traditional scheme.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems
Authors: Bonnevie, R. (Intern), Schmidt, M. N. (Intern), Mørup, M. (Intern)
Number of pages: 6
Pages: 1-6
Publication date: 2017

**Host publication information**

Title of host publication: Proceedings of 2017 IEEE 27th International Workshop on Machine Learning for Signal Processing (MLSP)
Publisher: IEEE
ISBN (Print): 978-1-5090-6342-0
Main Research Area: Technical/natural sciences
Workshop: 2017 IEEE international workshop on machine learning for signal processing, Tokyo, Jamaica, 25/09/2017 - 25/09/2017
Difference-of-convex optimization, Variational inference, Collapsed methods, Bayesian nonparametrics
DOIs:
10.1109/MLSP.2017.8168159
Source: FindIt
Source-ID: 2394021335
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

**Digital Arithmetic: Division Algorithms**

Division is one of the basic arithmetic operations supported by every computer system. The operation can be performed and implemented by either hardware or software, or by a combination of the two. Although division is not as frequent as addition and multiplication, nowadays, most processors implement it in hardware to not compromise the overall computation performances. This entry explains the basic algorithms, suitable for hardware and software, to implement division in computer systems. Two classes of algorithms implement division or square root: digit-recurrence and multiplicative (e.g., Newton–Raphson) algorithms. The first class of algorithms, the digit-recurrence type, is particularly suitable for hardware implementation as it requires modest resources and provides good performance on contemporary technology. The second class of algorithms, the multiplicative type, requires significant hardware resources and is more suitable for software implementation on the existing multiply units. The purpose of this entry is to provide an introductory survey using a presentation style suitable for the interested non-specialist readers as well.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, Polytechnic University of Turin
Authors: Montuschi, P. (Ekstern), Nannarelli, A. (Intern)
Pages: 348-63
Publication date: 2017

**Host publication information**

Title of host publication: Encyclopedia of Computer Science and Technology
Publisher: Taylor & Francis
ISBN (Print): 978-1-4822-0822-1
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
Source-ID: 140539818
Publication: Research - peer-review › Book chapter – Annual report year: 2017

**Digitalising the General Data Protection Regulation with Dynamic Condition Response Graphs**

We describe how the declarative Dynamic Condition Response (DCR) Graphs process notation can be used to digitalise the General Data Protection Regulation (GDPR) and make a first evaluation to what extent the formalisation and associated tool for end-user modelling and simulation can be used to clarify the meaning of the GDPR and its consequences for the main business process of a Danish funding agency.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Software and Process Engineering, IT University of Copenhagen, Exformatics A/S
Directional Total Generalized Variation Regularization for Impulse Noise Removal

A recently suggested regularization method, which combines directional information with total generalized variation (TGV), has been shown to be successful for restoring Gaussian noise corrupted images. We extend the use of this regularizer to impulse noise removal and demonstrate that using this regularizer for directional images is highly advantageous. In order to estimate directions in impulse noise corrupted images, which is much more challenging compared to Gaussian noise corrupted images, we introduce a new Fourier transform-based method. Numerical experiments show that this method is more robust with respect to noise and also more efficient than other direction estimation methods.
disability is related to lesion volume and microstructure.

**General information**

**State:** Published  
**Organisations:** Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, University of Copenhagen  
**Authors:** Ammitzbøll, C. (Ekstern), Dyrby, T. B. (Intern), Lyksborg, M. (Intern), Schreiber, K. (Ekstern), Ratzer, R. (Ekstern), Christensen, J. R. (Ekstern), Iversen, P. (Ekstern), Magyari, M. (Forskerdatabase), Garde, E. (Ekstern), Sørensen, P. S. (Ekstern), Siebner, H. R. (Ekstern), Sellebjerg, F. (Ekstern)  
**Pages:** 73-77  
**Publication date:** 2017  
**Main Research Area:** Technical/natural sciences

**Publication information**

**Journal:** Multiple Sclerosis and Related Disorders  
**Volume:** 20  
**ISSN (Print):** 2211-0348  
**Ratings:**  
Web of Science (2018): Indexed yes  
Scopus rating (2017): SNIP 0.944 SJR 1.123 CiteScore 2.66  
Scopus rating (2016): SNIP 0.729 SJR 0.961 CiteScore 2  
Scopus rating (2015): SNIP 0.512 SJR 0.624 CiteScore 1.13  
Scopus rating (2014): SNIP 0.401 SJR 0.511 CiteScore 0.92  
Scopus rating (2013): SNIP 0.385 SJR 0.333 CiteScore 0.79  
**Original language:** English  
**Magnetic Resonance Imaging, Multiple Sclerosis, Magnetisation transfer ratio, Diffusion tensor imaging, Expanded disability status scale, Multiple sclerosis functional composite**  
**DOIs:**  
10.1016/j.msard.2017.12.010  
**Publication:** Research - peer-review › Journal article – Annual report year: 2018

**Discrimination of haploid and diploid maize kernels via multispectral imaging**

The use of doubled haploids (DHs) in maize has become ubiquitous in maize breeding programmes as it allows breeders to go from cross to evaluation in as little as 2 years. Two important aspects of the in vivo DH system used in maize are as follows: (i) the identification of haploid progeny and (ii) doubling of the haploid genome to produce fertile inbred lines. This study is focused on the first step. Currently, identification of maize haploid progeny is performed manually using the R1-nj seed colour marker. This is a labour-intensive and time-consuming process; a method for automated sorting of haploids would increase the efficiency of DH line development. In this study, six inbred lines were crossed with the maternal haploid inducer &euro;RWS/RWK-76&euro; and a sample of seed was sorted manually for each line. Using the VideometerLab 3 system, spectral imaging techniques were applied to discriminate between haploids and hybrids. Using DNA markers to confirm the haploid/diploid state of the tested seed, for the majority of genotypes haploid identification was possible with over 50% accuracy.

**General information**

**State:** Published  
**Organisations:** Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Iowa State University, Videometer A/S  
**Authors:** De La Fuente, G. N. (Ekstern), Carstensen, J. M. (Intern), Adsetts Edberg Hansen, M. (Ekstern), Lübbenstedt, T. (Ekstern)  
**Pages:** 50-60  
**Publication date:** 2017  
**Main Research Area:** Technical/natural sciences

**Publication information**

**Journal:** Plant Breeding  
**Volume:** 136  
**Issue number:** 1  
**ISSN (Print):** 0179-9541  
**Ratings:**  
BFI (2018): BFI-level 1  
Web of Science (2018): Indexed yes  
BFI (2017): BFI-level 1  
Scopus rating (2017): SNIP 0.772 SJR 0.714 CiteScore 1.6
Distinguishability Revisited: Depth Dependent Bounds on Reconstruction Quality in Electrical Impedance Tomography:

Depth dependent bounds on reconstruction quality in electrical impedance tomography

The reconstruction problem in electrical impedance tomography is highly ill-posed, and it is often observed numerically that reconstructions have poor resolution far away from the measurement boundary but better resolution near the measurement boundary. The observation can be quantified by the concept of distinguishability of inclusions. This paper provides mathematically rigorous results supporting the intuition. Indeed, for a model problem lower and upper bounds on the distinguishability of an inclusion are derived in terms of the boundary data. These bounds depend explicitly on the distance of the inclusion to the boundary, i.e. the depth of the inclusion. The results are obtained for disk inclusions in a homogeneous background in the unit disk. The theoretical bounds are verified numerically using a novel, exact characterization of the forward map as a tridiagonal matrix.
General information
State: Published
Organisations: Scientific Computing, Applied functional analysis, Department of Applied Mathematics and Computer Science
Authors: Garde, H. (Intern), Knudsen, K. (Intern)
Pages: 697-720
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: S I A M Journal on Applied Mathematics
Volume: 77
Issue number: 2
ISSN (Print): 0036-1399
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.295 SJR 1.108 CiteScore 1.87
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.76 SJR 1.068 SNIP 1.294
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.926 SNIP 1.202 CiteScore 1.63
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.06 SNIP 1.264 CiteScore 1.58
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.952 SNIP 1.14 CiteScore 1.61
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.012 SNIP 1.234 CiteScore 1.69
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.778 SNIP 1.195 CiteScore 1.49
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.809 SNIP 1.098
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.191 SNIP 1.544
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.116 SNIP 1.268
Scopus rating (2007): SJR 1 SNIP 1.262
Scopus rating (2006): SJR 0.919 SNIP 1.39
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.942 SNIP 1.375
Scopus rating (2004): SJR 0.964 SNIP 1.556
Scopus rating (2003): SJR 1.265 SNIP 1.659
Scopus rating (2002): SJR 0.94 SNIP 1.432
Scopus rating (2001): SJR 1.45 SNIP 1.601
Scopus rating (2000): SJR 0.626 SNIP 1.403
Scopus rating (1999): SJR 0.61 SNIP 1.401
Original language: English
Electrical impedance tomography, Depth dependence, Harmonic morphism, Sigenvale bounds, Distinguishability
Electronic versions: 16m1072991.pdf
Distributed co-simulation of embedded control software with exhaust gas recirculation water handling system using INTO-CPS

Engineering complex Cyber-Physical Systems, such as emission reduction control systems for large two-stroke engines, require advanced modelling of both the cyber and physical aspects. Different tools are specialised for each of these domains and a combination of tools validating different properties is often desirable. However, it is non-trivial to be able to combine such different models of different constituent elements. In order to reduce the need for expensive tests on the real system it is advantageous to be able to combine such heterogeneous models in a joint co-simulation in order to reduce the overall costs of validation. This paper demonstrates how this can be achieved for a commercial system developed by MAN Diesel & Turbo using a newly developed tool chain based on the Functional Mock-up Interface standard for co-simulation supporting different operating systems. The generality of the suggested approach also enables future scenarios incorporating constituent models supplied by sub-suppliers while protecting their Intellectual Property.

General information
State: Published
Organisations: Copenhagen Center for Health Technology, Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, Aarhus University, MAN Diesel & Turbo, MAN Diesel and Turbo SE
Authors: Pedersen, N. (Ekstern), Lausdahl, K. (Ekstern), Sanchez, E. V. (Ekstern), Larsen, P. G. (Ekstern), Madsen, J. (Intern)
Number of pages: 10
Pages: 73-82
Publication date: 2017

Host publication information
Title of host publication: SIMULTECH 2017 - Proceedings of the 7th International Conference on Simulation and Modeling Methodologies, Technologies and Applications
Publisher: SCITEPRESS Digital Library
ISBN (Electronic): 9789897582653
BFI conference series: Simulation and Modeling Methodologies, Technologies and Applications (5010788)
Main Research Area: Technical/natural sciences
Conference: 7th International Conference on Simulation and Modeling Methodologies, Technologies and Applications, SIMULTECH 2017, Madrid, Spain, 26/07/2017 - 26/07/2017
Co-Simulation, Cyber-Physical-Systems, Distributed Simulation, Embedded Control System, Exhaust Gas Recirculation, INTO-CPS, Parallel Simulation
Source: Scopus
Source-ID: 85029350314
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Distributed primal–dual interior-point methods for solving tree-structured coupled convex problems using message-passing

In this paper, we propose a distributed algorithm for solving coupled problems with chordal sparsity or an inherent tree structure which relies on primal–dual interior-point methods. We achieve this by distributing the computations at each iteration, using message-passing. In comparison to existing distributed algorithms for solving such problems, this algorithm requires far fewer iterations to converge to a solution with high accuracy. Furthermore, it is possible to compute an upper-bound for the number of required iterations which, unlike existing methods, only depends on the coupling structure in the problem. We illustrate the performance of our proposed method using a set of numerical examples.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Linköping University
Authors: Khoshfetrat Pakazad, S. (Ekstern), Hansson, A. (Ekstern), Andersen, M. S. (Intern), Nielsen, I. (Ekstern)
Pages: 401-435
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Optimization Methods and Software
Volume: 32
Issue number: 3
ISSN (Print): 1055-6788
Ratings:
Distributed Optimization, Primal–dual interior-point method, Message-passing, High precision solution

Distributed Semidefinite Programming with Application to Large-scale System Analysis

Distributed algorithms for solving coupled semidefinite programs (SDPs) commonly require many iterations to converge. They also put high computational demand on the computational agents. In this paper we show that in case the coupled problem has an inherent tree structure, it is possible to devise an efficient distributed algorithm for solving such problems. The proposed algorithm relies on predictor-corrector primal-dual interior-point methods, where we use a message-passing algorithm to compute the search directions distributedly. Message-passing here is closely related to dynamic programming over trees. This allows us to compute the exact search directions in a finite number of steps. This is because, computing the search directions requires a recursion over the tree structure and hence, terminates after an upward and downward pass through the tree. Furthermore this number can be computed a priori and only depends on the coupling structure of the problem. We use the proposed algorithm for analyzing robustness of large-scale uncertain systems distributedly. We
test the performance of this algorithm using numerical examples.
Domain Specific Language for Modeling Waste Management Systems

In order to develop sustainable waste management systems with considering life cycle perspective, scientists and domain experts in environmental science require readily applicable tools for modeling and evaluating the life cycle impacts of the waste management systems. Practice has proved that modeling these systems with general-purpose tools is a cumbersome task. On one hand, the scientists have to spend considerable amount of time to understand these tools in order to develop their models. On another hand, integrated assessments are becoming gradually common in environmental management and therefore scientists are also faced with the problem of integrating models across scales and domains, which is not a straightforward process.

Domain-Specific Languages (DSLs) are languages which are specialized for a specific application domain and they promise to increase developer productivity by raising the level of abstraction. They allow domain experts, who are non-programmers, to directly encode their domain knowledge about what a system under development should do. In this thesis, we utilize domain-specific languages, on the basis of the flow-based programming (FBP) paradigm, to model and evaluate environmental technologies i.e. solid waste management systems. Flow-based programming is used to support concurrent execution of the processes, and provides a model-integration language for composing processes from homogeneous or heterogeneous domains. And a domain-specific language is used to define atomic processes and domain-specific validation rules for composite processes. We call these DSLs, which are based on FBP paradigm, domain-specific flow based languages and we provide a formal framework to develop them. To this end, we advocate aspect-oriented concepts to FBP to separate cross-cutting concerns, by providing an extension called AOFBP. Afterwards, we propose the framework based on this extension, and we use a formal language called ForSpec, which is an extension of FORMULA, to formally specify the structural and behavioral semantics of the sub-languages proposed in this framework. Finally, we propose a domain specific language for modeling of waste-management systems on the basis of our framework. We evaluate the language by providing a set of case studies. The contributions of this thesis are; addressing separation of concerns in Flow-based programming and providing the formal specification of its syntax and semantics; a formal language and framework to specify domain-specific flow based languages; design and develop domain specific languages for waste management modeling; and finally our work also can be considered as another case study for structural and behavioral semantics specifications in ForSpec and FORMULA.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Software and Process Engineering, Department of Environmental Engineering, Residual Resource Engineering
Authors: Zarrin, B. (Intern), Baumeister, H. (Intern), Damgaard, A. (Intern)
Number of pages: 233
Publication date: 2017

Publication Information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Original language: English
Series: DTU Compute PHD-2016
Number: 407
ISSN: 0900-3192
Main Research Area: Technical/natural sciences
Electronic versions: phd407_Zarrin_B.pdf
Publication: Research › Ph.D. thesis – Annual report year: 2017

Do we educate engineers that can engineer?
Since 2008, the Bachelor of Engineering education at the Technical University of Denmark has been CDIO-based, including the software technology and IT and economics study lines. Consequently, the study plans of these study lines were revised to include cross-disciplinary CDIO projects in each of the first four semesters. These projects replaced 11 smaller, course-specific projects in the old study plans. The first three semesters contain design-build projects spanning several courses, and the fourth semester centers around a stand-alone CDIO project. These team-based projects aim at training the students' engineering skills (CDIO competence category 4) and at improving the students' skills in CDIO
In the tenth year of operation, we now decided to investigate how content students and employers are with our students' engineering skills. To this end, we have designed a survey to provide us with insights for improving our study lines and to address the question: “Are we educating engineers who can engineer?” The questionnaire is aligned with the CDIO syllabus and can also serve for surveying other study lines, since it is not study line specific. To obtain meaningful results, we decided to target students who have at least passed the first four terms and companies that have hosted a significant number of students in the last 3 years in internships or for the final thesis. These companies interact with the students for almost one year at the end of their studies, providing a good foundation for the company supervisors to answer questions about the students' abilities as an engineer. In this paper, we discuss the design and result of the questionnaire and the obtained results. As mentioned above, the survey will give us and the CDIO community detailed insights as to how our students and their employers experience the result of our education.
The purpose of this paper is to study frames for a Hilbert space $H$, having the form $(Tnϕ)n=0∞$ for some $ϕ∈H$ and an operator $T:H→H$. We characterize the frames that have such a representation for a bounded operator $T$, and discuss the properties of this operator. In particular, we prove that the image chain of $T$ has finite length $N$ in the overcomplete case; furthermore $(Tnϕ)n=0∞$ has the very particular property that $(Tnϕ)n=DN−1∪(Tnϕ)n=N+ℓ∞$ is a frame for $H$ for all $ℓ∈N0$. We also prove that frames of the form $(Tnϕ)n=0∞$ are sensitive to the ordering of the elements and to norm-perturbations of the generator $ϕ$ and the operator $T$. On the other hand positive stability results are obtained by considering perturbations of the generator $ϕ$ belonging to an invariant subspace on which $T$ is a contraction.
Long-term investors can often bear the risk of outsized market movements or tail events more easily than the average investor; for bearing this risk, they hope to earn significant excess returns. Rebalancing periodically to a fixed benchmark allocation, however, is not the way to do this. In the presence of time-varying investment opportunities, portfolio weights should be adjusted as new information arrives to take advantage of favorable regimes and reduce potential drawdowns. This thesis contributes to a better understanding of financial markets' behavior in the form of a model-based framework for dynamic asset allocation. Regime-switching models can match financial markets' tendency to change their behavior abruptly and the phenomenon that the new behavior often persists for several periods after a change. Regime shifts lead to time-varying parameters and, in addition, the parameters within the regimes and the transition probabilities change over time. Using recursive and adaptive estimation techniques to capture this, we are able to better reproduce the volatility persistence that dynamic asset allocation benefits from. With this approach it is sufficient to distinguish between two regimes in stock returns in order for it to be profitable to change asset allocation based solely on the inferred regimes, both in a single-asset and multiasset universe. We advocate the use of model predictive control for translating forecasts into a dynamic strategy and controlling drawdowns by solving a multi-period optimization problem. We implement this based on forecasts from a multivariate hidden Markov model with time-varying parameters. Our results show that a substantial amount of value can be added by adjusting the asset allocation to the current market conditions, rather than rebalancing periodically to a static benchmark. By proposing a practical approach to drawdown control, we demonstrate the theoretical link to dynamic asset allocation and the importance of identifying and acting on regime shifts in order to limit losses and build robust portfolios.
Dynamic Optimization of UV Flash Processes

UV ash processes, also referred to as isoenergetic-isochoric ash processes, occur for dynamic simulation and optimization of vapor-liquid equilibrium processes. Dynamic optimization and nonlinear model predictive control of distillation columns, certain two-phase ow problems, as well as oil reservoirs with signi_cant compositional and thermal e_ects may be conducted as dynamic optimization of UV ash processes. The dynamic optimization problem involving a UV ash problem is formulated as a bilevel optimization problem. This problem is solved using a gradient based single-shooting method. The gradients are computed using the adjoint method and di_erent o_the-shelf optimization software (fmincon, IPOPT, KNITRO, NPSOL) are used for the numerical optimization. Computational results are reported for a ash process involving benzene, toluene and diphenyl. The computational experiments demonstrate that the optimization solver, the compiler, and high-performance linear algebra software are all important for e cient dynamic optimization of UV ash processes.

Dynamic portfolio optimization across hidden market regimes
Regime-based asset allocation has been shown to add value over rebalancing to static weights and, in particular, reduce potential drawdowns by reacting to changes in market conditions. The predominant approach in previous studies has been to specify in advance a static decision rule for changing the allocation based on the state of financial markets or the economy. In this article, model predictive control (MPC) is used to dynamically optimize a portfolio based on forecasts of the mean and variance of financial returns from a hidden Markov model with time-varying parameters. There are computational advantages to using MPC when estimates of future returns are updated every time a new observation becomes available, since the optimal control actions are reconsidered anyway. MPC outperforms a static decision rule for changing the allocation and realizes both a higher return and a significantly lower risk than a buy-and-hold investment in various major stock market indices. This is after accounting for transaction costs, with a one-day delay in the implementation of allocation changes, and with zero-interest cash as the only alternative to the stock indices. Imposing a trading penalty that reduces the number of trades is found to increase the robustness of the approach.
Dynamic Rearrangement of Cell States Detected by Systematic Screening of Sequential Anticancer Treatments

Signaling networks are nonlinear and complex, involving a large ensemble of dynamic interaction states that fluctuate in space and time. However, therapeutic strategies, such as combination chemotherapy, rarely consider the timing of drug perturbations. If we are to advance drug discovery for complex diseases, it will be essential to develop methods capable of identifying dynamic cellular responses to clinically relevant perturbations. Here, we present a Bayesian dose-response framework and the screening of an oncological drug matrix, comprising 10,000 drug combinations in melanoma and pancreatic cancer cell lines, from which we predict sequentially effective drug combinations. Approximately 23% of the tested combinations showed high-confidence sequential effects (either synergistic or antagonistic), demonstrating that cellular perturbations of many drug combinations have temporal aspects, which are currently both underutilized and poorly understood.
Dynamics of a railway vehicle on a laterally disturbed track

In this article a theoretical investigation of the dynamics of a railway bogie running on a tangent track with a periodic disturbance of the lateral track geometry is presented. The dynamics is computed for two values of the speed of the vehicle in combination with different values of the wavelength and amplitude of the disturbance. Depending on the combinations of the speed, the wavelength and the amplitude, straight line forward motion, different modes of symmetric or asymmetric periodic oscillations or aperiodic motions, which are presumably chaotic, are found. Statistical methods are applied for the investigation. In the case of sinusoidal oscillations they provide information about the phase shift between the different variables and the amplitudes of the oscillations. In the case of an aperiodic motion the statistical measures indicate some non-smooth transitions.
Objectives: Studies have shown that the mandibular permanent first molar (M1(inf)) in young children with isolated cleft palate is characterized by delay in maturation and has reduced crown width. Consequently, it is of interest to investigate the early maturation and width of the follicle and crown of M1(inf) in children with combined cleft lip and palate.
Design: Retrospective, longitudinal study. Cephalometric X-rays of 47 consecutive Danish children with UCCLP (37 males; 10 females) and 44 with unilateral incomplete cleft lip (UICL) (29 males; 15 females) examined at 2 and 22 months of age. UICL served as control group. Maturation (according to Haavikko), width of follicle (FW) and crown (CW) of M1(inf) were assessed.

Results: The maturation of the first mandibular molar was delayed in both genders at 2 and 22 months of age. FW and CW were smaller in children with UCCLP at both 2 and 22 months of age. There was a positive correlation between maturation and FW. Conclusions: Maturation of the first mandibular molar is delayed in both genders, and FW and CW were reduced in UCCLP compared to controls. Maturation was correlated with FW.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, University of Copenhagen
Authors: Hermann, N. V. (Ekstern), Darvann, T. A. (Intern), Kreiborg, S. (Ekstern)
Pages: 196-201
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Orthodontics & Craniofacial Research
Volume: 20
Issue number: 4
ISSN (Print): 1601-6335
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.549 SJR 1.318 CiteScore 2.2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.4 SJR 0.965 SNIP 0.974
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.886 SNIP 1.321 CiteScore 1.55
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.242 SNIP 1.295 CiteScore 1.65
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.309 SNIP 1.48 CiteScore 2.01
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.253 SNIP 1.527 CiteScore 2.08
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.716 SNIP 0.946 CiteScore 1.77
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.989 SNIP 1.413
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.631 SNIP 1.027
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.137 SNIP 1.209
Scopus rating (2007): SJR 0.83 SNIP 0.882
Scopus rating (2006): SJR 0.706 SNIP 1.12
Scopus rating (2005): SJR 0.362 SNIP 0.816
Scopus rating (2004): SJR 0.341 SNIP 0.547
Scopus rating (2003): SJR 0.322 SNIP 0.452
Scopus rating (2002): SJR 0.408 SNIP 0.327
**Economic Analysis of Additive Manufacturing Integration in Injection Molding Process Chain**

The purpose of this research is to analyze how additive manufacturing can create value when it is utilized as a supportive technology to injection molding by quantifying the cost advantages that can be obtained. Tooling for the product development phase is investigated as pilot integration area of additive manufacturing with injection molding. Cost considerations are discussed through the development of a cost estimation model. The study shows that integration of additive manufacturing in the product development phase for fabrication of soft tooling is economically convenient with a cost reduction of 79.8% and 89.9%. The cost models on additive manufacturing have been built so far on the idea of substituting injection molding with additive manufacturing. In response to this literature gap, this research addresses the advantages of additive manufacturing utilized in a synergistic rather than disruptive way to create value in the injection molding process chain.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Applied Mathematics and Computer Science, HEC Paris
Authors: Charalambis, A. (Intern), Kerbache, L. (Ekstern), Tosello, G. (Intern), Pedersen, D. B. (Intern), Mischkot, M. (Intern)
Number of pages: 6
Publication date: 2017
Event: Paper presented at International Conference on Industrial Engineering and Systems Management (IESM 2017), Saarbrücken, Germany.
Main Research Area: Technical/natural sciences
Publication: Research - peer-review › Paper – Annual report year: 2017

**Economic MPC based on LPV model for thermostatically controlled loads**

Rapid increase of the renewable energy share in electricity production requires optimization and flexibility of the power consumption side. Thermostatically controlled loads (TCLs) have a large potential for regulation service provision. Economic model predictive control (MPC) is an advanced control method which can be used to synchronize the power consumption with undischpactable renewable electricity production. Thermal behavior of TCLs can be described by linear models based on energy balance of the system. In some cases, parameters of the model may be time-varying. In this work, we present a modified economic MPC based on linear parameter-varying model. In particular, we provide an exact transformation from a standard economic MPC formulation to a linear program. We assume that the variables influencing the model parameters are known (predictable) for the prediction horizon of the controller. As a case study, we present control system that minimizes operational cost of swimming pool heating system, where parameters of the model depend on the weather forecast. Simulation results demonstrate that the proposed method is able to deal with this kind of systems.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Scientific Computing, Technical University of Liberec, Novosibirsk State Technical University
Authors: Zemtsov, N. (Ekstern), Hlava, J. (Ekstern), Frantsuzova, G. (Ekstern), Madsen, H. (Intern), Junker, R. G. (Intern), Jørgensen, J. B. (Intern)
Number of pages: 5
Publication date: 2017

**Host publication information**

Title of host publication: Proceedings of 2017 International Siberian Conference on Control and Communications (SIBCON)
Publisher: IEEE
ISBN (Print): 9781509010813
Main Research Area: Technical/natural sciences
Conference: 2017 International Siberian Conference on Control and Communications, Astana, Kazakhstan, 29/06/2017 - 29/06/2017
Economic model predictive control, Linear timevarying model, Smart energy grid, Thermostatically controlled loads
Economic Optimizing Control for Single-Cell Protein Production in a U-Loop Reactor

The production of single-cell protein (SCP) in a U-loop reactor by a methanotroph is a cost efficient sustainable alternative to protein from fish meal obtained by over-fishing the oceans. SCP serves as animal feed. In this paper, we present a mathematical model that describes the dynamics of SCP production in a U-loop reactor. We use this model to compute an optimal start-up trajectory by solution of an economic optimizing optimal control problem. The optimal start-up trajectory is an unstable attractor. The practical implementation of this optimal start-up trajectory can be conducted by a proportional controller for the substrate concentration in the top tank of the U-loop reactor.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Center for Energy Resources Engineering, Department of Chemical and Biochemical Engineering, PROSYS - Process and Systems Engineering Centre, Centre for oil and gas – DTU, Technical University of Denmark
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Pages: 1759-1764
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 27th European Symposium on Computer Aided Process Engineering – ESCAPE 27
Volume: 40
Publisher: Elsevier
Series: Computer Aided Chemical Engineering
ISSN: 1570-7946
Main Research Area: Technical/natural sciences
Conference: 27th European Symposium on Computer Aided Process Engineering, Barcelona, Spain, 01/10/2017 - 01/10/2017
U-Loop Reactor, Single Cell Protein, Optimization, Optimal Control

EEG Based Inference of Spatio-Temporal Brain Dynamics

Electroencephalography (EEG) provides a measure of brain activity and has improved our understanding of the brain immensely. However, there is still much to be learned and the full potential of EEG is yet to be realized. In this thesis we suggest to improve the information gain of EEG using three different approaches; 1) by recovery of the EEG sources, 2) by representing and inferring the propagation path of EEG sources, and 3) by combining EEG with functional magnetic resonance imaging (fMRI). The common goal of the methods, and thus of this thesis, is to improve the spatial dimension of EEG.

The main topic of this thesis is the localization of the EEG generators. This entails solving both a forward and an inverse problem. The inverse problem maps the EEG signal recorded on the scalp to its origin in the brain. It is a highly ill-posed problem which we tackle by employing a sparsity promoting ‘spike and slab’ like method augmented with physiologically relevant source priors. The incorporated temporal and spatial priors exploit coherence between neighboring time samples and between neighboring source locations, respectively. We show that these augmentations effectively increase the source recovery ability.

The forward problem describes the propagation of neuronal activity in the brain to the EEG electrodes on the scalp. The geometry and conductivity of the head layers are normally required to model this path. We propose a framework for inferring forward models which is based on the EEG signal and a low dimensional representation of forward models. The representation is built by principal component analysis of a corpus of forward models. The method can be used to recover subject-specific forward models when structural scans and/or conductivity estimations are not available.

Finally we investigate the extraction of EEG components having bandpower dynamics correlated with fMRI components. We show that adding anatomical information to the inference scheme improves the recovery of correlated components compared to only using functional information. The anatomical information is incorporated through the EEG forward model and assumes that the activity of the fMRI component overlaps spatially with the origin of the coupled EEG component.
We performed simultaneous recordings of electroencephalography (EEG) from multiple students in a classroom, and measured the inter-subject correlation (ISC) of activity evoked by a common video stimulus. The neural reliability, as quantified by ISC, has been linked to engagement and attentional modulation in earlier studies that used high-grade equipment in laboratory settings. Here we reproduce many of the results from these studies using portable low-cost equipment, focusing on the robustness of using ISC for subjects experiencing naturalistic stimuli. The present data shows that stimulus-evoked neural responses, known to be modulated by attention, can be tracked for groups of students with synchronized EEG acquisition. This is a step towards real-time inference of engagement in the classroom.
EEG source imaging assists decoding in a face recognition task

EEG based brain state decoding has numerous applications. State of the art decoding is based on processing of the multivariate sensor space signal, however evidence is mounting that EEG source reconstruction can assist decoding. EEG source imaging leads to high-dimensional representations and rather strong a priori information must be invoked. Recent work by Edelman et al. (2016) has demonstrated that introduction of a spatially focal source space representation can improve decoding of motor imagery. In this work we explore the generality of Edelman et al. hypothesis by considering decoding of face recognition. This task concerns the differentiation of brain responses to images of faces and scrambled faces and poses a rather difficult decoding problem at the single trial level. We implement the pipeline using spatially focused features and show that this approach is challenged and source imaging does not lead to an improved decoding. We design a distributed pipeline in which the classifier has access to brain wide features which in turn does lead to a 15% reduction in the error rate using source space features. Hence, our work presents supporting evidence for the hypothesis that source imaging improves decoding.
**Effect-driven QuickChecking of compilers**

How does one test a language implementation with QuickCheck (aka. property-based testing)? One approach is to generate programs following the grammar of the language. But in a statically-typed language such as OCaml too many of these candidate programs will be rejected as ill-typed by the type checker. As a refinement Pałka et al. propose to generate programs in a goal-directed, bottom-up reading up of the typing relation. We have written such a generator. However many of the generated programs has output that depend on the evaluation order, which is commonly under-specified in languages such as OCaml, Scheme, C, C++, etc. In this paper we develop a type and effect system for conservatively detecting evaluation-order dependence and propose its goal-directed reading as a generator of programs that are independent of evaluation order. We illustrate the approach by generating programs to test OCaml's two compiler backends against each other and report on a number of bugs we have found doing so.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Formal Methods, Technical University of Denmark
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Number of pages: 23
Pages: 1-23
Publication date: 2017

**Host publication information**

Title of host publication: Proceedings of the ACM on Programming Languages
Volume: 1
Publisher: Association for Computing Machinery
Series: Proceedings of the ACM on Programming Languages
ISSN: 2475-1421
Main Research Area: Technical/natural sciences
QuickCheck, compiler testing, type and effect system
DOIs:
10.1145/3110259
Source: FindIt
Source-ID: 2373440841
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

**Effective connectivity and gamma oscillations in a group at risk of psychosis**

22q11.2 Deletion Syndrome (22q11.2DS) has been shown to be associated with a markedly increased risk for schizophrenia. Therefore, 22q11.2DS is a homogeneous genetic liability model which enables studies intending to identify functional abnormalities that may precede disease onset of schizophrenia. Being able to define these functional abnormalities could potentially assist in the search of biomarkers for schizophrenia. These are highly desired since early notification as well as early treatment have shown positive effects on everyday functioning in schizophrenia patients.

This thesis aimed at looking for functional abnormalities, known to be found in schizophrenia, in a cohort of 22q11.2 deletion carriers. The search for functional abnormalities in the 22q11.2 deletion syndrome cohort, were carried out measuring EEG while subjects engaged in a roving mismatch negativity (MMN) paradigm as well as an auditory steady state paradigm. Both of these paradigms are known to involve processes that are impaired in schizophrenia. This thesis ties together the three main contributions which are divided into three studies. In the first study, the responses to a roving MMN paradigm were assessed in 22q11.2 deletion carriers and healthy controls. Both conventional analysis of the MMN paradigm responses as well as a more sophisticated approach by means of Dynamic Causal Modelling (DCM) were carried out. DCM is a technique to extract effective connectivity between pre-specified brain areas. With this technique we investigated the underlying network of change detection in the two groups. While we found no indication of a reduced MMN response at the scalp level in the 22q11.2 deletion carriers, the underlying network of change detection differed as compared to healthy controls.

Second study extended study number one by employing a parametric DCM to study the underlying network of repetition suppression in 22q11.2 deletion carriers and healthy controls. While results for the control group indicated a processing in accordance with the predictive coding theory, this was not the case for the 22q11.2 deletion carriers.

Finally, in the third study the ability to generate 40 Hz cortical oscillations were assessed in 22q11.2 deletion carriers as well as healthy controls using an auditory steady state paradigm. Here, it was found that both phase and power of the 40 Hz oscillatory activity were reduced in 22q11.2 deletion carriers as compared to healthy controls.

In the three studies, results both similar and dissimilar to what is observed in the schizophrenia literature were found. The studies contribute in understanding the underlying pathology of 22q11.2 deletion syndrome and if results are confirmed by longitudinal follow up studies, the results might contribute in the search of biomarkers for schizophrenia.
Effect of different oral oxytetracycline treatment regimes on selection of antimicrobial resistant coliforms in nursery pigs

A major concern derived from using antimicrobials in pig production is the development of resistance. This study aimed to assess the impact of selected combinations of oral dose and duration of treatment with oxytetracycline (OTC) on selection of tetracycline resistant (TET-R) coliforms recovered from swine feces. The work encompassed two studies: 1) OTC 5 mg/kg and 20 mg/kg were administered to nursery pigs for 3 and 10 days, respectively, under controlled experimental conditions, and 2) 10 mg/kg, 20 mg/kg and 30 mg/kg OTC were given to a higher number of pigs for 6, 3 and 2 days, respectively, under field conditions. Statistical modeling was applied to analyze trends in the proportion of TET-R coliforms. In the experimental study, no statistical difference in proportion of TET-R coliforms was observed between treatments at the end of the trial (day 18) and compared to day 0. In the field study, treatment had a significant effect on the proportion of TET-R bacteria two days after the end of treatment (2dAT) with the regimes "low dose-six days" and "medium dose-three days" yielding the highest and lowest proportions of TET-R strains, respectively. No indication of co-selection for ampicillin- and sulphonamide-R bacteria was observed for any treatment at 2dAT. By the end of the nursery period, the proportion of TET-R bacteria was not significantly different between treatments and compared to day 0. Our results suggest that similar resistance levels might be obtained by using different treatment regimes regardless of the combinations of oral dose-duration of treatment.
Effect of Linked Rules on Business Process Model Understanding

Business process models are widely used in organizations by information systems analysts to represent complex business requirements and by business users to understand business operations and constraints. This understanding is extracted from graphical process models as well as business rules. Prior research advocated integrating business rules into business process models to improve the effectiveness of important organizational activities, such as developing shared understanding, effective communication, and process improvement. However, whether such integrated modeling can improve the understanding of business processes has not been empirically evaluated. In this paper, we report on an experiment that investigates the effect of linked rules, a specific rule integration approach, on business process model understanding. Our results indicate that linked rules are associated with better time efficiency in interpreting business operations, less mental effort, and partially associated with improved accuracy of understanding.

General information
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Pages: 200-215
Publication date: 2017

Host publication information
Title of host publication: Business Process Management
Publisher: Springer
ISBN (Print): 978-3-319-64999-3
Series: Lecture Notes in Computer Science
Volume: 10445
ISSN: 0302-9743
Main Research Area: Technical/natural sciences
Conference: 15th International Conference on Business Process Management (BPM 2017), Barcelona, Spain, 10/09/2017 - 10/09/2017
Business Process Modeling, Business Rule Modeling, Cognitive Research
Electronic versions: BPM_v21.pdf
DOIs: 10.1007/978-3-319-65000-5_12
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Effect of tetracycline dose and treatment-mode on selection of resistant coliform bacteria in nursery pigs

This study describes results of a randomized clinical trial investigating the effect of oxytetracycline treatment dose and mode of administration on selection of antibiotic resistant coliform bacteria in fecal samples from nursery pigs. Nursery pigs (pigs of 4-7 weeks of age) were treated with oxytetracycline against Lawsonia intracellularis induced diarrhea in five pig herds. Each group was randomly allocated to one of five treatment groups: oral flock treatment with (i) high (20 mg/kg), (ii) medium (10 mg/kg) and (iii) low (5 mg/kg) dosage, (iv) oral-pen-wise (small group) treatment (10 mg/kg), and (v) individual intramuscular injection treatment (10mg/kg). All groups were treated once a day for five days. In all groups, treatment caused a rise in numbers and proportion of tetracycline resistant coliform bacteria right after treatment, followed by a significant drop by the time where pigs left the nursery unit. Counts and proportion of tetracycline-resistant coliforms did not vary significantly between treatment groups, except immediately after treatment, where the highest treatment dose resulted in the highest number of resistant coliforms. A control group treated with tiamuline did not show significant changes in number or proportion of tetracycline resistant coliform bacteria right after treatment, followed by a significant drop by the time where pigs left the nursery unit. Counts and proportion of tetracycline-resistant coliforms did not vary significantly between treatment groups, except immediately after treatment, where the highest treatment dose resulted in the highest number of resistant coliforms. A control group treated with tiamuline did not show significant changes in number or proportion of tetracycline resistant coliforms. Selection for tetracycline-resistant coliforms was significantly correlated to selection for ampicillin- and sulfonamide-resistant, but not to cefotaxime-resistant strains. In conclusion, difference in dose of oxytetracycline and the way the drug was applied did not cause significantly different selection of tetracycline resistant coliform bacteria, under the conditions tested. IMPORTANCE Antimicrobial resistance is a global threat to human health. Treatment of livestock with antimicrobials has a direct impact on this problem, and there is a need to improve the ways that we use antimicrobial in livestock production. We hypothesized that antibiotic resistance development following treatment of diarrhea in nursery pigs could be reduced by either lowering the dose of oxytetracycline or by replacing the commonly used practice of flock treatment with individual or small group treatments, since this would reduce the number of pigs treated. However, the study showed no significant difference between treatment-groups with respect to the number or proportion of tetracycline resistant coliforms selected. The most important conclusion is that under the practical field conditions, there will be no added value in terms of lowering resistance development by exchanging flock treatment with individual or small group treatment of nursery pigs. The reason for lack of effect of single animal treatment is probably that such animals share the environment with treated animals and take up resistant bacteria from the environment.
Effects of Exposure to Carbon Dioxide and Bioeffluents on Perceived Air Quality, Self-assessed Acute Health Symptoms and Cognitive Performance

The purpose of this study was to examine the effects on humans of exposure to carbon dioxide (CO₂) and bioeffluents. In three of the five exposures, the outdoor air supply rate was high enough to remove bioeffluents, resulting in a CO₂ level of 500 ppm. Chemically pure CO₂ was added to this reference condition to create exposure conditions with CO₂ at 1,000 ppm or 3,000 ppm. In two further conditions, the outdoor air supply rate was restricted so that the bioeffluent CO₂ reached 1,000 ppm or 3,000 ppm. The same twenty-five subjects were exposed for 255 minutes to each condition. Subjective ratings, physiological responses and cognitive performance were measured. No statistically significant effects on perceived air quality, acute health symptoms or cognitive performance were seen during exposures when CO₂ was added. Exposures to bioeffluents with CO₂ at 3,000 ppm reduced perceived air quality, increased the intensity of reported headache, fatigue, sleepiness and difficulty in thinking clearly, and reduced speed of addition, the response time in a redirection task and the number of correct links made in the cue-utilisation test. This suggests that moderate concentrations of bioeffluents, but not pure CO₂, will result in deleterious effects on occupants during typical indoor exposures.

General Information

State: Published
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Pages: 47-64
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication Information

Journal: Indoor Air
Volume: 27
Issue number: 1
ISSN (Print): 0905-6947
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.9
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.55
Effects of imaging gradients in sequences with varying longitudinal storage time-Case of diffusion exchange imaging

Purpose: To illustrate the potential bias caused by imaging gradients in correlation MRI sequences using longitudinal magnetization storage (LS) and examine the case of filter exchange imaging (FEXI) yielding maps of the apparent exchange rate (AXR). Methods: The effects of imaging gradients in FEXI were observed on yeast cells. To analyze the AXR bias, signal evolution was calculated by applying matrix exponential operators. Results: A sharp threshold for the slice thickness was identified, below which the AXR is increasingly underestimated. The bias can be understood in terms of an extended low-pass diffusion filtering during the LS interval, which is more pronounced at lower exchange rates. For a total exchange rate constant larger than 1 s⁻¹, the AXR bias is expected to be negligible when slices thicker than 2.5mm are used. Conclusion: In correlation experiments like FEXI, relying on LS with variable duration, imaging gradients may
cause disrupting effects that cannot be easily mitigated and should be carefully considered for unbiased results. In typical clinical applications of FEXI, the imaging gradients are expected to cause a negligible AXR bias. However, the AXR bias may be significant in preclinical settings or whenever thin imaging slices are used.

**General information**

State: Published
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Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Magnetic Resonance in Medicine
ISSN (Print): 0740-3194
Ratings:
- BFI (2018): BFI-level 1
- BFI (2017): BFI-level 1
- Scopus rating (2017): CiteScore 3.77 SJR 1.89 SNIP 1.411
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 3.52 SJR 1.945 SNIP 1.451
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 2.329 SNIP 1.481 CiteScore 3.54
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 2.015 SNIP 1.382 CiteScore 3.32
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 2.039 SNIP 1.433 CiteScore 3.46
- ISI indexed (2013): ISI indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 2.158 SNIP 1.553 CiteScore 3.61
- ISI indexed (2012): ISI indexed yes
- BFI (2011): BFI-level 2
- Scopus rating (2011): SJR 2.16 SNIP 1.461 CiteScore 3.45
- ISI indexed (2011): ISI indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 2.356 SNIP 1.606
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 2.331 SNIP 1.553
- BFI (2008): BFI-level 1
- Scopus rating (2008): SJR 2.468 SNIP 1.5
- BFI (2007): BFI-level 1
- Scopus rating (2007): SJR 2.397 SNIP 1.536
- BFI (2006): BFI-level 1
- Scopus rating (2006): SJR 2.319 SNIP 1.756
- BFI (2005): BFI-level 1
- Scopus rating (2005): SJR 2.298 SNIP 1.833
- BFI (2004): BFI-level 1
- Scopus rating (2004): SJR 2.154 SNIP 1.741
Efficient configurations for block ciphers with unified ENC/DEC paths

Block Ciphers providing the combined functionalities of encryption and decryption are required to operate in modes of operation like CBC and ELMd. Hence such architectures form critical building blocks for secure cryptographic implementations. Depending on the algebraic structure of a given cipher, there may be multiple ways of constructing the combined encryption/decryption circuit, each targeted at optimizing lightweight design metrics like area or power etc. In this paper we look at how the choice of circuit configuration affects the energy required to perform one encryption/decryption. We begin by analyzing 12 circuit configurations for the Advanced Encryption Standard (AES-128) cipher and establish some design rules for energy efficiency. We then extend our analysis to several lightweight block ciphers. In the second part of the paper we also investigate area optimized circuits for combined implementations of these ciphers.

Electrophysiological evidence for differences between fusion and combination illusions in audiovisual speech perception

Incongruent audiovisual speech stimuli can lead to perceptual illusions such as fusions or combinations. Here, we investigated the underlying audiovisual integration process by measuring ERPs. We observed that visual speech-induced suppression of P2 amplitude (which is generally taken as a measure of audiovisual integration) for fusions was comparable to suppression obtained with fully congruent stimuli, whereas P2 suppression for combinations was larger. We argue that these effects arise because the phonetic incongruency is solved differently for both types of stimuli. This article is protected by copyright. All rights reserved.
End-to-end information extraction without token-level supervision

Most state-of-the-art information extraction approaches rely on token-level labels to find the areas of interest in text. Unfortunately, these labels are time-consuming and costly to create, and consequently, not available for many real-life IE tasks. To make matters worse, token-level labels are usually not the desired output, but just an intermediary step. End-to-end (E2E) models, which take raw text as input and produce the desired output directly, need not depend on token-level labels. We propose an E2E model based on pointer networks, which can be trained directly on pairs of raw input and output text. We evaluate our model on the ATIS data set, MIT restaurant corpus and the MIT movie corpus and compare to neural baselines that do use token-level labels. We achieve competitive results, within a few percentage points of the baselines, showing the feasibility of E2E information extraction without the need for token-level labels. This opens up new possibilities, as for many tasks currently addressed by human extractors, raw input and output data are available, but not token-level labels.
Enhancing collaborative intrusion detection networks against insider attacks using supervised intrusion sensitivity-based trust management model

To defend against complex attacks, collaborative intrusion detection networks (CIDNs) have been developed to enhance the detection accuracy, which enable an IDS to collect information and learn experience from others. However, this kind of networks is vulnerable to malicious nodes which are utilized by insider attacks (e.g., betrayal attacks). In our previous research, we developed a notion of intrusion sensitivity and identified that it can help improve the detection of insider attacks, whereas it is still a challenge for these nodes to automatically assign the values. In this article, we therefore aim to design an intrusion sensitivity-based trust management model that allows each IDS to evaluate the trustworthiness of others by considering their detection sensitivities, and further develop a supervised approach, which employs machine learning techniques to automatically assign the values of intrusion sensitivity based on expert knowledge. In the evaluation, we compare the performance of three different supervised classifiers in assigning sensitivity values and investigate our trust model under different attack scenarios and in a real wireless sensor network. Experimental results indicate that our trust model can enhance the detection accuracy of malicious nodes and achieve better performance as compared with similar models.

General information
State: Published
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Number of pages: 11
Pages: 135-145
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Network and Computer Applications
Volume: 77
ISSN (Print): 1084-8045
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 5.13 SJR 0.784 SNIP 2.401
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.42 SJR 0.728 SNIP 2.486
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.775 SNIP 2.665 CiteScore 3.98
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.878 SNIP 2.943 CiteScore 3.82
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.69 SNIP 2.741 CiteScore 3.21
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.537 SNIP 2.028 CiteScore 2.48
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.438 SNIP 1.896 CiteScore 1.97
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.388 SNIP 1.022
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.414 SNIP 1.484
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.544 SNIP 1.315
Scopus rating (2007): SJR 0.635 SNIP 2.635
Scopus rating (2006): SJR 0.414 SNIP 1.846
Scopus rating (2005): SJR 0.201 SNIP 0.802
Scopus rating (2004): SJR 0.238 SNIP 0.624
Scopus rating (2003): SJR 0.413 SNIP 0.891
Enhancing Trust Management for Wireless Intrusion Detection via Traffic Sampling in the Era of Big Data

Internet of Things (IoT) has been widely used in our daily life, which enables various objects to be interconnected for data exchange, including physical devices, vehicles, and other items embedded with network connectivity. Wireless sensor network (WSN) is a vital application of IoT, providing many kinds of information among sensors, whereas such network is vulnerable to a wide range of attacks, especially insider attacks, due to its natural environment and inherent unreliable transmission. To safeguard its security, intrusion detection systems (IDSs) are widely adopted in a WSN to defend against insider attacks through implementing proper trust-based mechanisms. However, in the era of big data, sensors may generate excessive information and data, which could degrade the effectiveness of trust computation. In this paper, we focus on this challenge and propose a way of combining Bayesian-based trust management with traffic sampling for wireless intrusion detection under a hierarchical structure. In the evaluation, we investigate the performance of our approach in both a simulated and a real network environment. Experimental results demonstrate that packet-based trust management would become ineffective in a heavy traffic environment, and that our approach can help lighten the burden of IDSs in handling traffic while maintaining the detection of insider attacks.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cyber Security, Technical University of Denmark, University of Aizu, Singapore University of Technology and Design, University of New Brunswick
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Pages: 7234 - 7243
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: IEEE Access
Volume: 6
ISSN (Print): 2169-3536
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.49
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 5.13
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 4.32
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 3.16
BFI (2013): BFI-level 1
Original language: English
Electronic versions:
08105800.pdf
DOIs:
10.1109/ACCESS.2017.2772294
Source: FindIt
Source-ID: 2394676400
Publication: Research - peer-review › Journal article – Annual report year: 2018
Enhancing User Experience in Next Generation Mobile Devices Using Eye Tracking as a Biometric Sensor

A good User Experience is not about just “getting the job done” in the most efficient way. It is also about the subjective elements, providing a positive experience to the user while doing so; emotionally and affectively, having the user engage with the service or product.

Knowing when this takes place means we need ways of measuring concepts like attention. The basis for this should preferably be rooted in our understanding of the anatomically based attention networks of the brain.

This thesis looks at biometric markers of cognitive and affective processes; at the overview level Electroencephalography (EEG), Galvanic Skin Conductance (GSR), Heart Rate and Heart Rate Variability as well as Face Expression Detection – and in much more detail Eye Tracking.

A simple framework for relating eye movements and pupil dilations to the visual processing system and to the attentional networks is suggested. It is demonstrated that it is possible to identify components of attention and cognitive load using low cost eye tracking in conventional office settings. It is also shown that aspects of surprise, similar to negativity feedback error coding, is measurable. Behavioural patterns possibly related to time on target, cognitive load, performance or stimuli are inferred. The existence of possibly unique individual gaze patterns related to visual stimuli or to the brain’s Default Mode Network are shown.

A way of synchronizing EEG and Eye Tracking is also suggested, and in addition, a few software assets (a Python interface to The Eye Tribe tracker and an implementation of the Attention Network Test (ANT)) have been created.

General information
State: Published
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Number of pages: 260
Publication date: 2017

Publication information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Original language: English

Series: DTU Compute PHD-2016
Number: 433
ISSN: 0909-3192
Main Research Area: Technical/natural sciences
Electronic versions: phd433_Bakgaard_P.pdf

Relations
Projects:
Enhancing User Experience in Next Generation Mobile Devices Using Eye Tracking as a Biometric Sensor
Publication: Research › Ph.D. thesis – Annual report year: 2017

Epistemic Planning: (Dagstuhl Seminar 17231)
The seminar Epistemic Planning brought together the research communities of Dynamic Epistemic Logic, Knowledge Representation and Reasoning, and Automated Planning to address fundamental problems on the topic of epistemic planning. In the context of this seminar, dynamic epistemic logic investigates the formal semantics of communication and communicative actions, knowledge representation and reasoning focuses on theories of action and change, and automated planning investigates computational techniques and tools to generate plans. The original goals of the seminar were to develop benchmarks for epistemic planning, to explore the relationship between knowledge and belief in multi-agent epistemic planning, to develop models of agency and capability in epistemic planning and to explore action types and their representations (these originally separate goals were merged during the seminar), and finally to identify practical tools and resources. An additional goal explored during the workshop was the correspondence between planning problems and games.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Arizona State University, Universite de Lorraine, University of Toronto
ePNK Applications and Annotations
The ePNK is an Eclipse based framework and platform for developing and integrating Petri net tools and applications. One of its core features is that new types of Petri nets can be realized and plugged into the ePNK without any programming by providing a model of the concepts of the new type, the so-called Petri net type definition (PNTD). Moreover, the ePNK allows developers customizing the graphical appearance of the features of a new Petri net type. The main idea and features of the ePNK have been presented before [1, 2]. One important aspect of the ePNK, however, has not been discussed yet: realizing new applications for the ePNK and, in particular, visualizing the result of an application in the graphical editor of the ePNK by using annotations, and interacting with the end user using these annotations.
In this paper, we give an overview of the concepts of ePNK applications by discussing the implementation of a simulator for YAWL nets [3].

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Software and Process Engineering
Authors: Kindler, E. (Intern)
Pages: 27-32
Publication date: 2017

Erratum to: A global approach for sparse representation of uncertainty in Life Cycle Assessments of waste management systems
Erratum to: Int J Life Cycle Assess DOI 10.1007/s11367-015-1014-4

General information
State: Published
Authors: Bisinella, V. (Intern), Conradsen, K. (Intern), Christensen, T. H. (Intern), Astrup, T. F. (Intern)
Number of pages: 1
Estimation of the transmission dynamics of African swine fever virus within a swine house

The spread of African swine fever virus (ASFV) threatens to reach further parts of Europe. In countries with a large swine production, an outbreak of ASF may result in devastating economic consequences for the swine industry. Simulation models can assist decision makers setting up contingency plans. This creates a need for estimation of parameters. This study presents a new analysis of a previously published study. A full likelihood framework is presented including the impact of model assumptions on the estimated transmission parameters. As animals were only tested every other day, an interpretation was introduced to cover the weighted infectiousness on unobserved days for the individual animals (WIU). Based on our model and the set of assumptions, the within- and between-pen transmission parameters were estimated to $\beta_w = 1.05$ (95% CI 0.62-1.72), $\beta_b = 0.46$ (95% CI 0.17-1.00), respectively, and the WIU = 1.00 (95% CI 0-1). Furthermore, we simulated the spread of ASFV within a pig house using a modified SEIR-model to establish the time from infection of one animal until ASFV is detected in the herd. Based on a chosen detection limit of 2.55% equivalent to 10 dead pigs out of 360, the disease would be detected 13-19 days after introduction.
Evaluating challenge-based trust mechanism in medical smartphone networks: an empirical study

Intrusion detection systems (IDSs) are one of the widely adopted security tools in protecting computer networks, whereas it is still a big challenge for a single IDS to identify various threats in practice. Collaborative intrusion detection networks (CIDNs) are then developed in order to enhance the detection capability of a single IDS. However, CIDNs are known to suffer from insider attacks, in which malicious nodes can perform adversary actions. To mitigate this issue, challenge-based trust mechanisms are one of the promising solutions in literature, which are robust against various common insider threats. With the popularity of mobile devices, medical smartphone networks (MSNs) have become an emerging network architecture for healthcare organizations to improve the quality of medical services. Due to the sensitivity, there is a great need to defend MSNs against insider attacks. In this work, we conduct an empirical study to investigate and evaluate the implementation of challenge-based mechanism in MSNs. Our work aims to complement current literature, through providing insights and learned lessons (i.e., whether it is suitable to deploy such a mechanism in MSNs).

Evaluation of optical functional surfaces on the injection moulding insert by micro milling process

This study presents the optimization of micro milling process for manufacturing injection moulding inserts with an optical functional surface. The objective is the optimal surface functionality. Micro ridges were used as the microstructures to realize the function to generate contrast between orthogonally textured areas by reflecting light in different directions. In order to maximize the contrast, a sample was machined with the same structures and dimensions, according to a Design of Experiments (DOEs) to optimize the milling parameters by considering the contrast as a response. The contrast was evaluated based on the image processing method. The proper cutting condition was selected in order to obtain machined surface with the highest contrast and the results presented by DOE analysis. The correlations between the cutting parameters, the burrs height, and the function were determined. The contrast was found to be proportional to the spindle speed and feed rate and "oil+air" was considered as the preferred cooling method.
Evidence logics with relational evidence

We introduce a family of logics for reasoning about relational evidence: evidence that involves an ordering of states in terms of their relative plausibility. We provide sound and complete axiomatizations for the logics. We also present several evidential actions and prove soundness and completeness for the associated dynamic logics.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, University of Amsterdam
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Pages: 17-32
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Lecture Notes in Computer Science
Volume: 10445
ISSN (Print): 0302-9743
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 0.9 SJR 0.295 SNIP 0.655
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.67 SJR 0.339 SNIP 0.642
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.369 SNIP 0.684 CiteScore 0.37
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.354 SNIP 0.743 CiteScore 0.42
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.36 SNIP 0.761 CiteScore 0.49
ISI indexed (2013): ISI indexed no
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.346 SNIP 0.762 CiteScore 0.49
ISI indexed (2012): ISI indexed no
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.338 SNIP 0.765 CiteScore 0.49
ISI indexed (2011): ISI indexed no
Evidence of complex contagion of information in social media: An experiment using Twitter bots

It has recently become possible to study the dynamics of information diffusion in techno-social systems at scale, due to the emergence of online platforms, such as Twitter, with millions of users. One question that systematically recurs is whether information spreads according to simple or complex dynamics: does each exposure to a piece of information have an independent probability of a user adopting it (simple contagion), or does this probability depend instead on the number of sources of exposure, increasing above some threshold (complex contagion)? Most studies to date are observational and, therefore, unable to disentangle the effects of confounding factors such as social reinforcement, homophily, limited attention, or network community structure. Here we describe a novel controlled experiment that we performed on Twitter using ‘social bots’ deployed to carry out coordinated attempts at spreading information. We propose two Bayesian statistical models describing simple and complex contagion dynamics, and test the competing hypotheses. We provide experimental evidence that the complex contagion model describes the observed information diffusion behavior more accurately than simple contagion. Future applications of our results include more effective defenses against malicious propaganda campaigns on social media, improved marketing and advertisement strategies, and design of effective network intervention techniques.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, University of Southern California
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Number of pages: 12
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: PLoS One
Volume: 12
Issue number: 9
Article number: e0184148
ISSN (Print): 1932-6203
Examination of heterogeneous societies: Identifying subpopulations by contrasting cultures

The recent development of data analytic tools rooted around the Multi-Group Latent Class Analysis (MGLCA) has enabled the examination of heterogeneous datasets in a cross-cultural context. Although the MGLCA is considered as an established and popular cross-cultural data analysis approach, the infinite relational model (IRM) is a new and disruptive type of unsupervised clustering approach that has been developed recently by cognitive psychologists and computer...
scientists. In this article, an extended version of the IRM coined the multinominal IRM—or mIRM in short—is applied to a cross-cultural analysis of survey data available from the World Value Survey organization. Specifically, the present work analyzes response patterns of the Portrait Value Questionnaire (PVQ) representing Schwartz’s 10 basic values of Japanese and Swedes. The applied model exposes heterogeneous structures of the two societies consisting of fine-grained response patterns expressed by the respective subpopulations and extracts latent typological structures contrasting and highlighting similarities and differences between these two societies. In the final section, we discuss similarities and differences identified between the MGLCA and the mIRM approaches, which indicate potential applications and contributions of the mIRM and the general IRM framework for future cross-cultural data analyses.

General information
State: Published
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Number of pages: 19
Pages: 39–57
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Cross-Cultural Psychology
Volume: 48
Issue number: 1
ISSN (Print): 0022-0221
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.101 SJR 1.018 CiteScore 1.78
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): SJR 1.247 SNIP 1.472 CiteScore 2.18
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.244 SNIP 1.572 CiteScore 2.11
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.374 SNIP 2.111 CiteScore 2.37
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.96 SNIP 1.286 CiteScore 1.81
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.277 SNIP 1.436 CiteScore 1.66
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.177 SNIP 1.652 CiteScore 1.73
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.322 SNIP 1.548
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.091 SNIP 1.521
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.234 SNIP 1.569
Scopus rating (2007): SJR 1.943 SNIP 1.998
Scopus rating (2006): SJR 1.614 SNIP 1.74
Scopus rating (2005): SJR 1.248 SNIP 1.061
Scopus rating (2004): SJR 1.064 SNIP 1.419
Scopus rating (2003): SJR 1.274 SNIP 1.637
Scopus rating (2002): SJR 1.064 SNIP 1.496
Scopus rating (2001): SJR 1.527 SNIP 1.667
Scopus rating (2000): SJR 1.216 SNIP 1.612
Scopus rating (1999): SJR 1.195 SNIP 1.652
Original language: English
Heterogeneity, Cross-cultural data analysis, Intracultural data analysis, Clustering, Data structuring, Unsupervised machine learning, Nonparametric Bayesian relational modeling, Infinite relational model, World Value Survey, Schwartz’s
Excavating the mother lode of human-generated text: A systematic review of research that uses the Wikipedia corpus

Although primarily an encyclopedia, Wikipedia's expansive content provides a knowledge base that has been continuously exploited by researchers in a wide variety of domains. This article systematically reviews the scholarly studies that have used Wikipedia as a data source, and investigates the means by which Wikipedia has been employed in three main computer science research areas: information retrieval, natural language processing, and ontology building. We report and discuss the research trends of the identified and examined studies. We further identify and classify a list of tools that can be used to extract data from Wikipedia, and compile a list of currently available data sets extracted from Wikipedia.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, Elon University, Concordia University, University of Oulu
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Number of pages: 25
Pages: 505–529
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Information Processing & Management
Volume: 53
Issue number: 2
ISSN (Print): 0306-4573
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 2.66 SJR 0.92 CiteScore 4.23
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.83 SJR 0.705 SNIP 2.007
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.73 SNIP 1.978 CiteScore 2.37
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.762 SNIP 1.955 CiteScore 2.07
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.675 SNIP 1.614 CiteScore 2.05
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.606 SNIP 1.684 CiteScore 1.99
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.849 SNIP 2.588 CiteScore 2.58
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.877 SNIP 2.198
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 0.974 SNIP 2.441
BFI (2008): BFI-level 2
Exploring Effect of Location Number on Map-Based Graphical Password Authentication

Graphical passwords (GPs) that authenticate users using images are considered as one potential alternative to overcome the issues of traditional textual passwords. Based on the idea of utilizing an extremely large image, map-based GPs like PassMap and GeoPass have been developed, where users can select their secrets (geographical points) on a world map. In particular, PassMap allows users to select two locations on a map, while GeoPass reduces the number of locations to only one. At first glance, selecting one location is more vulnerable to attacks, while increasing the location number may add burden on users. In the literature, there is no research exploring this issue. Motivated by this, our purpose in this work is to explore the effect of location number (the number of geographical points) and compare two schemes of PassMap and GeoPass in terms of users' performance and feedback. In this work, we develop a generic and open platform for realizing map-based schemes, and conduct a user study with 60 participants. The study reveals that selecting two locations would not degrade the scheme performance. Our effort aims to complement exiting research studies in this area.

Exploring Energy Consumption of Juice Filming Charging Attack on Smartphones: A Pilot Study

With the increasing demand of smartphone charging, more and more public charging stations are under construction (e.g., airports, subways, shops). This scenario may expose a good chance for cybercriminals to launch charging attacks and steal user's private information. Juice filming charging (JFC) attack is one example, which can steal users' sensitive
information from both Android OS and iOS devices, through automatically recording phone-screen information and the user inputs during the charging process. The rationale is that users’ information can be leaked through a standard micro USB connector that employs the Mobile High-Definition Link (MHL) standard. Motivated by the potential damage of charging attack, we focus on JFC attack in this paper, and investigate for the first time the energy consumption, especially CPU usage caused by JFC attack. In particular, we conduct a user study with over 500 participants and identify that JFC attack may increase CPU usage when connecting the phone to the malicious charger, but this anomaly is hard for raising the attention from a common user. Our work aims to complement existing state-of-the-art results, raise more attention and stimulate more research on charging attacks.

**General information**
State: Published
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Pages: 199-213
Publication date: 2017

**Host publication information**
Title of host publication: Network and System Security 2017
Volume: 10394
Publisher: Springer
ISBN (Print): 9783319647005
Series: Lecture Notes in Computer Science
Volume: 10394
ISSN: 0302-9743
Main Research Area: Technical/natural sciences
Conference: 11th International Conference on Network and System Security, Helsinki, Finland, 21/08/2017 - 21/08/2017

**DOIs:**
10.1007/978-3-319-64701-2_15
Source: FindIt
Source-ID: 2372953630
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

**Exploring the Use of Design of Experiments in Industrial Processes Operating Under Closed-Loop Control:**

**Experimentation in closed-loop systems**
Industrial manufacturing processes often operate under closed-loop control, where automation aims to keep important process variables at their set-points. In process industries such as pulp, paper, chemical and steel plants, it is often hard to find production processes operating in open loop. Instead, closed-loop control systems will actively attempt to minimize the impact of process disturbances. However, we argue that an implicit assumption in most experimental investigations is that the studied system is open loop, allowing the experimental factors to freely affect the important system responses. This scenario is typically not found in process industries. The purpose of this article is therefore to explore issues of experimental design and analysis in processes operating under closed-loop control and to illustrate how Design of Experiments can help in improving and optimizing such processes. The Tennessee Eastman challenge process simulator is used as a test-bed to highlight two experimental scenarios. The first scenario explores the impact of experimental factors that may be considered as disturbances in the closed-loop system. The second scenario exemplifies a screening design using the set-points of controllers as experimental factors. We provide examples of how to analyze the two scenarios.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Luleå University of Technology
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Number of pages: 14
Pages: 1601-1614
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Quality and Reliability Engineering International
Volume: 33
Issue number: 7
Explosion i rökammare med biogas
En biogasreaktor exploderade 1990 på Vejle Centrala reningsverk. Nu, 24 år senare, när biogas är populärare än någonsin, har händelsen helt försvunnit från tillgängliga, öppna källor

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Statistics and Data Analysis
Authors: Hedlund, F. H. (Intern)
Pages: 20-23
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Kemivärlden Biotech med Kemisk Tidsskrift
Issue number: 4
ISSN (Print): 1650-0725
Original language: English
Source: PublicationPreSubmission
Source-ID: 134614807
Publication: Communication › Journal article – Annual report year: 2017

Research on the process of process modeling (PPM) studies how process models are created. It typically uses the logs of the interactions with the modeling tool to assess the modeler’s behavior. In this paper we suggest to introduce an additional stream of data (i.e., eye tracking) to improve the analysis of the PPM. We show that, by exploiting this additional source of information, we can refine the detection of comprehension phases (introducing activities such as "semantic validation" or "problem understanding") as well as provide more exploratory visualizations (e.g., combined modeling phase diagram, heat maps, fixations distributions) both static and dynamic (i.e., movies with the evolution of the model and eye tracking data on top).

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Software and Process Engineering, University of Innsbruck
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Pages: 461-473
Publication date: 2017

Host publication information
Title of host publication: Business Process Management Workshops
Publisher: Springer
Editors: Dumas, M., Fantinato, M.
ISBN (Print): 978-3-319-58457-7
Series: Lecture Notes in Business Information Processing
Volume: 281
ISSN: 1865-1348
Main Research Area: Technical/natural sciences
Process of Process Modeling, Eye Tracking, Modeling Phase Diagram
Electronic versions:
2016_taproviz_2.pdf
DOIs:
10.1007/978-3-319-58457-7_34
Source: PublicationPreSubmission
Source-ID: 132123546
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017
Fast architecture-level synthesis of fault-tolerant flow-based microfluidic biochips

Microfluidic-based lab-on-a-chips have emerged as a popular technology for implementation of different biochemical test protocols used in medical diagnostics. However, in the manufacturing process or during operation of such chips, some faults may occur that leads to damage of the chip, which in turn results in wastage of expensive reagent fluids. In order to make the chip fault-tolerant, the state-of-the-art technique adopts simulated annealing (SA) based approach to synthesize a fault-tolerant architecture. However, the SA method is time consuming and non-deterministic with over-simplified model that usually derive sub-optimal results. Thus, we propose a progressive optimization procedure for the synthesis of fault-tolerant flow-based microfluidic biochips. Simulation results demonstrate that proposed method is efficient compared to the state-of-the-art techniques and can provide effective solutions in 88% (on average) less CPU time compared to state-of-the-art technique over three benchmark bioprotocols.

Fast Dynamic Arrays

We present a highly optimized implementation of tiered vectors, a data structure for maintaining a sequence of n elements supporting access in time O(1) and insertion and deletion in time O(n) for > 0 while using o(n) extra space. We consider several different implementation optimizations in C++ and compare their performance to that of vector and set from the standard library on sequences with up to 10^8 elements. Our fastest implementation uses much less space than set while providing speedups of 40× for access operations compared to set and speedups of 10,000× compared to vector for insertion and deletion operations while being competitive with both data structures for all other operations.
Fast, versatile, and non-destructive biscuit inspection system using spectral imaging

A fast, versatile, and non-destructive method for assessing biscuit quality is presented. The method integrates color (or browning) measurement, moisture assessment, compositional and dimensional measurements on a spectral imaging platform using the silicon range 400–1000 nm.

Fatigue Damage Evolution in Fibre Composites for Wind Turbine Blades

One of the largest challenges in wind turbine design, is realistically predicting the lifetime of the blades. Wind turbine blades experience a high number of fatigue load cycles during their life-time, and the fatigue damage mechanisms of the non-crimp fabric based glass fibre composites used for the load carrying parts of wind turbine blades are not well understood. This PhD project establishes experimental methods making it possible to monitor the damage initiation and progression of fibre composites in 3D using X-ray CT. To overcome the resolution challenges of X-ray CT, a tension clamp solution that applies load to the specimen during X-ray CT examination is presented, and the advantage of combining X-ray CT with other techniques such as transilluminated white light imaging is demonstrated. The established methods are used to monitor the damage initiation and progression of fatigue damage on the micro-scale in the non-crimp fabric based composites used for wind turbine blades.

The results show that fibre fractures in the unidirectional (UD) load carrying fibre bundles initiate from off-axis cracks in the thin supporting backing fibre bundles. With an increasing number of fatigue load cycles, the UD fibre fractures progress gradually into the thickness direction of the UD fibre bundles, which eventually results in final fracture of the fibre composite. It is also found that the UD fibre fracture regions generally grow larger and initiate earlier at cross-over regions of the backing fibre bundles than at single backing fibre bundle regions. Furthermore, UD Fibre fractures are only observed to initiate at locations where the backing fibre bundles are ‘in contact’ with a UD fibre bundle. By observing the damage progression in 3D, it is also clear that the UD fibre fractures initiated and progressed as local 3D phenomena rather than being homogeneously distributed within the UD fibre bundles. Hence, the results show the importance of considering the problem in 3D.

The knowledge obtained on the fatigue damage mechanisms during the project can not only be used to improve the materials, but also sets the stage for X-ray CT based modelling. This is a step towards more realistic fatigue life-time modelling of fibre composites used for wind turbine blades, which will make it possible to push the design limits of wind turbine blades and thereby decrease the cost of energy for the wind energy production. In addition, the methods established during the PhD project can be applied to other problems, material systems, and load conditions in the future, which opens up for many new opportunities.
Fault and meal detection by redundant continuous glucose monitors and the unscented Kalman filter

The purpose of this study is to develop a method for detecting and compensating the anomalies of continuous glucose monitoring (CGM) sensors as well as detecting unannounced meals. Both features, sensor fault detection/correction and meal detection, are necessary to have a reliable artificial pancreas. The aim is to investigate the best detection results achievable with the proposed detection configuration in a perfect situation, and to have the results as a benchmark against which the imperfect scenarios of the proposed fault detection can be compared. The perfect situation that we set up here is in terms of a patient simulation model, where the model in the detector is the same as the patient simulation model used for evaluation of the detector. The detection module consists of two CGM sensors, two fault detectors, a fault isolator, and an adaptive unscented Kalman filter (UKF). Two types of sensor faults, i.e., drift and pressure induced sensor attenuation (PISA), are simulated by a Gaussian random walk model. Each of the fault detectors has a local UKF that receives the signal from the associated sensor, detects faults, and finally tunes the adaptive UKF. A fault isolator that accepts data from the two fault detectors differentiates between a sensor fault and an unannounced meal appearing as an anomaly in the CGM data. If the fault isolator indicates a sensor fault, a method based on the covariance matching technique tunes the covariance of the measurement noise associated with the faulty sensor. The main UKF uses the tuned noise covariances and fuses the CGM data from the two sensors. The drift detection sensitivity and specificity are 80.9% and 92.6%, respectively. The sensitivity and specificity of PISA detection are 78.1% and 82.7%, respectively. The fault detectors can detect 100 out of 100 simulated drifts and 485 out of 500 simulated PISA events. Compared to a nonadaptive UKF, the adaptive UKF reduces the deviation of the CGM measurements from their paired blood glucose concentrations from 72.0% to 12.5% when CGM is corrupted by drift, and from 10.7% to 6.8% when CGM is corrupted by PISA. The fault isolator can detect 199 out of 200 unannounced meals. The average change in the glucose concentrations between the meals and the detection time points is 46.3 mg/dL.
Fault diagnosis and condition monitoring of wind turbines

This paper describes a model-free method for the fault diagnosis and condition monitoring of rotor systems in wind turbines. Both fault diagnosis and monitoring can be achieved without using a model for the wind turbine, applied controller, or wind profiles. The method is based on measurements from standard sensors on modern wind turbines, including moment sensors and rotor angle sensors. This approach will allow the method to be applied to existing wind turbines without any modifications. The method is based on the detection of asymmetries in the rotor system caused by changes or faults in the rotor system. A multiblade coordinate transformation is used directly on the measured flap-wise and edge-wise moments followed by signal modulation. Changes or faults in the rotor system will result in unique signatures in the set of modulation signals. These signatures are described through the amplitudes and phase information of the modulation signals. It is possible to detect and isolate which blade is faulty or has been changed based on these signatures. Furthermore, the faulty component can be isolated, ie, the actuator, sensor or blade, and the type of fault can be determined. The method can be used both on- and off-line.
Fault-Tolerant Topology and Routing Synthesis for IEEE Time-Sensitive Networking

Time-Sensitive Networking (TSN) is a set of IEEE standards that extend Ethernet for safety-critical and real-time applications. TSN is envisioned to be widely used in several applications areas, from industrial automation to in-vehicle networking. A TSN network is composed of end systems interconnected by physical links and bridges (switches). The data in TSN is exchanged via streams. We address safety-critical real-time systems, and we consider that the streams use the Urgency-Based Scheduler (UBS) traffic-type, suitable for hard real-time traffic. We are interested in determining a fault-tolerant network topology, consisting of redundant physical links and bridges, the routing of each stream in the applications, such that the architecture cost is minimized, the applications are fault-tolerant (i.e., the critical streams have redundant disjoint routes), and the timing constraints of the applications are satisfied. We propose three approaches to
solve this optimization problem: (1) a heuristic solution, (2) a Greedy Randomized Adaptive Search Procedure (GRASP) metaheuristic, and (3) a Constraint Programming-based model. The approaches are evaluated on several test cases, including a test case from General Motors Company.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, General Motors Company
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Number of pages: 10
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 25th International Conference on Real-Time Networks and Systems
Publisher: Association for Computing Machinery
ISBN (Print): 978-1-4503-5286-4
Main Research Area: Technical/natural sciences
Conference: 25th International Conference on Real-Time Networks and Systems, Grenoble, France, 04/10/2017 - 04/10/2017
Safety-Critical Systems, TSN, Fault-Tolerant Architectures
Electronic versions:
rtns2017.pdf
DOIs:
10.1145/3139258.3139284
Source: PublicationPreSubmission
Source-ID: 140106677
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

FELIX: an algorithm for indexing multiple crystallites in X-ray free-electron laser snapshot diffraction images
A novel algorithm for indexing multiple crystals in snapshot X-ray diffraction images, especially suited for serial crystallography data, is presented. The algorithm, FELIX, utilizes a generalized parametrization of the Rodrigues-Frank space, in which all crystal systems can be represented without singularities. The new algorithm is shown to be capable of indexing more than ten crystals per image in simulations of cubic, tetragonal, and monoclinic crystal diffraction patterns. It is also used to index an experimental serial crystallography dataset from lysozyme microcrystals. The increased number of indexed crystals is shown to result in a better signal-to-noise ratio, and fewer images are needed to achieve the same data quality as when indexing one crystal per image. The relative orientations between the multiple crystals indexed in an image show a slight tendency of the lysozme microcrystals to adhere on (110) facets.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Department of Physics, Neutrons and X-rays for Materials Physics, Theoretical Atomic-scale Physics, Deutsches Elektronensynchroton DESY
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Number of pages: 9
Pages: 1075-1083
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Applied Crystallography
Volume: 50
Issue number: 4
ISSN (Print): 0021-8898
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.72 SJR 1.635 SNIP 1.346
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.51 SJR 1.221 SNIP 1.211
Web of Science (2016): Indexed yes
Fighting Smoldering Fires in Silos – A Cautionary Note on Using Carbon Dioxide to Inert

This communication seeks to draw attention to the hazards of releasing liquid carbon dioxide into environments where an ignitable atmosphere may exist. Static discharges have sufficient energy to ignite flammable vapors and an internal explosion may result when fighting smoldering fires using this approach.
A recent article in Biomass and Bioenergy examines an explosion in a Norwegian wood pellet silo when attempting to suppress a smoldering fire with CO₂. The article argues that the electrostatic hazard of CO₂ is widely under-appreciated and incidents like this are avoidable.

**Finite volume method room acoustic simulations integrated into the architectural design process**

In many cases, room acoustics are neglected during the early stage of building design. This can result in serious acoustical problems that could have been easily avoided and can be difficult or expensive to remedy at later stages. Ideally, the room acoustic design should interact with the architectural design from the earliest design stage, as a part of a holistic design process. A new procedure to integrate room acoustics into architectural design is being developed in a Ph.D. project, with the aim of promoting this early stage holistic design process. This project aims to develop a new hybrid simulation tool combining wave-based and geometrical acoustics methods. One of the important aspects is the flexibility to represent realistic geometric shapes, for which the finite volume method (FVM) is chosen for the wave-based part of the tool. As a starting point, the computational efficiency of high-order two-dimensional FVM for defining an efficient wave-based simulation tool is investigated. Preliminary two-dimensional FVM simulation results are presented, which illuminate the suitability for handling complex geometries compared to other wave based simulation methods.
First hitting probabilities for semi Markov chains and estimation

We first consider a stochastic system described by an absorbing semi-Markov chain with finite state space and we introduce the absorption probability to a class of recurrent states. Afterwards, we study the first hitting probability to a subset of states for an irreducible semi-Markov chain. In the latter case, a nonparametric estimator for the first hitting probability is proposed and the asymptotic properties of strong consistency and asymptotic normality are proven. Finally, a numerical application on a five-state system is presented to illustrate the performance of this estimator.
First-Order Logic According to Harrison
We present a certified declarative first-order prover with equality based on John Harrison’s Handbook of Practical Logic and Automated Reasoning, Cambridge University Press, 2009. ML code reflection is used such that the entire prover can be executed within Isabelle as a very simple interactive proof assistant. As examples we consider Pelletier’s problems 1-46.

Flexible indexing of repetitive collections
Highly repetitive strings are increasingly being amassed by genome sequencing experiments, and by versioned archives of source code and webpages. We describe practical data structures that support counting and locating all the exact occurrences of a pattern in a repetitive text, by combining the run-length encoded Burrows-Wheeler transform (RLBWT) with the boundaries of Lempel-Ziv 77 factors. One such variant uses an amount of space comparable to LZ77 indexes, but it answers count queries between two and four orders of magnitude faster than all LZ77 and hybrid index implementations, at the cost of slower locate queries. Combining the RLBWT with the compact directed acyclic word graph answers locate queries for short patterns between four and ten times faster than a version of the run-length compressed suffix array (RLCSA) that uses comparable memory, and with very short patterns our index achieves speedups even greater than ten with respect to RLCSA.
Foderkvalitet og andre faktorer af betydning for forbruget af antibiotika på minkgårde

Antibiotikaforbruget hos mink er steget gradvist gennem det seneste årti, og forbruget på den enkelte gård påvirkes af en række faktorer. Tidligere studier har vist at forekomsten af diarre og ordination af antibiotika er influeret af foderleverandøren. Formålet med dette studie (Jensen et al. 2017) var at undersøge for eventuelle effekter af de foderparametre, som indgår i den frivillige foderkontrol, på ordination af antibiotika til mink. Studiet inkluderede alle undersøgte foderbatch fra 12 fodercentraler og tilknyttede 1472 minkgårde i perioden 2012– 2014. De undersøgte foderparametre omfattede både kemiske parametre og mikrobiologiske parametre. Data blev analyseret ved multivariat variantsanalyse i to modeller. I den første model var responsvariablen ordination af antibiotika på en given gård i tidsrum på 3,5 eller 7 dage fra dagen efter udfodring af den givne batch. I den anden model var responsvariablen en proportion af de gårde der var tilknyttet en given fodercentral, dvs. andelen af gårde som fik antibiotika i tilknytning til udfodring af en given batch. Analyserne korrigerede for kendte faktorer med indflydelse på antibiotikaforbruget (p < 0.0001), herunder årstids variation, tidstrends, besætningsstørrelse og udbrud af Pseudomonas aeruginosa. I alle modeller var kimtallet for fæcale coccer signifikant (p < 0.0001) relateret til ordination af antibiotika.

General information
State: Published
Organisations: National Veterinary Institute, Epidemiology, Diagnostic & Development, Department of Applied Mathematics and Computer Science , Statistics and Data Analysis, Kopenhagen Fur
Authors: Jensen, V. F. (Intern), Chriél, M. (Intern), Sommer, H. M. (Intern), Struve, T. (Ekstern), Clausen, J. (Ekstern)
Pages: 95-98
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Faglig Årsberetning
Volume: 2017
ISSN (Print): 2445-9437
Original language: English
Mink (neovison vison), Foderkvalitet, Antibiotika, Faktorer
Electronic versions:
Foderkvalitet og andre faktorer af betydning for forbruget af antibiotika på minkgårde.pdf
Links:
Source: PublicationPreSubmission
Source-ID: 146104550
Publication: Research - peer-review › Journal article – Annual report year: 2018

Foreign object detection in multispectral X-ray images of food items using sparse discriminant analysis

Non-invasive food inspection and quality assurance are becoming viable techniques in food production due to the introduction of fast and accessible multispectral X-ray scanners. However, the novel devices produce massive amount of data and there is a need for fast and accurate algorithms for processing it. We apply a sparse classifier for foreign object detection and segmentation in multispectral X-ray. Using sparse methods makes it possible to potentially use fewer variables than traditional methods and thereby reduce acquisition time, data volume and classification speed. We report our results on two datasets with foreign objects, one set with spring rolls and one with minced meat. Our results indicate that it is possible to limit the amount of data stored to 50% of the original size without affecting classification accuracy of materials used for training. The method has attractive computational properties, which allows for fast classification of items in new images.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science , Image Analysis & Computer Graphics, Statistics and Data Analysis, Copenhagen Center for Health Technology, Teknologisk Institut
Pages: 350-361
Publication date: 2017

Host publication information
Title of host publication: SCIA 2017
Volume: 10269
Formal Analysis of Graphical Security Models

The increasing usage of computer-based systems in almost every aspects of our daily life makes more and more dangerous the threat posed by potential attackers, and more and more rewarding a successful attack. Moreover, the complexity of these systems is also increasing, including physical devices, software components and human actors interacting with each other to form so-called socio-technical systems. The importance of socio-technical systems to modern societies requires verifying their security properties formally, while their inherent complexity makes manual analyses impracticable.

Graphical models for security offer an unrivalled opportunity to describe socio-technical systems, for they allow to represent different aspects like human behaviour, computation and physical phenomena in an abstract yet uniform manner. Moreover, these models can be assigned a formal semantics, thereby allowing formal verification of their properties. Finally, their appealing graphical notations enable to communicate security concerns in an understandable way also to non-experts, often in charge of the decision making.

This dissertation argues that automated techniques can be developed on graphical security models to evaluate qualitative and quantitative security properties of socio-technical systems and to synthesise optimal attack and defence strategies.

In support to this claim we develop analysis techniques for widely-used graphical security models such as attack trees and attack-defence trees. Our analyses cope with the optimisation of multiple parameters of an attack and defence scenario. Improving on the literature, in case of conflicting parameters such as probability and cost we compute the set of optimal solutions in terms of Pareto efficiency. Moreover, we investigate the relation between attack and attack-defence trees and stochastic models in a verification-oriented setting, with the aim of leveraging the great many mature tools and analysis techniques developed for instance in the area of games.
Formal Development and Verification of Safe Railway Control Systems

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Software and Process Engineering
Authors: Haxthausen, A. E. (Intern)
Publication date: 2017
Event: Poster session presented at Transport Summer Summit DTU 2017, Lyngby, Denmark.
Main Research Area: Technical/natural sciences
Electronic versions:
Transportday2017V2.pdf
Source: PublicationPreSubmission
Source-ID: 140539598
Publication: Research › Poster – Annual report year: 2017

Formalization of Many-Valued Logics
Partiality is a key challenge for computational approaches to artificial intelligence in general and natural language in particular. Various extensions of classical two-valued logic to many-valued logics have been investigated in order to meet this challenge. We use the proof assistant Isabelle to formalize the syntax and semantics of many-valued logics with determinate as well as indeterminate truth values. The formalization allows for a concise presentation and makes automated verification possible.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Authors: Villadsen, J. (Intern), Schlichtkrull, A. (Intern)
Pages: 219-256
Publication date: 2017

Host publication information
Title of host publication: Partiality and Underspecification in Information, Languages, and Knowledge
Publisher: Cambridge Scholars Press
Editors: Christiansen, H., Jiménez-López, M. D., Loukanova, R., Moss, L.
ISBN (Print): 978-1-4438-7947-7
Main Research Area: Technical/natural sciences
Publication: Research - peer-review › Book chapter – Annual report year: 2017

Formalizing and proving a typing result for security protocols in Isabelle/HOL
There are several works on the formalization of security protocols and proofs of their security in Isabelle/HOL; there have also been tools for automatically generating such proofs. This is attractive since a proof in Isabelle gives a higher assurance of the correctness than a pen-and-paper proof or the positive output of a verification tool. However several of these works have used a typed model, where the intruder is restricted to "well-typed" attacks. There also have been several works that show that this is actually not a restriction for a large class of protocols, but all these results so far are again pen-and-paper proofs. In this work we present a formalization of such a typing result in Isabelle/HOL. We formalize a constraint-based approach that is used in the proof argument of such typing results, and prove its soundness, completeness and termination. We then formalize and prove the typing result itself in Isabelle. Finally, to illustrate the real-world feasibility, we prove that the standard Transport Layer Security (TLS) handshake satisfies the main condition of the typing result.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Formal Methods
Authors: Hess, A. V. (Intern), Modersheim, S. (Intern)
Pages: 451-63
Publication date: 2017

Host publication information
Title of host publication: Proceedings of 2017 IEEE 30th Computer Security Foundations Symposium
Publisher: IEEE
ISBN (Print): 9781538632161
ISSN: 1940-1434
Formalizing a Paraconsistent Logic in the Isabelle Proof Assistant

We present a formalization of a so-called paraconsistent logic that avoids the catastrophic explosiveness of inconsistency in classical logic. The paraconsistent logic has a countably infinite number of non-classical truth values. We show how to use the proof assistant Isabelle to formally prove theorems in the logic as well as meta-theorems about the logic. In particular, we formalize a meta-theorem that allows us to reduce the infinite number of truth values to a finite number of truth values, for a given formula, and we use this result in a formalization of a small case study.

Formal modelling and verification of interlocking systems featuring sequential release

In this article, we present a method and an associated toolchain for the formal verification of the new Danish railway interlocking systems that are compatible with the European Train Control System (ETCS) Level 2. We have made a generic and reconfigurable model of the system behaviour and generic safety properties. This model accommodates sequential release - a feature in the new Danish interlocking systems. To verify the safety of an interlocking system, first a domain-specific description of interlocking configuration data is constructed and validated. Then the generic model and safety properties are automatically instantiated with the well-formed description of interlocking configuration data. This instantiation produces a model instance in the form of a Kripke structure, and concrete safety properties expressed as invariants. Finally, using a combination of SMT based bounded model checking (BMC) and inductive reasoning, it is verified that the generated model instance satisfies the generated safety properties. Using this method, we are able to verify the safety properties for model instances corresponding to railway networks of industrial size. Experiments show that BMC is also efficient for finding bugs in the railway interlocking designs. Additionally, benchmarking results comparing the performance of our approach with alternative verification techniques on the interlocking models are presented.
Formulating and testing a method for perturbing precipitation time series to reflect anticipated climatic changes

Urban water infrastructure has very long planning horizons, and planning is thus very dependent on reliable estimates of the impacts of climate change. Many urban water systems are designed using time series with a high temporal resolution. To assess the impact of climate change on these systems, similarly high-resolution precipitation time series for future climate are necessary. Climate models cannot at their current resolutions provide these time series at the relevant scales. Known methods for stochastic downscaling of climate change to urban hydrological scales have known shortcomings in constructing realistic climate-changed precipitation time series at the sub-hourly scale. In the present study we present a deterministic methodology to perturb historical precipitation time series at the minute scale to reflect non-linear expectations to climate change. The methodology shows good skill in meeting the expectations to climate change in extremes at the event scale when evaluated at different timescales from the minute to the daily scale. The methodology also shows good skill with respect to representing expected changes of seasonal precipitation. The methodology is very robust against the actual magnitude of the expected changes as well as the direction of the changes (increase or decrease), even for situations where the extremes are increasing for seasons that in general should have a decreasing trend in precipitation. The methodology can provide planners with valuable time series representing future climate that can be used as input to urban hydrological models and give better estimates of climate change impacts on these systems.

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Rambøll Danmark A/S
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Pages: 345-355
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Hydrology and Earth System Sciences
Volume: 21
Issue number: 1
ISSN (Print): 1027-5606
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.412 SJR 2.023 CiteScore 4.1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.22 SJR 2.361 SNIP 1.656
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.209 SNIP 1.494 CiteScore 3.74
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.141 SNIP 1.628 CiteScore 3.71
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.872 SNIP 1.521 CiteScore 3.39
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
In this position paper we describe select aspects of our experience with health-related self-tracking, the data generated, and processes surrounding those. In particular we focus on how bilateral patient-clinician engagement may be fostered by the combination of technology and method. We exemplify with a case study where a PTSD-suffering veteran has been self-tracking a specific symptom precursor. The availability of high-resolution self-tracking data on the occurrences of even a single symptom created new opportunities in the therapeutic process for identifying underlying triggers of symptoms. The patient was highly engaged in self-tracking and sharing the collected data. We suggest a key reason was the collaborative effort in defining the data collection protocol and discussion of the data. The therapist also engaged highly in the self-tracking data, as it supported the existing therapeutic process in reaching insights otherwise unobtainable.

**Fostering Bilateral Patient-Clinician Engagement in Active Self-Tracking of Subjective Experience**

In this position paper we describe select aspects of our experience with health-related self-tracking, the data generated, and processes surrounding those. In particular we focus on how bilateral patient-clinician engagement may be fostered by the combination of technology and method. We exemplify with a case study where a PTSD-suffering veteran has been self-tracking a specific symptom precursor. The availability of high-resolution self-tracking data on the occurrences of even a single symptom created new opportunities in the therapeutic process for identifying underlying triggers of symptoms. The patient was highly engaged in self-tracking and sharing the collected data. We suggest a key reason was the collaborative effort in defining the data collection protocol and discussion of the data. The therapist also engaged highly in the self-tracking data, as it supported the existing therapeutic process in reaching insights otherwise unobtainable.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, Konsulent Blomseth, Danish Defence Military Psychology Unit
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Number of pages: 4
Publication date: 2017

**Host publication information**

Title of host publication: Proceedings of Pervasive Health 2017
Publisher: Association for Computing Machinery
Fractional and complex pseudo-splines and the construction of Parseval frames

Pseudo-splines of integer order \((m, ℓ)\) were introduced by Daubechies, Han, Ron, and Shen as a family which allows interpolation between the classical B-splines and the Daubechies' scaling functions. The purpose of this paper is to generalize the pseudo-splines to fractional and complex orders \((z, ℓ)\) with \(α = \Re z ≥ 1\). This allows increased flexibility in regard to smoothness: instead of working with a discrete family of functions from \(C^m, m∈\mathbb{N}_0\), one uses a continuous family of functions belonging to the Hölder spaces \(C^{α−1}\). The presence of the imaginary part of \(z\) allows for direct utilization in complex transform techniques for signal and image analyses. We also show that in analogue to the integer case, the generalized pseudo-splines lead to constructions of Parseval wavelet frames via the unitary extension principle. The regularity and approximation order of this new class of generalized splines is also discussed.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics, Universität Passau
Authors: Massopust, P. (Intern), Forster, B. (Ekstern), Christensen, O. (Intern)
Pages: 12-24
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information

Journal: Applied Mathematics and Computation
Volume: 314
ISSN (Print): 0096-3003
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
BFI (2015): BFI-level 1
BFI (2014): BFI-level 1
BFI (2013): BFI-level 1
BFI (2012): BFI-level 1
BFI (2011): BFI-level 1
BFI (2010): BFI-level 1
BFI (2009): BFI-level 1
BFI (2008): BFI-level 1
Original language: English
Numerical Methods, Filters, Fractional and complex B-splines, Framelets, Parseval frames, Pseudo-splines, Unitary extension principle (UEP), Computational methods, Filters (for fluids), Mathematical techniques, Approximation orders, B splines, Extension principles, Imaginary parts, Increased flexibility, Scaling functions, Interpolation

Fraud Risk Modelling: Requirements Elicitation in the Case of Telecom Services

Telecom providers are losing tremendous amounts of money due to fraud risks posed to Telecom services and products. Currently, they are mainly focusing on fraud detection approaches to reduce the impact of fraud risks against their services. However, fraud prevention approaches should also be investigated in order to further reduce fraud risks and improve the revenue of Telecom providers. Fraud risk modelling is a fraud prevention approach aims at identifying the potential fraud risks, estimating the damage and setting up preventive mechanisms before the fraud risks lead to actual losses. In this paper, we highlight the important requirements for a usable and context-aware fraud risk modelling approach for Telecom services. To do so, we have conducted two workshops with experts from a Telecom provider and experts from multi-disciplinary areas. In order to show and document the requirements, we present two exemplary Telecom fraud scenarios, analyse and estimate the impacts of fraud risks qualitatively.
From concept to in vivo testing: Microcontainers for oral drug delivery

This work explores the potential of polymeric micrometer sized devices (microcontainers) as oral drug delivery systems (DDS). Arrays of detachable microcontainers (D-MCs) were fabricated on a sacrificial layer to improve the handling and facilitate the collection of individual D-MCs. A model drug, ketoprofen, was loaded into the microcontainers using supercritical CO2 impregnation, followed by deposition of an enteric coating to protect the drug from the harsh gastric environment and to provide a fast release in the intestine. In vitro, in vivo and ex vivo studies were performed to assess the viability of the D-MCs as oral DDS. D-MCs improved the relative oral bioavailability by 180% within 4h, and increased the absorption rate by 2.4 times compared to the control. This work represents a significant step forward in the translation of these devices from laboratory to clinic.
Enteric coating, Microtechnology, Oral drug delivery, Supercritical impregnation

DOIs: 10.1016/j.jconrel.2017.10.013

Relations
Projects:
From concept to in vivo testing: Microcontainers for oral drug delivery
Source: Findit
Source-ID: 2392221100
Publication: Research - peer-review › Journal article – Annual report year: 2017

From Higher-Order Differentials to Polytopic Cryptyanalysis

Polytopic cryptanalysis was introduced at EUROCRYPT 2016 as a cryptanalytic technique for low-data-complexity attacks on block ciphers. In this paper, we give an account of how the technique was developed, quickly go over the basic ideas and techniques of polytopic cryptanalysis, look into how the technique differs from previously existing cryptographic techniques, and discuss whether the attack angle can be useful for developing improved cryptanalytic techniques.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cyber Security
Authors: Tiessen, T. (Intern)
Pages: 544-552
Publication date: 2017
From LZ77 to the run-length encoded burrows-wheeler transform, and back

The Lempel-Ziv factorization (LZ77) and the Run-Length encoded Burrows-Wheeler Transform (RLBWT) are two important tools in text compression and indexing, being their sizes $z$ and $r$ closely related to the amount of text self-repetitiveness. In this paper we consider the problem of converting the two representations into each other within a working space proportional to the input and the output. Let $n$ be the text length. We show that RLBWT can be converted to LZ77 in $O(n \log r)$ time and $O(r)$ words of working space. Conversely, we provide an algorithm to convert LZ77 to RLBWT in $O(n(\log r + \log z))$ time and $O(r + z)$ words of working space. Note that $r$ and $z$ can be constant if the text is highly repetitive, and our algorithms can operate with (up to) exponentially less space than naive solutions based on full decompression.

General Information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, University of Udine
Authors: Policriti, A. (Ekstern), Prezza, N. (Intern)
Number of pages: 10
Publication date: 2017

From Raw Data to Social Systems - Separating the Signal from the Noise in Smartphone Sensor Measurements

Digital tools for communication and information exchange have been ingrained in our lives. We google our information and we skype our parents. We use the Internet to shop for groceries, do banking, and study. We play massively multiplayer online games, belong to online communities, and date online. However, this does not mean that our lives have really moved to the digital domain. Even though the Internet makes it possible to exist without ever leaving the confines of bedrooms, we still choose to meet our friends in person or to travel through physical, rather than virtual, space. There is a richness to personal contact and direct experience that has not yet been replaced by the digital services. Until this shift happens, we continue to analyze and investigate our offline lives in the pursuit for deepening our understanding of human nature. Digital breadcrumbs, which we leave behind with every online action, are relatively easy to collect. Capturing our
offline behaviors, on the other hand, is not trivial. Scientist often rely on data that approximates only one aspect of our lives. For example, mobile operator logs reveal who we call, but not who we meet. An alternative approach is to derive proxies of certain behaviors from smartphone sensor readings. Copenhagen Networks Study (CNS) employs this method, among others, to build the biggest dataset of the kind available to researchers in academia. The thesis shows a path from collecting raw smartphone data for CNS, through extracting increasingly meaningful information, to gaining novel insights into human behavior. Step by step, I turn a cryptic and seemingly uninteresting collection of hardware identifiers and received signal strengths into a detailed record of people’s lives: where they go, who they encounter, who they become friends with. I compare their offline activities and social ties to their online representations and find a surprisingly small overlap. The methods I propose the thesis constitute a more privacy-aware alternative to currently employed social sensing approaches. I show how to track the mobility and interactions of participants without sharing the results with third parties inadvertently. At the same time, the findings presented in this thesis emphasize the fragility of our privacy: the data we today consider as safe to share today, tomorrow might prove to carry rich information about our lives.
Further Generalisations of Twisted Gabidulin Codes

We present a new family of maximum rank distance (MRD) codes. The new class contains codes that are neither equivalent to a generalised Gabidulin nor to a twisted Gabidulin code, the only two known general constructions of linear MRD codes.

Gabor Frames in ℓ2(ℤ) and Linear Dependence

We prove that an overcomplete Gabor frame in (Formula presented.) generated by a finitely supported sequence is always linearly dependent. This is a particular case of a general result about linear dependence versus independence for Gabor systems in (Formula presented.) with modulation parameter 1 / M and translation parameter N for some (Formula presented.) and generated by a finite sequence g in (Formula presented.) with K nonzero entries.
This thesis consists of four papers. The first one introduces generalized translation invariant systems and considers their frame properties, the second and third paper give new results on the theory of Gabor frames, and the fourth is a review paper with proofs and new results on the Feichtinger algebra.

The generalized translation invariant (GTI) systems provide, for the first time, a framework which can describe frame properties of both discrete and continuous systems. The results yield the well-known characterizations of dual frame pairs and Parseval frames of Gabor- and wavelet- curvelet- and shearlet-type and for (generalized) shift-invariant systems and their continuous formulations.

This thesis advances the theory of both separable and non-separable, discrete, semicontinuous and continuous Gabor systems. In particular, the well established structure theory for separable lattice Gabor frames is extended and generalized significantly to Gabor systems with time-frequency shifts along closed subgroups in the time-frequency plane. This includes density results, the Walnut representation, the Wexler-Raz biorthogonality relations, the Bessel duality and the duality principle between Gabor frames and Gabor Riesz bases.

The theory of GTI systems and Gabor frames in this thesis is developed and presented in the setting of locally compact abelian groups, however, even in the euclidean setting the results given here improve the existing theory.

Finally, the thesis contains a review paper with proofs of all the major results on the Banach space of functions known as the Feichtinger algebra. This includes many of its different characterizations and treatment of its many equivalent norms, its minimality among all time-frequency shift invariant Banach spaces and aspects of its dual space, operators on the space and the kernel theorem for the Feichtinger algebra. The work also includes new findings such as a characterization among all Banach spaces, a forgotten theorem by Reiter on Banach space isomorphisms of the Feichtinger algebra, and new useful inequalities.

Gabor frames on locally compact abelian groups and related topics
This thesis consists of four papers. The first one introduces generalized translation invariant systems and considers their frame properties, the second and third paper give new results on the theory of Gabor frames, and the fourth is a review paper with proofs and new results on the Feichtinger algebra.

The generalized translation invariant (GTI) systems provide, for the first time, a framework which can describe frame properties of both discrete and continuous systems. The results yield the well-known characterizations of dual frame pairs and Parseval frames of Gabor- and wavelet- curvelet- and shearlet-type and for (generalized) shift-invariant systems and their continuous formulations.

This thesis advances the theory of both separable and non-separable, discrete, semicontinuous and continuous Gabor systems. In particular, the well established structure theory for separable lattice Gabor frames is extended and generalized significantly to Gabor systems with time-frequency shifts along closed subgroups in the time-frequency plane. This includes density results, the Walnut representation, the Wexler-Raz biorthogonality relations, the Bessel duality and the duality principle between Gabor frames and Gabor Riesz bases.

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General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science , Mathematics
Functional Magnetic Resonance Imaging (fMRI) gives us a unique insight into the processes of the brain, and opens up for analyzing the functional activation patterns of the underlying sources. Task-inferred supervised learning with restrictive assumptions in the regression set-up, restricts the exploratory nature of the analysis. Fully unsupervised independent component analysis (ICA) algorithms, on the other hand, can struggle to detect clear classifiable components on single-subject data. We attribute this shortcoming to inadequate modeling of the fMRI source signals by failing to incorporate its temporal nature. fMRI source signals, biological stimuli and non-stimuli-related artifacts are all smooth over a time-scale compatible with the sampling time (TR). We therefore propose Gaussian process ICA (GPICA), which facilitates temporal dependency by the use of Gaussian process source priors. On two fMRI data sets with different sampling frequency, we show that the GPICA-inferred temporal components and associated spatial maps allow for a more definite interpretation than standard temporal ICA methods. The temporal structures of the sources are controlled by the covariance of the Gaussian process, specified by a kernel function with an interpretable and controllable temporal length scale parameter. We propose a hierarchical model specification, considering both instantaneous and convolutive mixing, and we infer source spatial maps, temporal patterns and temporal length scale parameters by Markov Chain Monte Carlo. A companion implementation made as a plug-in for SPM can be downloaded from https://github.com/dittehald/GPICA.
Generalized shift-invariant systems and approximately dual frames

Dual pairs of frames yield a procedure for obtaining perfect reconstruction of elements in the underlying Hilbert space in terms of superpositions of the frame elements. However, practical constraints often force us to apply sequences that do not exactly form dual frames. In this article, we consider the important case of generalized shift-invariant systems and provide various ways of estimating the deviation from perfect reconstruction that occur when the systems do not form dual frames. The deviation from being dual frames will be measured either in terms of a perturbation condition or in terms of the deviation from equality in the duality conditions.
Generative Temporal Modelling of Neuroimaging - Decomposition and Nonparametric Testing

The goal of this thesis is to explore two improvements for functional magnetic resonance imaging (fMRI) analysis; namely our proposed decomposition method and an extension to the non-parametric testing framework. Analysis of fMRI allows researchers to investigate the functional processes of the brain, and provides insight into neuronal coupling during mental processes or tasks.

The decomposition method is a Gaussian process-based independent components analysis (GPICA), which incorporates a temporal dependency in the sources. A hierarchical model specification is used, featuring both instantaneous and convolutive mixing, and the inferred temporal patterns. Spatial maps are seen to capture smooth and localized stimuli-related components, and often identifiable noise components. The implementation is freely available as a GUI/SPM plugin, and we recommend using GPICA as an additional tool when performing ICA on fMRI data to investigate the effect of the temporal source prior.

In fMRI, statistical tests are used to investigate the significance of activation in specific brain regions. By extending the non-parametric testing framework to incorporate functional prior knowledge, an increase in sensitivity can be achieved, entailing better evaluations and conclusions. The functional prior knowledge is incorporated by use of a proposed Graph-Based Cluster Permutation Test (GBCPT), entailing the possibility to expand the use of cluster permutations to multiple applications, wherever a graph-based setup can be used.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics, Universidad Nacional de San Luis
Authors: Benavente, A. (Ekstern), Christensen, O. (Intern), Zakowicz, M. I. (Ekstern)
Pages: 177-189
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Annals of Functional Analysis
Volume: 8
Issue number: 2
ISSN (Print): 2008-8752
Original language: English
DOIs: 10.1215/20088752-3784315
Source: FindIt
Source-ID: 2351105195
Publication: Research - peer-review › Journal article – Annual report year: 2017
Geometrical Characterisation of Individual Fibres From X-Ray Tomograms

We have developed an image analysis pipeline that can extract individual fibre tracks from low contrast X-ray tomograms of unidirectional composites with high fibre volume fraction. Measuring individual fibre tracks opens up the possibility of modelling the empirical data in a statistical manner. Thus, allowing to analyse the spatial distribution of the parameters characterising the orientation and curvature of these individual fibres, which can also provide insights on the interactions amongst the individual fibres. Finite element models (FEMs) can be built from the extracted geometry to simulate the performance of the scanned fibre structure under realistic conditions. Moreover, aspects of the fibre architecture that influence the macroscopic behaviour of the composite can be quantified. Examples are 2D FEMs to predict the transverse stiffness or the quantification of fibre orientations to estimate the compression strength. And last but not least, already developed analytical and numerical models to describe the composite’s behaviour can be validated against the observed data.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Statistics and Data Analysis
Authors: Emerson, M. J. (Intern), Dahl, V. A. (Intern), Mikkelsen, L. P. (Intern), Dahl, A. B. (Intern), Conradsen, K. (Intern)
Number of pages: 1
Pages: 59
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 30th Nordic Seminar on Computational Mechanics (NSCM-30)
Editors: Høsberg, J., Pedersen, N.
BFI conference series: Nordic Seminar on Computational Mechanics (5010906)
Main Research Area: Technical/natural sciences
Conference: 30th Nordic Seminar on Computational Mechanics (NSCM-30), Copenhagen, 25/10/2017 - 25/10/2017
X-ray tomography, Individual Fibres, Unidirectional Composites, Modelling
Electronic versions:
GEOMETRICAL_CHARACTERISATION.pdf
Publication: Research - peer-review ▶ Conference abstract in proceedings – Annual report year: 2017

Geostatistical modelling of the spatial life history of post-larval deepwater hake Merluccius paradoxus in the Benguela Current Large Marine Ecosystem

Optimal and sustainable management of fish resources cannot be ensured without a thorough understanding of the migration patterns and population (demographic stock) structure. Recent studies suggest that these aspects of the economically and ecologically important deepwater hake Merluccius paradoxus are not reflected in the current assessment and management practices for the Benguela Current Large Marine Ecosystem. In this study, we compiled data from multiple demersal trawl surveys from the entire distribution area and applied state-of-the-art geostatistical population modelling (GeoPop) to estimate growth rate, mortality, and spatial and temporal distribution patterns of M. paradoxus. The data and the model enabled us to follow temporal and spatial changes in the distribution and infer movements from the recruitment/nursery areas, through the juvenile phase and the adults' migration to the spawning areas outside/upstream of the nursery areas. The results indicated one primary recruitment/nursery area on the west coast of South Africa and a secondary less-productive recruitment/nursery area on the south coast near Port Elizabeth. Juveniles initially migrated away from the main recruitment area, followed by natal homing by larger individuals. This pattern was highly consistent through the time-series of the study. This perception of a, primarily, panmictic population that performs transboundary migrations between Namibia and South Africa corresponds largely to the hypothesis and data plots given in recent studies. We recommend that fisheries assessment, advice and management take into consideration these aspects of the distribution and population (stock) structure of M. paradoxus.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, Department of Applied Mathematics and Computer Science, Section for Marine Living Resources, Department for Agriculture, Forestry and Fisheries, Ministry of Fisheries and Marine Resources
Pages: 349-361
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: African Journal of Marine Science
Gradient distortions in EEG provide motion tracking during simultaneous EEG-fMRI

Conference abstract, selected for oral presentation by Malte Laustsen.
Graphite nodules in fatigue-tested cast iron characterized in 2D and 3D

Thick-walled ductile iron casts have been studied by applying (i) cooling rate calculations by FVM, (ii) microstructural characterization by 2D SEM and 3D X-ray tomography techniques and (iii) fatigue testing of samples drawn from components cast in sand molds and metal molds. An analysis has shown correlations between cooling rate, structure and fatigue strengths demonstrating the benefit of 3D structural characterization to identify possible causes of premature fatigue failure of ductile cast iron.
Graphs with No Induced Five-Vertex Path or Antipath
We prove that a graph $G$ contains no induced five-vertex path and no induced complement of a five-vertex path if and only if $G$ is obtained from 5-cycles and split graphs by repeatedly applying the following operations: substitution, split unification, and split unification in the complement, where split unification is a new class-preserving operation introduced here.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Princeton University, University of Grenoble, Wesleyan University
Authors: Chudnovsky, M. (Ekstern), Esperet, L. (Ekstern), Lemoine, L. (Ekstern), Maceli, P. (Ekstern), Maffray, F. (Ekstern), Penev, I. (Intern)
Pages: 221–232
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Graph Theory
Volume: 84
Issue number: 3
ISSN (Print): 0364-9024
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Hardware Tailored Linear Algebra for Implicit Integrators in Embedded NMPC.

Nonlinear Model Predictive Control (NMPC) requires the efficient treatment of the dynamic model in the form of a system of continuous-time differential equations. Newton-type optimization relies on a numerical simulation method in addition to the propagation of first or higher order derivatives. In the case of stiff or implicitly defined dynamics, implicit integration schemes are typically preferred. This paper proposes a tailored implementation of the necessary linear algebra routines (LU factorization and triangular solutions), in order to allow for a considerable computational speedup of such integrators. In particular, the open-source BLASFEO framework is presented as a library of efficient linear algebra routines for small to
medium-scale embedded optimization applications. Its performance is illustrated on the nonlinear optimal control example of a chain of masses. The proposed library allows for considerable speedups and it is found to be overall competitive with both a code-generated solver and a high-performance BLAS implementation.

General information
State: Published
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Pages: 14392-14398
Publication date: 2017
Conference: 20th IFAC World Congress 2017, Toulouse, France, 09/07/2017 - 09/07/2017
Main Research Area: Technical/natural sciences

Harnessing Flexibility from Hot and Cold
As has been often reported, electricity systems with high levels of variable wind and solar power generation would benefit from demand flexibility. What is not as often mentioned is that electrification of the transport and heat sectors could exacerbate the need for flexibility, if they are implemented as inflexible loads. This demand could also be made more flexible, but it comes with a cost. The main issue is to identify the cases in which the benefits will outweigh those costs, a matter that will naturally depend on the evolution of specific energy systems. In this article, we lay out some generic principles and characteristics related to heat sector flexibility and demonstrate its possibilities using specific examples. While we generally use the word heat here, most of the discussions also apply to cool, which, after all, is just another form of temperature difference. A major potential for flexibility in the heat sector results from the low cost of storing heat, which allows opportunities to shift electricity demand. Another possibility is to utilize hybrid systems in which either electricity or fuel can be used to produce heat depending on price variations between the two options.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Centre for IT-Intelligent Energy Systems in Cities, University College Dublin, Tsinghua University, Katholieke Universiteit Leuven, German Aerospace Center, VTT - Technical Research Centre of Finland, Imperial College London
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Harvesting Smartphone Privacy Through Enhanced Juice Filming Charging Attacks

The increasingly high demand for smartphone charging in people’s daily lives has apparently encouraged much more public charging stations to be deployed in various places (e.g., shopping malls, airports). However, these public charging facilities may open a hole for cyber-criminals to infer private information and data from smartphone users. Juice filming charging (JFC) attack is a particular type of charging attacks, which is capable of stealing users’ sensitive information from both Android OS and iOS devices, through automatically monitoring and recording phone screen during the whole charging period. The rationale is that phone screen can be leaked through a standard micro USB connector, which adopts
the Mobile High-Definition Link (MHL) standard. In practice, we identify that how to efficiently extract information from the captured videos remains a challenge for current JFC attack. To further investigate its practical influence, in this work, we focus on enhancing its performance in the aspects of extracting texts from images and correlating information, and then conducting a user study in a practical scenario. The obtained results demonstrate that our enhanced JFC attack can outperform the original one in collecting users’ information at large and extracting sensitive data with a higher accuracy. Our work aims to complement existing results and stimulate more efforts in defending smartphones against charging threats.

General information
State: Published
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Number of pages: 18
Pages: 291-308
Publication date: 2017

Host publication information
Title of host publication: Information Security
Volume: 10599
Publisher: Springer
ISBN (Print): 978-3-319-69658-4
ISBN (Electronic): 978-3-319-69659-1
Series: Lecture Notes in Computer Science
Volume: 10599
ISSN: 0302-9743
Main Research Area: Technical/natural sciences
Conference: 20th International conference on information security, Ho Chi Minh City, Viet Nam, 22/11/2017 - 22/11/2017
Mobile privacy and security, Android and iOS, Charging threat, OCR technology, Juice filming charging attack
DOIs: 10.1007/978-3-319-69659-1_16
Source: FindIt
Source-ID: 2392917670
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Hearables in hearing care: discovering usage patterns through IoT devices
Hearables are on the rise as next generation wearables, capable of streaming audio, modifying soundscapes or functioning as biometric sensors. The recent introduction of IoT (Internet of things) connected hearing aids offer new opportunities for hearables to collect QS quantified self data that capture user intents and thereby provide insights to adjust the settings of the device. In our study 6 participants shared their QS data capturing when they remotely changed their device settings over 6 weeks. The data confirms that the participants preferred to actively change programs rather than use a single default setting provided by an audiologist. Furthermore, their unique usage patterns indicate a need for designing hearing aids, which as hearables adapt their settings dynamically to individual preferences during the day.

General information
State: Published
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Pages: 39–49
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 19th International Conference on Human-Computer Interaction (HCI 2017)
Publisher: Springer Science+Business Media
Series: Lecture Notes in Computer Science
Volume: 10289
ISSN: 0302-9743
BFI conference series: Human-Computer Interaction International Conference (5000411)
Main Research Area: Technical/natural sciences
Conference: 19th International Conference on Human-Computer Interaction (HCI 2017), Vancouver, Canada, 09/07/2017 - 09/07/2017
Hearables, Quantified self
Heating of indoor swimming pools by solar thermal collectors in summerhouses in Denmark

General information
State: Published
Organisations: Department of Civil Engineering, Section for Building Energy, Department of Applied Mathematics and Computer Science, Dynamical Systems, Centre for IT-Intelligent Energy Systems in Cities, Eurisco Aps.
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Number of pages: 38
Publication date: 2017

Publication information
Publisher: Technical University of Denmark, Department of Civil Engineering
ISBN (Print): 9788778774606
Original language: English
Series: DTU Byg Sagsrapport
Number: R-366
Main Research Area: Technical/natural sciences
Electronic versions: Untitled_32.pdf
Source: PublicationPreSubmission
Source-ID: 128931966
Publication: Research › Report – Annual report year: 2017

Helbredstjek af dansk sundhedsteknologi: Sektorudviklingsrapport
Sådan kan samarbejde mellem industrien, universiteterne og sundhedsvæsenet skabe gode løsninger til forebyggelse, diagnostik, patientbehandling og rehabilitering

General information
State: Published
Organisations: Office for Innovation & Sector Services, Copenhagen Center for Health Technology, Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, Center for Energy Resources Engineering, Scientific Computing, Department of Management Engineering, Technology and Innovation Management, Department of Electrical Engineering, Biomedical Engineering, Department of Micro- and Nanotechnology, Nano Bio Integrated Systems, Department of Photonics Engineering, Diode Lasers and LED Systems, Department of Energy Conversion and Storage, Electrofunctional materials, IT Service, National Space Institute, Innovation and Research-based consultancy, Department of Chemical and Biochemical Engineering, The Danish Polymer Centre, Office for Research and Relations, It-branchen, manjourm.dk
Number of pages: 72
Publication date: 2017

Publication information
Publisher: Technical University of Denmark (DTU)
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions: 2017.02.16.DTU_Sektorudviklingsrapport_Helbredstjek_af_dansk_sundhedsteknologi.pdf
Publication: Commissioned › Report – Annual report year: 2017

High-level synthesis for reduction of WCET in real-time systems
The increasing design complexity of systems-on-chip (SoCs) requires designers to work at higher levels of abstraction. High-level synthesis (HLS) is one approach towards this. It allows designers to synthesize hardware directly from code written in a high-level programming language and to more quickly explore alternative implementations by re-running the synthesis with different optimization parameters and pragmas. HLS is particularly interesting for FPGA circuits, where
different hardware implementations can easily be loaded into the target device. Another perspective on HLS is performance. Compared to executing the high-level language code on a processor, HLS can be used to create hardware that accelerates critical parts of the code. When discussing performance in the context of real-time systems, it is the worst-case execution time (WCET) of a task that matters. WCET obviously benefits from hardware acceleration, but it may also benefit from a tighter bound on the WCET. This paper explores the use of and integration of accelerators generated using HLS into a time-predictable processor intended for real-time systems. The high-level design tool, Vivado HLS, is used to generate hardware accelerators from benchmark code, and the system using the generated hardware accelerators is evaluated against the WCET of the original code. The design evaluation is carried out using the Patmos processor from the open-source T-CREST platform and implemented on a Xilinx Artix 7 FPGA. The WCET speed-up achieved is between a factor of 5 and 70.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, Technical University of Denmark
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Number of pages: 6
Pages: 1-6
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 2017 IEEE Nordic Circuits and Systems Conference (NORCAS): NORCHIP and International Symposium of System-on-Chip (SoC)
Publisher: IEEE
ISBN (Print): 978-1-5386-2845-4
ISBN (Electronic): 978-1-5386-2844-7
Main Research Area: Technical/natural sciences
Conference: Nordic Circuits and Systems Conference (NORCAS): NORCHIP and International Symposium of System-on-Chip (SoC), Linköping, Sweden, 23/10/2017 - 23/10/2017
Electronic versions: 08124945.pdf
DOIs: 10.1109/NORCHIP.2017.8124945
Source: FindIt
Source-ID: 2393856967
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

High Performance with Prescriptive Optimization and Debugging
Parallel programming is the dominant approach to achieve high performance in computing today. Correctly writing efficient and fast parallel programs is a big challenge mostly carried out by experts. We investigate optimization and debugging of parallel programs.

We argue that automatic parallelization and automatic vectorization is attractive as it transparently optimizes programs. The thesis contributes an improved dependence analysis for explicitly parallel programs. These improvements lead to more loops being vectorized, on average we achieve a speedup of 1.46 over the existing dependence analysis and vectorizer in GCC.

Automatic optimizations often fail for theoretical and practical reasons. When they fail we argue that a hybrid approach can be effective. Using compiler feedback, we propose to use the programmer’s intuition and insight to achieve high performance. Compiler feedback enlightens the programmer why a given optimization was not applied, and suggest how to change the source code to make it more amenable to optimizations. We show how this can yield significant speedups and achieve 2.4 faster execution on a real industrial use case.

To aid in parallel debugging we propose the prescriptive debugging model, which is a user-guided model that allows the programmer to use his intuition to diagnose bugs in parallel programs. The model is scalable, yet capable enough, to be general-purpose. In our evaluation we demonstrate low run time overhead and logarithmic scalability. This enable the model to be used on extremely large parallel systems.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Formal Methods, Embedded Systems Engineering
Authors: Jensen, N. B. (Intern), Probst, C. W. (Intern), Karlsson, S. (Intern)
Number of pages: 204
Publication date: 2017
High-resolution magnetic resonance imaging reveals nuclei of the human amygdala: manual segmentation to automatic atlas

The amygdala is composed of multiple nuclei with unique functions and connections in the limbic system and to the rest of the brain. However, standard in vivo neuroimaging tools to automatically delineate the amygdala into its multiple nuclei are still rare. By scanning postmortem specimens at high resolution (100-150µm) at 7T field strength (n = 10), we were able to visualize and label nine amygdala nuclei (anterior amygdaloid, cortico-amygdaloid transition area; basal, lateral, accessory basal, central, cortical medial, paralaminar nuclei). We created an atlas from these labels using a recently developed atlas building algorithm based on Bayesian inference. This atlas, which will be released as part of FreeSurfer, can be used to automatically segment nine amygdala nuclei from a standard resolution structural MR image. We applied this atlas to two publicly available datasets (ADNI and ABIDE) with standard resolution T1 data, used individual volumetric data of the amygdala nuclei as the measure and found that our atlas i) discriminates between Alzheimer’s disease participants and age-matched control participants with 84% accuracy (AUC=0.915), and ii) discriminates between individuals with autism and age-, sex- and IQ-matched neurotypically developed control participants with 59.5% accuracy (AUC=0.59). For both datasets, the new ex vivo atlas significantly outperformed (all p <.05) estimations of the whole amygdala derived from the segmentation in FreeSurfer 5.1 (ADNI: 75%, ABIDE: 54% accuracy), as well as classification based on whole amygdala volume (using the sum of all amygdala nuclei volumes; ADNI: 81%, ABIDE: 55% accuracy). This new atlas and the segmentation tools that utilize it will provide neuroimaging researchers with the ability to explore the function and connectivity of the human amygdala nuclei with unprecedented detail in healthy adults as well as those with neurodevelopmental and neurodegenerative disorders.
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 4.583 SNIP 1.852 CiteScore 6.71
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 4.323 SNIP 2.03 CiteScore 6.9
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 4.489 SNIP 2.028 CiteScore 7.06
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 4.026 SNIP 1.972 CiteScore 6.86
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.728 SNIP 1.818 CiteScore 6.31
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 3.654 SNIP 1.869
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 3.954 SNIP 1.899
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 4.196 SNIP 1.771
Web of Science (2008): Indexed yes
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 3.467 SNIP 1.94
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 3.78 SNIP 1.921
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 3.481 SNIP 1.803
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.003 SNIP 1
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.696 SNIP 0.404
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.528 SNIP 0.262
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.418 SNIP 0.348
Scopus rating (1999): SJR 0.665 SNIP 0.502
Original language: English
Alzheimer's, Amygdala, Atlas, Autism, Ex vivo, Medial temporal lobe
Electronic versions:
1_s2.0_S1053811917303427_main.pdf
DOIs:
10.1016/j.neuroimage.2017.04.046
Source: FindIt
Source-ID: 2358389773
Publication: Research - peer-review › Journal article – Annual report year: 2017
High temperature SU-8 pyrolysis for fabrication of carbon electrodes

In this work, we present the investigation of the pyrolysis parameters at high temperature (1100 °C) for the fabrication of two-dimensional pyrolytic carbon electrodes. The electrodes were fabricated by pyrolysis of lithographically patterned negative epoxy based photore sist SU-8. A central composite experimental design was used to identify the influence of dwell time at the highest pyrolysis temperature and heating rate on electrical, electrochemical and structural properties of the pyrolytic carbon: Van der Pauw sheet resistance measurements, cyclic voltammetry, electrochemical impedance spectroscopy and Raman spectroscopy were used to characterize the pyrolytic carbon.

The results show that the temperature increase from 900 °C to 1100 °C improves the electrical and electrochemical properties. At 1100 °C, longer dwell time leads to lower resistivity, while the variation of the pyrolysis parameters has small influence on electrochemical performance.

General information
State: Published
Organisations: Department of Micro- and Nanotechnology, Nanocarbon, Department of Applied Mathematics and Computer Science, Cognitive Systems
Pages: 91-99
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Analytical and Applied Pyrolysis
Volume: 125
ISSN (Print): 0165-2370
Ratings:
  BFI (2018): BFI-level 1
  Web of Science (2018): Indexed yes
  BFI (2017): BFI-level 1
  Scopus rating (2017): SNIP 1.312 SJR 1.129 CiteScore 3.91
  Web of Science (2017): Indexed Yes
  BFI (2016): BFI-level 1
  Scopus rating (2016): CiteScore 4.11 SJR 1.379 SNIP 1.572
  Web of Science (2016): Indexed yes
  BFI (2015): BFI-level 1
  Scopus rating (2015): SJR 1.489 SNIP 1.635 CiteScore 4.06
  Web of Science (2015): Indexed yes
  BFI (2014): BFI-level 1
  Scopus rating (2014): SJR 1.691 SNIP 1.954 CiteScore 4.08
  Web of Science (2014): Indexed yes
  BFI (2013): BFI-level 1
  Scopus rating (2013): SJR 1.036 SNIP 1.921 CiteScore 3.6
  ISI indexed (2013): ISI indexed yes
  Web of Science (2013): Indexed yes
  BFI (2012): BFI-level 1
  Scopus rating (2012): SJR 1.408 SNIP 1.77 CiteScore 3.26
  ISI indexed (2012): ISI indexed yes
  BFI (2011): BFI-level 1
  Scopus rating (2011): SJR 1.388 SNIP 1.603 CiteScore 3.07
  ISI indexed (2011): ISI indexed yes
  BFI (2010): BFI-level 1
  Scopus rating (2010): SJR 1.181 SNIP 1.424
  Web of Science (2010): Indexed yes
  BFI (2009): BFI-level 1
  Scopus rating (2009): SJR 1.296 SNIP 1.418
  BFI (2008): BFI-level 1
  Scopus rating (2008): SJR 1.247 SNIP 1.43
  Scopus rating (2007): SJR 1.334 SNIP 1.977
High throughput in situ scattering of roll-to-roll coated functional polymer films

The development of conjugated polymers for organic electronics and photovoltaics has relied heavily on advanced X-ray scattering techniques almost since the earliest studies in the field. Almost from the beginning, structural studies focused on how the polymers self-organize in thin films, and the relation between chemical configuration of the polymer, structure and performance. This chapter presents the latest developments where structural analysis is applied as in situ characterization of structure formation during roll-to-roll coating of photoactive layers for solar cells.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Department of Energy Conversion and Storage, Imaging and Structural Analysis
Authors: Andreasen, J. W. (Intern)
Pages: 159-174
Publication date: 2017

Host publication information
Title of host publication: Conjugated Polymers and Oligomers: Structural and Soft Matter Aspects
Publisher: World Scientific
Editor: Knaapila, M.
Chapter: 6
Series: Materials and Energy
Volume: 9
Main Research Area: Technical/natural sciences
DOIs:
10.1142/9789813225763_0006
Source: Findit
Source-ID: 2394647980
Publication: Research - peer-review › Book chapter – Annual report year: 2017

Høringssvar - Vejledning for kolonne 3-virksomheder - Sikring af risikovirksomheder

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Statistics and Data Analysis
Authors: Hedlund, F. H. (Intern)
Number of pages: 38
Publication date: 2017
Applicant: Rigspolitiet - SINE
Main Research Area: Technical/natural sciences

Publication information
Finished: 19/04/2017
Number of pages: 38
Høringssvar - Vejledning om definition større uheld 2017

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Statistics and Data Analysis
Authors: Hedlund, F. H. (Intern)
Number of pages: 11
Publication date: 2017
Applicant: Miljøstyrelsen
Main Research Area: Technical/natural sciences

Publication information
Number of pages: 11
Original language: Danish
Electronic versions:
Frank_Hedlund_COWI_h_ringssvar_Vejledning_om_definition_st_re_uheld_2017.pdf
Source: PublicationPreSubmission
Source-ID: 140019504
Publication: Commissioned › Question & Answer/hearing contribution – Annual report year: 2017

How to foster a High-Tech entrepreneurial mind-set – A multidisciplinary engineering course for Bachelor students

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Department of Micro- and Nanotechnology, National Food Institute, Research Group for Microbial Biotechnology and Biorefining, Office for Study Programmes and Student Affairs, Department of Civil Engineering, Department of Management Engineering, Technology and Innovation Management
Authors: Rootzén, H. (Intern), Berg, R. H. (Intern), Hobley, T. J. (Intern), Andersson, P. H. (Intern), Yoshinaka, Y. (Intern), Jensen, L. B. (Intern)
Publication date: 2017
Main Research Area: Technical/natural sciences
Entrepreneurial mind-set, Multidisciplinary teams, Preparing professionals
Source: PublicationPreSubmission
Source-ID: 131137226
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

Human health no-effect levels of TiO2 nanoparticles as a function of their primary size
As engineered nanomaterials are increasingly introduced on the market into a broad range of commodities or nanoproducts, there is a need for operational, reliable tool, enabling to consistently assess the risks and impacts associated with the releases of nanoparticles. The lack of a developed metric that accurately represents their toxic effects while capturing the influence of the most relevant physicochemical properties is one of the major impediments. Here, we investigate the relationships between the toxic responses of nano-sized and micro-sized particles in in vivo toxicological studies and their physicochemical properties. Our results for TiO2 particles indicate statistically significant associations between the primary particle size and their toxicity responses for combined inhalation and ingestion exposure routes, although the numerical values should be considered with care due to the inability to encompass influences from other relevant physicochemical properties like surface coatings. These findings allow for expressing mass-based adverse effect levels as a continuous function of the primary size of particles. This meaningful, exploratory metric can thus be used for screening purposes and pave the way for reaching adaptive, robust risk assessments of nanomaterials, e.g. for setting up consistent threshold levels, as well as consistent life cycle assessments of nanoproducts. We provide examples of such applications.
Idempotent and p-potent quadratic functions: distribution of nonlinearity and co-dimension

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics, Austrian Academy of Sciences, Sabanci University
Authors: Anbar Meidl, N. (Intern), Meidl, W. M. (Ekstern), Topuzoglu, A. (Ekstern)
Number of pages: 27
Pages: 265–291
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Designs, Codes and Cryptography
Volume: 82
Issue number: 1
ISSN (Print): 0925-1022
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.274 SJR 0.549 CiteScore 1.09
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.09 SJR 0.585 SNIP 1.286
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.564 SNIP 1.015 CiteScore 0.82
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.712 SNIP 1.42 CiteScore 0.99
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.736 SNIP 1.435 CiteScore 0.92
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.824 SNIP 1.515 CiteScore 0.98
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.901 SNIP 1.299 CiteScore 1.08
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Seeds of Barley (Hordeum vulgare) are infected by a high number of fungi, including pathogens such as Fusarium graminearum, F. culmorum, F. poae, F. avenaceum and Pyrenophora teres. Fusarium spp. is a widely distributed fungus causing yield reduction in a range of agricultural crops and many species in the genus produce mycotoxins responsible for serious quality deterioration. In malting barley, Fusarium also has a negative effect by causing gushing in beer. A number of barley seeds (app. 200) assumed to be infected by fungal from different origins and years of cultivation were tested by NGS sequencing the ITS (Internal Transcribed Spacer) region from total DNA. Approximately 2-4000 sequences were obtained from each seed and these were subsequently identified to species level in order to give an exact identification of fungal genera on each seed. The main fungal genera identified were Fusarium, Pyrenophora, Epicoccum, Didymella, Alternaria, Bipolaris and Microdochium. The fungal composition and quantities on each seed varied significantly. Some were infected mainly by a single fungus and some were infected by multiple fungi. All seeds were prior to this evaluated by multispectral imaging on the dorsal and ventral sides by the VideometerLab multispectral imaging system (Videometer A/S, Harsholm, Denmark). This system is an instrument equipped with 19 different light emitting diodes at wavelengths ranging from 375 to 970nm (ultraviolet, visual and lower wavelength of the near-infrared region) in the reflectance mode (5 Mpix per band, pixel size app. 45 μm x 45 μm). Spectral information over the surface of seeds may be combined with information about size, shape, and texture of the seeds. This information links detection of fungal infection with other seed characteristics known from general seed testing. Analytical separation of the identified fungi was based on mean pixel intensity and a normalized Canonical Discriminant Analysis (nCDA) using the images of infected and healthy seeds. The potential of using spectral characteristics of the fungal species as a way to provide a fast optical screening method for fungal contamination of barley on the fungal species level was investigated by comparing results from the next generation sequencing and multispectral imaging.
Image fusion and denoising using fractional-order gradient information

Image fusion and denoising are significant in image processing because of the availability of multi-sensor and the presence of the noise. The first-order and second-order gradient information have been effectively applied to deal with fusing the noiseless source images. In this paper, due to the advantage of the fraction-order derivative, we first integrate the fractional order gradients of noisy source images as the target fraction-order feature, and make it fit with the fractional-order gradient of the fused image. Then we introduce the total variation (TV) regularization for removing the noise. By adding the data fitting term between the fused image and a preprocessed image, a new convex variational model is proposed for fusing the noisy source images. Furthermore, an alternating direction method of multiplier (ADMM) is developed for solving the proposed variational model. Numerical experiments show that the proposed method outperforms the conventional total variation in methods for simultaneously fusing and denoising.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, University of Electronic Science and Technology of China
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Number of pages: 23
Publication date: 2017

Publication information
Publisher: Technical University of Denmark (DTU)
Original language: English
Volume: 05
ISSN: 1601-2321
Main Research Area: Technical/natural sciences
Image fusion and denoising, Alternating direction method of multiplier, Inverse problem, Fractional-order derivative, Structure tensor
Electronic versions: tr17_05_Dong_Y.pdf
Publication: Research › Report – Annual report year: 2017

Image reconstruction under non-Gaussian noise

During acquisition and transmission, images are often blurred and corrupted by noise. One of the fundamental tasks of image processing is to reconstruct the clean image from a degraded version. The process of recovering the original image from the data is an example of inverse problem. Due to the ill-posedness of the problem, the simple inversion of the degradation model does not give any good reconstructions. Therefore, to deal with the ill-posedness it is necessary to use some prior information on the solution or the model and the Bayesian approach.

Additive Gaussian noise has been extensively studied since it produces simple and tractable mathematical models. However, in the real applications, the noise is much more complicated and it cannot be well simulated by additive Gaussian noise; for instance, it may be signal dependent, very impulsive, multiplicative, mixed, etc. This PhD thesis intends to solve some of the many open questions for image restoration under non-Gaussian noise. The two main kinds of noise studied in this PhD project are the impulse noise and the Cauchy noise.

Impulse noise is due to for instance the malfunctioning pixel elements in the camera sensors, errors in analogue-to-digital conversion, faulty memory locations in hardware. Cauchy noise is characterized by a very impulsive behaviour and it is mainly used to simulate atmospheric and underwater acoustic noise, in radar and sonar applications, biomedical images and synthetic aperture radar images. For both noise models we introduce new variational models to recover the clean and sharp images from degraded images. Both methods are verified by using some simulated test problems. The experiments clearly show that the new methods outperform the former ones.

Furthermore, we have carried out a theoretical study on the two most known estimates: maximum a posteriori (MAP) estimate and conditional mean (CM) estimate for non-Gaussian noise. With only the convexity assumption on the data fidelity term, we introduce some cost functions for which the CM and MAP estimates are proper Bayes estimators and we also prove that the CM estimate outperforms the MAP estimate, when the error depends on Bregman distances.

This PhD project can have many applications in the modern society, in fact the reconstruction of high quality images with less noise and more details enhances the image processing operations, such as edge detection, segmentation, etc.
Imaging for monitoring downstream processing of fermentation broths

In relation to downstream processing of a fermentation broth coagulation/flocculation is a typical pretreatment method for separating undesirable particles/impurities from the wanted product. In the coagulation process the negatively charged impurities are destabilized by adding of a clarifying agent thereby neutralizing the charges on the particles. Particles thus agglomerate. Larger agglomerates are formed in the flocculation process by adding a polymer, which forms bridges between the particles. The operation of coagulators, flocculators and clarifiers requires trained operators implying the human factor to play a major risk with regard to performance. Better process monitoring will provide the means for improved control giving higher yield, better quality, and minimize the consumption of water. In particular, the optimal separation of biomass from a soluble enzyme phase is often dependent on an initial coagulation of the biomass and a final flocculation of the solids just prior to separation. We investigate flocculation processes at Novozymes facilities so that the response time and risk of error is minimized. We use oCelloScope [1], an automated microscope, for imaging samples from the flocculation process and subsequently we extract image features for qualitative and quantitative image characterization. The processing include image morphology, image segmentation and image quantification. The aim is to correlate image information to “quality” of the separation process. Here we report our initial finding. [1] M.Fredborg et al. Journal of Clinical Microbiology Vol 51 Number 7 p. 2047–2053 (2013); http://www.biosensesolutions.dk

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science , Scientific Computing
Authors: Sciacchitano, F. (Intern), Dong, Y. (Intern), Hansen, P. C. (Intern)
Number of pages: 115
Publication date: 2017

Publication information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Original language: English
Series: DTU Compute PHD-2016
Number: 426
ISSN: 0909-3192
Main Research Area: Technical/natural sciences
Electronic versions:
phd426_Sciacchitano_F.pdf

Relations
Projects:
Image reconstruction under non-Gaussian noise
Publication: Research › Ph.D. thesis – Annual report year: 2017

Immersive Algorithms: Better Visualization with Less Information
Visualizing algorithms, such as drawings, slideshow presentations, animations, videos, and software tools, is a key concept to enhance and support student learning. A typical visualization of an algorithm show the data and then perform computation on the data. For instance, a standard visualization of a standard binary search on an array shows an array of sorted numbers and then illustrate the action of the algorithm in a step-by-step fashion. However, this approach does not fully capture the computational environment from the perspective of the algorithm. Specifically, the algorithm does not "see" the full sorted array, but only the single position that it accesses during each step of the computation. To fix this discrepancy we introduce the immersive principle that states that at any point in time, the displayed information should closely match the information accessed by the algorithm. We give several examples of immersive visualizations of basic algorithms and data structures, discuss methods for
implementing it, and briefly evaluate it.

**Implementation of advanced process control on the four tank pilot plant**

The four tank process laboratory experiment is used as a relevant case to unfold problems that arise when implementing advanced process control such as model predictive control. The controller, which is executed on a computer, and the process equipment communicate using OPC to exchange process measurements and actuator set points. The process equipment is described along with the setup of the PLC and the OPC server in order to be able to access process variables on a dimensional scale. A process emulator in which a process simulator is embedded in an OPC interface has been developed in Python. Using the detailed information of sensor and actuator calibration as well as PLC functionality, the emulator appears identical to the actual process and may be used to perform virtual tests of controllers prior to commissioning. Examples of how to interact with OPC servers are presented for both Matlab and Python. An MPC has been designed based on a linearized model of the process and tested using the emulator. This controller was then implemented on a realization of the process at the Technical University of Denmark, demonstrating MPC experimentally.

**Importance of waste composition for Life Cycle Assessment of waste management solutions**

The composition of waste materials has fundamental influence on environmental emissions associated with waste treatment, recycling and disposal, and may play an important role also for the Life Cycle Assessment (LCA) of waste management solutions. However, very few assessments include effects of the waste composition and waste LCAs often rely on poorly justified data from secondary sources. This study systematically quantifies the influence and uncertainty on
LCA results associated with selection of waste composition data. Three archetypal waste management scenarios were modelled with the waste LCA model EASETECH based on detailed waste composition data from the literature. The influence from waste composition data on the LCA results was quantified with a step-wise Global Sensitivity Analysis (GSA) approach involving contribution, sensitivity, uncertainty and discernibility analyses. The waste composition data contributed significantly to the LCA results and the uncertainty associated with these results. The importance of 405 individual waste properties was evaluated in comparison with 345 technology parameters. Overall, less than 10 physico-chemical properties dominated the output uncertainty of the LCA results, although these properties had low sensitivity in the model. Moreover, the uncertainties associated with the physico-chemical properties were responsible for output uncertainties that spanned from impacts to benefits. The GSA approach applied in this study constitutes a valuable tool for systematically assessing the importance of waste composition and for consciously collecting and using waste composition data within LCAs of waste management systems.
Improved detection of chemical substances from colorimetric sensor data using probabilistic machine learning

We present a data-driven machine learning approach to detect drug- and explosives-precursors using colorimetric sensor technology for air-sampling. The sensing technology has been developed in the context of the CRIM-TRACK project. At present a fully-integrated portable prototype for air sampling with disposable sensing chips and automated data acquisition has been developed. The prototype allows for fast, user-friendly sampling, which has made it possible to produce large datasets of colorimetric data for different target analytes in laboratory and simulated real-world application scenarios. To make use of the highly multi-variate data produced from the colorimetric chip a number of machine learning techniques are employed to provide reliable classification of target analytes from confounders found in the air streams. We demonstrate that a data-driven machine learning method using dimensionality reduction in combination with a probabilistic classifier makes it possible to produce informative features and a high detection rate of analytes. Furthermore, the probabilistic machine learning approach provides a means of automatically identifying unreliable measurements that could produce false predictions. The robustness of the colorimetric sensor has been evaluated in a series of experiments focusing on the amphetamine pre-cursor phenylacetone as well as the improvised explosives pre-cursor hydrogen peroxide. The analysis demonstrates that the system is able to detect analytes in clean air and mixed with substances that occur naturally in real-world sampling scenarios. The technology under development in CRIM-TRACK has the potential as an effective tool to control trafficking of illegal drugs, explosive detection, or in other law enforcement applications.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, Copenhagen Center for Health Technology, Department of Micro- and Nanotechnology, Surface Engineering, Cranfield University, Securetec Detektions-Systeme AG, Pro Design Electronic GmbH, Gammadata Instrument AB
Number of pages: 8
Publication date: 2017

Host publication information
Title of host publication: Proceedings of SPIE
Volume: 10183
Publisher: SPIE - International Society for Optical Engineering
Article number: 1018307
ISBN (Print): 9781510608672
Series: Proceedings of SPIE - International Society for Optical Engineering
Volume: 10183
Improved Power Decoding of One-Point Hermitian Codes

We propose a new partial decoding algorithm for one-point Hermitian codes that can decode up to the same number of errors as the Guruswami–Sudan decoder. Simulations suggest that it has a similar failure probability as the latter one. The algorithm is based on a recent generalization of the power decoding algorithm for Reed–Solomon codes and does not require an expensive root-finding step. In addition, it promises improvements for decoding interleaved Hermitian codes.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics, University of Ulm
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Number of pages: 9
Publication date: 2017

Host publication information
Title of host publication: Proceedings of International Workshop on Coding and Cryptography 2017
BFI conference series: Workshop on Coding and Cryptography (5010052)
Main Research Area: Technical/natural sciences
Conference: Tenth International Workshop on Coding and Cryptography 2017, Saint-Petersburg, Russian Federation, 18/09/2017 - 18/09/2017
Electronic versions:
2017_wcc_hermitianpower.pdf
Source: PublicationPreSubmission
Source-ID: 140540870
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Improving Loop Dependence Analysis

Programmers can no longer depend on new processors to have significantly improved single-thread performance. Instead, gains have to come from other sources such as the compiler and its optimization passes. Advanced passes make use of information on the dependencies related to loops. We improve the quality of that information by reusing the information given by the programmer for parallelization. We have implemented a prototype based on GCC into which we also add a new optimization pass. Our approach improves the amount of correctly classified dependencies resulting in 46% average improvement in single-thread performance for kernel benchmarks compared to GCC 6.1.

General information
State: Published
Organisations: Formal Methods, Department of Applied Mathematics and Computer Science, Embedded Systems Engineering
Authors: Jensen, N. B. (Intern), Karlsson, S. (Intern)
Number of pages: 24
Pages: 1-24
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: ACM Transactions on Architecture and Code Optimization
Volume: 14
Improving SAR Automatic Target Recognition Models with Transfer Learning from Simulated Data

Data-driven classification algorithms have proved to do well for automatic target recognition (ATR) in synthetic aperture radar (SAR) data. Collecting data sets suitable for these algorithms is a challenge in itself as it is difficult and expensive. Due to the lack of labeled data sets with real SAR images of sufficient size, simulated data play a big role in SAR ATR development, but the transferability of knowledge learned on simulated data to real data remains to be studied further. In this letter, we show the first study of Transfer Learning between a simulated data set and a set of real SAR images. The simulated data set is obtained by adding a simulated object radar reflectivity to a terrain model of individual point scatters, prior to focusing. Our results show that a Convolutional Neural Network (Convnet) pretrained on simulated data has a great advantage over a Convnet trained only on real data, especially when real data are sparse. The advantages of pretraining the models on simulated data show both in terms of faster convergence during the training phase and on the end accuracy when benchmarked on the Moving and Stationary Target Acquisition and Recognition data set. These results encourage SAR ATR development to continue the improvement of simulated data sets of greater size and complex scenarios in order to build robust algorithms for real life SAR ATR applications.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, National Space Institute, Microwaves and Remote Sensing, Terma A/S
Authors: Malmgren-Hansen, D. (Intern), Kusk, A. (Intern), Dall, J. (Intern), Nielsen, A. A. (Intern), Engholm, R. (Ekstern), Skriver, H. (Intern)
Pages: 1484-8
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Volume: 14
Issue number: 9
ISSN (Print): 1545-598X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.638 SJR 1.486 CiteScore 3.57
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.13 SJR 1.528 SNIP 1.959
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.496 SNIP 2.089 CiteScore 3.09
Individual fibre segmentation from 3D X-ray computed tomography for characterising the fibre orientation in unidirectional composite materials

The aim of this paper is to characterise the fibre orientation in unidirectional fibre reinforced polymers, namely glass and carbon fibre composites. The compression strength of the composite is related to the orientation of the fibres. Thus the orientation is essential when designing materials for wind turbine blades. The calculation of the fibre orientation distribution is based on segmenting the individual fibres from volumes that have been acquired through X-ray tomography. The segmentation method presented in this study can accurately extract individual fibres from low contrast X-ray scans of composites with high fibre volume fraction. From the individual fibre orientations, it is possible to obtain results which are independent of the scanning quality. The compression strength for both composites is estimated from the average fibre orientations and is found to be of the same order of magnitude as the measured values.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Department of Wind Energy, Composites and Materials Mechanics
Authors: Emerson, M. J. (Intern), Jespersen, K. M. (Intern), Dahl, A. B. (Intern), Conradsen, K. (Intern), Mikkelsen, L. P. (Intern)
Pages: 83–92
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Composites Part A: Applied Science and Manufacturing
Volume: 97
ISSN (Print): 1359-835X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SJR 1.539 SNIP 2.105 CiteScore 4.92
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.82 SJR 1.478 SNIP 2.146
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.532 SNIP 2.219 CiteScore 4.09
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.703 SNIP 2.568 CiteScore 4.08
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.635 SNIP 2.86 CiteScore 3.92
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.582 SNIP 2.752 CiteScore 3.36
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.48 SNIP 2.557 CiteScore 3.23
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.599 SNIP 2.313
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.561 SNIP 2.03
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.441 SNIP 1.924
Scopus rating (2007): SJR 1.267 SNIP 2.227
Web of Science (2007): Indexed yes
Scopus rating (2005): SJR 1.133 SNIP 2.121
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.244 SNIP 1.718
Scopus rating (2003): SJR 1.203 SNIP 1.435
Scopus rating (2002): SJR 1.244 SNIP 1.534
Scopus rating (2001): SJR 1.431 SNIP 1.361
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.808 SNIP 1.337
Scopus rating (1999): SJR 0.829 SNIP 1.117
Original language: English
Polymer-matrix composites (PMCs), Strength, Non-destructive testing Misalignment
DOIs:

Relations
Projects:
Individual fibre segmentation from 3D X-ray computed tomography for characterising the fibre orientation in unidirectional composite materials
Source: FindIt
Source-ID: 2351025373
Publication: Research - peer-review › Journal article – Annual report year: 2017
Inferring human intentions from the brain data
The human brain is a massively complex organ composed of approximately a hundred billion densely interconnected, interacting neural cells. The neurons are not wired randomly - instead, they are organized in local functional assemblies. It is believed that the complex patterns of dynamic electric discharges across the neural tissue are responsible for emergence of high cognitive function, conscious perception and voluntary action. The brain’s capacity to exercise free will, or internally generated free choice, has long been investigated by philosophers, psychologists and neuroscientists. Rather than assuming a causal power of conscious will, the neuroscience of volition is based on the premise that “mental states rest on brain processes”, and hence by measuring spatial and temporal correlates of volition in carefully controlled experiments we can infer about their underlying mind processes, including concepts as intriguing as “free will”, “agency” and “consciousness”. Recent developments in electrophysiology and neuroimaging methods allow for increasingly more accurate estimation of spatial and temporal characteristics of decision processes.

The work presented in this thesis is intended to contribute to our understanding of the dynamics of voluntary decision processes about prospective action. In the two presented studies we probe different types of decisions and compare them in terms of behavioral and EEG characteristics. We show that decision processes are manifested by complex, broadband modulation of brain oscillatory patterns, primarily in Alpha (8-12Hz) and Beta (16-30Hz) ranges. Our results suggest that decisions about whether to act or not, what type of action to perform, and about the timing of the action have distinct dynamic representations, and thus are to some extent mediated by different neural components. Furthermore, free action can be partially explained by low level behavioral preferences, especially in contexts where no explicit incentive favors one action over another.

Apart from the investigation of volition, considerable part of the work presented in this thesis is dedicated to experiment design methodology and efficient EEG processing methods. We have developed a dedicated, flexible Virtual Reality Environment (VRE) platform, suitable for investigation of volition and action preparation processes with range of modalities, including electroencephalography (EEG), functional magnetic resonance (fMRI), eye-tracking (ET) and behavioral measures. By providing ecologically valid, semi-realistic experience we aimed at reinforcing the natural decision processes and minimize the problem of random-sequence generation and fatigue in participants undergoing highly repeatable cognitive experiments. Other methodological contributions presented in the thesis are related to efficient, automatized and highly data-preserving methods for processing of EEG data, based on minimal number of arbitrarily selected parameters.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, Copenhagen Center for Health Technology
Authors: Stanek, K. (Intern), Winther, O. (Intern), Hansen, L. K. (Intern)
Number of pages: 207
Publication date: 2017

Publication information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Original language: English
Series: DTU Compute PHD-2016
Number: 420
ISSN: 0909-3192
Main Research Area: Technical/natural sciences
Electronic versions: phd420_Stanek_K.pdf

Relations
Projects:
Inferring human intentions from the brain data
Publication: Research › Ph.D. thesis – Annual report year: 2017

Inferring Person-to-person Proximity Using WiFi Signals
Today's societies are enveloped in an ever-growing telecommunication infrastructure. This infrastructure offers important opportunities for sensing and recording a multitude of human behaviors. Human mobility patterns are a prominent example of such a behavior which has been studied based on cell phone towers, Bluetooth beacons, and WiFi networks as proxies for location. However, while mobility is an important aspect of human behavior, understanding complex social systems requires studying not only the movement of individuals, but also their interactions. Sensing social interactions on a large scale is a technical challenge and many commonly used approaches—including RFID badges or Bluetooth scanning—offer only limited scalability. Here we show that it is possible, in a scalable and robust way, to accurately infer
person-to-person physical proximity from the lists of WiFi access points measured by smartphones carried by the two individuals. Based on a longitudinal dataset of approximately 800 participants with ground-truth interactions collected over a year, we show that our model performs better than the current state-of-the-art. Our results demonstrate the value of WiFi signals in social sensing as well as potential threats to privacy that they imply.

**General information**

**State:** Published  
**Organisations:** Department of Applied Mathematics and Computer Science, Cognitive Systems, Stanford University  
**Authors:** Sapiezynski, P. (Intern), Stopczynski, A. (Intern), Wind, D. K. (Intern), Leskovec, J. (Ekstern), Jørgensen, S. L. (Intern)  
**Number of pages:** 11  
**Publication date:** 2017

**Host publication information**

**Title of host publication:** Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies  
**Volume:** 1  
**Place of publication:** New York,  
**Publisher:** Association for Computing Machinery  
**Article number:** 24  
**Series:** Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies  
**ISSN:** 2474-9567  
**Main Research Area:** Technical/natural sciences

**Social sensing, Wifi, Proximity, Interactions, Social networks**

**Electronic versions:**  
1610.04730.pdf  
**DOIs:**  
10.1145/3090089  
**Source:** PublicationPreSubmission  
**Source-ID:** 138400312  
**Publication: Research - peer-review › Article in proceedings – Annual report year: 2017**

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**Infinite von Mises-Fisher Mixture Modeling of Whole Brain fMRI Data**

Cluster analysis of functional magnetic resonance imaging (fMRI) data is often performed using gaussian mixture models, but when the time series are standardized such that the data reside on a hypersphere, this modeling assumption is questionable. The consequences of ignoring the underlying spherical manifold are rarely analyzed, in part due to the computational challenges imposed by directional statistics. In this letter, we discuss a Bayesian von Mises-Fisher (vMF) mixture model for data on the unit hypersphere and present an efficient inference procedure based on collapsed Markov chain Monte Carlo sampling. Comparing the vMF and gaussian mixture models on synthetic data, we demonstrate that the vMF model has a slight advantage inferring the true underlying clustering when compared to gaussian-based models on data generated from both a mixture of vMFs and a mixture of gaussians subsequently normalized. Thus, when performing model selection, the two models are not in agreement. Analyzing multisubject whole brain resting-state fMRI data from healthy adult subjects, we find that the vMF mixture model is considerably more reliable than the gaussian mixture model when comparing solutions across models trained on different groups of subjects, and again we find that the two models disagree on the optimal number of components. The analysis indicates that the fMRI data support more than a thousand clusters, and we confirm this is not a result of overfitting by demonstrating better prediction on data from held-out subjects. Our results highlight the utility of using directional statistics to model standardized fMRI data and demonstrate that whole brain segmentation of fMRI data requires a very large number of functional units in order to adequately account for the discernible statistical patterns in the data.

**General information**

**State:** Published  
**Organisations:** Department of Applied Mathematics and Computer Science, Cognitive Systems  
**Authors:** Røge, R. (Intern), Madsen, K. H. (Intern), Schmidt, M. N. (Intern), Mørup, M. (Intern)  
**Pages:** 2712-2741  
**Publication date:** 2017  
**Main Research Area:** Technical/natural sciences

**Publication information**

**Journal:** Neural Computation  
**Volume:** 29  
**Issue number:** 10  
**ISSN (Print):** 0899-7667  
**Ratings:**  
**BFI (2018):** BFI-level 2
Information Flow for Timed Automata

One of the key demands of cyberphysical systems is that they meet their safety goals. Timed Automata has established itself as a formalism for modelling and analysing the real-time safety aspects of cyberphysical systems. Increasingly it is also demanded that cyberphysical systems meet a number of security goals for confidentiality and integrity. Information Flow Control is an approach to ensuring that there are no flows of information that violate the stated security policy.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Formal Methods
Authors: Nielsen, F. (Intern), Nielsen, H. R. (Intern), Vasilikos, P. (Intern)
Number of pages: 19
Pages: 3-21
Publication date: 2017

Host publication information
Title of host publication: Models, Algorithms, Logics and Tools
Volume: 10460
Publisher: Springer
ISBN (Print): 9783319631202
Series: Lecture Notes in Computer Science
Volume: 10460
ISSN: 0302-9743
Main Research Area: Technical/natural sciences
Conference: KiMFest, Aalborg, Denmark, 19/08/2017 - 19/08/2017
Computer Science, Theory of Computation, Software Engineering, Simulation and Modeling, Programming Languages, Compilers, Interpreters, Artificial Intelligence (incl. Robotics), Computer Systems Organization and Communication Networks
DOIs: 10.1007/978-3-319-63121-9_1
Source: FindIt
Source-ID: 2373080612
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

In-line 3D print failure detection using computer vision
Here we present our findings on a novel real-time vision system that allows for automatic detection of failure conditions that are considered outside of nominal operation. These failure modes include warping, build plate delamination and extrusion failure. Our system consists of a calibrated camera whose position and orientation is known in the machine coordinate system. We simulate what the object under print should look like for any given moment in time. This is compared to a segmentation of the current print, and statistical detection of significant deviation. We demonstrate that this methodology precisely and unambiguously detects the time point of print failure.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Department of Mechanical Engineering, Manufacturing Engineering
Number of pages: 4
Publication date: 2017

Host publication information
Title of host publication: Dimensional Accuracy and Surface Finish in Additive Manufacturing
Main Research Area: Technical/natural sciences
Conference: euspen and ASPE Special Interest Group Meeting: Additive Manufacturing, Leuven, Belgium, 10/10/2017 - 10/10/2017
Failure detection, Computer vision, Fused deposition modeling (FDM)
Source: PublicationPreSubmission
Source-ID: 139557938
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Innovative and collaborative industrial mathematics in Europe
This paper presents a brief review of how industrial mathematics, inspired by the Oxford Study Group activity, organized itself in Europe, gave rise to the European Consortium for Mathematics in Industry, the series of European Study Groups with Industry, and to new modes of productive contacts between industry and applied mathematicians in academia.
Integrated Inflammatory Stress (ITIS) Model

During the last decade, there has been an increasing interest in the coupling between the acute inflammatory response and the Hypothalamic-Pituitary-Adrenal (HPA) axis. The inflammatory response is activated acutely by pathogen- or damage-related molecular patterns, whereas the HPA axis maintains a long-term level of the stress hormone cortisol which is also anti-inflammatory. A new integrated model of the interaction between these two subsystems of the inflammatory system is proposed and coined the integrated inflammatory stress (ITIS) model. The coupling mechanisms describing the interactions between the subsystems in the ITIS model are formulated based on biological reasoning and its ability to describe clinical data. The ITIS model is calibrated and validated by simulating various scenarios related to endotoxin (LPS) exposure. The model is capable of reproducing human data of tumor necrosis factor alpha, adrenocorticotropic hormone (ACTH) and cortisol and suggests that repeated LPS injections lead to a deficient response. The ITIS model predicts that the most extensive response to an LPS injection in ACTH and cortisol concentrations is observed in the early hours of the day. A constant activation results in elevated levels of the variables in the model while a prolonged change of the oscillations in ACTH and cortisol concentrations is the most pronounced result of different LPS doses predicted by the model.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Technical University of Denmark, North Carolina State University, Frederiksberg Hospital, Roskilde University
Authors: Bangsgaard, E. O. (Ekstern), Hjorth, P. G. (Intern), Olufsen, M. S. (Ekstern), Mehlsen, J. (Ekstern), Ottesen, J. T. (Ekstern)
Pages: 1487–1509
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Bulletin of Mathematical Biology
Volume: 79
Issue number: 7
ISSN (Print): 0092-8240
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 0.944 SJR 0.717 CiteScore 1.47
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.4 SJR 0.682 SNIP 0.779
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.758 SNIP 0.73 CiteScore 1.34
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.659 SNIP 0.74 CiteScore 1.32
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.809 SNIP 0.982 CiteScore 1.68
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.951 SNIP 1.215 CiteScore 2.06
ISI indexed (2012): ISI indexed yes
We propose an approach for instructing a robot using natural language to solve complex tasks in a dynamic environment. In this study, we elaborate on a framework that allows a humanoid robot to understand natural language, derive symbolic representations of its sensorimotor experience, generate complex plans according to the current world state, and monitor plan execution. The presented development supports replacing missing objects and suggesting possible object locations. It is a realization of the concept of structural bootstrapping developed in the context of the European project Xperience. The framework is implemented within the robot development environment ArmarX. We evaluate the framework on the humanoid robot ARMAR-III in the context of two experiments: a demonstration of the real execution of a complex task in the kitchen environment on ARMAR-III and an experiment with untrained users in a simulation environment.
Interactive Stable Ray Tracing

Interactive ray tracing applications running on commodity hardware can suffer from objectionable temporal artifacts due to a low sample count. We introduce stable ray tracing, a technique that improves temporal stability without the over-blurring and ghosting artifacts typical of temporal post-processing filters. Our technique is based on sample reprojection and explicit hole filling, rather than relying on hole-filling heuristics that can compromise image quality. We make reprojection practical in an interactive ray tracing context through the use of a super-resolution bitmask to estimate screen space sample density. We show significantly improved temporal stability as compared with supersampling and an existing reprojection technique. We also investigate the performance and image quality differences between our technique and temporal antialiasing, which typically incurs a significant amount of blur. Finally, we
demonstrate the benefits of stable ray tracing by combining it with progressive path tracing of indirect illumination.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, NVIDIA
Authors: Dal Corso, A. (Intern), Salvi, M. (Ekstern), Kolb, C. (Ekstern), Frisvad, J. R. (Intern), Lefohn, A. (Ekstern), Luebke, D. (Ekstern)
Number of pages: 10
Publication date: 2017

Host publication information
Title of host publication: HPG '17 Proceedings of High Performance Graphics
Publisher: Association for Computing Machinery
ISBN (Print): 978-1-4503-5101-0
Main Research Area: Technical/natural sciences
Conference: High-Performance Graphics 2017, Los Angeles, United States, 28/07/2017 - 28/07/2017

Reprojection, Dynamic scene, Caching, Temporal stability, GPU
DOIs:
10.1145/3105762.3105769
Source: PublicationPreSubmission
Source-ID: 137970914
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Interpolation from Grid Lines: Linear, Transfinite and Weighted Method
When two sets of line scans are acquired orthogonal to each other, intensity values are known along the lines of a grid. To view these values as an image, intensities need to be interpolated at regularly spaced pixel positions. In this paper we evaluate three methods for interpolation from grid lines: linear, transfinite and weighted. Linear method does not preserve the known values along the grid lines. Transfinite method, known from mesh generation, preserves the known values but might cause overshoot. The weighted method, which we propose, is designed to combine the desired properties of transfinite method close to grid lines, and the stability of the linear method. We perform an extensive evaluation of the three interpolation methods across a range of upsampling rates for two data sets. Depending on the upsampling rate, we show significant difference in the performance of the three methods. We find that the transfinite interpolation works well for small upsampling rates and the proposed weighted interpolation method performs very well for all relevant upsampling rates.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Statistics and Data Analysis
Authors: Lindberg, A. W. (Intern), Jørgensen, T. M. (Intern), Dahl, V. A. (Intern)
Pages: 338–349
Publication date: 2017

Host publication information
Title of host publication: Image Analysis
Publisher: Springer
ISBN (Print): 978-3-319-59126-1
Series: Lecture Notes in Computer Science
Volume: 10270
ISSN: 0302-9743
Main Research Area: Technical/natural sciences
Conference: 20th Scandinavian Conference on Image Analysis, Tromsø, Norway, 12/06/2017 - 12/06/2017
Interpolation, Image processing, Performance analysis, Line scans, Medical image analysis
Electronic versions:
chp_3A10.1007_2F978_3_319_59129_2_29.pdf
DOIs:
10.1007/978-3-319-59129-2 29
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Intrinsic Grassmann Averages for Online Linear and Robust Subspace Learning
Principal Component Analysis (PCA) is a fundamental method for estimating a linear subspace approximation to high-dimensional data. Many algorithms exist in literature to achieve a statistically robust version of PCA called RPCA. In this paper, we present a geometric framework for computing the principal linear subspaces in both situations that amounts to
computing the intrinsic average on the space of all subspaces (the Grassmann manifold). Points on this manifold are defined as the subspaces spanned by K-tuples of observations. We show that the intrinsic Grassmann average of these subspaces coincide with the principal components of the observations when they are drawn from a Gaussian distribution. Similar results are also shown to hold for the RPCA. Further, we propose an efficient online algorithm to do subspace averaging which is of linear complexity in terms of number of samples and has a linear convergence rate. When the data has outliers, our proposed online robust subspace averaging algorithm shows significant performance (accuracy and computation time) gain over a recently published RPCA methods with publicly accessible code. We have demonstrated competitive performance of our proposed online subspace algorithm method on one synthetic and two real data sets. Experimental results depicting stability of our proposed method are also presented. Furthermore, on two real outlier corrupted datasets, we present comparison experiments showing lower reconstruction error using our online RPCA algorithm. In terms of reconstruction error and time required, both our algorithms outperform the competition.

Invariant manifolds and the parameterization method in coupled energy harvesting piezoelectric oscillators
Energy harvesting systems based on oscillators aim to capture energy from mechanical oscillations and convert it into electrical energy. Widely extended are those based on piezoelectric materials, whose dynamics are Hamiltonian submitted to different sources of dissipation: damping and coupling. These dissipations bring the system to low energy regimes, which is not desired in long term as it diminishes the absorbed energy. To avoid or to minimize such situations, we propose that the coupling of two oscillators could benefit from theory of Arnold diffusion. Such phenomenon studies O(1) energy variations in Hamiltonian systems and hence could be very useful in energy harvesting applications. This article is a first step towards this goal. We consider two piezoelectric beams submitted to a small forcing and coupled through an electric circuit. By considering the coupling, damping and forcing as perturbations, we prove that the unperturbed system possesses a 4-dimensional Normally Hyperbolic Invariant Manifold with 5 and 4-dimensional stable and unstable manifolds, respectively. These are locally unique after the perturbation. By means of the parameterization method, we numerically compute parameterizations of the perturbed manifold, its stable and unstable manifolds and study its inner dynamics. We show evidence of homoclinic connections when the perturbation is switched on.
Scopus rating (2016): SJR 0.847 SNIP 1.211 CiteScore 1.71
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.041 SNIP 1.29 CiteScore 1.79
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.068 SNIP 1.209 CiteScore 1.71
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.071 SNIP 1.347 CiteScore 1.76
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.083 SNIP 1.226 CiteScore 1.69
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.982 SNIP 1.165 CiteScore 1.58
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.061 SNIP 1.127
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.023 SNIP 1.164
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.33 SNIP 1.225
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.394 SNIP 1.311
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.14 SNIP 1.16
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.37 SNIP 1.29
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.073 SNIP 1.231
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.401 SNIP 1.605
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.067 SNIP 1.348
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.465 SNIP 1.355
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.389 SNIP 1.283
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 1.315 SNIP 1.109

Original language: English
Damped oscillators, Energy harvesting systems, Parameterization method, Normally hyperbolic invariant manifolds, Homoclinic connections, Arnold diffusion

DOIs:
10.1016/j.physd.2017.04.003
Source: PublicationPreSubmission
Source-ID: 131378593
Publication: Research - peer-review › Journal article – Annual report year: 2017
Inverse Optimization and Forecasting Techniques Applied to Decision-making in Electricity Markets

This thesis deals with the development of new mathematical models that support the decision-making processes of market players. It addresses the problems of demand-side bidding, price-responsive load forecasting and reserve determination. From a methodological point of view, we investigate a novel approach to model the response of aggregate price-responsive load as a constrained optimization model, whose parameters are estimated from data by using inverse optimization techniques.

The problems tackled in this dissertation are motivated, on one hand, by the increasing penetration of renewable energy production and smart grid technologies in power systems, that is expected to continue growing in the coming years. Non-dispatchable electricity generation cannot ensure a certain production at all times, since it depends on meteorological factors. Also, smart grid technologies are affecting the consumption patterns that the load traditionally exhibited. On the other hand, this thesis is motivated by the decision-making processes of market players. In response to these challenges, this thesis provides mathematical models for decision-making under uncertainty in electricity markets.

Demand-side bidding refers to the participation of consumers, often through a retailer, in energy trading. Under the smart-grid paradigm, the demand bids must reflect the elasticity of the consumers to changes in electricity price. Traditional forecasting models are typically not able to reflect this elasticity, hence we propose two novel approaches to estimate market bids. Both approaches are data-driven and take into account the uncertainty of future factors, as, for example, price. In both cases, demand-side bids that comprise a price-energy term decrease the expected imbalances and also increase the profit of retailers participating in electricity markets.

In the field of load forecasting, this thesis provides a novel approach to model time series and forecast loads under the real-time pricing setup. The relationship between price and aggregate response of the load is characterized by an optimization problem, which is shaped by a set of unknown parameters. Such parameters are estimated from data by using an inverse optimization framework. The usability of the proposed method is studied and we conclude that inverseoptimization-based modeling is a computationally attractive method that outperforms the forecasting capabilities of traditional time series models. Regarding the reserve determination, the special characteristics of the Danish power system do not allow for co-optimizing the unit commitment and reserve requirements. Hence, we propose a probabilistic framework, where the reserve requirements are computed based on scenarios of wind power and load forecast errors and power plant outages. The solution of the stochastic optimization models increases the safety of the overall system while decreases the associated reserve costs, with respect to the method currently used by the Danish TSO.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems
Authors: Saez Gallego, J. (Intern), Madsen, H. (Intern)
Number of pages: 190
Publication date: 2017

Publication information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Original language: English
Series: DTU Compute PHD-2016
Number: 425
ISSN: 0909-3192
Main Research Area: Technical/natural sciences
Electronic versions: phd425_Gallego_JS.pdf

Relations
Projects:
Inverse Optimization and Forecasting Techniques Applied to Decision-making in Electricity Markets
Publication: Research › Ph.D. thesis – Annual report year: 2017

Investigating Circadian Rhythmicity in Pain Sensitivity Using a Neural Circuit Model for Spinal Cord Processing of Pain
Primary processing of painful stimulation occurs in the dorsal horn of the spinal cord. In this article, we introduce mathematical models of the neural circuitry in the dorsal horn responsible for processing nerve fiber inputs from noxious stimulation of peripheral tissues and generating the resultant pain signal. The differential equation models describe the average firing rates of excitatory and inhibitory interneuron populations, as well as the wide dynamic range (WDR) neurons whose output correlates with the pain signal. The temporal profile of inputs on the different afferent nerve fibers that signal noxious and innocuous stimulation and the excitability properties of the included neuronal populations are constrained by experimental results. We consider models for the spinal cord circuit in isolation and when top-down inputs from higher brain areas that modulate pain processing are included. We validate the models by replicating experimentally observed phenomena of A fiber inhibition of pain and wind-up. We then use the models to investigate mechanisms for the
observed phase shift in circadian rhythmicity of pain that occurs with neuropathic pain conditions. Our results suggest that changes in neuropathic pain rhythmicity can occur through dysregulation of inhibition within the dorsal horn circuit.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Rensselaer Polytechnic Institute, University of Michigan
Authors: Crodee, J. (Ekstern), Piltz, S. H. (Intern), Booth, V. (Ekstern), Hagenauer, M. (Ekstern)
Pages: 23-48
Publication date: 2017

Host publication Information
Title of host publication: Women in Mathematical Biology
Volume: 8
Publisher: Springer
Editors: Layton, A., Miller, L.
ISBN (Print): 978-3-319-60304-9

Series: Women in Mathematical Biology
Volume: 8
ISSN: 2364-5733
Main Research Area: Technical/natural sciences
Workshop: Research Collaboration Workshop for Women in Mathematical Biology, Knoxville, United States, 22/06/2015 - 22/06/2015
Mathematics, Physiological, Cellular and Medical Topics, Mathematical Modeling and Industrial Mathematics
DOIs:
10.1007/978-3-319-60304-9_2
Source: FindIt
Source-ID: 2373459127
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Investigating the influence of product perception and geometric features
Research in emotional design and Kansei Engineering has shown that aesthetics play a significant role in the appeal of a product. This paper contributes to establishing a methodology to identify the relationships between perceptions, aesthetic features, desire to own and background of consumers. Surveys were conducted with 71 participants to gather their perceptions of 11 vase concepts. Advanced statistical analyses, including mixed models, were applied to allow generalisation of the results beyond the data sample. Significant relations between the desire to own a product and how the product is perceived were found (the desire to own was found to be related to beautiful, expensive, elegant, exciting, feminine, common and dynamic vases), as well as between the perceptions and the parameters describing the form of the vases (a vase was perceived as beautiful if it had many curved lines and was simple and tall). An automated mixed model analysis was conducted and revealed that general rules can be found between aesthetic features, perceptions and ownership, which can apply across gender and culture. The findings include design rules that link aesthetic features with perceptions. These contribute to research as guidelines for design synthesis and can either be implemented via shape grammars or parametric modelling approaches. These rules are also interesting for 3D printing applications, especially important when the consumer is the designer. Some of these design rules are linked to the desire to own a product, they have implications for industry, and they offer guidelines to creating attractive products that people want to own.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Department of Management Engineering, Technology and Innovation Management, Imperial College London, University of Tokyo
Authors: Perez Mata, M. (Intern), Ahmed-Kristensen, S. (Ekstern), Brockhoff, P. B. (Intern), Yanagisawa, H. (Ekstern)
Pages: 357–379
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Research in Engineering Design
Volume: 28
Issue number: 3
ISSN (Print): 0934-9839
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Investigation of Tooling for Anisotropic Optical Functional Surfaces

This paper studied steel inserts with anisotropic surfaces for injection moulding. The inserts surfaces were machined by a five-axis micro-milling machine and the surface structures will be replicated by injection moulding. The aim of the surface structuring is to maximize visible contrast between horizontally orthogonal textured surfaces from a certain viewing angle, of both the insert and the polymer replicas. The contrast is defined by the difference of the reflectance between two areas with horizontally orthogonal textures under a certainly fixed light source. The brightness of the surface is assessed by
processing the images obtained from a digital microscope Hirox RH-2000 [1]. Figure 1 illustrates the studied surface structure and the microscope. The optical axis of microscope can be tilted within 90 degrees from the horizontal level, which simulates the viewing angle; the analysed surface texture can be rotated horizontally by the adjusting the stage so only one surface was used to achieve orthogonal textures and images at different rotation angle can be captured. Via image processing tool, the reflectance (brightness of the obtained images) will be analysed and therefore the contrast can be calculated.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Danish Meteorological Institute
Authors: Li, D. (Intern), Regi, F. (Intern), Zhang, Y. (Intern), Madsen, M. H. (Ekstern), Nielsen, J. B. (Intern), Tosello, G. (Intern)
Number of pages: 1
Publication date: 2017
Main Research Area: Technical/natural sciences
Anisotropic surface, Surface characterization, Digital microscope, Design of experiment, Milling process optimization, Tool wear
Electronic versions:
draft_Met_props_2017_v4_fra_Yazh_completed_abstract.pdf
Source: PublicationPreSubmission
Source-ID: 134705831
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

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**Large Scale Computing for the Modelling of Whole Brain Connectivity**

The human brain constitutes an impressive network formed by the structural and functional connectivity patterns between billions of neurons. Modern functional and diffusion magnetic resonance imaging (fMRI and dMRI) provides unprecedented opportunities for exploring the functional and structural organization of the brain in continuously increasing resolution. From these images, networks of structural and functional connectivity can be constructed. Bayesian stochastic block modelling provides a prominent data-driven approach for uncovering the latent organization, by clustering the networks into groups of nodes with a shared connectivity pattern. Modelling the brain in great detail on a whole-brain scale is essential to fully understand the underlying organization of the brain and reveal the relations between structure and function, that allows sophisticated cognitive behaviour to emerge from ensembles of neurons. Relying on Markov Chain Monte Carlo (MCMC) simulations as the workhorse in Bayesian inference however poses significant computational challenges, especially when modelling networks at the scale and complexity supported by high-resolution whole-brain MRI. In this thesis, we present how to overcome these computational limitations and apply Bayesian stochastic block models for un-supervised data-driven clustering of whole-brain connectivity in full image resolution. We implement high-performance software that allows us to efficiently apply stochastic blockmodelling with MCMC sampling on large complex networks. To obtain the necessary computational performance, we find that both hardware and model specific properties must be taken into consideration - to an extend not supported by generic modelling tools. Computational overhead is reduced by an approach, where key values are cached to avoid re-computations, while tablelookups are utilized for frequently computed special functions. The efficient memory-management of C++ is utilized to implement dedicated data-structures, optimized to facilitate performance-critical operations related to the inference procedure. Furthermore, the software is based on a modular design, which allows us to couple and explore different models and sampling procedures in runtime, still being applied to full-sized data. Using the implemented tools, we demonstrate that the models successfully can be applied for clustering whole-brain connectivity networks. Without being informed of spatial information, the data-driven models can discover spatial homogeneous regions that are meaningful and in agreement with existing anatomical atlases. We further demonstrate that structural and functional connectivity share information, allowing us to jointly model both modalities. For limited, noisy fMRI data we find that integrating structural information aids in discovering the functional organization better than using the fMRI data alone. Though structure and function describes very different properties of the brain, we find that probabilistic modelling provides an intuitive data-driven approach for uncovering the latent organization in connectivity networks. We find that the stochastic block models can be computationally scaled to model wholebrain connectivity, and by doing so allows us to better utilize the full potential of high-resolution MRI and advances our understanding of both the functional and structural organization of the entire brain.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems
Authors: Albers, K. J. (Intern), Schmidt, M. N. (Intern), Merup, M. (Intern)
Number of pages: 224
Publication date: 2017

**Publication information**

Publisher: DTU Compute
LBAS: Lanczos Bidiagonalization with Subspace Augmentation for Discrete Inverse Problems
The regularizing properties of Lanczos bidiagonalization are powerful when the underlying Krylov subspace captures the dominating components of the solution. In some applications the regularized solution can be further improved by augmenting the Krylov subspace with a low-dimensional subspace that represents specific prior information. Inspired by earlier work on GMRES we demonstrate how to carry these ideas over to the Lanczos bidiagonalization algorithm.

Learning to Act: Qualitative Learning of Deterministic Action Models
In this article we study learnability of fully observable, universally applicable action models of dynamic epistemic logic. We introduce a framework for actions seen as sets of transitions between propositional states and we relate them to their dynamic epistemic logic representations as action models. We introduce and discuss a wide range of properties of actions and action models and relate them via correspondence results. We check two basic learnability criteria for action models: finite identifiability (conclusively inferring the appropriate action model in finite time) and identifiability in the limit (inconclusive convergence to the right action model). We show that deterministic actions are finitely identifiable, while arbitrary (non-deterministic) actions require more learning power—they are identifiable in the limit. We then move on to a particular learning method, i.e. learning via update, which proceeds via restriction of a space of events within a learning-specific action model. We show how this method can be adapted to learn conditional and unconditional deterministic action models. We propose update learning mechanisms for the afore mentioned classes of actions and analyse their computational complexity. Finally, we study a parametrized learning method which makes use of the upper bound on the number of propositions relevant for a given learning scenario. We conclude with describing related work and numerous directions of further work.
Lempel-Ziv Compression in a Sliding Window

We present new algorithms for the sliding window Lempel-Ziv (LZ77) problem and the approximate rightmost LZ77 parsing problem. Our main result is a new and surprisingly simple algorithm that computes the sliding window LZ77 parse in $O(w)$ space and either $O(n)$ expected time or $O(n \log \log w + z \log \log \sigma)$ deterministic time. Here, $w$ is the window size, $n$ is the size of the input string, $z$ is the number of phrases in the parse, and $\sigma$ is the size of the alphabet. This matches the space and time bounds of previous results while removing constant size restrictions on the alphabet size. To achieve our result, we combine a simple modification and augmentation of the suffix tree with periodicity properties of sliding windows. We also apply this new technique to obtain an algorithm for the approximate rightmost LZ77 problem that uses $O(n \log z + \log \log n)$ time and $O(n)$ space and produces a $(1 + \epsilon)$-approximation of the rightmost parsing (any constant $\epsilon > 0$). While this does not improve the best known time-space trade-offs for exact rightmost parsing, our algorithm is significantly simpler and exposes a direct connection between sliding window parsing and the approximate rightmost matching problem.
power. We build upon a probabilistic model for wind speed and introduce a dynamic power curve. The model thus decomposes the dynamics of wind power prediction errors into wind speed forecast errors and errors related to the conversion from wind speed to wind power. We test the proposed model on an out-of-sample period of 1 year for a wind farm with a rated capacity of 21 MW. The model outperforms simple as well as advanced benchmarks on horizons ranging from 1 to 24 h.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Centre for IT-Intelligent Energy Systems in Cities
Authors: Iversen, J. E. B. (Intern), Morales González, J. M. (Intern), Møller, J. K. (Intern), Trombe, P. (Intern), Madsen, H. (Intern)
Pages: 33–44
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Wind Energy
Volume: 20
Issue number: 1
ISSN (Print): 1095-4244
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.18 SJR 1.051 SNIP 1.834
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.37 SJR 1.079 SNIP 2.316
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.201 SNIP 2.165 CiteScore 3.06
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.209 SNIP 3.688 CiteScore 3.42
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.235 SNIP 2.486 CiteScore 2.75
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.062 SNIP 2.297 CiteScore 2.36
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.892 SNIP 2.582 CiteScore 2.49
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.364 SNIP 2.026
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 0.885 SNIP 1.439
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.743 SNIP 1.555
Web of Science (2008): Indexed yes
Lineær regression – lidt mere tekniske betragtninger om $R^2$ og et godt alternativ

Dette ekstra lille notat om den såkaldte $R^2$-værdi, som kan beregnes i forbindelse med lineær regression, skal ses i sammenhæng med vores ikke-tekniske notat om samme emne. Ud over at få defineret tingene matematisk præcist, vil vi foreslå spredningen $\sigma$ som et godt alternativ. De to hænger nært sammen, måler for så vidt det samme, $R^2$ på en relativ måde og $\sigma$ på en absolut måde. Spredningen $\sigma$ kan ses i ret direkte sammenhæng med usikkerhedsbetrægtninger mere generelt, som vi i det store billede mener er ret vigtige.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Københavns Universitet
Authors: Brockhoff, P. B. (Intern), Ekstrøm, C. T. (Ekstern), Hansen, E. (Ekstern)
Number of pages: 4
Pages: 31-34
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: LMFK-Bladet
Volume: 2017
Issue number: 2
ISSN (Print): 0906-0855
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: English
Electronic versions:
LMFK2017_paper3.pdf

Bibliographical note
Artikal i LMFK-Bladet (non-review paper)
Source: PublicationPreSubmission
Source-ID: 140538840
Publication: Communication › Journal article – Annual report year: 2017

Lineær regression: lidt mere tekniske betragtninger om $R^2$ og et godt alternativ

Dette ekstra lille notat om den såkaldte $R^2$-værdi, som kan beregnes i forbindelse med lineær regression, skal ses i sammenhæng med vores ikke-tekniske notat om samme emne (Brockhoff et al., 2017). Ud over at få defineret tingene matematisk præcist, vil vi foreslå spredningen $\sigma$ som et godt alternativ. De to hænger nært sammen, måler for så vidt det samme, $R^2$ på en relativ måde og $\sigma$ på en absolut måde. Spredningen $\sigma$ kan ses i ret direkte sammenhæng med usikkerhedsbetrægtninger mere generelt, som vi i det store billede mener er ret vigtige.
Linear discrete-time state space realization of a modified quadruple tank system with state estimation using Kalman filter

In this paper, we used the modified quadruple tank system that represents a multi-input-multi-output (MIMO) system as an example to present the realization of a linear discrete-time state space model and to obtain the state estimation using Kalman filter in a methodical mannered. First, an existing dynamics of the system of stochastic differential equations is linearized to produce the deterministic-stochastic linear transfer function. Then the linear transfer function is discretized to produce a linear discrete-time state space model that has a deterministic and a stochastic component. The filtered part of the Kalman filter is used to estimates the current state, based on the model and the measurements. The static and dynamic Kalman filter is compared and all results is demonstrated through simulations.
lmerTest Package: Tests in Linear Mixed Effects Models

One of the frequent questions by users of the mixed model function lmer of the lme4 package has been: How can I get p values for the F and t tests for objects returned by lmer? The lmerTest package extends the 'lmerMod' class of the lme4 package, by overloading the anova and summary functions by providing p values for tests for fixed effects. We have implemented the Satterthwaite's method for approximating degrees of freedom for the t and F tests. We have also implemented the construction of Type I - III ANOVA tables. Furthermore, one may also obtain the summary as well as the anova table using the Kenward-Roger approximation for denominator degrees of freedom (based on the KRmodcomp function from the pbkrtest package). Some other convenient mixed model analysis tools such as a step method, that performs backward elimination of nonsignificant effects - both random and fixed, calculation of population means and multiple comparison tests together with plot facilities are provided by the package as well.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis
Authors: Kuznetsova, A. (Intern), Brockhoff, P. B. (Intern), Christensen, R. H. B. (Intern)
Number of pages: 26
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Statistical Software
Volume: 82
Issue number: 13
ISSN (Print): 1548-7660
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
We present a formal logical approach using a combinatory categorial grammar for entity level sentiment analysis that utilizes machine learning techniques for efficient syntactical tagging and performs a deep structural analysis of the syntactical properties of texts in order to yield precise results. The method should be seen as an alternative to pure machine learning methods for sentiment analysis, which are argued to have high difficulties in capturing long distance dependencies, and can be dependent on significant amount of domain specific training data. The results show that the method yields high correctness, but further investment is needed in order to improve its robustness.
Logic analysis and verification of n-input genetic logic circuits

Nature is using genetic logic circuits to regulate the fundamental processes of life. These genetic logic circuits are triggered by a combination of external signals, such as chemicals, proteins, light and temperature, to emit signals to control other gene expressions or metabolic pathways accordingly. As compared to electronic circuits, genetic circuits exhibit stochastic behavior and do not always behave as intended. Therefore, there is a growing interest in being able to analyze and verify the logical behavior of a genetic circuit model, prior to its physical implementation in a laboratory. In this paper, we present an approach to analyze and verify the Boolean logic of a genetic circuit from the data obtained through stochastic analog circuit simulations. The usefulness of this analysis is demonstrated through different case studies illustrating how our approach can be used to verify the expected behavior of an n-input genetic logic circuit.

Lost in Time and Space: States of High Arousal Disrupt Implicit Acquisition of Spatial and Sequential Context Information

Biased cognition during high arousal states is a relevant phenomenon in a variety of topics: from the development of post-traumatic stress disorders or stress-triggered addictive behaviors to forensic considerations regarding crimes of passion. Recent evidence indicates that arousal modulates the engagement of a hippocampus-based "cognitive" system in favor of a striatum-based "habit" system in learning and memory, promoting a switch from flexible, contextualized to more rigid, reflexive responses. Existing findings appear inconsistent, therefore it is unclear whether and which type of context processing is disrupted by enhanced arousal. In this behavioral study, we investigated such arousal-triggered cognitive-state shifts in human subjects. We validated an arousal induction procedure (three experimental conditions: violent scene, erotic scene, neutral control scene) using pupillometry (Preliminary Experiment, n = 13) and randomly administered this method to healthy young adults to examine whether high arousal states affect performance in two core domains of contextual processing, the acquisition of spatial (spatial discrimination paradigm; Experiment 1, n = 66) and sequence information (learned irrelevance paradigm; Experiment 2, n = 84). In both paradigms, spatial location and sequences were
encoded incidentally and both displacements when retrieving spatial position as well as the predictability of the target by a
cue in sequence learning changed stepwise. Results showed that both implicit spatial and sequence learning were
disrupted during high arousal states, regardless of valence. Compared to the control group, participants in the arousal
conditions showed impaired discrimination of spatial positions and abolished learning of
associative sequences. Furthermore, Bayesian analyses revealed evidence against the null models. In line with recent
models of stress effects on cognition, both experiments provide evidence for decreased engagement of flexible, cognitive
systems supporting encoding of context information in active cognition during acute arousal, promoting reduced sensitivity
for contextual details. We argue that arousal fosters cognitive adaptation towards less demanding, more present-oriented
information processing, which prioritizes a current behavioral response set at the cost of contextual cues. This transient
state of behavioral perseverance might reduce reliance on context information in unpredictable environments and thus
represent an adaptive response in certain situations.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Software and Process Engineering,
 University of Innsbruck
Authors: Maran, T. (Ekstern), Sachse, P. (Ekstern), Martini, M. (Ekstern), Weber, B. (Intern), Pinggera, J. (Ekstern),
Zuggal, S. (Ekstern), Furtner, M. (Ekstern)
Number of pages: 17
Publication date: 2017

**Publication information**

Journal: Frontiers in Human Neuroscience
Volume: 11
Article number: 206
ISSN (Print): 1662-5161
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.12 SJR 1.471 CiteScore 3.04
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.38 SJR 1.794 SNIP 1.114
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.964 SNIP 1.033 CiteScore 3.47
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.648 SNIP 0.957 CiteScore 3.23
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.124 SNIP 0.963 CiteScore 3.41
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Scopus rating (2012): SJR 2.686 SNIP 1.171 CiteScore 4.05
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Scopus rating (2011): SJR 2.055 SNIP 0.857 CiteScore 2.35
ISI indexed (2011): ISI indexed no
Scopus rating (2010): SJR 1.725 SNIP 0.97
Scopus rating (2009): SJR 1.486 SNIP 0.629
Original language: English
Arousal, Stress, Context processing, Associative learning, Spatial learning, Multiple memory systems

Electronic versions:
fnbeh_11_00206.pdf

DOIs:
10.3389/fnbeh.2017.00206

Publication: Research - peer-review › Journal article – Annual report year: 2017
Lower bounds on the run time of the univariate marginal distribution algorithm on OneMax

The Univariate Marginal Distribution Algorithm (UMDA), a popular estimation of distribution algorithm, is studied from a run time perspective. On the classical OneMax benchmark function, a lower bound of $\Omega(\mu \sqrt{n} + n \log n)$, where $\mu$ is the population size, on its expected run time is proved. This is the first direct lower bound on the run time of the UMDA. It is stronger than the bounds that follow from general black-box complexity theory and is matched by the run time of many evolutionary algorithms. The results are obtained through advanced analyses of the stochastic change of the frequencies of bit values maintained by the algorithm, including carefully designed potential functions. These techniques may prove useful in advancing the field of run time analysis for estimation of distribution algorithms in general.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Hasso Plattner Institute, Potsdam
Authors: Krejca, M. S. (Ekstern), Witt, C. (Intern)
Pages: 65-79
Publication date: 2017

Host publication information
Title of host publication: 14th ACM/SIGEVO Workshop on Foundations of Genetic Algorithms
Publisher: Association for Computing Machinery
ISBN (Print): 9781450346511
Main Research Area: Technical/natural sciences
Conference: 14th ACM/SIGEVO Workshop on Foundations of Genetic Algorithms, Copenhagen, Denmark, 12/01/2017 - 12/01/2017

Managerial implications for improving continuous production processes
Data analytics remains essential for process improvement and optimization. Statistical process control and design of experiments are among the most powerful process and product improvement methods available. However, continuous process environments challenge the application of these methods. In this article we highlight SPC and DoE implementation challenges described in the literature for managers, researchers and practitioners interested in continuous production process improvement. The results may help managers support the implementation of these methods and make researchers and practitioners aware of methodological challenges in continuous process environments.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Luleå University of Technology
Authors: Capaci, F. (Ekstern), Vanhatalo, E. (Ekstern), Bergquist, B. (Ekstern), Kulahci, M. (Intern)
Number of pages: 11
Publication date: 2017
Many-to-Many Information Flow Policies

Information flow techniques typically classify information according to suitable security levels and enforce policies that are based on binary relations between individual levels, e.g., stating that information is allowed to flow from one level to another. We argue that some information flow properties of interest naturally require coordination patterns that involve sets of security levels rather than individual levels: some secret information could be safely disclosed to a set of confidential channels of incomparable security levels, with individual leaks considered instead illegal; a group of competing agencies might agree to disclose their secrets, with individual disclosures being undesired, etc. Motivated by this we propose a simple language for expressing information flow policies where the usual admitted flow relation between individual security levels is replaced by a relation between sets of security levels, thus allowing to capture coordinated flows of information.

The flow of information is expressed in terms of causal dependencies and the satisfaction of a policy is defined with respect to an event structure that is assumed to capture the causal structure of system computations. We suggest applications to secret exchange protocols, program security and security architectures, and discuss the relation to classic notions of information flow control.

Matching and Compression of Strings with Automata and Word Packing

Dynamic Relative Compression, Dynamic Partial Sums, and Substring Concatenation

Given a static reference string $R$ and a source string $S$, a relative compression of $S$ with respect to $R$ is an encoding of $S$ as a sequence of references to substrings of $R$. Relative compression schemes are a classic model of compression and have recently proved very successful for compressing highly-repetitive massive data sets such as genomes and web-data. We initiate the study of relative compression in a dynamic setting where the compressed source string $S$ is subject to edit operations. The goal is to maintain the compressed representation compactly, while supporting edits and allowing efficient random access to the (uncompressed) source string. We present new data structures that achieve optimal time for updates and queries while using space linear in the size of the optimal relative compression, for nearly all combinations of parameters. We also present solutions for restricted and extended sets of updates. To achieve these results, we revisit the dynamic partial sums problem and the substring concatenation problem. We present new optimal or near optimal bounds for these problems. Plugging in our new results we also immediately obtain new bounds for the string indexing for patterns with wildcards problem and the dynamic text and static pattern matching problem. Subsequence Automata with Default Transitions

Let $S$ be a string of length $n$ with characters from an alphabet of size $\alpha$. The subsequence automaton of $S$ (often called the directed acyclic subsequence graph) is the minimal deterministic finite automaton accepting all subsequences of $S$. A straightforward construction shows that the size (number of states and transitions) of the subsequence automaton is $O(n)$ and that this bound is asymptotically optimal. In this paper, we consider subsequence automata with default transitions, that is, special transitions to be taken only if none of the regular transitions match the current character, and which do not consume the current character. We show that with default transitions, much smaller subsequence automata are possible, and provide a full trade-off between the size of the automaton and the delay, i.e., the maximum number of consecutive default transitions followed before consuming a character. Specifically, given any integer parameter $k$, $1 < k$, ...
we present a subsequence automaton with default transitions of size $O(nk \log k)$ and delay $O(\log k)$. Hence, with $k = 2$ we obtain an automaton of size $O(n \log)$ and delay $O(\log)$. At the other extreme, with $k = \infty$, we obtain an automaton of size $O(n)$ and delay $O(1)$, thus matching the bound for the standard subsequence automaton construction. Finally, we generalize the result to multiple strings. The key component of our result is a novel hierarchical automata construction of independent interest.

Deterministic Indexing for Packed Strings

Given a string $S$ of length $n$, the classic string indexing problem is to preprocess $S$ into a compact data structure that supports efficient subsequent pattern queries. In the deterministic variant the goal is to solve the string indexing problem without any randomization (at preprocessing time or query time). In the packed variant the strings are stored with several character in a single word, giving us the opportunity to read multiple characters simultaneously. Our main result is a new string index in the deterministic and packed setting. Given a packed string $S$ of length $n$ over an alphabet $\Sigma$, we show how to preprocess $S$ in $O(n)$ (deterministic) time and space $O(n)$ such that given a packed pattern string of length $m$ we can support queries in (deterministic) time $O(m + \log m + \log \log n)$, where $w = \log$ is the number of characters packed in a word of size $w = (\log n)$. Our query time is always at least as good as the previous best known bounds and whenever several characters are packed in a word, i.e., $\log w$, the query times are faster.

Dynamic Partial Sums in Constant Time and Succinct Space

With the Ultra Wide Word-RAM Model

The dynamic partial sums problem is to dynamically maintain an array of $n$ integers while supporting efficient access, update and partial sums queries. This classic problem, and its variations, are very well studied in many different computational models [Fre82, FS89, Fen94, HSS11, HR03, HRS96, RRR01, PD04]. We solve the partial sums problem in the ultra wide word-RAM model, recently introduced by Farzan et al. [FLONS15], where we, in constant time, are allowed to manipulate words of size $w^2$ and access $w$ memory locations. Farzan et al. [FLONS15] additionally gave a solution to the dynamic partial sums problem by simulating the RAMBO model to obtain a result by Brodnik et al. [BKMN06]. In this paper we present an improved solution to the dynamic partial sums problem in the ultra wide word-RAM model that supports all operations in either constant or $O(\log \log n)$ time, depending on whether we allow multiplication, and succinct space. We pose as an open problem whether it is possible in the ultra wide word-RAM model to additionally support the classic select operation in constant time.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Authors: Skjoldjensen, F. R. (Intern), Bille, P. (Intern), Gørtz, I. L. (Intern), Thomassen, C. (Intern)
Number of pages: 80
Publication date: 2017

Publication information
Publisher: DTU Compute
Original language: English

Series: DTU Compute PHD-2017
Volume: 446
ISSN: 0909-3192
Main Research Area: Technical/natural sciences
Electronic versions:
phd446_Skjoldjensen_FR.pdf

Relations
Projects:
Matching and Compression of Strings with Automata and Word Packing
Publication: Research › Ph.D. thesis – Annual report year: 2017

Matematikkommissionen - Afrapportering

Matematikkommissionen er nedsat som følge af ønsket om at styrke det faglige niveau i matematik i gymnasiet. Kommissionen skal bl.a. give forslag til udvikling af faget indhold, didaktik, prøveformer og faglige overgange dels fra grundskole til gymnasiale uddannelser og dels videre til videregående uddannelser.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics, Københavns Åbne Gymnasium, Professionshøjskolen UCC, Sct. Knuds Gymnasium, KNord Handelsgymnasium, Københavns Universitet, Roskilde University, Aalborg University, University of Southern Denmark, TICRA
Authors: Grønbæk, N. (Forskerdatabase), Rasmussen, A. (Ekstern), Skott, C. K. (Ekstern), Bang-Jensen, J. (Ekstern), Jensen, K. B. S. (Forskerdatabase), Fajstrup, L. (Forskerdatabase), Schou, M. H. (Forskerdatabase), Christensen, M. (Ekstern), Lumholt, M. (Ekstern), Kjærup, R. M. (Ekstern), Jørgensen, S. (Forskerdatabase), Hansen, S. L. (Forskerdatabase), Markvorsen, S. (Intern)
Number of pages: 47
Publication date: 2017
Matrix-Exponential Distributions in Applied Probability

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Universidad Nacional Autonoma de Mexico
Authors: Bladt, M. (Ekstern), Nielsen, B. F. (Intern)
Number of pages: 736
Publication date: 2017

Publication information
Publisher: Springer
ISBN (Print): 978-1-4939-7049-0
Original language: English
Series: Matrix-exponential Distributions in Applied Probability
Main Research Area: Technical/natural sciences
DOIs: 10.1007/978-1-4939-7049-0
Source: FindIt
Source-ID: 2372521615
Publication: Research - peer-review › Book – Annual report year: 2017

Maximum auto-mutual-information factor analysis
Based on the information theoretical measure mutual information derived from entropy and Kullback-Leibler divergence, an alternative to maximum autocorrelation factor analysis is sketched.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics
Authors: Nielsen, A. A. (Intern)
Number of pages: 2
Publication date: 2017

Host publication information
Title of host publication: Proceedings Volume 10427, Image and Signal Processing for Remote Sensing XXIII
Volume: 10427
Publisher: SPIE - International Society for Optical Engineering
Series: Proceedings of SPIE, the International Society for Optical Engineering
Volume: 104270
ISSN: 0277-786X
Main Research Area: Technical/natural sciences
DOIs: 10.1117/12.2278290
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Maximum number of common zeros of homogeneous polynomials over finite fields
About two decades ago, Tsfasman and Boguslavsky conjectured a formula for the the maximum number of common zeros that r linearly independent homogeneous polynomials of degree d in m + 1 variables with coefficients in a finite field with q elements can have in the corresponding m-dimensional projective space over that finite field. Recently, it has been shown by Datta and Ghorpade that this conjecture is valid if r is at most m + 1 and can be invalid otherwise. Moreover a new conjecture was proposed for many values of r beyond m + 1. In this paper, we prove that this new conjecture holds true for several values of r.
particular, this settles the new conjecture completely when \( d = 3 \). Our result also includes the positive result of Datta and Ghorpade as a special case. Further, we also determine the maximum number of zeros in certain cases not covered by the earlier conjectures and results, namely, the case of \( d = q - 1 \) and of \( d = q \).

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics
Authors: Beelen, P. (Intern), Datta, M. (Intern), Ghorpade, S. R. (Intern)
Number of pages: 13
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Proceedings of the American Mathematical Society
ISSN (Print): 0002-9939
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.017 SJR 1.183 CiteScore 0.74
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.68 SJR 1.176 SNIP 0.966
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.099 SNIP 1.058 CiteScore 0.68
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.282 SNIP 1.092 CiteScore 0.71
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.217 SNIP 1.115 CiteScore 0.71
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.108 SNIP 1.055 CiteScore 0.64
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.185 SNIP 1.069 CiteScore 0.63
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.166 SNIP 0.961
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.114 SNIP 0.984
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.174 SNIP 1.152
Scopus rating (2007): SJR 0.932 SNIP 1.088
Web of Science (2007): Indexed yes
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.025 SNIP 1.042
Scopus rating (2004): SJR 0.986 SNIP 0.941
Scopus rating (2003): SJR 0.925 SNIP 0.921
Scopus rating (2002): SJR 0.96 SNIP 1.028
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.943 SNIP 0.949
Web of Science (2001): Indexed yes
Medial structure generation for registration of anatomical structures

Medial structures (skeletons and medial manifolds) have shown capacity to describe shape in a compact way. In the field of medical imaging, they have been employed to enrich the description of organ anatomy, to improve segmentation, or to describe the organ position in relation to surrounding structures. Methods for generation of medial structures, however, are prone to the generation of medial artifacts (spurious branches) that traditionally need to be pruned before the medial structure can be used for further computations. The act of pruning can affect main sections of the medial surface, hindering its performance as shape descriptor. In this work, we present a method for the computation of medial structures that generates smooth medial surfaces that do not need to be explicitly pruned. Additionally, we present a validation framework for medial surface evaluation. Finally, we apply this method to create a parametric model of the cochlea shape that yields better registration results between cochleae.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Copenhagen Center for Health Technology, Alma IT Systems, Universitat Autonoma de Barcelona, ICREA
Authors: Vera, S. (Ekstern), Gil, D. (Ekstern), Kjer, H. M. (Intern), Fagertun, J. (Intern), Paulsen, R. R. (Intern), González Ballester, M. A. (Ekstern)
Pages: 313-344
Publication date: 2017

Host publication information

Title of host publication: Skeletonization: Theory, Methods and Applications
Publisher: Elsevier
ISBN (Print): 978-0-08-101291-8
Main Research Area: Technical/natural sciences
DOIs: 10.1016/B978-0-08-101291-8.00013-4
Source: FindIt
Source-ID: 2392798601
Publication: Research - peer-review › Book chapter – Annual report year: 2017

Methods and Tools for the Analysis, Verification and Synthesis of Genetic Logic Circuits,

Synthetic biology has emerged as an important discipline in which engineers and biologists are working together to design new and useful biological systems composed of genetic circuits. The purpose of developing genetic circuits is to carry out desired logical functions inside a living cell. This usually requires simulating the mathematical models of these genetic circuits and perceive whether or not the circuit behaves appropriately. Furthermore, synthetic biology utilizes the concepts from electronic design automation (EDA) of abstraction and automated construction to generate genetic circuits with the aim to reduce the in-vitro (wet-lab) experiments. To address this, several automated tools have been developed to improve the process of genetic design automation (GDA) with different capabilities. This thesis attempts to contribute to the advancement of GDA tools by introducing capabilities which we believe that no other existing GDA tools support. First, we introduce a user-friendly simulation tool, called D-VASim, which allows user to perform virtual laboratory experimentation by dynamically interacting with the model during runtime. This dynamic interaction with the model gives user a feeling of being in the lab performing wet-lab experiments virtually. This tool allows users to perform both determinisitic and stochastic simulations. Next, this dissertation introduces a methodology to perform timing analyses of genetic logic circuits, which allows user to analyze the threshold value and propagation delays of genetic logic circuits. In this thesis, it has been demonstrated, through in-silico experimentation, that the threshold value and propagation delay plays a vital role in the correct functioning of genetic circuit. It has also been shown how some circuit parameters effect these two important design characteristics. This thesis also introduces an automated approach to analyze the behavior of genetic logic circuits from the simulation data. With this capability, the boolean logic of complex genetic circuits can be analyzed and/or verified automatically. It is also shown in this thesis that the proposed approach is effective to determine the variation in the behavior of genetic circuits when the circuit’s parameters are changed. In addition, the thesis also attempts to propose a synthesis and technology mapping tool, called GeneTech, for genetic circuits. It allows users to construct a genetic circuit by only specifying its behavior in the form of boolean expression. For technology mapping, this tool uses a gates library developed by the collective efforts of the researchers at MIT and Boston
universities. It is shown experimentally that the tool is able to provide all feasible solutions, containing different genetic components, to achieve the specified boolean behavior. Finally, it has been shown how D-VASim can be used along with other tools for useful purposes, like model checking. With respect to this, an experimental workflow is proposed for checking genetic circuits using the statistical model checking (SMC) utility of the Uppaal tool and the timing analysis capability of D-VASim. We further demonstrated how the reliability of a simulation can be improved by using the real parameter values. In this regard, the relationship between the simulation parameters and real parameters have been derived.

Microservices: Yesterday, Today, and Tomorrow
Microservices is an architectural style inspired by service-oriented computing that has recently started gaining popularity. Before presenting the current state of the art in the field, this chapter reviews the history of software architecture, the reasons that led to the diffusion of objects and services first, and microservices later. Finally, open problems and future challenges are introduced. This survey primarily addresses newcomers to the discipline, while offering an academic viewpoint on the topic. In addition, we investigate some practical issues and point out a few potential solutions.
Model checking exact cost for attack scenarios

Attack trees constitute a powerful tool for modelling security threats. Many security analyses of attack trees can be seamlessly expressed as model checking of Markov Decision Processes obtained from the attack trees, thus reaping the benefits of a coherent framework and a mature tool support. However, current model checking does not encompass the exact cost analysis of an attack, which is standard for attack trees. Our first contribution is the logic erPCTL with cost-related operators. The extended logic allows to analyse the probability of an event satisfying given cost bounds and to compute the exact cost of an event. Our second contribution is the model checking algorithm for erPCTL. Finally, we apply our framework to the analysis of attack trees.

General information
State: Published
Organisations: Formal Methods, Department of Applied Mathematics and Computer Science
Authors: Aslanyan, Z. (Intern), Nielson, F. (Intern)
Pages: 210-31
Publication date: 2017

Model Checking Geographically Distributed Interlocking Systems Using UMC

The current trend of distributing computations over a network is here, as a novelty, applied to a safety critical system, namely a railway interlocking system. We show how the challenge of guaranteeing safety of the distributed application has been attacked by formally specifying and model checking the relevant distributed protocols. By doing that we obey the safety guidelines of the railway signalling domain, that require formal methods to support the certification of such products. We also show how formal modelling can help designing alternative distributed solutions, while maintaining adherence to safety constraints.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Software and Process Engineering, Technical University of Denmark
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Pages: 278–286
Publication date: 2017

Host publication information
Title of host publication: 2017 25th Euromicro International Conference on Parallel, Distributed and Network-based Processing (PDP)
Publisher: IEEE
Main Research Area: Technical/natural sciences
Conference: 2017 25th Euromicro International Conference on Parallel, Distributed and Network-based Processing, St. Petersburg, Russian Federation, 06/03/2017 - 06/03/2017
Model checking, Distributed systems, Railway interlocking systems
DOIs: 10.1109/PDP.2017.66
Source: PublicationPreSubmission
Source-ID: 132970961
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017
Model for Simulating Fasting Glucose in Type 2 Diabetes and the Effect of Adherence to Treatment.

The primary goal of this paper is to predict fasting glucose levels in type 2 diabetes (T2D) in long-acting insulin treatment. The paper presents a model for simulating insulin-glucose dynamics in T2D patients. The model combines a physiological model of type 1 diabetes (T1D) and an endogenous insulin production model in T2D. We include a review of sources of variance in fasting glucose values in long-acting insulin treatment, with respect to dose guidance algorithms. We use the model to simulate fasting glucose levels in T2D long-acting insulin treatment and compare the results with clinical trial results where a dose guidance algorithm was used. We investigate sources of variance and through simulations evaluate the contribution of adherence to variance and dose guidance quality. The results suggest that the model for simulation of T2D patients is sufficient for simulating fasting glucose levels during titration in a clinical trial. Adherence to insulin injections plays an important role considering variance in fasting glucose. For adherence levels 100%, 70% and 50%, the coefficient of variation of simulated fasting glucose levels were similar to observed variances in insulin treatment. The dose guidance algorithm suggested too large doses in 0.0%, 5.3% and 24.4% of cases, respectively. Adherence to treatment is an important source of variance in long-acting insulin titration.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Scientific Computing, Novo Nordisk A/S
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Pages: 15086-15091
Publication date: 2017
Conference: 20th IFAC World Congress 2017, Toulouse, France, 09/07/2017 - 09/07/2017
Main Research Area: Technical/natural sciences

Publication information
Journal: IFAC-PapersOnLine
Volume: 50
Issue number: 1
ISSN (Print): 2405-8963
Ratings:
Scopus rating (2017): CiteScore 0.68 SJR 0.26 SNIP 0.434
Scopus rating (2016): CiteScore 0.45 SJR 0.234 SNIP 0.328
Scopus rating (2015): SJR 0.298 SNIP 0.39
Scopus rating (2014): SJR 0.298 SNIP 0.383
Scopus rating (2013): SJR 0.326 SNIP 0.41
Scopus rating (2012): SJR 0.265 SNIP 0.331
Scopus rating (2011): SJR 0.257 SNIP 0.324
Scopus rating (2010): SJR 0.197 SNIP 0.276
Scopus rating (2009): SJR 0.211 SNIP 0.29
Scopus rating (2008): SJR 0.172 SNIP 0.239
Scopus rating (2007): SJR 0.195 SNIP 0.271
Scopus rating (2006): SJR 0.21 SNIP 0.284
Scopus rating (2005): SJR 0.192 SNIP 0.445
Scopus rating (2004): SJR 0.245 SNIP 0.419
Scopus rating (2003): SJR 0.26 SNIP 0.403
Original language: English
Electronic versions:
1_s2.0_S2405896317334493_main.pdf
DOIs:
10.1016/j.ifacol.2017.08.2527
Source: Findit
Source-ID: 2392248369
Publication: Research - peer-review › Conference article – Annual report year: 2017

Modeling and Verification of Insider Threats Using Logical Analysis
In this paper, we combine formal modeling and analysis of infrastructures of organizations with sociological explanation to provide a framework for insider threat analysis. We use the higher order logic (HOL) proof assistant Isabelle/HOL to support this framework. In the formal model, we exhibit and use a common trick from the formal verification of security protocols, showing that it is applicable to insider threats. We introduce briefly a three-step process of social explanation, illustrating that it can be applied fruitfully to the characterization of insider threats. We introduce the insider theory
constructed in Isabelle that implements this process of social explanation. To validate that the social explanation is generally useful for the analysis of insider threats and to demonstrate our framework, we model and verify the insider threat patterns of entitled independent and Ambitious Leader in our Isabelle/HOL framework.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cyber Security, Middlesex University
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Number of pages: 12
Pages: 534-545
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**

Journal: IEEE Systems Journal
Volume: 11
Issue number: 2
ISSN (Print): 1932-8184
Ratings:
- BFI (2018): BFI-level 1
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Scopus rating (2017): SNIP 1.847 SJR 0.595 CiteScore 3.68
- Web of Science (2017): Indexed Yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 3.15 SJR 0.609 SNIP 1.78
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 0.852 SNIP 2.262 CiteScore 3.36
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 0.747 SNIP 2.337 CiteScore 2.92
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 0.71 SNIP 2.018 CiteScore 3.05
- ISI indexed (2013): ISI indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 0.424 SNIP 1.331 CiteScore 2.17
- ISI indexed (2012): ISI indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 0.303 SNIP 1.124 CiteScore 1.43
- ISI indexed (2011): ISI indexed no
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 0.363 SNIP 1.187
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 0.261 SNIP 1.504
- BFI (2008): BFI-level 1
- Scopus rating (2008): SJR 0.559 SNIP 4.747

Original language: English
Automated verification, Formal modeling, Insider threats

**Modeling dynamic functional connectivity using a wishart mixture model**

Dynamic functional connectivity (dFC) has recently become a popular way of tracking the temporal evolution of the brains functional integration. However, there does not seem to be a consensus on how to choose the complexity, i.e. number of brain states, and the time-scale of the dynamics, i.e. the window length. In this work we use the Wishart Mixture Model (WMM) as a probabilistic model for dFC based on variational inference. The framework admits arbitrary window lengths and number of dynamic components and includes the static one-component model as a special case. We exploit that the
WMM framework provides model selection by quantifying models generalization to new data. We use this to quantify the number of states within a prespecified window length. We further propose a heuristic procedure for choosing the window length based on contrasting for each window length the predictive performance of dFC models to their static counterparts and choosing the window length having largest difference as most favorable for characterizing dFC. On synthetic data we find that generalizability is influenced by window length and signal-to-noise ratio. Too long windows cause dynamic states to be mixed together whereas short windows are more unstable and influenced by noise and we find that our heuristic correctly identifies an adequate level of complexity. On single subject resting state fMRI data we find that dynamic models generally outperform static models and using the proposed heuristic points to a windowlength of around 30 seconds provides largest difference between the predictive likelihood of static and dynamic FC.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems
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Number of pages: 4
Pages: 1-4
Publication date: 2017

**Host publication information**
Title of host publication: Proceedings of the 2017 International Workshop on Pattern Recognition in Neuroimaging
Publisher: IEEE
ISBN (Print): 978-1-5386-3159-1

Series: 2017 International Workshop on Pattern Recognition in Neuroimaging (pmi)
Main Research Area: Technical/natural sciences
Conference: 2017 International Workshop on Pattern Recognition in Neuroimaging, Toronto, Canada, 21/06/2017 - 21/06/2017
Brain modeling, Data models, Predictive models, Hidden Markov models, Bayes methods, Signal to noise ratio
Electronic versions:
prni_2017_post.pdf
DOIs:
10.1109/PRNI.2017.7981505
Source: FindIt
Source-ID: 2372484795
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

**Modeling Pharmacokinetics and Pharmacodynamics of Glucagon for Simulation of the Glucoregulatory System in Patients with Type 1 Diabetes.**
The goal of this thesis was to develop a pharmacokinetics/pharmacodynamics (PK/PD) model for glucagon. The proposed PD model included multiplication of the stimulating glucagon effect and inhibiting insulin effect on the endogenous glucose production (EGP). Moreover, the concentration-response relationship of glucagon and EGP was characterized by a non-linear function, where the response saturated for high concentrations of glucagon. The novel EGP model extended Hovorka's glucoregulatory model to include the effect of glucagon. The PK/PD model described both regular glucagon and a novel glucagon analogue in healthy dogs. The extended glucoregulatory model translated to the human species and described glucose-insulin-glucagon dynamics in healthy subjects and patients with type 1 diabetes (T1D). The extended glucoregulatory model was successfully validated by leave-one-out cross-validation in seven T1D patients which justified its use for simulations. The final model parameters were estimated from three to four datasets from each patient. The validated extended glucoregulatory model was used for in silico studies. The model replicated a clinical study of the effect of glucagon at varying insulin levels. The simulations also suggested new glucagon doses to be tested in a similar in vivo study to provide new insight to the relationship between insulin, glucagon, and EGP. Finally, the model was used to conduct a large original simulation study investigating an insulin dependent glucagon dosing regimen for treatment of insulin-induced mild hypoglycemia.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Copenhagen Center for Health Technology, Center for Energy Resources Engineering, Dynamical Systems, Zealand Pharma A/S
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Number of pages: 260
Publication date: 2017

**Publication information**
Publisher: Technical University of Denmark (DTU)
Original language: English
Modeling Structural Brain Connectivity

The human brain consists of a gigantic complex network of interconnected neurons. Together all these connections determine who we are, how we react and how we interpret the world. Knowledge about how the brain is connected can further our understanding of the brain’s structural organization, help improve diagnosis, and potentially allow better treatment of a wide range of neurological disorders.

Tractography based on diffusion magnetic resonance imaging is a unique tool to estimate this “structural connectivity” of the brain non-invasively and in vivo. During the last decade, brain connectivity has increasingly been analyzed using graph theoretic measures adopted from network science and this characterization of the brain’s structural connectivity has been shown to be useful for the classification of populations, such as healthy and diseased subjects. The structural connectivity of the brain estimated using tractography is, however, derived by integrating noisy estimates of the local fiber orientation in each voxel, entailing biases and limitations in the estimated connections and resulting in noisy graphs.

In this thesis, the ability of stochastic block models to extract the latent organization of structural brain connectivity graphs is investigated. It is found that both the stochastic block model and its non-parametric extension, the infinite relational model, are able to reliably extract a clustering that better accounts for structural connectivity than cortical atlases based solely upon surface morphology. Furthermore, a statistical prediction framework to quantify the ability of a cortical parcellation to account for structural connectivity is proposed. It is tested on two commonly used cortical atlases that are both based on surface morphology, as well as on a recently proposed cortical parcellation by Glasser et al. (2016) that is based on both task and resting-state functional magnetic resonance imaging, cortical thickness and myelin. It is found that all three atlases capture the structural connectivity much better than random, but also that the parcellation based on multiple modalities is superior to those solely based on surface morphology.

The generation of structural brain connectivity graphs comprises a comprehensive processing pipeline, with various experimenter-defined parameters. The settings of these parameters are, however, unclear and this subjective aspect complicates the cross-comparison of studies investigating structural brain connectivity derived from tractography. Even though scan acquisition parameters, i.e. spatial resolution, angular resolution and b-value, are often discussed as possible factors influencing the final result, the impact of these factors on the derived structural connectivity graph has not yet been investigated. Herein, structural connectivity graphs, generated using different combinations of the three aforementioned acquisition parameters, are validated by comparison to a connectivity graph derived using invasive tracer injections in monkeys. It is found that the choice of acquisition parameters influences the derived structural connectivity graph and that higher angular resolution is always beneficial. Surprisingly, it is also found that higher spatial resolution does not improve the derived graph, but further investigation is needed to confirm this result.

General information

State: Published
Authors: Ambrosen, K. M. S. (Intern), Mørup, M. (Intern), Dyrby, T. B. (Intern), Schmidt, M. N. (Intern)
Number of pages: 148
Publication date: 2017

Publication information

Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Original language: English

Series: DTU Compute PHD-2016
Number: 443
ISSN: 0909-3192
Main Research Area: Technical/natural sciences
Electronic versions:
Modeling surface imperfections in thin films and nanostructured surfaces
Accurate scatterometry and ellipsometry characterization of non-perfect thin films and nanostructured surfaces are challenging. Imperfections like surface roughness make the associated modelling and inverse problem solution difficult due to the lack of knowledge about the imperfection on the surface. Combining measurement data from several instruments increases the knowledge of non-perfect surfaces. In this paper we investigate how to incorporate this knowledge of surface imperfection into inverse methods used in scatterometry and ellipsometry using the Rigorous Coupled Wave Analysis. Three classes of imperfections are examined. The imperfections are introduced as periodic structures with a super cell periods ten times larger than the simple grating period. Two classes of imperfections concern the grating and one class concern the substrate. It is shown that imperfections of a few nanometers can severely change the reflective response on silicon gratings. Inverse scatterometry analyses of gratings with imperfection using simulated data with white noise have been performed. The results show that scatterometry is a robust technology that is able to characterize grating imperfections provided that the imperfection class is known.

Modeling the Anisotropic Reflectance of a Surface with Microstructure Engineered to Obtain Visible Contrast after Rotation
Engineering of surface structure to obtain specific anisotropic reflectance properties has interesting applications in large scale production of plastic items. In recent work, surface structure has been engineered to obtain visible reflectance contrast when observing a surface before and after rotating it 90 degrees around its normal axis. We build an analytic anisotropic reflectance model based on the microstructure engineered to obtain such contrast. Using our model to render synthetic images, we predict the above mentioned contrasts and compare our predictions with the measurements reported in previous work. The benefit of an analytical model like the one we provide is its potential to be used in computer vision for estimating the quality of a surface sample. The quality of a sample is indicated by the resemblance of camera-based contrast measurements with contrasts predicted for an idealized surface structure. Our predictive model is also useful in optimization of the microstructure configuration, where the objective for example could be to maximize reflectance contrast.
Modeling the Temporal Nature of Human Behavior for Demographics Prediction

Mobile phone metadata is increasingly used for humanitarian purposes in developing countries as traditional data is scarce. Basic demographic information is however often absent from mobile phone datasets, limiting the operational impact of the datasets. For these reasons, there has been a growing interest in predicting demographic information from mobile phone metadata. Previous work focused on creating increasingly advanced features to be modeled with standard machine learning algorithms. We here instead model the raw mobile phone metadata directly using deep learning, exploiting the temporal nature of the patterns in the data. From high-level assumptions we design a data representation and convolutional network architecture for modeling patterns within a week. We then examine three strategies for aggregating patterns across weeks and show that our method reaches state-of-the-art accuracy on both age and gender prediction using only the temporal modality in mobile metadata. We finally validate our method on low activity users and evaluate the modeling assumptions.
assessment method has three different kinds of input. The exposure is calculated from the product consumption and the allergen contamination in the food product. The exposure is then compared to the thresholds to which allergic individuals react in order to calculate the chance of allergic reaction in the population.

In allergen risk assessment, the emphasis was on the threshold data, and no effort was made on consumption data. Moreover, no pan-European consumption data suitable for allergen risk assessment are available. A procedure for grouping food products automatically across countries is proposed. Thus, the allergen risk assessment can be performed cross-nationally and for the correct food group.

Then the two probabilistic risk assessment methods usually used were reviewed and compared. First order Monte-Carlo simulations are used in one method [14], whereas the other one combines second order Monte-Carlo simulations with Bayesian inferences [13]. An alternative method using second order Monte-Carlo simulations was proposed to take into account the uncertainty from the inputs. The uncertainty propagation from the inputs to the risk of allergic reaction was also evaluated for all the methods using uncertainty analysis [11].

The recommended approach for the allergen risk assessment was implemented in a Shiny application with the R software. Thus, allergen risk assessment can be performed easily by non-statisticians with the interactive application.

**Modelling Dietary Exposure to Chemical Components in Heat-Processed Meats**

Several chemical compounds that potentially increase the risk of developing cancer in humans are formed during heat processing of meat. Estimating the overall health impact of these compounds in the population requires accurate estimation of the exposure to the chemicals, as well as the probability that different levels of exposure result in disease. The overall goal of this study was to evaluate the impact of variability of exposure patterns and uncertainty of exposure data in burden of disease estimates. We focus on the first phase of burden of disease modelling, i.e. the estimation of exposure to selected compounds in the Danish population, based on concentration and consumption data. One of the challenges that arises in the probabilistic modelling of exposure is the presence of “artificial” zero counts in concentration data due to the detection level of the applied tests. Zero-inflated models, e.g. the Poisson-Lognormal approach, are promising tools to address this obstacle. The exposure estimates can then be applied to dose-response models to quantify the cancer risk.
Modelling Digital Media Objects

The goal of this thesis is to investigate two relevant issues regarding computational representation and classification of digital multi-media objects. With a special focus on music, a model for representation of objects comprising multiple heterogeneous data types is investigated. Necessary to this work are considerations regarding integration of multiple diverse data modalities and evaluation of the resulting concept representation.

Regarding modelling of data exhibiting certain sequential structure, a number of theoretical and empirical results are presented. These are results related to model parameter estimation and the use of sequence models in a classification scenario. The latter being of importance in various digital multimedia navigation and retrieval tasks.

In the fields of topic modelling and multi-modal integration, we formulate a model to describe entities composed of multiple aspects. The particular aspects considered in the publications are sound, song lyrics, and user-provided metadata. This model integrates the diverse data types comprising the objects and defines concrete unified representations in a joint "semantic" space. Within the context of this model, general measures of similarity between such multi-modal objects are investigated.

In the fields of method of moments and sequence modelling, we increase practical applicability of a certain moment based parameter estimation method for Hidden Markov models by showing how to use full-length sequences in the estimation process. Consequently, this impacts the quality of the estimated model parameters.

Subsequently, we show how to perform time series classification using a composite likelihood formulated from third order moments defined by the Hidden Markov model. Compared to the conventional likelihood based method, our contribution is less computationally expensive, while retaining the level of classification performance.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems
Authors: Troelsgaard, R. (Intern), Hansen, L. K. (Intern), Larsen, J. (Intern)
Number of pages: 97
Publication date: 2017

Publication information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Original language: English
Series: DTU Compute PHD-2016
Number: 439
ISSN: 0909-3192
Main Research Area: Technical/natural sciences
Electronic versions:
phd439_Troelsgaard_R.pdf

Relations
Projects:
Modelling Digital Media Objects
Publication: Research › Ph.D. thesis – Annual report year: 2017

Modelling the thermal properties of large diameter fibre ropes

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Center for Intelligent Drug Delivery and Sensing Using Microcontainers and Nanomechanics, University of Southern Denmark
Authors: Oland, E. (Ekstern), Bossolini, E. (Intern), Nielsen, O. W. (Ekstern), Sørensen, M. P. (Intern), Veje, C. (Ekstern)
Publication date: 2017
Modified planar functions and their components

Zhou ([20]) introduced modified planar functions in order to describe \((2^n; 2^n; 2^n; 1)\) relative difference sets \(R\) as a graph of a function on the finite field \(F_{2^n}\), and pointed out that projections of \(R\) are difference sets that can be described by negabent or bent\(_4\) functions, which are Boolean functions given in multivariate form. One of the objectives of this paper is to contribute to the understanding of these component functions of modified planar functions. Moreover, we obtain a description of modified planar functions by their components which is similar to that of the classical planar functions in odd characteristic as a vectorial bent function. We finally point out that though these components behave somewhat different than the multivariate bent\(_4\) functions, they are bent or semibent functions shifted by a certain quadratic term, a property which they share with their multivariate counterpart.
Monitoring of the thermal deformations on polymer parts using a vision system

Dimensional measurements in production environment are affected by non-controlled temperature conditions. In the case of polymer parts the high thermal expansion coefficient leads to significant dimensional changes. In order to achieve high accuracy in dimensional measurements, thermal deformations must be monitored and the measurements compensated. In this investigation thermal deformations on polymer parts are monitored using a vision system consisting of a camera equipped with telecentric lenses focused on the surface of the part. The magnification of the optics and an axial illumination allow appreciating the surface texture and surface details on the parts. A set of images is acquired at varying temperature. Digital image correlation with subpixel resolution is performed on images to estimate the displacement of the surface features. The effectiveness of the calculation is related to the quality of the surface features captured by the camera. Experimental tests are performed on a commercial ABS (Acrylonitrile Butadiene Styrene) part. Two series of pictures are acquired in different locations of the part during a cooling period of 10 minutes. Traceability of the method is established through a calibrated artefact for optical microscopes. Displacement measurement uncertainties lower than 0.5 μm have been documented.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Applied Mathematics and Computer Science
Authors: Dalla Costa, G. (Intern), Madruga, D. G. (Intern), De Chiffre, L. (Intern)
Number of pages: 2
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 17th International Conference of the European Society for Precision Engineering and Nanotechnology
Publisher: The European Society for Precision Engineering and Nanotechnology
Main Research Area: Technical/natural sciences
Conference: 17th euspen International Conference & Exhibition, Hannover, Germany, 29/05/2017 - 29/05/2017
Dimensional Metrology, Vision System, Image Processing

Motif trie: An efficient text index for pattern discovery with don't cares
We introduce the motif trie data structure, which has applications in pattern matching and discovery in genomic analysis, plagiarism detection, data mining, intrusion detection, spam fighting and time series analysis, to name a few. Here the extraction of recurring patterns in sequential and textual data is one of the main computational bottlenecks. For this, we address the problem of extracting maximal patterns with at most k don't care symbols and at least q occurrences, according to a maximality notion we define. We apply the motif trie to this problem, also showing how to build it efficiently. As a result, we give the first algorithm that attains a stronger notion of output-sensitivity, where the cost for an input sequence of n symbols is proportional to the actual number of occurrences of each pattern, which is at most n (much smaller in practice). This avoids the best-known cost of O(nc) per pattern, for constant c>1, which is otherwise impractical for massive sequences with large n.
MR spectroscopy of hepatic fat and adiponectin and leptin levels during testosterone therapy in type 2 diabetes: a randomized, double-blinded, placebo-controlled trial

Men with type 2 diabetes mellitus (T2D) often have lowered testosterone levels and an increased risk of cardiovascular disease (CVD). Ectopic fat increases the risk of CVD, whereas subcutaneous gluteofemoral fat protects against CVD and...
has a beneficial adipokine-secreting profile. Testosterone replacement therapy (TRT) may reduce the content of ectopic fat and improve the adipokine profile in men with T2D. A randomized, double-blinded, placebo-controlled study in 39 men aged 50-70 years with T2D and bioavailable testosterone levels
Multilevel techniques for Reservoir Simulation

The subject of this thesis is the development, application and study of novel multilevel methods for the acceleration and improvement of reservoir simulation techniques. The motivation for addressing this topic is a need for more accurate predictions of porous media flow and the ability to carry out these computations in a timely manner. This will lead to better decision making in the production of oil and gas. The goal is attained in various ways throughout the thesis work. Specifically, three fields of multilevel methods have been addressed in this work, namely:

• Nonlinear multigrid (the Full Approximation Scheme)
• Variational (Galerkin) upscaling
• Linear solvers and preconditioners

First, a nonlinear multigrid scheme in the form of the Full Approximation Scheme (FAS) is implemented and studied for a 3D three-phase compressible rock/ﬂuids immiscible reservoir simulator with a coupled well model. In a fair way, it is compared to the state-of-the-art solution scheme used in industry and research simulators. It is found that FAS improves time-to-solution by having a larger basin of attraction, faster initial convergence, data locality and a lower memory footprint. The study is extended to include a hybrid strategy, where FAS is combined with Newton’s method to construct a multilevel nonlinear preconditioner. This method demonstrates high efficiency and robustness.

Second, an improved IMPES formulated reservoir simulator is implemented using a novel variational upscaling approach based on element-based Algebraic Multigrid (AMGe). In particular, an advanced AMGe technique with guaranteed approximation properties is used to construct a coarse multilevel hierarchy of Raviart-Thomas and L2 spaces for the Galerkin coarsening of a mixed formulation of the reservoir simulation equations. By experimentation it is found that the AMGe based upscaling technique provided very accurate results while reducing the computational time proportionally to the reduction in degrees of freedom. Furthermore, it is demonstrated that the AMGe coarse spaces (interpolation operators) can be used for both variational upscaling and the construction of linear solvers. In particular, it is found to be beneficial (or even necessary) to apply an AMGe based multigrid solver to solve the upscaled problems. It is found that the AMGe upscaling changes the spectral properties of the matrix, which renders well-known state-of-the-art solvers for this type of system useless.

Third, FAS is combined with AMGe with guaranteed approximation properties to obtain a nonlinear multigrid solver for unstructured meshes. The FAS-AMGe solver is applied to a simplistic but numerically challenging mixed (velocity/pressure) model for porous media flow. In a fair way, FAS-AMGe is compared to Newton’s method and Picard iterations. It is found that FAS-AMGe is faster for the cases considered.

Finally, a number of multigrid linear solvers and preconditioners are implemented for various linear systems. In particular AMGe are used in the construction of multigrid preconditioners. These are compared to two state-of-the-art block diagonal preconditioners based on 1) a Schur complement with an Algebraic Multigrid (AMG) solver and 2) an augmented Lagrangian formulation using the Auxiliary Space AMG solver.

In addition to the research mentioned above, a sequential in-house COmpositional reservoir SImulator (COSI) with many features is parallelized in a distributed setting (MPI) using the PETSc framework. A parallel preconditioner based on the Constrained Pressure Residual method, Algebraic Multigrid and Restricted Additive Overlapping Schwarz withIncomplete LU solves on each subdomain is implemented. It is found that switching the traditionally used method, namely parallel ILU, with Restricted Additive Overlapping Schwarz results in a significant increase in parallel scalability while still maintaining similar robustness and efficiency.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Center for Energy Resources Engineering
Multi-Period Trading via Convex Optimization

We consider a basic model of multi-period trading, which can be used to evaluate the performance of a trading strategy. We describe a framework for single-period optimization, where the trades in each period are found by solving a convex optimization problem that trades off expected return, risk, transaction cost and holding cost such as the borrowing cost for shorting assets. We then describe a multi-period version of the trading method, where optimization is used to plan a sequence of trades, with only the first one executed, using estimates of future quantities that are unknown when the trades are chosen. The single period method traces back to Markowitz; the multi-period methods trace back to model predictive control. Our contribution is to describe the single-period and multi-period methods in one simple framework, giving a clear description of the development and the approximations made. In this paper, we do not address a critical component in a trading algorithm, the predictions or forecasts of future quantities. The methods we describe in this paper can be thought of as good ways to exploit predictions, no matter how they are made. We have also developed a companion open-source software library that implements many of the ideas and methods described in the paper.

Multi-volumeSegmentationwithTetrahedralMesh

Volume segmentation is efficient for reconstructing material structure, which is important for several analyses, e.g. simulation with finite element method, measurement of quantitative information like surface area, surface curvature, volume, etc. We are concerned about the representations of the 3D volumes, which can be categorized into two groups: fixed voxel grids [1] and unstructured meshes [2]. Among these two representations, the voxel grids are more popular since manipulating a fixed grid is easier than an unstructured mesh, but they are less efficient for quantitative
measurements. In many cases, the voxel grids are converted to explicit meshes, however the conversion may reduce the accuracy of the segmentations, and the effort for meshing is also not trivial. On the other side, methods using unstructured meshes have difficulty in handling topology changes. To reduce the complexity, previous methods only represent the surfaces, thus they only segment a single region without exterior or interior information (e.g. holes). Finally, yet importantly, previous methods of both representations have issues with multi-material segmentation, where vacuum and overlapping between surfaces occur. This paper proposes a method for volume segmentation using a tetrahedral mesh. The compelling advantages of our method include: natural multi-material support; output is tetrahedral mesh that can be utilized for simulation and analysis directly; and the ability to control the resolution for compact meshes. We are also experimenting to prove our advantages on high accuracy; and the potentiality to accompany shape prior information during segmentation.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Statistics and Data Analysis
Authors: Nguyen Trung, T. (Intern), Dahl, V. A. (Intern), Bærentzen, J. A. (Intern)
Number of pages: 2
Publication date: 2017
Main Research Area: Technical/natural sciences
Electronic versions:
Nguyen_Dahl_B_barentzen_2017_Multi_phase_Volume_Segmentation_with_Tetrahedral_Mesh.pdf
Publication: Research - peer-review • Paper – Annual report year: 2017

Multiple shooting applied to robust reservoir control optimization including output constraints on coherent risk measures
The production life of oil reservoirs starts under significant uncertainty regarding the actual economical return of the recovery process due to the lack of oil field data. Consequently, investors and operators make management decisions based on a limited and uncertain description of the reservoir. In this work, we propose a new formulation for robust optimization of reservoir well controls. It is inspired by the multiple shooting (MS) method which permits a broad range of parallelization opportunities and output constraint handling. This formulation exploits coherent risk measures, a concept traditionally used in finance, to bound the risk on constraint violation. We propose a reduced sequential quadratic programming (rSQP) algorithm to solve the underlying optimization problem. This algorithm exploits the structure of the coherent risk measures, thus a large set of constraints are solved within sub-problems. Moreover, a variable elimination procedure allows solving the optimization problem in a reduced space and an iterative active-set method helps to handle a large set of inequality constraints. Finally, we demonstrate the application of constraints to bound the risk of water production peaks rather than worst-case satisfaction.

General information
State: Published
Organisations: Center for Energy Resources Engineering, Department of Applied Mathematics and Computer Science, Scientific Computing, Norwegian University of Science and Technology
Authors: Codas, A. (Ekstern), Hanssen, K. G. (Ekstern), Foss, B. (Ekstern), Capolei, A. (Intern), Jørgensen, J. B. (Intern)
Pages: 479-497
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Computational Geosciences
Volume: 21
Issue number: 3
ISSN (Print): 1420-0597
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.385 SJR 0.985 CiteScore 2.71
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.6 SJR 0.894 SNIP 1.466
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.184 SNIP 1.498 CiteScore 2.91
Multi-scale spatio-temporal analysis of human mobility

The recent availability of digital traces generated by phone calls and online logins has significantly increased the scientific understanding of human mobility. Until now, however, limited data resolution and coverage have hindered a coherent description of human displacements across different spatial and temporal scales. Here, we characterise mobility behaviour across several orders of magnitude by analysing similar to 850 individuals’ digital traces sampled every similar to 16 seconds for 25 months with similar to 10 meters spatial resolution. We show that the distributions of distances and waiting times between consecutive locations are best described by log-normal and gamma distributions, respectively, and that natural time-scales emerge from the regularity of human mobility. We point out that log-normal distributions also characterise the patterns of discovery of new places, implying that they are not a simple consequence of the routine of modern life.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, Copenhagen Center for Health Technology, University of London
Authors: Alessandretti, L. (Ekstern), Sapiezynski, P. (Intern), Jørgensen, S. L. (Intern), Baronchelli, A. (Ekstern)
Number of pages: 17
Publication date: 2017
Main Research Area: Technical/natural sciences
Multi-site solar power forecasting using gradient boosted regression trees

The challenges to optimally utilize weather dependent renewable energy sources call for powerful tools for forecasting. This paper presents a non-parametric machine learning approach used for multi-site prediction of solar power generation on a forecast horizon of one to six hours. Historical power generation and relevant meteorological variables related to 42 individual PV rooftop installations are used to train a gradient boosted regression tree (GBRT) model. When compared to single-site linear autoregressive and variations of GBRT models the multi-site model shows competitive results in terms of root mean squared error on all forecast horizons. The predictive performance and the simplicity of the model setup make the boosted tree model a simple and attractive compliment to conventional forecasting techniques. (C) 2017 Elsevier Ltd. All rights reserved.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Toyota Central R&D Labs
Authors: Persson, C. S. (Intern), Bacher, P. (Intern), Shiga, T. (Ekstern), Madsen, H. (Intern)
Number of pages: 14
Pages: 423-436
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Solar Energy
Volume: 150
ISSN (Print): 0038-092X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.791 SJR 1.615 CiteScore 4.89
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.52 SJR 1.504 SNIP 1.746
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.912 SNIP 2.085 CiteScore 4.61
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.962 SNIP 2.671 CiteScore 4.77
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.99 SNIP 2.85 CiteScore 4.44
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.605 SNIP 2.517 CiteScore 3.65
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.283 SNIP 2.178 CiteScore 3.19
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.369 SNIP 2.16
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.265 SNIP 2.158
Multispectral UV imaging for determination of the tablet coating thickness

The applicability of off-line multispectral ultraviolet (UV) imaging in combination with multivariate data analysis was investigated to determine the coating thickness and its distribution on the tablet surface during lab scale coating. The UV imaging results were compared with the weight gain measured for each individual tablet and the corresponding coating thickness and its distribution measured by terahertz pulsed imaging (TPI). Three different tablet formulations were investigated, two of which contained UV active tablet cores. Three coating formulations were applied: Aquacoat® ECD (a mainly translucent coating) and Eudragit® NE (a turbid coating containing solid particles). It was shown that UV imaging is a fast and non-destructive method to predict individual tablet weight gain as well as coating thickness. The coating thickness distribution profiles determined by UV imaging correlated to the results of the TPI measurements. UV imaging appears to hold a significant potential as a PAT tool for determination of the tablet coating thickness and its distribution resulting from its high measurement speed, high molar absorptivity and a high scattering coefficient, in addition to relatively low costs.
Multispectral x-ray CT: multivariate statistical analysis for efficient reconstruction
Recent developments in multispectral X-ray detectors allow for an efficient identification of materials based on their chemical composition. This has a range of applications including security inspection, which is our motivation. In this paper, we analyze data from a tomographic setup employing the MultiX detector, that records projection data in 128 energy bins covering the range from 20 to 160 keV. Obtaining all information from this data requires reconstructing 128 tomograms, which is computationally expensive. Instead, we propose to reduce the dimensionality of projection data prior to reconstruction and reconstruct from the reduced data. We analyze three linear methods for dimensionality reduction using a dataset with 37 equally-spaced projection angles. Four bottles with different materials are recorded for which we are able to obtain similar discrimination of their content using a very reduced subset of tomograms compared to the 128 tomograms that would otherwise be needed without dimensionality reduction.
NaDeA: A Natural Deduction Assistant with a Formalization in Isabelle

We present a new software tool for teaching logic based on natural deduction. Its proof system is formalized in the proof assistant Isabelle such that its definition is very precise. Soundness of the formalization has been proved in Isabelle. The tool is open source software developed in TypeScript / JavaScript and can thus be used directly in a browser without any further installation. Although developed for computer science bachelor students who are used to study and program concrete computer code in a programming language we consider the approach relevant for a broader audience and for other proof systems as well.

Nash Equilibria in Symmetric Graph Games with Partial Observation

We investigate a model for representing large multiplayer games, which satisfy strong symmetry properties. This model is made of multiple copies of an arena; each player plays in his own arena, and can partially observe what the other players do. Therefore, this game has partial information and symmetry constraints, which make the computation of Nash equilibria difficult. We show several undecidability results, and for bounded-memory strategies, we precisely characterize the complexity of computing pure Nash equilibria for qualitative objectives in this game model.
New approach for validating the segmentation of 3D data applied to individual fibre extraction

We present two approaches for validating the segmentation of 3D data. The first approach consists on comparing the amount of estimated material to a value provided by the manufacturer. The second approach consists on comparing the segmented results to those obtained from imaging modalities that provide a better resolution and therefore a more accurate segmentation. The imaging modalities used for comparison are scanning electron microscopy, optical microscopy and synchrotron CT. The validation methods are applied to the assess the segmentation of individual fibres from X-ray microtomograms.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Statistics and Data Analysis, Department of Wind Energy, Composites and Materials Mechanics
Authors: Emerson, M. J. (Intern), Dahl, A. B. (Intern), Dahl, V. A. (Intern), Conradsen, K. (Intern), Mikkelsen, L. P. (Intern)
Number of pages: 2
Publication date: 2017

Host publication information

Title of host publication: Proceedings of 3rd International Conference on Tomography of Materials and Structures
Main Research Area: Technical/natural sciences
Conference: 3rd International Conference on Tomography of 3D Materials and Structures, Lund, Sweden, 26/06/2017 - 28/06/2017
Segmentation, Composite characterisation, Validation, Fibre analysis

Relations

Activities:
New approach for validating the segmentation of 3D data applied to individual fibre extraction
Source: PublicationPreSubmission
Source-ID: 134493070
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

New frontiers of quantified self 3: Exploring understudied categories of users

Quantified Self (QS) field needs to start thinking of how situated needs may affect the use of self-tracking technologies. In this workshop we will focus on the idiosyncrasies of specific categories of users.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, University of Turin, University of Sydney, University of Glasgow, Technische Universität Berlin, University of Washington, Madeira Interactive Technologies Institute
Authors: Rapp, A. (Ekstern), Cena, F. (Ekstern), Kay, J. (Ekstern), Kummerfeld, B. (Ekstern), Hopfgartner, F. (Ekstern), Plumbaum, T. (Ekstern), Larsen, J. E. (Intern), Epstein, D. A. (Ekstern), Gouveia, R. (Ekstern)
Number of pages: 4
Pages: 861-864
Publication date: 2017

Host publication information

Publisher: Association for Computing Machinery
ISBN (Electronic): 9781450351904
BFI conference series: ACM International Joint Conference on Pervasive and Ubiquitous Computing (5000606)
Main Research Area: Technical/natural sciences
Personal informatics, Quantified Self, Self-tracking
DOIs: 10.1145/3123024.3124456
Source: Scopus
Source-ID: 85030838022
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017
Nonlinear Model Predictive Control of a Cable-Robot-Based Motion Simulator

In this paper we present the implementation of a model-predictive controller (MPC) for real-time control of a cable-robot-based motion simulator. The controller computes control inputs such that a desired acceleration and angular velocity at a defined point in simulator's cabin are tracked while satisfying constraints imposed by working space and allowed cable forces of the robot. In order to fully use the simulator capabilities, we propose an approach that includes the motion platform actuation in the MPC model. The tracking performance and computation time of the algorithm are investigated in computer simulations. Furthermore, for motion simulation scenarios where the reference trajectories are not known beforehand, we derive an estimate on how much motion simulation fidelity can maximally be improved by any reference prediction scheme compared to the case when no prediction scheme is applied. (C) 2017, IFAC (International Federation of Automatic Control) Hosting by Elsevier Ltd. All rights reserved.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Max-Planck-Institut, University of Freiburg
Authors: Katliar, M. (Ekstern), Fischer, J. (Ekstern), Frison, G. (Intern), Diehl, M. (Ekstern), Teufel, H. (Ekstern), Buelthoff, H. H. (Ekstern)
Pages: 9833-9839
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: IFAC-PapersOnLine
Volume: 50
Issue number: 1
ISSN (Print): 2405-8963
Ratings:
Scopus rating (2017): CiteScore 0.68 SJR 0.26 SNIP 0.434
Scopus rating (2016): CiteScore 0.45 SJR 0.234 SNIP 0.328
Scopus rating (2015): SJR 0.298 SNIP 0.39
Scopus rating (2014): SJR 0.298 SNIP 0.383
Scopus rating (2013): SJR 0.326 SNIP 0.41
Scopus rating (2012): SJR 0.265 SNIP 0.331
Scopus rating (2011): SJR 0.257 SNIP 0.324
Scopus rating (2010): SJR 0.197 SNIP 0.276
Scopus rating (2009): SJR 0.211 SNIP 0.29
Scopus rating (2008): SJR 0.172 SNIP 0.239
Scopus rating (2007): SJR 0.195 SNIP 0.271
Scopus rating (2006): SJR 0.21 SNIP 0.284
Scopus rating (2005): SJR 0.192 SNIP 0.445
Scopus rating (2004): SJR 0.245 SNIP 0.419
Scopus rating (2003): SJR 0.26 SNIP 0.403
Original language: English
Model predictive control, Cable robots, Vehicle simulators, Motion cueing, Control and Systems Engineering
Electronic versions: 1_s2.0_S2405896317313678_main.pdf
DOIs: 10.1016/j.ifacol.2017.08.901
Source: FindIt
Source-ID: 2392248472
Publication: Research - peer-review › Journal article – Annual report year: 2018

Number of solutions of systems of homogeneous polynomial equations over finite fields

We consider the problem of determining the maximum number of common zeros in a projective space over a finite field for a system of linearly independent multivariate homogeneous polynomials defined over that field. There is an elaborate conjecture of Tsfasman and Boguslavsky that predicts the maximum value when the homogeneous polynomials have the same degree that is not too large in comparison to the size of the finite field. We show that this conjecture holds in the affirmative if the number of polynomials does not exceed the total number of variables. This extends the results of Serre (1991) and Boguslavsky (1997) for the case of one and two polynomials, respectively. Moreover, it complements our recent result that the conjecture is false, in general, if the number of polynomials exceeds the total number of variables.

General information
Numerical Multilevel Upscaling for Incompressible Flow in Reservoir Simulation: An Element-based Algebraic Multigrid (AMGe) Approach

We study the application of a finite element numerical upscaling technique to the incompressible two-phase porous media total velocity formulation. Specifically, an element agglomeration based Algebraic Multigrid (AMGe) technique with improved approximation properties [37] is used, for the first time, to generate upscaled and accurate coarse systems for the reservoir simulation equations. The upscaling technique is applied to both the mixed system for velocity and pressure and to the hyperbolic transport equations providing fully upscaled systems. By introducing additional degrees of freedom associated with non-planar interfaces between agglomerates, the coarse velocity space has guaranteed approximation properties. The employed AMGe technique provides coarse spaces with desirable local mass conservation and stability properties analogous to the original pair of Raviart-Thomas and piecewise discontinuous polynomial spaces, resulting in strong mass conservation for the upscaled systems. Due to the guaranteed approximation properties and the generic nature of the AMGe method, recursive multilevel upscaling is automatically obtained. Furthermore, this technique works for both structured and unstructured meshes. Multiscale Mixed Finite Elements exhibit accuracy for general unstructured meshes but do not in general lead to nested hierarchy of spaces. Multiscale multilevel mimetic finite differences generate nested spaces but lack the adaptivity of the flux representation on coarser levels that the proposed AMGe approach offers. Thus, the proposed approach can be seen as a rigorous bridge that merges the best properties of these two existing methods. The accuracy and stability of the studied multilevel AMGe upscaling technique is demonstrated on two challenging test cases.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Center for Energy Resources Engineering, Lawrence Livermore National Laboratory
Authors: Christensen, M. L. C. (Intern), Villa, U. (Ekstern), Engsig-Karup, A. P. (Intern), Vassilevski, P. S. (Ekstern)
Pages: B102-37
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: SIAM Journal on Scientific Computing
Volume: 39
Issue number: 1
ISSN (Print): 1064-8275
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.612 SJR 1.973 CiteScore 2.61
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.45 SJR 1.992 SNIP 1.734
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.963 SNIP 1.844 CiteScore 2.3
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.872 SNIP 2.022 CiteScore 2.43
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.928 SNIP 2.136 CiteScore 2.72
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.739 SNIP 1.77 CiteScore 2.19
Offset Risk Minimization for Open-loop Optimal Control of Oil Reservoirs

Simulation studies of oil field water flooding have demonstrated a significant potential of optimal control technology to improve industrial practices. However, real-life applications are challenged by unknown geological factors that make reservoir models highly uncertain. To minimize the associated financial risks, the oil literature has used ensemble-based methods to manipulate the net present value (NPV) distribution by optimizing sample estimated risk measures. In general, such methods successfully reduce overall risk. However, as this paper demonstrates, ensemble-based control strategies may result in individual profit outcomes that perform worse than real-life dominating strategies. This poses significant financial risks to oil companies whose main concern is to avoid unacceptable low profits. To remedy this, this paper proposes offset risk minimization. Unlike existing methodology, the offset method uses the NPV offset distribution to minimize risk relative to a competing reference strategy. Open-loop simulations of a 3D two-phase synthetic reservoir demonstrate the potential of offset risk minimization to significantly improve the worst case profit offset relative to real-life best practices. The results suggest that it may be more relevant to consider the NPV offset distribution than the NPV distribution when minimizing risk in production optimization.
On a combination of the 1-2-3 conjecture and the antimagic labeling conjecture

This paper is dedicated to studying the following question: Is it always possible to injectively assign the weights 1, ..., |E(G)| to the edges of any given graph G (with no component isomorphic to K2) so that every two adjacent vertices of G get distinguished by their sums of incident weights? One may see this question as a combination of the well-known 1-2-3 Conjecture and the Antimagic Labelling Conjecture. Throughout this paper, we exhibit evidence that this question might be true. Benefiting from the investigations on the Antimagic Labelling Conjecture, we first point out that several classes of graphs, such as regular graphs, indeed admit such assignments. We then show that trees also do, answering a recent conjecture of Arumugam, Premalatha, Bača and Semaničová-Feňovčíková. Towards a general answer to the question above, we then prove that claimed assignments can be constructed for any graph, provided we are allowed to use some number of additional edge weights. For some classes of sparse graphs, namely 2-degenerate graphs and graphs with maximum average degree 3, we show that only a small (constant) number of such additional weights suffices.
On a directed variation of the 1-2-3 and 1-2 Conjectures

In this paper, we consider the following question, which stands as a directed analogue of the well-known 1-2-3 Conjecture: Given any digraph \( D \) with no arc \( uv \) verifying \( d^+(u) = d^-(v) = 1 \), is it possible to weight the arcs of \( D \) with weights among 1; 2; 3 so that, for every arc \( uv \) of \( D \), the sum of incident weights out-going from \( u \) is different from the sum of incident weights in-coming to \( v \)? We answer positively to this question, and investigate digraphs for which even the weights among 1; 2 are sufficient. In relation with the so-called 1-2 Conjecture, we also consider a total version of the problem, which we prove to be false. Our investigations turn to have interesting relations with open questions related to the 1-2-3 Conjecture.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science , Algorithms and Logic , Ecole Normale Superieure de Lyon, AGH University of Science and Technology
Authors: Barme, E. (Ekstern), Bensmail, J. (Intern), Przybyło, J. (Ekstern), Wozniak, M. (Ekstern)
Pages: 123-131
Publication date: 2017
Main Research Area: Technical/natural sciences
Online Conformance Checking for Petri Nets and Event Streams
Within process mining, we can identify conformance checking as the task of computing the extent to which executions of a process model are in line with the reference behavior. Most approaches currently available in the literature (for imperative models, such as Petri nets) perform just a-posteriori analyses. This means that the amount of nonconformant behavior is quantified after the completion of the current execution. The tool presented in this paper, instead, proposes an approach for online conformance checking: not only it is capable of quantifying the deviating behavior on the fly, but the computation complexity is also restricted to a constant complexity per event analyzed. This enables the online analysis of an infinite stream of events. The tool is implemented as a package of the ProM framework and promising results have been obtained and are presented in this paper.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Software and Process Engineering
Authors: Burattin, A. (Intern)
Number of pages: 5
Publication date: 2017

Host publication information
Title of host publication: Online Proceedings of the BPM Demo Track 2017
Main Research Area: Technical/natural sciences
Conference: 15th International Conference on Business Process Management (BPM 2017), Barcelona, Spain, 10/09/2017 - 10/09/2017
Online process mining, Conformance checking, Event stream
Electronic versions:
BPM_2017_paper_153.pdf
Source: PublicationPreSubmission
Source-ID: 137907392
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

On multivariate Wilson bases
A Wilson system is a collection of finite linear combinations of time frequency shifts of a square integrable function. In this paper we give an account of the construction of bimodular Wilson bases in higher dimensions from Gabor frames of redundancy two.

General information
State: Published
Organisations: Mathematics, Department of Applied Mathematics and Computer Science, University of Oregon, University of Maryland
Authors: Bownik, M. (Ekstern), Jakobsen, M. S. (Intern), Lemvig, J. (Intern), Okoudjou, K. A. (Ekstern)
Number of pages: 4
Pages: 192-5
Publication date: 2017

Host publication information
Title of host publication: Proceedings of 2017 International Conference on Sampling Theory and Applications
Publisher: IEEE
ISBN (Print): 978-1-5386-1565-2
Main Research Area: Technical/natural sciences
Conference: 2017 International Conference on Sampling Theory and Applications, Tallinn, Estonia, 03/07/2017 - 03/07/2017
DOIs:
10.1109/SAMPTA.2017.8024456
Source: FindIt
Source-ID: 2374256540
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

On permutation polynomials over finite fields: differences and iterations
The Carlitz rank of a permutation polynomial f over a finite field F_q is a simple concept that was introduced in the last decade. Classifying permutations over F_q with respect to their Carlitz ranks has some advantages, for instance f with a given Carlitz rank can be approximated by a rational linear transformation. In this note we present our recent results on the permutation behaviour of polynomials f+g, where f is a permutation over F_q of a given Carlitz rank, and g ∈ F_q[x] is of prescribed degree. We describe the relation of this problem to the well-known Chowla-Zassenhaus conjecture. We also study iterations of permutation polynomials by
using the approximation property that is mentioned above.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics, University of Sarajevo, University of Warwick, Universidade Federal do Rio de Janeiro, Leiden University, Sabanci University
Authors: Anbar Meidl, N. (Intern), Odzak, A. (Ekstern), Patel, V. (Ekstern), Quoos, L. (Ekstern), Somoza, A. (Ekstern), Topuzoglu, A. (Ekstern)
Number of pages: 13
Publication date: 2017

**Host publication information**
Title of host publication: Women in Numbers
Main Research Area: Technical/natural sciences
Electronic versions:
WINN.pdf

**Bibliographical note**
conference paper submitted to Women in Numbers Europe
Source: PublicationPreSubmission
Source-ID: 134439164
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

**On q-power cycles in cubic graphs**
In the context of a conjecture of Erdos and Gyárfás, we consider, for any \( q \geq 2 \), the existence of q-power cycles (i.e. with length a power of \( q \)) in cubic graphs. We exhibit constructions showing that, for every \( q \geq 3 \), there exist arbitrarily large cubic graphs with no q-power cycles. Concerning the remaining case \( q = 2 \) (which corresponds to the conjecture of Erdos and Gyárfás), we show that there exist arbitrarily large cubic graphs whose only 2-power cycles have length 4 only, or 8 only.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Authors: Bensmail, J. (Intern)
Pages: 211–220
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Discussiones Mathematicae. Graph Theory
Volume: 37
ISSN (Print): 1234-3099
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.095 SJR 0.633 CiteScore 0.64
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.42 SJR 0.495 SNIP 0.717
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.592 SNIP 0.892 CiteScore 0.38
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.507 SNIP 0.834 CiteScore 0.4
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.721 SNIP 0.984 CiteScore 0.51
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.62 SNIP 0.693 CiteScore 0.34
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.379 SNIP 0.384 CiteScore 0.3
Scopus rating (2010): SJR 0.417 SNIP 0.496
On site characterisation of the overall heat loss coefficient: comparison of different assessment methods by a blind validation exercise on a round robin test box

Several studies have shown that the actual thermal performance of buildings after construction may deviate significantly from its performance anticipated at design stage. As a result, there is growing interest in on site testing as a means to assess real performance. The IEA EBC Annex 58-project 'Reliable Building Energy Performance Characterisation Based on Full Scale Dynamic Measurements' focused on on site testing and dynamic data analysis methods that can be used to characterise the actual thermal performance and energy efficiency of building components and whole buildings. The research within this project was driven by case studies. The current paper describes one of them: the thermal characterisation of a round robin test box. This test box can be seen as a scale model of a building, and was built by one of the participants. During the project, its fabric properties remained unknown to all other participants. Full scale measurements have been performed on the test box in different countries under real climatic conditions. The obtained dynamic data has been distributed to all participants who had to characterise the thermal performance of the test box’s fabric based on the provided data. The paper compares the result of different techniques, ranging from a simple quasi-stationary analysis to advanced dynamic data analysis methods, which can be used to characterise the thermal performance based on on-site collected data.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, University of Leuven, CIEMAT
Authors: Roels, S. (Ekstern), Bacher, P. (Intern), Bauwens, G. (Ekstern), Castaño, S. (Ekstern), Jiménez, M. J. (Ekstern), Madsen, H. (Intern)
Pages: 179-189
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Energy and Buildings
Volume: 153
ISSN (Print): 0378-7788
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.96 SJR 2.061 SNIP 2.12
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.64 SJR 2.055 SNIP 1.968
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.04 SNIP 2.146 CiteScore 4.07
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.079 SNIP 2.875 CiteScore 4.21
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.852 SNIP 2.404 CiteScore 3.79
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.745 SNIP 2.696 CiteScore 3.36
ISI indexed (2012): ISI indexed yes
On the approximation of the canard explosion point in singularly perturbed systems without an explicit small parameter

A canard explosion is the dramatic change of period and amplitude of a limit cycle of a system of nonlinear ODEs in a very narrow interval of the bifurcation parameter. It occurs in slow–fast systems and is well understood in singular perturbation problems where a small parameter epsilon defines the time-scale separation. We present an iterative algorithm for the determination of the canard explosion point which can be applied for a general slow–fast system without an explicit small parameter. We also present assumptions under which the algorithm gives accurate estimates of the canard explosion point. Finally, we apply the algorithm to the van der Pol equations, a Templator model for a self-replicating system and a model for intracellular calcium oscillations with no explicit small parameters and obtain very good agreement with results from numerical simulations.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics
Authors: Brøns, M. (Intern), Kristiansen, K. U. (Intern)
Pages: 1-23
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Dynamical Systems
On the difference between permutation polynomials over finite fields

The well-known Chowla and Zassenhaus conjecture, proven by Cohen in 1990, states that if \( p > (d^2 - 3d + 4)^2 \), then there is no complete mapping polynomial \( f \) in \( \mathbb{F}_p[x] \) of degree \( d \geq 2 \). For arbitrary finite fields \( \mathbb{F}_q \), a similar non-existence result is obtained recently by I¸sık, Topuzo˘glu and Winterhof in terms of the Carlitz rank of \( f \). Cohen, Mullen and Shiue generalized the Chowla-Zassenhaus-Cohen Theorem significantly in 1995, by considering differences of permutation polynomials. More precisely, they showed that if \( f \) and \( f + g \) are both permutation polynomials of degree \( d \geq 2 \) over \( \mathbb{F}_p \), with \( p > (d^2 - 3d + 4)^2 \), then the degree \( k \) of \( g \) satisfies \( k \geq 3d/5 \), unless \( g \) is constant. In this article, assuming \( f \) and \( f + g \) are permutation polynomials in \( \mathbb{F}_q[x] \), we give lower bounds for \( k \) in terms of the Carlitz rank of \( f \) and \( q \). Our results generalize the above mentioned result of I¸sık et al. We also show for a special class of polynomials \( f \) of Carlitz rank \( n \geq 1 \) that if \( f + x \) is a permutation over \( \mathbb{F}_q \), with \( \gcd(k + 1, q - 1) = 1 \), then \( k \geq (q - n)/(n + 3) \).

On the Keyhole Hypothesis: High Mutual Information between Ear and Scalp EEG

We propose and test the keyhole hypothesis that measurements from low dimensional EEG, such as ear-EEG reflect a broadly distributed set of neural processes. We formulate the keyhole hypothesis in information theoretical terms. The experimental investigation is based on legacy data consisting of 10 subjects exposed to a battery of stimuli, including alpha-attenuation, auditory onset, and mismatch-negativity responses and a new medium-long EEG experiment involving data acquisition during 13 h. Linear models were estimated to lower bound the scalp-to-ear capacity, i.e., predicting ear-EEG data from simultaneously recorded scalp EEG. A cross-validation procedure was employed to ensure unbiased estimates. We present several pieces of evidence in support of the keyhole hypothesis: There is a high mutual information between data acquired at scalp electrodes and through the ear-EEG "keyhole," furthermore we show that the view represented as a linear mapping is stable across both time and mental states. Specifically, we find that ear-EEG data can be predicted reliably from scalp EEG. We also address the reverse view, and demonstrate that large portions of the scalp EEG can be predicted from ear-EEG, with the highest predictability achieved in the temporal regions and when using ear-
EEG electrodes with a common reference electrode.

**General information**
State: Published
Organisations: Copenhagen Center for Health Technology, Department of Applied Mathematics and Computer Science, Cognitive Systems, Aarhus University
Authors: Mikkelsen, K. B. (Ekstern), Kidmose, P. (Ekstern), Hansen, L. K. (Intern)
Number of pages: 9
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Frontiers in Human Neuroscience
Volume: 11
Article number: 341
ISSN (Print): 1662-5161
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.12 SJR 1.471 CiteScore 3.04
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.38 SJR 1.794 SNIP 1.114
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.964 SNIP 1.033 CiteScore 3.47
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.648 SNIP 0.957 CiteScore 3.23
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.124 SNIP 0.963 CiteScore 3.41
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Scopus rating (2012): SJR 2.686 SNIP 1.171 CiteScore 4.05
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Scopus rating (2011): SJR 2.055 SNIP 0.857 CiteScore 2.35
ISI indexed (2011): ISI indexed no
Scopus rating (2010): SJR 1.725 SNIP 0.97
Scopus rating (2009): SJR 1.486 SNIP 0.629
Original language: English
EEG, Ear-EEG, Mobility, Mutual information, Prediction
Electronic versions:
fnhum_11_00341.pdf
DOIs:
10.3389/fnhum.2017.00341
Source: Findit
Source-ID: 2372328052
Publication: Research - peer-review › Journal article – Annual report year: 2017

**On the Minimum Number of Spanning Trees in k-Edge-Connected Graphs**
We show that a k-edge-connected graph on n vertices has at least \( n(k/2)^{n-1} \) spanning trees. This bound is tight if k is even and the extremal graph is the n-cycle with edge multiplicities k/2. For k odd, however, there is a lower bound \( c_k n^{n-1} \), where \( c_3 > k/2 \). Specifically, \( c_3 > 1.77 \) and \( c_5 > 2.75 \). Not surprisingly, \( c_3 \) is smaller than the corresponding number for 4-edge-connected graphs. Examples show that \( c_3 < 2 + \sqrt{3} = 1.93 \). However, we have no examples of 5-edge-connected graphs with fewer spanning trees than the n-cycle with all edge multiplicities (except one) equal to 3, which is almost 6-regular. We have no examples of 5-regular 5-edge-connected graphs with fewer than 3.09\( n^{n-1} \) spanning trees, which is more than the corresponding number for 6-regular 6-edge-connected graphs. The analogous surprising phenomenon occurs for each higher odd edge connectivity and regularity.
On the regularization of impact without collision: the Painlevé paradox and compliance

We consider the problem of a rigid body, subject to a unilateral constraint, in the presence of Coulomb friction. We regularize the problem by assuming compliance (with both stiffness and damping) at the point of contact, for a general class of normal reaction forces. Using a rigorous mathematical approach, we recover impact without collision (IWC) in both the inconsistent and the indeterminate Painlevé paradoxes, in the latter case giving an exact formula for conditions that separate IWC and lift-off. We solve the problem for arbitrary values of the compliance damping and give explicit asymptotic expressions in the limiting cases of small and large damping, all for a large class of rigid bodies.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics, University of Bristol
Authors: Hogan, S. J. (Ekstern), Kristiansen, K. U. (Intern)
Number of pages: 18
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences
Volume: 473
Issue number: 2202
Article number: 20160773
ISSN (Print): 1364-5021
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.325 SJR 0.931
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.85 SJR 0.832 SNIP 1.237
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.936 SNIP 1.359 CiteScore 2.07
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.974 SNIP 1.523 CiteScore 2.15
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.021 SNIP 1.604 CiteScore 2.35
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.972 SNIP 1.552 CiteScore 2.08
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.883 SNIP 1.474 CiteScore 1.88
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.925 SNIP 1.497
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.007 SNIP 1.601
On the structure of dynamic principal component analysis used in statistical process monitoring

When principal component analysis (PCA) is used for statistical process monitoring it relies on the assumption that data are time independent. However, industrial data will often exhibit serial correlation. Dynamic PCA (DPCA) has been suggested as a remedy for high-dimensional and time-dependent data. In DPCA the input matrix is augmented by adding time-lagged values of the variables. In building a DPCA model the analyst needs to decide on (1) the number of lags to add, and (2) given a specific lag structure, how many principal components to retain. In this article we propose a new analyst driven method to determine the maximum number of lags in DPCA with a foundation in multivariate time series analysis. The method is based on the behavior of the eigenvalues of the lagged autocorrelation and partial autocorrelation matrices. Given a specific lag structure we also propose a method for determining the number of principal components to retain. The number of retained principal components is determined by visual inspection of the serial correlation in the squared prediction error statistic, Q (SPE), together with the cumulative explained variance of the model. The methods are illustrated using simulated vector autoregressive and moving average data, and tested on Tennessee Eastman process data.
A Wilson system is a collection of finite linear combinations of time frequency shifts of a square integrable function. It is well known that, starting from a tight Gabor frame for $L^2(\mathbb{R})$ with redundancy 2, one can construct an orthonormal Wilson basis for $L^2(\mathbb{R}^d)$ whose generator is well localized in the time-frequency plane. In this paper we use the fact that a Wilson system is a shift-invariant system to explore its relationship with Gabor systems. Specifically, we show that one can construct $d$-dimensional orthonormal Wilson bases starting from tight Gabor frames of redundancy $2^k$, where $k=1, 2, \ldots$. These results generalize most of the known results about the existence of orthonormal Wilson bases.
Open semantic analysis: The case of word level semantics in Danish

The present research is motivated by the need for accessible and efficient tools for automated semantic analysis in Danish. We are interested in tools that are completely open, so they can be used by a critical public, in public administration, non-governmental organizations and businesses. We describe data-driven models for Danish semantic relatedness, word intrusion and sentiment prediction. Open Danish corpora were assembled and unsupervised learning implemented for explicit semantic analysis and with Gensim’s Word2vec model. We evaluate the performance of the two models on three different annotated word datasets. We test the semantic representations’ alignment with single word sentiment using supervised learning. We find that logistic regression and large random forests perform well with Word2vec features.

Operator representations of frames

The purpose of this paper is to consider representations of frames \( \{ f_k \}_{k \in I} \) in a Hilbert space \( \mathcal{H} \) of the form \( \{ f_k \}_{k \in I} = \{ T f_0 \}_{k \in I} \) for a linear operator \( T \); here the index set \( I \) is either \( \mathbb{Z} \) or \( \mathcal{L}_0 \). While a representation of this form is available under weak conditions on the frame, the analysis of the properties of the operator \( T \) requires more work. For example it is a delicate issue to obtain a representation with a bounded operator, and the availability of such a representation not only depends on the frame considered as a set, but also on the chosen indexing. Using results from operator theory we show that by embedding the Hilbert space \( \mathcal{H} \) into a larger Hilbert space, we can always represent a frame via iterations of a bounded operator, composed with the orthogonal projection onto \( \mathcal{H} \). The paper closes with a discussion of an open problem concerning representations of Gabor frames via iterations of a bounded operator.
Operator Representations of Frames: Boundedness, Duality, and Stability

The purpose of the paper is to analyze frames \((\text{Formula presented.})\) having the form \((\text{Formula presented.})\) for some linear operator \((\text{Formula presented.})\). A key result characterizes boundedness of the operator \(T\) in terms of shift-invariance of a certain sequence space. One of the consequences is a characterization of the case where the representation \((\text{Formula presented.})\) can be achieved for an operator \(T\) that has an extension to a bounded bijective operator \((\text{Formula presented.})\). In this case we also characterize all the dual frames that are representable in terms of iterations of an operator \(V\); in particular we prove that the only possible operator is \((\text{Formula presented.})\). Finally, we consider stability of the representation \((\text{Formula presented.})\) rather surprisingly, it turns out that the possibility to represent a frame on this form is sensitive towards some of the classical perturbation conditions in frame theory. Various ways of avoiding this problem will be discussed. Throughout the paper the results will be connected with the operators and function systems appearing in applied harmonic analysis, as well as with general group representations.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science , Mathematics
Authors: Christensen, O. (Intern), Hasannasab, M. (Intern)
Pages: 483-499
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Integral Equations and Operator Theory
Volume: 88
Issue number: 4
ISSN (Print): 0378-620X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.072 SJR 1.076 CiteScore 0.77
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.78 SJR 1.119 SNIP 1.069
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.418 SNIP 1.265 CiteScore 0.93
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.144 SNIP 1.469 CiteScore 0.83
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.129 SNIP 1.179 CiteScore 0.8
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.191 SNIP 1.315 CiteScore 0.81
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.046 SNIP 1.003 CiteScore 0.62
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.759 SNIP 0.923
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.015 SNIP 0.763
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.816 SNIP 0.791
Scopus rating (2007): SJR 1.256 SNIP 1.438
Scopus rating (2006): SJR 0.859 SNIP 0.958
Scopus rating (2005): SJR 1.147 SNIP 1.257
Scopus rating (2004): SJR 0.978 SNIP 1.297
Optimal allocation of reviewers for peer feedback

Peer feedback is the act of letting students give feedback to each other on submitted work. There are multiple reasons to use peer feedback, including students getting more feedback, time saving for teachers and increased learning by letting students reflect on work by others. In order for peer feedback to be effective students should give and receive useful feedback. A key challenge in peer feedback is allocating the feedback givers in a good way. It is important that reviewers are allocated to submissions such that the feedback distribution is fair - meaning that all students receive good feedback.

In this paper we present a novel way to intelligently allocate reviewers for peer feedback. We train a statistical model to infer the quality of feedback based on a dataset of feedback quality evaluations. This dataset contains more than 20,000 reviews where the receiver of the feedback has indicated the quality of the feedback. Using this model together with historical data we calculate the feedback-giving skill of each student and uses that as input to an allocation algorithm that assigns submissions to reviewers, in order to optimize the feedback quality for all students.

We test the performance of our allocation strategy using real data from over 600 peer feedback sessions and simulate the effects of different allocation strategies. By comparing our method with a random allocation algorithm and a "super-informed oracle" algorithm we demonstrate that we are able to allocate reviewers to submissions in such a way that all submissions receive feedback of similar quality and that we are able to significantly outperform simple random allocation of reviewers. Additionally we investigate the effect of pre-allocating reviews in comparison to allocating reviewers live during the review process and show that live-allocation leads to better results. Our method is robust to reviews not being completed and other real-life quirks and improves as more feedback data is collected.

Optimistic and pessimistic self-assessment of own diets is associated with age, self-rated health and weight status in Danish adults
The aim of this study was to analyse concordance between Danish adults’ recorded diet quality and their own assessment of the healthiness and to examine socio-demographic, health and behavioural characteristics associated with an optimistic or pessimistic self-assessment. Data were derived from The Danish National Survey of Diet and Physical Activity 2011-2013 and included a random sample of 3014 adults (18-75 y). Diet quality was evaluated on the basis of seven-day pre-coded food diaries and categorised ‘unhealthy’, ‘somewhat healthy’ and ‘healthy’. Self-assessment of the healthiness of own diets was registered via personal interviews and categorised healthy enough ‘to a high degree’, ’to some degree’ or ’not at all/only partly’. Highly and somewhat optimistic self-assessment, respectively, were defined as assessing own diets as healthy enough to a high degree or to some degree while having unhealthy diets. Highly and somewhat pessimistic self-assessment, respectively, were defined as assessing own diets as not healthy enough or healthy enough to some degree while having healthy diets. Multiple logistic regression models were used to examine characteristics associated with optimistic and pessimistic self-assessments, respectively. Among individuals with unhealthy diets, 13% were highly optimistic and 42% somewhat optimistic about the healthiness of their diets. Among individuals with healthy diets, 14% were highly pessimistic and 51% somewhat pessimistic about the healthiness of their diets. Highly optimistic self-assessment was associated with increasing age, excellent self-rated health, normal weight and a moderate activity level. Highly pessimistic self-assessment was associated with decreasing age, good self-rated health and being overweight or obese. The findings indicate that people seem to use personal health characteristics as important references when assessing the healthiness of their diets.
Optimization of hospital ward resources with patient relocation using Markov chain modeling

Overcrowding of hospital wards is a well-known and often revisited problem in the literature, yet it appears in many different variations. In this study, we present a mathematical model to solve the problem of ensuring sufficient beds to hospital wards by re-distributing beds that are already available to the hospital. Patient flow is modeled using a homogeneous continuous-time Markov chain and optimization is conducted using a local search heuristic. Our model accounts for patient relocation, which has not been done analytically in literature with similar scope. The study objective is to ensure that patient occupancy is reflected by our Markov chain model, and that a local optimum can be derived within a reasonable runtime. Using a Danish hospital as our case study, the Markov chain model is statistically found to reflect occupancy of hospital beds by patients as a function of how hospital beds are distributed. Furthermore, our heuristic is found to efficiently derive the optimal solution. Applying our model to the hospital case, we found that relocation of daily arrivals can be reduced by 11.7% by re-distributing beds that are already available to the hospital.

General information
State: Published
Organisations: Department of Management Engineering, Management Science, Operations Research, Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Aalborg University
Authors: Andersen, A. R. (Intern), Nielsen, B. F. (Intern), Reinhardt, L. B. (Ekstern)
Pages: 1152-1163
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: European Journal of Operational Research
Volume: 260
Issue number: 1
ISSN (Print): 0377-2217
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.08 SJR 2.437 SNIP 2.375
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.83 SJR 2.489 SNIP 2.433
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.225 SNIP 2.364 CiteScore 3.59
Optimization on Spaces of Curves
This thesis is concerned with computational and theoretical aspects of Riemannian metrics on spaces of regular curves, and their applications. It was recently proved that second order constant coefficient Sobolev metrics on curves are geodesically complete. We extend this result to the case of Sobolev metrics with coefficient functions depending on the length of the curve. We show how to apply this result to analyse a wide range of metrics on the submanifold of unit and constant speed curves.

We present a numerical discretization of second order Sobolev metrics on the space of regular curves in $\mathbb{R}^d$, and methods to solve the initial and boundary value problem for geodesics allowing us to compute the Karcher mean and principal components analysis of data of curves. We apply the methods to study shape variation in synthetic data in the Kimia
shape database, in HeLa cell nuclei and cycles of cardiac deformations.

Finally we investigate a new application of Riemannian shape analysis in shape optimization. We setup a simple elliptic model problem, and describe how to apply shape calculus to obtain directional derivatives in the manifold of planar curves. We present an implementation based on parametrization of immersions by B-splines, which ties in naturally with Isogeometric Analysis to solve the PDE. We give numerical examples of solutions, and compare the Riemannian optimization algorithms with different choices of metrics to a naive unregularized discretize-first approach.
Paley-wiener type perturbations of frames and the deviation from perfect reconstruction

Frame theory is an efficient tool to obtain expansions of elements in separable Hilbert spaces that are similar to the ones obtained via orthonormal bases, however, with considerably more flexibility. In this paper we give a survey of known results about frame expansions and perturbation theory, combined with an extension to approximately dual frames. We will show, e.g., that perturbation of a pair of dual frames in the Paley-Wiener sense leads to a deviation from perfect reconstruction that can be controlled in terms of the frame bounds of the involved sequences. The paper contains an Appendix, which motivates the analysis of frames via classical results.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics, Universidad Nacional de San Luis
Paper-Based Digital Microfluidic Chip for Multiple Electrochemical Assay Operated by a Wireless Portable Control System

The printing and modular fabrication of a paper-based active microfluidic lab on a chip implemented with electrochemical sensors (ECSs) is developed and integrated on a portable electrical control system. The electrodes of a chip plate for active electrowetting actuation of digital drops and an ECS for multiple analysis assays are fabricated by affordable printing techniques. For enhanced sensitivity of the sensor, the working electrode is modified through the electrochemical method, namely by reducing graphene with voltammetry and coating gold nanoparticles by amperometry. Detachable sensor and absorber modules are assembled modularly on an open chip plate, forming various novel hybridized open–closed chip formats. By varying the coupled or decoupled sensor modules, excellent detection of three diagnostic biological molecules is demonstrated (glucose, dopamine, and uric acid in human serum). With a newly designed portable power supply and wireless control system, the active paper-based chip platform can be utilized as an advanced point-of-care device for multiple assays in digital microfluidics.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, Chulalongkorn University, Sogang University
Number of pages: 8
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Advanced Materials Technologies
Volume: 2
Issue number: 3
ISSN (Print): 2365-709x
Ratings:
Web of Science (2017): Indexed yes
Web of Science (2016): Indexed yes
Pathway computation in models derived from bio-science text sources
This paper outlines a system, OntoScape, serving to accomplish complex inference tasks on knowledge bases and bio-
models derived from life-science text corpora. The system applies so-called natural logic, a form of logic which is readable
for humans. This logic affords ontological representations of complex terms appearing in the text sources. Along with
logical propositions, the system applies a semantic graph representation facilitating calculation of bio-pathways. More
generally, the system affords means of query answering appealing to general and domain specific inference rules.

Performance Improvements and Congestion Reduction for Routing-based Synthesis for Digital Microfluidic Biochips
Routing-based synthesis for digital microfluidic biochips yields faster assay execution times compared to module-based
synthesis. We show that routing-based synthesis can lead to deadlocks and livelocks in specific cases, and that
dynamically detecting them and adjusting the probabilities associated with different droplet movements can alleviate the
situation. We also introduce methods to improve the efficiency of wash droplet routing during routing-based synthesis, and
to support non-reconfigurable modules, such as integrated heaters and detectors. We obtain increases in success rates
when dealing with resource-constrained chips and reductions in average assay execution time.
Phenomenological theory of collective decision-making

An essential task of groups is to provide efficient solutions for the complex problems they face. Indeed, considerable efforts have been devoted to the question of collective decision-making related to problems involving a single dominant feature. Here we introduce a quantitative formalism for finding the optimal distribution of the group members’
competences in the more typical case when the underlying problem is complex, i.e., multidimensional. Thus, we consider teams that are aiming at obtaining the best possible answer to a problem having a number of independent sub-problems. Our approach is based on a generic scheme for the process of evaluating the proposed solutions (i.e., negotiation). We demonstrate that the best performing groups have at least one specialist for each sub-problem â€“ but a far less intuitive result is that finding the optimal solution by the interacting group members requires that the specialists also have some insight into the sub-problems beyond their unique field(s). We present empirical results obtained by using a large-scale database of citations being in good agreement with the above theory. The framework we have developed can easily be adapted to a variety of realistic situations since taking into account the weights of the sub-problems, the opinions or the relations of the group is straightforward. Consequently, our method can be used in several contexts, especially when the optimal composition of a group of decision-makers is designed.
In this preliminary work, we present our current status on how to use single-camera photogrammetry to determine the orientation of an additively manufactured partly finished object that has been repositioned in the printing chamber, from a single image taken with a calibrated camera, and comparing this to the CAD model of the object. We describe how this knowledge can be used to update the machine code of the printer, such that printing of the object can be resumed in the new location. This opens possibilities for embedding and assembling foreign parts into the additive manufacturing pipeline, adding another layer of flexibility to the process. However, due to various errors sources in estimating the orientation of the object, more work is needed before this update can be applied.

**General information**

**State:** Published

**Organisations:** Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Department of Mechanical Engineering, Manufacturing Engineering

**Authors:** Jensen, J. N. (Intern), Lyngby, R. A. (Intern), Aanæs, H. (Intern), Eiríksson, E. R. (Intern), Nielsen, J. B. (Intern), Wilm, J. (Intern), Pedersen, D. B. (Intern)

**Number of pages:** 3

**Publication date:** 2017

**Host publication information**

**Title of host publication:** Joint Special Interest Group meeting between euspen and ASPE

**Main Research Area:** Technical/natural sciences

**Conference:** euspen and ASPE Special Interest Group Meeting: Additive Manufacturing, Leuven, Belgium, 10/10/2017 - 10/10/2017

**Repositioning, Photogrammetry, Computer vision, Additive manufacturing**

**Source:** PublicationPreSubmission

**Source-ID:** 139558095

**Publication:** Research - peer-review › Article in proceedings – Annual report year: 2017

**PicPrint: Embedding pictures in additive manufacturing**

Here we present PicPrint, a method and tool for producing an additively manufactured lithophane, enabling transferring and embedding 2D information into additively manufactured 3D objects. The method takes an input image and converts it to a corresponding height-map, indicating the material density required to achieve a brightness specified at any given location. Non-linear scattering properties are compensated for using predefined falloff profiles. Using the produced height-map, a watertight mesh is distorted to match the specified material densities, after which the mesh is ready for either direct printing on an additive manufacturing system, or transfer to other geometries via Boolean mesh operations.

**General information**

**State:** Published

**Organisations:** Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Department of Mechanical Engineering, Manufacturing Engineering

Pillar-type acoustic metasurface
We theoretically investigate acoustic metasurfaces consisting of either a single pillar or a line of identical pillars on a thin plate, and we report on the dependence on the geometrical parameters of both the monopolar compressional and dipolar bending modes. We show that for specific dimensions of the resonators, bending and compressional modes may be simultaneously excited. We study their interaction with an antisymmetric Lamb wave, whether or not they occur at the same frequency, with particular consideration for the amplitude and phase of waves emitted by the pillars at resonance. Especially, the analysis of both the amplitude and the phase of the wave at the common resonant frequency downstream from a line of pillars demonstrates that the reemitted waves allow for the transmission with phase shift of $\pi$. 

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Université de Lille, Pierre and Marie Curie University - University of Paris VI
Authors: Jin, Y. (Ekstern), Bonello, B. (Ekstern), Moiseyenko, R. (Intern), Pennec, Y. (Ekstern), Boyko, O. (Ekstern), Djafari-Rouhani, B. (Ekstern)
Number of pages: 8
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Physical Review B
Volume: 96
Issue number: 10
Article number: 104311
ISSN (Print): 2469-9950
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.34 SJR 1.604 SNIP 1.04
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 3.16 SJR 2.339 SNIP 1.151
Web of Science (2016): Indexed yes
Scopus rating (2015): SJR 2.377 SNIP 1.13 CiteScore 2.8
Web of Science (2015): Indexed yes
Scopus rating (2014): SJR 2.762 SNIP 1.316 CiteScore 3.3
Web of Science (2014): Indexed yes
Scopus rating (2013): SJR 2.813 SNIP 1.326 CiteScore 3.55
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Scopus rating (2012): SJR 3.173 SNIP 1.378 CiteScore 3.57
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Scopus rating (2011): SJR 3.326 SNIP 1.423 CiteScore 3.61
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
Polynomial Collocation for Handling an Inaccurately Known Measurement Configuration in Electrical Impedance Tomography

The objective of electrical impedance tomography is to reconstruct the internal conductivity of a physical body based on measurements of current and potential at a finite number of electrodes attached to its boundary. Although the conductivity is the quantity of main interest in impedance tomography, a real-world measurement configuration includes other unknown parameters as well: The information on the contact resistances, electrode positions, and body shape is almost always incomplete. In this work, the dependence of the electrode measurements on all aforementioned model properties is parametrized via polynomial collocation. The availability of such a parametrization enables efficient simultaneous reconstruction of the conductivity and other unknowns by a Newton-type output least squares algorithm, which is demonstrated by two-dimensional numerical experiments based on both noisy simulated data and experimental data from two water tanks.

General information
State: Published
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Pages: 202-23
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: SIAM Journal on Applied Mathematics
Volume: 77
Issue number: 1
ISSN (Print): 0036-1399
Ratings:
BFI (2018): BFI-level 2
Let $F[[z; s, d]]$ be a ring of Ore polynomials over a field. We give a new deterministic algorithm for computing the Popov form $P$ of a non-singular matrix $A \in F[[z; s, d]]^{n\times n}$. Our main focus is to ensure controlled growth in the size of coefficients from $F$ in the case $F = k(z)$, and even $k = Q$. Our algorithms are based on constructing from $A$ a linear system over $F$ and performing a structured fraction-free Gaussian elimination. The algorithm is output sensitive, with a cost that depends on the orthogonality defect of the input matrix: the sum of the row degrees in $A$ minus the sum of the row degrees in $P$. The resulting bit-complexity for the differential and shift polynomial case over $Q(z)$ improves upon the previous best.
Prediction of Motion Induced Image Degradation Using a Markerless Motion Tracker

In this work a markerless motion tracker, TCL2, is used to predict image quality in 3D T1 weighted MPRAGE MRI brain scans. An experienced radiologist scored the image quality for 172 scans as being usable or not usable, i.e. if a repeated scan was required. Based on five motion parameters, a classification algorithm was trained and an accuracy for identifying not usable images of 95.9% was obtained with a sensitivity of 91.7% and specificity of 96.3%. This work shows the feasibility of the markerless motion tracker for predicting image quality with a high accuracy.

Prediction of pork quality parameters by applying fractals and data mining on MRI

This work firstly investigates the use of MRI, fractal algorithms and data mining techniques to determine pork quality parameters non-destructively. The main objective was to evaluate the capability of fractal algorithms (Classical Fractal algorithm, CFA; Fractal Texture Algorithm, FTA and One Point Fractal Texture Algorithm, OPFTA) to analyse MRI in order to predict quality parameters of loin. In addition, the effect of the sequence acquisition of MRI (Gradient echo, GE; Spin echo, SE and Turbo 3D, T3D) and the predictive technique of data mining (Isotonic regression, IR and Multiple linear regression, MLR) were analysed. Both fractal algorithm, FTA and OPFTA are appropriate to analyse MRI of loins. The sequence acquisition, the fractal algorithm and the data mining technique seems to influence on the prediction results. For most physico-chemical parameters, prediction equations with moderate to excellent correlation coefficients were achieved by using the following combinations of acquisition sequences of MRI, fractal algorithms and data mining techniques: SE-FTA-MLR, SE-OPFTA-IR, GE-OPFTA-MLR, SE-OPFTA-MLR, with the last one offering the best prediction results. Thus, SE-OPFTA-MLR could be proposed as an alternative technique to determine physico-chemical traits of fresh and dry-cured loins in a non-destructive way with high accuracy.
Preface for the special issue on Interaction and Concurrency Experience 2015

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Formal Methods, University of Bologna, Universite de Lorraine, IMT Institute for Advanced Studies Lucca
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Number of pages: 1
Pages: 1
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Logical and Algebraic Methods in Programming
Volume: 86
Issue number: 1
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): CiteScore 0.86 SJR 0.325 SNIP 0.959
Web of Science (2017): Indexed Yes
Scopus rating (2016): CiteScore 0.88 SJR 0.346 SNIP 1.171
Scopus rating (2015): SJR 0.243 SNIP 1.121 CiteScore 0.55
Original language: English
DOIs:
10.1016/j.jlamp.2016.10.003
Source: FindIt
Source-ID: 2349359314
Publication: Research - peer-review › Editorial – Annual report year: 2017

Probabilistic models for structured sparsity
Sparsity has become an increasingly popular choice of regularization in machine learning and statistics. The sparsity assumption for a matrix X means that most of the entries in X are equal to exactly zero. Structured sparsity is a generalization of sparsity and assumes that the set of locations of the non-zero coefficients in X contains structure that can be exploited. This thesis deals with probabilistic models for structured sparsity for regularization of ill-posed problems. The aim of the thesis is two-fold; to construct sparsity promoting prior distributions for structured sparsity and to derive efficient inference algorithms for these distributions. The work explores a class of models that uses Gaussian processes (Rasmussen and Williams, 2006) as a latent representation of the structure of sparsity patterns. This representation allows prior knowledge of the structure of the sparsity patterns to be encoded using generic covariance functions through the Gaussian process. This thesis focuses on two specific instances of ill-posed problems: linear inverse problems and time-varying covariance estimation. The first part of the thesis deals with probabilistic models for structured sparsity. This part of the thesis deals with the problem of finding sparse solutions to linear inverse problems. The proposed model and the associated inference algorithm are studied and evaluated using a set of numerical experiments, which include phase transition experiments, compressed sensing, phoneme classification and electroencephalography (EEG) source localization. The second part of the thesis deals with the problem of time-varying covariance estimation. A hierarchical model for a set of non-stationary time series with time-varying covariance matrices is proposed. The model is tailored to address the problem of dynamic functional connectivity in neuroimaging and it assumes that the instantaneous covariance matrix of each time series is decomposed into a non-negative linear combination of elements from a dictionary of shared covariance matrix components. A variational Bayes algorithm is derived for approximate posterior inference. The proposed model is validated using a functional magnetic resonance imaging (fMRI) dataset.
Process chain for fabrication of anisotropic optical functional surfaces on polymer components

This paper aims to introduce a process chain for fabrication of anisotropic optical functional surfaces on polymer products. The surface features under investigation are composed of micro serrated ridges. The scope was to maximize the visible contrast between horizontally orthogonal textured surfaces from a certain viewing angle. The process chain comprised three steps: tooling, replication, and quality assurance. Tooling was achieved by precision micro milling. Replication processes such as injection moulding, hot embossing, blow moulding, etc. were employed according to the specific type of product. In order to implement the traceability of the manufacturing process, the geometry and dimension of the micro structure on the tool and the replica were assessed via metrological methods. The functionality of the anisotropic surfaces on the polymer replicas were evaluated by a gonioreflectometer and image processing. Eventually, according to the function evaluation of polymer products, the process chain steps will be optimized by tuning the tooling and moulding processes.

Propagation of singularities for linearised hybrid data impedance tomography

For a general formulation of linearised hybrid inverse problems in impedance tomography, the qualitative properties of the solutions are analysed. Using an appropriate scalar pseudo-differential formulation, the problems are shown to permit propagating singularities under certain non-elliptic conditions, and the associated directions of propagation are precisely identified relative to the directions in which ellipticity is lost. The same result is found in the setting for the corresponding normal formulation of the scalar pseudo-differential equations. A numerical reconstruction procedure based of the least squares finite element method is derived, and a series of numerical experiments visualise exactly how the loss of ellipticity manifests itself as propagating singularities.
Pseudospherical surfaces with singularities
We study a generalization of constant Gauss curvature −1 surfaces in Euclidean 3-space, based on Lorentzian harmonic maps, that we call pseudospherical frontals. We analyse the singularities of these surfaces, dividing them into those of characteristic and non-characteristic type. We give methods for constructing all non-degenerate singularities of both types, as well as many degenerate singularities. We also give a method for solving the singular geometric Cauchy problem: construct a pseudospherical frontal containing a given regular space curve as a non-degenerate singular curve. The solution is unique for most curves, but for some curves there are infinitely many solutions, and this is encoded in the curvature and torsion of the curve.

General information
State: Published
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Pages: 905–928
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Annali di Matematica Pura ed Applicata
Volume: 196
Issue number: 3
ISSN (Print): 0373-3114
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.127 SJR 1.197 CiteScore 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.81 SJR 1.151 SNIP 0.998
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.197 SNIP 0.964 CiteScore 0.7
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.955 SNIP 0.875 CiteScore 0.74
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.891 SNIP 1.248 CiteScore 0.77
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.02 SNIP 0.992 CiteScore 0.73
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.486 SNIP 1.158 CiteScore 0.82
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.774 SNIP 1.167
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.268 SNIP 1.527
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.373 SNIP 1.432
Scopus rating (2007): SJR 0.829 SNIP 1.252
Scopus rating (2006): SJR 0.921 SNIP 1.203
Scopus rating (2005): SJR 0.418 SNIP 0.739
Scopus rating (2004): SJR 0.482 SNIP 0.661
Scopus rating (2003): SJR 0.518 SNIP 0.612
Scopus rating (2002): SJR 0.539 SNIP 0.799
The act of producing content - for example in forms of written reports - is one of the most used methods for teaching and learning all the way from primary school to university. It is a learning tool which helps students relate their theories to practice. Getting relevant and helpful feedback on this work is important to ensure a good learning experience for the students. Providing this feedback is often a time-consuming job for the teacher. An effective way to learn is to teach others, and similarly give feedback on work done by others. One way to approach a combined solution to the above challenges, is to use peer assessment in the classroom which as a learning method has become more and more popular.

In this paper we look at data collected using the web-based peer assessment system Peergrade. The dataset consists of over 350 courses at more than 20 educational institutions and with a total of more than 10,000 students. The students have together made more than 100,000 peer-evaluations of work by other students, and these evaluations together contain more than 10,000,000 words of text feedback. A key problem when using peer assessment is to ensure high quality feedback between peers. Feedback here can be a combination of quantitative / summative feedback (numerical) and qualitative / formative feedback (text). A lot of work has been done on validating and ensuring quality of quantitative feedback. We propose a way to let students evaluate the quality of the feedback they receive to obtain a quality measure for the feedback. We investigate this measure of feedback quality, which biases are present and what trends can be observed across the dataset. Using our measure of feedback quality, we investigate how it relates to various factors like the length of the feedback text, the number of spelling mistakes, how positive it is and measures of the student’s report-writing skills.

Quantifying functional connectivity in multi-subject fMRI data using component models

Functional magnetic resonance imaging (fMRI) is increasingly used to characterize functional connectivity between brain regions. Given the vast number of between-voxel interactions in high-dimensional fMRI data, it is an ongoing challenge to detect stable and generalizable functional connectivity in the brain among groups of subjects. Component models can be used to define subspace representations of functional connectivity that are more interpretable. It is, however, unclear which component model provides the optimal representation of functional networks for multi-subject fMRI datasets. A flexible cross-validation approach that assesses the ability of the models to predict voxel-wise covariance in new data, using three different measures of generalization was proposed. This framework is used to compare a range of component models with varying degrees of flexibility in their representation of functional connectivity, evaluated on both simulated and experimental resting-state fMRI data. It was demonstrated that highly flexible subject-specific component subspaces, as well as very constrained average models, are poor predictors of whole-brain functional connectivity, whereas the best-generalizing models account for subject variability within a common spatial subspace. Within this set of models, spatial Independent Component Analysis (sICA) on concatenated data provides more interpretable brain patterns, whereas a consistent-covariance model that accounts for subject-specific network scaling (PARAFAC2) provides greater stability in
functional connectivity relationships between components and their spatial representations. The proposed evaluation framework is a promising quantitative approach to evaluating component models, and reveals important differences between subspace models in terms of predictability, robustness, characterization of subject variability, and interpretability of the model parameters. Hum Brain Mapp, 2016.
Quantitative evaluation of peptide analogue distribution in mouse tissue using 3D computer modelling

The use of automated image analysis of microscopy images is increasing to enable high throughput approaches and unbiased analysis of the increasingly large data sets produced. This thesis investigates the use of automated image analysis to quantify peptide analogue distribution in mouse brain tissue. The main group of peptides included in this work was glucagon-like peptide 1 receptors agonists (GLP-1RA) used for treatment in diabetes and obesity. Two main image modalities have been applied for image acquisition; Light Sheet Fluorescence Microscopy (LSFM), and slide scanner images of 2D histology sections. The work demonstrates the use of automated image analysis based on image registration to quantify LSFM data of the peptide brain distribution following peripheral administration. The methodology was expanded during the PhD work to also include study of receptor mapping and brain activation. The automated analysis was enabled by integration with a digital multimodality brain atlas from the Allen Institute of Brain Science (AIBS). The work showed that GLP-1RAs accessed multiple brain regions mainly in the hypothalamus and hindbrain and led to increased brain activation in regions related to decreased food intake. The developed integrated brain atlas provides a novel analysis approach for LSFM data to aid researchers understand the complex brain biology related to development of pharmaceuticals with brain mode of action.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics
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Number of pages: 158
Publication date: 2017

Publication information
Publisher: Technical University of Denmark (DTU)
Original language: English

Series: DTU Compute PHD-2017
Volume: 458
ISSN: 0909-3192
Main Research Area: Technical/natural sciences
Electronic versions: phd458_Jensen_CB.pdf

Relations
Projects:
Quantitative evaluation of peptide analogue distribution in mouse tissue using 3D computer modelling
Publication: Research › Ph.D. thesis – Annual report year: 2017

Quantitatively Measured Anatomic Location and Volume of Optic Disc Drusen: An Enhanced Depth Imaging Optical Coherence Tomography Study
Optic disc drusen (ODD) are found in up to 2.4% of the population and are known to cause visual field defects. The purpose of the current study was to investigate how quantitatively estimated volume and anatomic location of ODD influence optic nerve function. Anatomic location, volume of ODD, and peripapillary retinal nerve fiber layer and macular ganglion cell layer thickness were assessed in 37 ODD patients using enhanced depth imaging optical coherence tomography. Volume of ODD was calculated by manual segmentation of ODD in 97 B-scans per eye. Anatomic characteristics were compared with optic nerve function using automated perimetric mean deviation (MD) and multifocal visual evoked potentials. Increased age (P = 0.015); larger ODD volume (P = 0.002); and more superficial anatomic ODD location (P = 0.007) were found in patients with ODD visible by ophthalmoscopy compared to patients with buried ODD. In a multivariate analysis, a worsening of MD was significantly associated with larger ODD volume (P <0.0001). No association was found between MD and weighted anatomic location, age, and visibility by ophthalmoscopy. Decreased ganglion cell layer thickness was significantly associated with worse MD (P = 0.025) and had a higher effect on MD when compared to retinal nerve fiber layer thickness. Large ODD volume is associated with optic nerve dysfunction. The worse
visual field defects associated with visible ODD should only be ascribed to larger ODD volume and not to a more superficial anatomic ODD location.
Querying Natural Logic Knowledge Bases

This paper describes the principles of a system applying natural logic as a knowledge base language. Natural logics are regimented fragments of natural language employing high level inference rules. We advocate the use of natural logic for knowledge bases dealing with querying of classes in ontologies and class-relationships such as are common in life-science descriptions. The paper adopts a version of natural logic with recursive restrictive clauses such as relative clauses and adnominal prepositional phrases. It includes passive as well as active voice sentences. We outline a prototype for partial translation of natural language into natural logic, featuring further querying and conceptual path finding in natural logic knowledge bases.

QuickChecking static analysis properties

A static analysis can check programs for potential errors. A natural question that arises is therefore: who checks the checker? Researchers have given this question varying attention, ranging from basic testing techniques, informal monotonicity arguments, thorough pen-and-paper soundness proofs, to verified fixed point checking. In this paper, we demonstrate how quickchecking can be useful to test a range of static analysis properties with limited effort. We show how to check a range of algebraic lattice properties, to help ensure that an implementation follows the formal specification of a lattice. Moreover, we offer a number of generic, type-safe combinators to check transfer functions and operators on lattices, to help ensure that these are, eg, monotone, strict, or invariant. We substantiate our claims by quickchecking a type analysis for the Lua programming language.
A cochlear implant is an electronic device which can restore sound to completely or partially deaf patients. For surgical planning, a patient-specific model of the inner ear must be built using high-resolution images accurately segmented. We propose a new framework for segmentation of micro-CT cochlear images using random walks, where a region term estimated by a Gaussian mixture model is combined with a shape prior initially obtained by a statistical shape model (SSM). The region term can then take advantage of the high contrast between the background and foreground, while the shape prior guides the segmentation to the exterior of the cochlea and to less contrasted regions inside the cochlea. The prior is obtained via a non-rigid registration regularized by a statistical shape model. The SSM constrains the inner parts of the cochlea and ensures valid output shapes of the inner ear.

**Random walks with statistical shape prior for cochlea and inner ear segmentation in micro-CT images**

**General information**

**State:** Published  
**Organisations:** Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Scientific Computing, Universitat Pompeu Fabra  
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**Number of pages:** 10  
**Pages:** 1-10  
**Publication date:** 2017  
**Main Research Area:** Technical/natural sciences  

**Publication information**

**Journal:** Machine Vision & Applications  
**ISSN (Print):** 0932-8092  
**Ratings:**  
BFI (2018): BFI-level 1  
Web of Science (2018): Indexed yes  
BFI (2017): BFI-level 1  
Scopus rating (2017): SNIP 1.601 SJR 0.485 CiteScore 2.62  
Web of Science (2017): Indexed Yes  
BFI (2016): BFI-level 1  
Scopus rating (2016): CiteScore 2.46 SJR 0.741 SNIP 1.386  
BFI (2015): BFI-level 1  
Scopus rating (2015): SJR 0.692 SNIP 1.612 CiteScore 2.23  
BFI (2014): BFI-level 1  
Scopus rating (2014): SJR 0.466 SNIP 1.883 CiteScore 1.84  
Web of Science (2014): Indexed yes  
BFI (2013): BFI-level 1
Rapid ice unloading in the Fleming Glacier region, southern Antarctic Peninsula, and its effect on bedrock uplift rates

Rapid regional warming in the Antarctic Peninsula has led to the significant retreat and eventual collapse of several major ice shelves since the 1970s, triggering the subsequent acceleration and thinning of their feeding glaciers. The Wordie Ice Shelf, lying off the west coast of the Antarctic Peninsula, has undergone long-term disintegration since the 1960s with a substantial calving event occurring around 1989, followed by continuous steady retreat and its almost-complete disappearance. The dynamic response of the upstream glaciers to the ice shelf collapse and the response of the solid Earth to the associated mass loss are not fully understood. To quantify the mass loss from the system, we generated a digital elevation model (DEM) using airborne vertical and oblique imagery from 1966 and compared it to a DEM derived from 2008 SPOT data. This analysis reveals lowering over that time of approximately 60 m at the front of Fleming Glacier. Using IceBridge and ICESat-2/GLAS data spanning 2002–2014, we show an increased rate of mean ice-surface lowering, with rates post-2008 more than twice those of 2002–2008. We use these load change data as a basis for the simulation of viscoelastic solid Earth deformation. We subtract modeled elastic deformation rates, and a suite of modeled viscous rates, from GPS-derived three-dimensional bedrock velocities at sites to the south of Fleming Glacier to infer properties of Earth rheology. Assuming the pre-breakup bedrock uplift was positive due to post-Last Glacial Maximum (LGM) ice retreat, our viscoelastic-corrected GPS uplift rates suggest upper mantle viscosities are \( >2 \times 10^{19} \) Pas and likely \( >1 \times 10^{20} \) Pas in this region, 1–2 orders of magnitude greater than previously found for the northern Antarctic Peninsula. Horizontal velocities at the GPS site nearest the Fleming Glacier, after the application of elastic and plate tectonic corrections, point away from Marguerite Bay rather than the present glacier front. This suggests that horizontal motion in the region reflects the earlier retreat of the glacier system following the LGM, compatible with a relatively strong mantle in this region. These findings highlight the need for improved understanding of ice load changes in this region through the late Holocene in order to accurately model glacial isostatic adjustment.

General information
Rationalization in architecture with surfaces foliated by elastic curves

We develop methods for rationalization of CAD surfaces using elastic curves, aiming at a costeffective fabrication method for architectural designs of complex shapes. By moving a heated flexible metal rod though a block of expanded polystyrene, it is possible to produce shapes with both positive and negative Gaussian curvature, either for direct use or for use as moulds for concrete casting. If we can control the shape of the rod, while moving, we can produce prescribed shapes.

The flexible rod assumes at all times the shape of an Euler elastica (or elastic curve). The elastica are given in closed analytic form using elliptic functions. We use a gradient-driven optimization to approximate arbitrary planar curves by planar elastic curves. The method depends on an explicit parameterization of the space of elastic curves and on a method for finding a good initial guess for the optimization.

We approximate CAD surfaces by first extracting a collection of planar surface curves and approximating these by elastica. Providing the data for these curves to robots holding the flexible rod, we can produce an elastica-foliated surface that approximates the given CAD surface. Since not all surfaces can be closely approximated by an elastica-foliated surface, an arbitrary CAD surface must first be subdivided into segments that can be approximated. We discuss strategies for subdividing an arbitrary surface into segments that can be closely approximated, taking into account the aesthetics of the segmentation and the production constraints. If the given surface is smooth, we want the approximating surface to be smooth as well, so we must ensure smooth transition between the surface segments of the final result.

As an alternative to rationalization of arbitrary designs, we also present a method for direct generation of design surfaces using foliated Euler elastica. Here we work from a grid of blocks, so the segmentation is given, but we must still ensure smooth transition between segments.
processors. The evaluation of the system shows that real-time processing of multiple effect configurations is possible, and that the estimation and control of latency ensures real-time behavior.

**General information**
State: Published
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Number of pages: 6
Publication date: 2017

**Host publication Information**
Title of host publication: Proceedings of IEEE 11th International Symposium on Embedded Multicore/Many-core Systems-on-Chip
Publisher: IEEE
Main Research Area: Technical/natural sciences
Electronic versions: dspapp.pdf
Source: PublicationPreSubmission
Source-ID: 140261845
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

**Real Time MRI Motion Correction with Markerless Tracking**
Prospective motion correction for MRI neuroimaging has been demonstrated using MR navigators and external tracking systems using markers. The drawbacks of these two motion estimation methods include prolonged scan time plus lack of compatibility with all image acquisitions, and difficulties validating marker attachment resulting in uncertain estimation of the brain motion respectively. We have developed a markerless tracking system, and in this work we demonstrate the use of our system for prospective motion correction, and show that despite being computationally demanding, markerless tracking can be implemented for real time motion correction.

**General information**
State: Published
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Publication date: 2017
Main Research Area: Technical/natural sciences
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

**Reducing artifacts from varying projection truncations**
We study samples with full and partial occlusion causing streak artifacts, and propose two modifications of filtered backprojection for artifact removal. Data is obtained by the SPring-8 synchrotron using a monochromatic parallel-beam scan [1]. Thresholding in the sinogram segments the metal, resulting in edges on which we apply 1) a smooth transition, or 2) a Dirichlet boundary condition.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Ostbayerische Technische Hochschule Regensburg, Technical University of Denmark, University of Copenhagen
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Number of pages: 2
Publication date: 2017
Main Research Area: Technical/natural sciences
X-ray tomography, Projection truncation, Streak artifacts, Boundary conditions
Source: FindIt
Source-ID: 2398346437
Publication: Research › Paper – Annual report year: 2018
Reducing the rate and duration of Re-ADMISSIONs among patients with unipolar disorder and bipolar disorder using smartphone-based monitoring and treatment - the RADMIS trials: Study protocol for two randomized controlled trials

Background: Unipolar and bipolar disorder combined account for nearly half of all morbidity and mortality due to mental and substance use disorders, and burden society with the highest health care costs of all psychiatric and neurological disorders. Among these, costs due to psychiatric hospitalization are a major burden. Smartphones comprise an innovative and unique platform for the monitoring and treatment of depression and mania. No prior trial has investigated whether the use of a smartphone-based system can prevent re-admission among patients discharged from hospital. The present RADMIS trials aim to investigate whether using a smartphone-based monitoring and treatment system, including an integrated clinical feedback loop, reduces the rate and duration of re-admissions more than standard treatment in unipolar disorder and bipolar disorder.

Methods: The RADMIS trials use a randomized controlled, single-blind, parallel-group design. Patients with unipolar disorder and patients with bipolar disorder are invited to participate in each trial when discharged from psychiatric hospitals in The Capital Region of Denmark following an affective episode and randomized to either (1) a smartphone-based monitoring system including (a) an integrated feedback loop between patients and clinicians and (b) context-aware cognitive behavioral therapy (CBT) modules (intervention group) or (2) standard treatment (control group) for a 6-month trial period. The trial started in May 2017. The outcomes are (1) number and duration of re-admissions (primary), (2) severity of depressive and manic (only for patients with bipolar disorder) symptoms; psychosocial functioning; number of affective episodes (secondary), and (3) perceived stress, quality of life, self-rated depressive symptoms, self-rated manic symptoms (only for patients with bipolar disorder), recovery, empowerment, adherence to medication, wellbeing, ruminations, worrying, and satisfaction (tertiary). A total of 400 patients (200 patients with unipolar disorder and 200 patients with bipolar disorder) will be included in the RADMIS trials.

Discussion: If the smartphone-based monitoring system proves effective in reducing the rate and duration of readmissions, there will be a basis for using a system of this kind in the treatment of unipolar and bipolar disorder in general and on a larger scale.
Reduction of variable-truncation artifacts from beam occlusion during in situ x-ray tomography: Paper

Many in situ x-ray tomography studies require experimental rigs which may partially occlude the beam and cause parts of the projection data to be missing. In a study of fluid flow in porous chalk using a percolation cell with four metal bars, drastic streak artifacts arise in the filtered backprojection (FBP) reconstruction at certain orientations. Projections with non-trivial variable truncation caused by the metal bars are the source of these variable-truncation artifacts. To understand the artifacts, a mathematical model of variable-truncation data as a function of metal bar radius and distance to sample is derived and verified numerically and with experimental data. The model accurately describes the arising variable-truncation artifacts across simulated variations of the experimental setup. Three variable-truncation artifact-reduction methods are proposed, all aimed at addressing sinogram discontinuities that are shown to be the source of the streaks. The ‘reduction to limited angle’ (RLA) method simply keeps only non-truncated projections; the ‘detector-directed smoothing’ (DDS) method smooths the discontinuities; while the ‘reflexive boundary condition’ (RBC) method enforces a zero derivative at the discontinuities. Experimental results using both simulated and real data show that the proposed methods effectively reduce variable-truncation artifacts. The RBC method is found to provide the best artifact reduction and preservation of image features using both visual and quantitative assessment. The analysis and artifact-reduction methods are designed in context of FBP reconstruction motivated by computational efficiency practical for large, real synchrotron data. While a specific variable-truncation case is considered, the proposed methods can be applied to general data cut-offs arising in different in situ x-ray tomography experiments.
Reflection ciphers

This paper investigates ciphers where the set of encryption functions is identical to the set of decryption functions, which we call reflection ciphers. Equivalently, there exists a permutation $P$, named the coupling permutation, such that decryption under $k$ corresponds to encryption under $P(k)$. We study the necessary properties for this coupling permutation. Special care has to be taken of some related-key distinguishers since, in the context of reflection ciphers, they may provide attacks in the single-key setting. We then derive some criteria for constructing secure reflection ciphers and analyze the security properties of different families of coupling permutations. Finally, we concentrate on the case of
reflection block ciphers and, as an illustration, we provide concrete examples of key schedules corresponding to several coupling permutations, which lead to new variants of the block cipher PRINCE.
Relationship between Optimum Mini-doses of Glucagon and Insulin Levels when Treating Mild Hypoglycaemia in Patients with Type 1 Diabetes - A Simulation Study

Hypoglycaemia remains the main limiting factor in type 1 diabetes management. We developed an insulin-dependent glucagon dosing regimen for treatment of mild hypoglycaemia based on simulations. A validated glucose-insulin-glucagon model was used to describe seven virtual patients with insulin pump-treated type 1 diabetes. In each simulation, one of ten different and individualized subcutaneous insulin boluses was administered to decrease plasma glucose (PG) from 7.0 to ≤3.9 mmol/l. Insulin levels were estimated as ratio of actual to baseline serum insulin concentration (se/ba-insulin), insulin on board (IOB) or percentage of IOB to total daily insulin dose (IOB/TDD). Insulin bolus sizes were chosen to provide predefined insulin levels when PG reached 3.9 mmol/l, where one of 17 subcutaneous glucagon boluses was administered. Optimum glucagon bolus to treat mild hypoglycaemia at varying insulin levels was the lowest dose that in most patients caused PG peak between 5.0 and 10.0 mmol/l and sustained PG ≥ 3.9 mmol/l for 2 hr after the bolus. PG response to glucagon declined with increasing insulin levels. The glucagon dose to optimally treat mild hypoglycaemia depended exponentially on insulin levels, regardless of how insulin was estimated. A 125-μg glucagon dose was needed to optimally treat mild hypoglycaemia when insulin levels were equal to baseline levels. In contrast, glucagon doses >500 μg were needed when se/ba-insulin >2.5, IOB >2.0 U or IOB/TDD >6%. Although the proposed model-based glucagon regimen needs confirmation in clinical trials, this is the first attempt to develop an insulin-dependent glucagon dosing regimen for treatment of insulin-induced mild hypoglycaemia in patients with type 1 diabetes.
Remarks on the boundary curve of a constant mean curvature topological disc

We discuss some consequences of the existence of the holomorphic quadratic Hopf differential on a conformally immersed constant mean curvature topological disc with analytic boundary. In particular, we derive a formula for the mean curvature as a weighted average of the normal curvature of the boundary curve, and a condition for the surface to be totally umbilic in terms of the normal curvature.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics, Universidad De Granada
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Pages: 1037-1043
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Complex Variables and Elliptic Equations
Volume: 62
Issue number: 8
ISSN (Print): 1747-6933
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.975 SJR 0.616 CiteScore 0.73
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.55 SJR 0.463 SNIP 0.846
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.624 SNIP 0.892 CiteScore 0.55
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.765 SNIP 1.182 CiteScore 0.61
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.744 SNIP 1.104 CiteScore 0.67
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.588 SNIP 0.79 CiteScore 0.5
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.752 SNIP 1.49 CiteScore 0.56
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.447 SNIP 0.509
BFI (2009): BFI-level 1
Rethinking Hearing Aid Fitting by Learning From Behavioral Patterns

The recent introduction of Internet connected hearing instruments offers a paradigm shift in hearing instrument fitting. Potentially this makes it possible for devices to adapt their settings to a changing context, inferred from user interactions. In a pilot study we enabled hearing instrument users to remotely enhance auditory focus and attenuate background noise to improve speech intelligibility. N=5, participants changed program settings and adjusted volume on their hearing instruments using their smartphones. We found that individual behavioral patterns affected the usage of the devices. A significant difference between program usage, and weekdays versus weekends, were found. Users not only changed programs to modify aspects of directionality and noise reduction, but also continuously adjusted the volume. Rethinking hearing instruments as devices that adaptively learn behavioral patterns based on user interaction, might provide a degree of personalization that has not been feasible due to lack of audiological resources.

General information
State: Published
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Number of pages: 7
Pages: 1733-1739
Publication date: 2017

Host publication information
Title of host publication: CHI’17 Extended Abstracts
Publisher: Association for Computing Machinery
ISBN (Print): 978-1-4503-4656-6
Main Research Area: Technical/natural sciences
Conference: ACM CHI 2017, Denver, United States, 06/05/2017 - 06/05/2017
Hearing impairment, User behavior, Health, Aging, Augmented audio

Risici ved midlertidige oplag af farligt gods.

[English summary] Following a major fireworks accident in Seest (2004), the statutory order implementing the EU Seveso directive in Denmark was enlarged in 2005 to cover also temporary storage of dangerous substances at transportation hubs such as marine terminals and railway yards. The rationale is quite sensible – the risk posed to nearby communities can be permanent even though the individual cargo is present temporarily only. The enlargement of order was ill conceived however, and implementation of the new measures has been troubled, in particular because transportation companies only have information on dangerous goods as provided in ADR/RID/IMO transportation documents, and the nature of this information is incompatible with the Seveso legislation's definition of dangerous substances. The paper provides a critical commentary on the rule-making and subsequent consultation processes and examines the dismal implementation status 12 years later (2017).
Risk for affective disorders is associated with greater prefrontal gray matter volumes: A prospective longitudinal study

Background: Major depression and bipolar disorders aggregates in families and are linked with a wide range of neurobiological abnormalities including cortical gray matter (GM) alterations. Prospective studies of individuals at familial risk may expose the neural mechanisms underlying risk transmission. Methods: We used voxel based morphometry to investigate changes in regional GM brain volume, over a seven-year period, in 37 initially healthy individuals having a mono- or di-zygotic twin diagnosed with major depression or bipolar disorder (high-risk group; mean age 41.6 yrs.) as compared to 36 individuals with no history of affective disorders in the index twin and firstdegree relatives (low-risk group; mean age 38.5 yrs.). Results: Groups did not differ in regional GM volume changes over time. However, independent of time, high-risk twins had significantly greater GM volumes in bilateral dorsal anterior cingulate, inferior frontal gyrus and temporoparietal regions as compared to low-risk twins. Further, individuals who developed an affective disorder at follow-up (n=12), had relatively the largest GM volumes, both at baseline and follow-up, in the right dorsal anterior cingulate cortex and right inferior frontal cortex compared to high- and low-risk twins who remained well at follow-up. Conclusion: This pattern of apparently stable greater regional GM volume may constitute a neural marker of an increased risk for developing an affective disorder in individuals at familial risk.
RNS Applications in Digital Signal Processing

In the past decades, the Residue Number System (RNS) has been adopted in DSP as an alternative to the traditional two's complement number system (TCS) because of the high speed of the obtained architectures and the savings in area and power dissipation. However, with the shrinking of device features and the advent of powerful design tools, the advantages offered by RNS are diminishing. In this chapter, we analyze the state-of-the-art RNS implementation for a number of common Digital Signal Processing (DSP) applications, we compare performance with respect to the TCS and consider trade-offs, and we identify some trends for implementing DSP on ASIC and FPGA platforms.

Robust Throughput Boosting for Low Latency Dynamic Partial Reconfiguration

Reducing the configuration time of portions of an FPGA at run time is crucial in contemporary FPGA-based accelerators. In this work, we propose a method to increase the throughput for FPGA dynamic partial reconfiguration by using standard IP blocks. The throughput is increased by over-clocking the configuration bitstream circuitry beyond the limits stated in the specifications of these standard blocks. The experimental results show that the most power efficient implementation can reach a throughput of about 780 MB/s, corresponding to a configuration latency of about 670 micro-seconds for bitstreams of 1.2 MB. We also investigate alternatives to boost the reconfiguration throughput and sketch a methodology to achieve the most power efficient implementation of FPGA-based accelerators.
Roots of the Chromatic Polynomial

The chromatic polynomial of a graph G is a univariate polynomial whose evaluation at any positive integer q enumerates the proper q-colourings of G. It was introduced in connection with the famous four colour theorem but has recently found other applications in the field of statistical physics. In this thesis we study the real roots of the chromatic polynomial, termed chromatic roots, and focus on how certain properties of a graph affect the location of its chromatic roots.

Firstly, we investigate how the presence of a certain spanning tree in a graph affects its chromatic roots. In particular we prove a tight lower bound on the smallest non-trivial chromatic root of a graph admitting a spanning tree with at most three leaves. Here, non-trivial means different from 0 or 1. This extends a theorem of Thomassen on graphs with Hamiltonian paths. We also prove similar lower bounds on the chromatic roots of certain minor-closed families of graphs.

Later, we study the Tutte polynomial of a graph, which contains the chromatic polynomial as a specialisation. We discuss a technique of Thomassen using which it is possible to deduce that the roots of the chromatic polynomial are dense in certain intervals. We extend Thomassen's technique to the Tutte polynomial and as a consequence, deduce a density result for roots of the Tutte polynomial. This partially answers a conjecture of Jackson and Sokal.

Finally, we refocus our attention on the chromatic polynomial and investigate the density of chromatic roots of several graph families. In particular, we show that the chromatic roots of planar graphs are dense in the interval (3; 4), except for a small interval around \( \phi + 2 \phi \approx 3.618 \), where \( \phi \) denotes the golden ratio. We also investigate the chromatic roots of related minor-closed classes of graphs and bipartite graphs.

Row Reduction Applied to Decoding of Rank Metric and Subspace Codes

We show that decoding of \( t \)-Interleaved Gabidulin codes, as well as list-\( t \) decoding of Mahdavifar–Vardy (MV) codes can be performed by row reducing skew polynomial matrices. Inspired by row reduction of \( F[x] \) matrices, we develop a general and flexible approach of transforming matrices over skew polynomial rings into a certain reduced form. We apply this to solve generalised shift register problems over skew polynomial rings which occur in decoding \( t \)-Interleaved Gabidulin codes. We obtain an algorithm with complexity \( O(n^2) \) where \( n \) measures the size of the input problem and is proportional to the code length \( n \) in the case of decoding. Further, we show how to perform the interpolation step of list-\( t \)-decoding MV codes in complexity \( O(n^2) \), where \( n \) is the number of interpolation constraints.
Safe Cooperating Cyber-Physical Systems using Wireless Communication

This paper presents an overview of the ECSEL project entitled "Safe Cooperating Cyber-Physical Systems using Wireless Communication" (SafeCOP), which runs during the period 2016–2019. SafeCOP targets safety-related Cooperating Cyber-Physical Systems (CO-CPS) characterised by use of wireless communication, multiple stakeholders, dynamic system definitions (openness), and unpredictable operating environments. SafeCOP will provide an approach to the safety assurance of CO-CPS, enabling thus their certification and development. The project will define a runtime manager architecture for runtime detection of abnormal behaviour, triggering if needed a safe degraded mode. SafeCOP will also develop methods and tools, which will be used to produce safety assurance evidence needed to certify cooperative functions. SafeCOP will extend current wireless technologies to ensure safe and secure cooperation, and also contribute to new standards and regulations, by providing certification authorities and standardization committees with the scientifically validated solutions needed to craft effective standards extended to also address cooperation and system-of-systems issues. The project has 28 partners from 6 European countries, and a budget of about 11 million Euros corresponding to about 1,300 person-months.
Scalable group level probabilistic sparse factor analysis

Many data-driven approaches exist to extract neural representations of functional magnetic resonance imaging (fMRI) data, but most of them lack a proper probabilistic formulation. We propose a scalable group level probabilistic sparse factor analysis (psFA) allowing spatially sparse maps, component pruning using automatic relevance determination (ARD) and subject specific heteroscedastic spatial noise modeling. For task-based and resting state fMRI, we show that the sparsity constraint gives rise to components similar to those obtained by group independent component analysis. The noise modeling shows that noise is reduced in areas typically associated with activation by the experimental design. The psFA model identifies sparse components and the probabilistic setting provides a natural way to handle parameter uncertainties. The variational Bayesian framework easily extends to more complex noise models than the presently considered.

General information

State: Published
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Pages: 6314-6318
Publication date: 2017

Host publication information

Title of host publication: Proceedings of 2017 IEEE International Conference on Acoustics, Speech and Signal Processing
Publisher: IEEE
ISBN (Print): 9781509041169

ISSN: 1520-6149
Main Research Area: Technical/natural sciences
Conference: 42nd IEEE International Conference on Acoustics, Speech and Signal Processing, New Orleans, United States, 05/03/2017 - 05/03/2017
Probabilistic logic, Principal component analysis, Analytical models, Data models, Correlation, Indexes, Graphics processing units, sparsity, Probabilistic factor analysis, Neuroimaging, Variational Bayes, Independent components
DOIs: 10.1109/ICASSP.2017.7953371
Source: FindIt
Scenario-Neutral Simulation of Flood Risk for Multiple Drivers

General information
State: Published
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Number of pages: 2
Publication date: 2017
Event: Abstract from 7th International Conference on Flood Management (ICFM7), Leeds, United Kingdom.
Main Research Area: Technical/natural sciences

Scene reassembly after multimodal digitization and pipeline evaluation using photorealistic rendering
Transparent objects require acquisition modalities that are very different from the ones used for objects with more diffuse reflectance properties. Digitizing a scene where objects must be acquired with different modalities requires scene reassembly after reconstruction of the object surfaces. This reassembly of a scene that was picked apart for scanning seems unexplored. We contribute with a multimodal digitization pipeline for scenes that require this step of reassembly. Our pipeline includes measurement of bidirectional reflectance distribution functions and high dynamic range imaging of the lighting environment. This enables pixelwise comparison of photographs of the real scene with renderings of the digital version of the scene. Such quantitative evaluation is useful for verifying acquired material appearance and reconstructed surface geometry, which is an important aspect of digital content creation. It is also useful for identifying and improving issues in the different steps of the pipeline. In this work, we use it to improve reconstruction, apply analysis by synthesis to estimate optical properties, and to develop our method for scene reassembly.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Department of Physics, Neutrons and X-rays for Materials Physics
Number of pages: 12
Pages: 7679-7690
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Applied Optics
Volume: 56
Issue number: 27
ISSN (Print): 1559-128X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.137 SJR 0.715 CiteScore 1.84
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.61 SJR 0.695 SNIP 1.124
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.837 SNIP 1.218 CiteScore 1.66
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scheduling and Fluid Routing for Flow-Based Microfluidic Laboratories-on-a-Chip

Microfluidic laboratories-on-chip (LoCs) are replacing the conventional biochemical analyzers and are able to integrate the necessary functions for biochemical analysis onchip. There are several types of LoCs, each having its advantages and limitations. In this paper we are interested in flow-based LoCs, in which a continuous flow of liquid is manipulated using integrated microvalves. By combining several microvalves, more complex units, such as micropumps, switches, mixers and multiplexers, can be built. We consider that the architecture of the LoC is given, and we are interested in synthesizing an implementation, consisting of the binding of operations in the application to the functional units of the architecture, the scheduling of operations and the routing and scheduling of the fluid flows, such that the application completion time is
minimized. To solve this problem, we propose a List Scheduling based Application Mapping (LSAM) framework and evaluate it by using real-life as well as synthetic benchmarks. When biochemical applications contain fluids that may adsorb on the substrate on which they are transported, the solution is to use rinsing operations for contamination avoidance. Hence, we also propose a rinsing heuristic, which has been integrated in the LSAM framework.

**General information**
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Pages: 615 - 628
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**
Journal: *IEEE Transactions on Computer- Aided Design of Integrated Circuits and Systems*
Volume: 37
Issue number: 3
ISSN (Print): 0278-0070
Ratings:
- BFI (2018): BFI-level 1
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Scopus rating (2017): SNIP 1.682 SJR 0.485 CiteScore 2.9
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 2.72 SJR 0.439 SNIP 1.814
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 0.582 SNIP 1.613 CiteScore 2.41
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 0.567 SNIP 1.815 CiteScore 2.18
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 0.613 SNIP 1.795 CiteScore 2.27
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 0.6 SNIP 1.464 CiteScore 1.88
- ISI indexed (2012): ISI indexed yes
- BFI (2011): BFI-level 2
- Scopus rating (2011): SJR 0.728 SNIP 1.524 CiteScore 2.08
- ISI indexed (2011): ISI indexed yes
- BFI (2010): BFI-level 2
- Scopus rating (2010): SJR 0.691 SNIP 1.343
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 0.774 SNIP 1.647
- BFI (2008): BFI-level 2
- Scopus rating (2008): SJR 0.822 SNIP 1.538
- Web of Science (2008): Indexed yes
- Scopus rating (2007): SJR 0.826 SNIP 1.679
- Scopus rating (2006): SJR 0.768 SNIP 1.795
- Web of Science (2006): Indexed yes
- Scopus rating (2005): SJR 0.935 SNIP 1.934
- Scopus rating (2004): SJR 0.803 SNIP 1.885
- Scopus rating (2003): SJR 1.459 SNIP 1.962
- Scopus rating (2002): SJR 1.387 SNIP 2.101
Scholia and scientometrics with Wikidata

Scholia is a tool to handle scientific bibliographic information through Wikidata. The Scholia Web service creates on-the-fly scholarly profiles for researchers, organizations, journals, publishers, individual scholarly works, and for research topics. To collect the data, it queries the SPARQL-based Wikidata Query Service. Among several display formats available in Scholia are lists of publications for individual researchers and organizations, publications per year, employment timelines, as well as coauthor and topic networks and citation graphs. The Python package implementing the Web service is also able to format Wikidata bibliographic entries for use in LaTeX/BIBTeX. Apart from detailing Scholia, we describe how Wikidata has been used for bibliographic information and we also provide some scientometric statistics on this information.

General information
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Number of pages: 16
Publication date: 2017

Host publication information
Title of host publication: Joint Proceedings of the 1st International Workshop on Scientometrics and 1st International Workshop on Enabling Decentralised Scholarly Communication
Main Research Area: Technical/natural sciences
Conference: Scientometrics and Enabling Decentralised Scholarly Communication, Portorož, Slovenia, 28/05/2017 - 28/05/2017
Electronic versions:
article_03.pdf
DOIs:
10.5281/zenodo.1036595
Source: PublicationPreSubmission
Source-ID: 140578356
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017
In a social network, the number of links of a node, or node degree, is often assumed as a proxy for the node’s importance or prominence within the network. It is known that social networks exhibit the (first-order) assortative mixing, i.e. if two nodes are connected, they tend to have similar node degrees, suggesting that people tend to mix with those of comparable prominence. In this paper, we report the second-order assortative mixing in social networks. If two nodes are connected, we measure the degree correlation between their most prominent neighbours, rather than between the two nodes themselves. We observe very strong second-order assortative mixing in social networks, often significantly stronger than the first-order assortative mixing. This suggests that if two people interact in a social network, then the importance of the most prominent person each knows is very likely to be the same. This is also true if we measure the average prominence of neighbours of the two people. This property is weaker or negative in non-social networks. We investigate a number of possible explanations for this property. However, none of them was found to provide an adequate explanation. We therefore conclude that second-order assortative mixing is a new property of social networks.

Second-Order Assortative Mixing In Social Networks

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, University College London
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Pages: 3-15
Publication date: 2017

Host publication information
Title of host publication: Complex Networks VIII: Proceedings of the 8th Conference on Complex Networks Complenet 2017
Publisher: Springer
ISBN (Print): 9783319542416
Secure Block Ciphers - Cryptanalysis and Design
The rapid evolution of computational devices and the widespread adoption of digital communication have deeply transformed the way we conduct both business and everyday life and they continue to do so. The ability to ensure confidentiality and integrity of information sent over digital channels is fundamental to this development and is absolutely essential for all private and corporate communication, ranging from bank transactions, digital citizen services, and remote computer access, to cell phone calls and instant messaging. The vast majority of secured data sent over all types of networks is encrypted using so-called symmetric ciphers. The security of our digital infrastructure thus rests at its very base on their security.

The central topic of this thesis is the security of block ciphers – the most prominent form of symmetric ciphers. This thesis is separated in two parts. The first part is an introduction to block ciphers and their cryptanalysis, the second part contains publications written and published during the PhD studies. The first publication evaluates the security of a modification of the AES in which the choice of S-box is unknown to the attacker. We find that some of the attacks that can be applied to the AES can be transferred to this block cipher, albeit with a higher attack complexity. The second publication introduces a new block cipher family which is targeted for new applications in fully homomorphic encryption and multi-party computation. We demonstrate the soundness of the design and its superior performance in these applications. The third publication treats the cryptanalysis of Simon, a cipher proposed by the NSA. In particular we discuss how the methods of differential and linear cryptanalysis can correctly be applied to ciphers of this type. The fourth publication introduces a cryptanalytic framework which generalizes differential cryptanalysis. We demonstrate that attacks based on impossible transitions in this framework can competitively break round-reduced block ciphers in the low-data setting.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science
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Number of pages: 151
Publication date: 2017

Publication information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Original language: English

Series: DTU Compute PHD-2016
Number: 412
ISSN: 0909-3192
Main Research Area: Technical/natural sciences
Electronic versions:
phd412_Tiessen_T.pdf

Relations
Projects:
Secure Block Ciphers - Cryptanalysis and Design
Publication: Research › Ph.D. thesis – Annual report year: 2017

Security And Privacy Issues in Healthcare Monitoring Systems: A Case Study
Security and privacy issues are rarely taken into account in automated systems for monitoring elderly people in their home, exposing inhabitants to a number of threats they are usually not aware of. As a case study to expose the major vulnerabilities these systems are exposed to, this paper reviews a generic example of automated healthcare monitoring system. The security and privacy issues identified in this case study can be easily generalised and regarded as alarm bells for all the pervasive healthcare professionals.
Security flows in OAuth 2.0 framework: A case study

The burst in smartphone use, handy design in laptops and tablets as well as other smart products, like cars with the ability to drive you around, manifests the exponential growth of network usage and the demand of accessing remote data on a large variety of services. However, users notoriously struggle to maintain distinct accounts for every single service that they use. The solution to this problem is the use of a Single Sign On (SSO) framework, with a unified single account to authenticate user’s identity throughout the different services. In April 2007, AOL introduced OpenAuth framework. After several revisions and despite its wide adoption, OpenAuth 2.0 has still several flaws that need to be fixed in several implementations. In this paper, we present a thorough review about both benefits of this single token authentication mechanism and its open flaws.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, Technical University of Denmark
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Pages: 396-406
Publication date: 2017

Host publication information
Publisher: Springer
ISBN (Print): 9783319662831
Series: Lecture Notes in Computer Science
Volume: 10489
ISSN: 0302-9743
Main Research Area: Technical/natural sciences
Theoretical Computer Science, Computer Science (all), Computer Science, Logics and Meanings of Programs, Programming Languages, Compilers, Interpreters, Software Engineering, Systems and Data Security, Computer Applications, Computer Systems Organization and Communication Networks
DOIs:
10.1007/978-3-319-66284-8_33
Source: FindIt
Source-ID: 2390613130
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017
Selecting local constraint for alignment of batch process data with dynamic time warping

There are two key reasons for aligning batch process data. The first is to obtain same-length batches so that standard methods of analysis may be applied, whilst the second reason is to synchronise events that take place during each batch so that the same event is associated with the same observation number for every batch. Dynamic time warping has been shown to be an effective method for meeting these objectives. This is based on a dynamic programming algorithm that aligns a batch to a reference batch, by stretching and compressing its local time dimension. The resulting “warping function” may be interpreted as a progress signature of the batch which may be appended to the aligned data for further analysis. For the warping function to be a realistic reflection of the progress of a batch, it is necessary to impose some constraints on the dynamic time warping algorithm, to avoid an alignment which is too aggressive and which contains pathological warping. Previous work has focused on addressing this issue using global constraints. In this work, we investigate the use of local constraints in dynamic time warping and define criteria for evaluating the degree of time distortion and variable synchronisation obtained. A local constraint scheme is extended to include constraints not previously considered, and a novel method for selecting the optimal local constraint with respect to the two criteria is proposed. For illustration, the method is applied to real data from an industrial bacteria fermentation process.

General information
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Pages: 161-170
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Chemometrics and Intelligent Laboratory Systems
Volume: 167
ISSN (Print): 0169-7439
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.222 SJR 0.672 CiteScore 2.82
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.6 SJR 0.652 SNIP 1.213
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.665 SNIP 1.258 CiteScore 2.68
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.88 SNIP 1.762 CiteScore 2.96
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.892 SNIP 1.43 CiteScore 2.67
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.87 SNIP 1.627 CiteScore 2.68
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.77 SNIP 1.323 CiteScore 2.27
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.761 SNIP 1.152
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.082 SNIP 1.314
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.96 SNIP 1.262
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.244 SNIP 1.324
Selection of non-zero loadings in sparse principal component analysis

Principal component analysis (PCA) is a widely accepted procedure for summarizing data through dimensional reduction. In PCA, the selection of the appropriate number of components and the interpretation of those components have been the key challenging features. Sparse principal component analysis (SPCA) is a relatively recent technique proposed for producing principal components with sparse loadings via the variance-sparsity trade-off. Although several techniques for deriving sparse loadings have been offered, no detailed guidelines for choosing the penalty parameters to obtain a desired level of sparsity are provided. In this paper, we propose the use of a genetic algorithm (GA) to select the number of non-zero loadings (NNZL) in each principal component while using SPCA. The proposed approach considerably improves the interpretability of principal components and addresses the difficulty in the selection of NNZL in SPCA. Furthermore, we compare the performance of PCA and SPCA in uncovering the underlying latent structure of the data. The key features of the methodology are assessed through a synthetic example, pitprops data and a comparative study of the benchmark Tennessee Eastman process.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, University of California
Authors: Gajjar, S. (Ekstern), Kulahci, M. (Intern), Palazoglu, A. (Ekstern)
Pages: 160-171
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Chemometrics and Intelligent Laboratory Systems
Volume: 162
ISSN (Print): 0169-7439
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.222 SJR 0.672 CiteScore 2.82
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.6 SJR 0.652 SNIP 1.213
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.665 SNIP 1.258 CiteScore 2.68
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.88 SNIP 1.762 CiteScore 2.96
Semi-Supervised Generation with Cluster-aware Generative Models

Deep generative models trained with large amounts of unlabelled data have proven to be powerful within the domain of unsupervised learning. Many real life data sets contain a small amount of labelled data points, that are typically disregarded when training generative models. We propose the Cluster-aware Generative Model, that uses unlabelled information to infer a latent representation that models the natural clustering of the data, and additional labelled data points to refine this clustering. The generative performances of the model significantly improve when labelled information is exploited, obtaining a log-likelihood of −79.38 nats on permutation invariant MNIST, while also achieving competitive semi-supervised classification accuracies. The model can also be trained fully unsupervised, and still improve the log-likelihood performance with respect to related methods.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, Copenhagen Center for Health Technology
Sensation of movement: An introduction

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, University of Copenhagen
Authors: Grünbaum, T. (Ekstern), Christensen, M. S. (Intern)
Pages: 1-6
Publication date: 2017

Host publication information
Title of host publication: Sensation of Movement
Publisher: Routledge
Editors: Christensen, M. S., Grünbaum, T.
ISBN (Print): 9781138646339
Series: Current Issues in Consciousness Research
Main Research Area: Technical/natural sciences
Electronic versions:
GrunbaumChristensen_Sensation_of_Movement_Intro_2017.pdf
Source: PublicationPreSubmission
Source-ID: 138507555
Publication: Research - peer-review › Book chapter – Annual report year: 2017

Sense of moving: Moving closer to the movement

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, University of Copenhagen
Authors: Christensen, M. S. (Intern), Grünbaum, T. (Forskerdatabase)
Pages: 64-84
Publication date: 2017

Host publication information
Title of host publication: Sensation of Movement
Publisher: Routledge
Editors: Christensen, M. S., Grünbaum, T.
ISBN (Print): 9781138646339
Chapter: 4
Series: Current Issues in Consciousness Research
Main Research Area: Technical/natural sciences
Electronic versions:
Christensen_Grunbaum_Sense_of_Movement_Ch_4_2017.pdf
Source: PublicationPreSubmission
Source-ID: 138507539
Publication: Research - peer-review › Book chapter – Annual report year: 2017
SensibleSleep: A Bayesian Model for Learning Sleep Patterns from Smartphone Events

We propose a Bayesian model for extracting sleep patterns from smartphone events. Our method is able to identify individuals' daily sleep periods and their evolution over time, and provides an estimation of the probability of sleep and wake transitions. The model is fitted to more than 400 participants from two different datasets, and we verify the results against ground truth from dedicated armband sleep trackers. We show that the model is able to produce reliable sleep estimates with an accuracy of 0.89, both at the individual and at the collective level. Moreover the Bayesian model is able to quantify uncertainty and encode prior knowledge about sleep patterns. Compared with existing smartphone-based systems, our method requires only screen on/off events, and is therefore much less intrusive in terms of privacy and more battery-efficient.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, Sony Mobile
Authors: Cuttone, A. (Intern), Bækgaard, P. (Intern), Sekara, V. (Intern), Jonsson, H. (Ekstern), Larsen, J. E. (Intern), Jørgensen, S. L. (Intern)
Pages: 1-20
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: P L o S One
Volume: 12
Issue number: 1
Article number: e0169901
ISSN (Print): 1932-6203
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.01 SJR 1.164 SNIP 1.111
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.11 SJR 1.236 SNIP 1.101
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.427 SNIP 1.136 CiteScore 3.32
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.559 SNIP 1.148 CiteScore 3.54
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.772 SNIP 1.153 CiteScore 3.94
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.982 SNIP 1.156 CiteScore 4.15
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.425 SNIP 1.233 CiteScore 4.58
ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.705 SNIP 1.178
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 2.614 SNIP 1.046
Web of Science (2009): Indexed yes
Separable explanations of neural network decisions

Deep Taylor Decomposition is a method used to explain neural network decisions. When applying this method to non-dominant classifications, the resulting explanation does not reflect important features for the chosen classification. We propose that this is caused by the dense layers and propose a method to alleviate the effect by applying regularization. We assess the result by measuring the quality of the resulting explanations objectively and subjectively.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems
Authors: Rieger, L. (Intern)
Number of pages: 8
Publication date: 2017

Host publication information
BFI conference series: Neural Information Processing Systems (5000199)
Main Research Area: Technical/natural sciences
Conference: 31st Conference on Neural Information Processing Systems, Long Beach, United States, 04/12/2017 - 04/12/2017
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Sequence Classification Using Third-Order Moments

Model-based classification of sequence data using a set of hidden Markov models is a well-known technique. The involved score function, which is often based on the class-conditional likelihood, can, however, be computationally demanding, especially for long data sequences. Inspired by recent theoretical advances in spectral learning of hidden Markov models, we propose a score function based on third-order moments. In particular, we propose to use the Kullback-Leibler divergence between theoretical and empirical third-order moments for classification of sequence data with discrete observations. The proposed method provides lower computational complexity at classification time than the usual likelihood-based methods. In order to demonstrate the properties of the proposed method, we perform classification of both simulated data and empirical data from a human activity recognition study.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems
Authors: Troelsgaard, R. (Intern), Hansen, L. K. (Intern)
Pages: 216-236
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Neural Computation
Volume: 30
Issue number: 1
ISSN (Print): 0899-7667
Setup for Scenario-free Modelling of Urban Flood Risk in Non-stationary Climate and Urban Development Conditions

An early flood warning system has been developed for urban catchments and is currently running in online operation in Copenhagen. The system is highly dependent on the quality of rainfall forecast inputs. An investigation of precipitation inputs from Radar Nowcast (RN), Numerical Weather Prediction (NWP) with assimilation of radar and cloud data (RA3), and Ensemble NWP with 25 members (S05) is conducted by comparing against rain gauge measurements and flood extent. Despite lower spatial and temporal resolution, the ensemble product seems promising for forecasting extreme events. A combination of the three forecast products is expected to yield the optimal input for flood warning.

General information
State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Monash University, Cooperative Research Centre for Water Sensitive Cities
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Number of pages: 4
Publication date: 2017
Event: Abstract from 14th IWA/IAHR International Conference on Urban Drainage 2017, Prague, Czech Republic.
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
Source-ID: 137133578
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

Short parietal lobe connections of the human and monkey brain

The parietal lobe has a unique place in the human brain. Anatomically, it is at the crossroad between the frontal, occipital, and temporal lobes, thus providing a middle ground for multimodal sensory integration. Functionally, it supports higher cognitive functions that are characteristic of the human species, such as mathematical cognition, semantic and pragmatic aspects of language, and abstract thinking. Despite its importance, a comprehensive comparison of human and simian intraparietal networks is missing. In this study, we used diffusion imaging tractography to reconstruct the major intralobar parietal tracts in twenty-one datasets acquired in vivo from healthy human subjects and eleven ex vivo datasets from five vervet and six macaque monkeys. Three regions of interest (postcentral gyrus, superior parietal lobule and inferior parietal lobule) were used to identify the tracts. Surface projections were reconstructed for both species and results compared to identify similarities or differences in tract anatomy (i.e., trajectories and cortical projections). In addition, post-mortem dissections were performed in a human brain. The largest tract identified in both human and monkey brains is a vertical pathway between the superior and inferior parietal lobules. This tract can be divided into an anterior (supramarginal gyrus) and a posterior (angular gyrus) component in both humans and monkey brains. The second prominent intraparietal tract connects the postcentral gyrus to both supramarginal and angular gyri of the inferior parietal lobule in humans but only to the supramarginal gyrus in the monkey brain. The third tract connects the postcentral gyrus to the anterior region of the superior parietal lobule and is more prominent in monkeys compared to humans. Finally, short U-shaped fibres in the medial and lateral aspects of the parietal lobe were identified in both species. A tract connecting the medial parietal cortex to the lateral inferior parietal lobule was observed in the monkey brain only. Our findings suggest a consistent pattern of intralobar parietal connections between humans and monkeys with some differences for those areas that have cytoarchitectonically distinct features in humans. The overall pattern of intraparietal connectivity supports the special role of the inferior parietal lobule in cognitive functions characteristic of humans.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, King's College London, SDN - Istituto di Ricerca Diagnostica e Nucleare, University of Oxford, Psychiatric Center Copenhagen, Rigshospitalet, Universite de Montreal
Pages: 339-357
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Cortex
Volume: 97
ISSN (Print): 0010-9452
Ratings:
BFI (2018): BFI-level 2
Short-term variations of Icelandic ice cap mass inferred from cGPS coordinate time series

As the global climate changes, understanding short-term variations in water storage is increasingly important. Continuously operating Global Positioning System (cGPS) stations in Iceland record annual periodic motion—the elastic response to winter accumulation and spring melt seasons—with peak-to-peak vertical amplitudes over 20 mm for those sites in the Central Highlands. Here for the first time for Iceland, we demonstrate the utility of these cGPS-measured displacements for estimating seasonal and shorter-term ice cap mass changes. We calculate unit responses to each of the five largest ice caps in central Iceland at each of the 62 cGPS locations using an elastic half-space model and estimate ice mass variations from the cGPS time series using a simple least squares inversion scheme. We utilize all three components of motion, taking advantage of the seasonal motion recorded in the horizontal. We remove secular velocities and accelerations and explore the impact that seasonal motions due to atmospheric, hydrologic, and nontidal ocean loading have on our inversion results. Our results match available summer and winter mass balance measurements well, and we reproduce the seasonal stake-based observations of loading and melting within the 1 math formula confidence bounds of the inversion. We identify nonperiodic ice mass changes associated with interannual variability in precipitation and other processes such as increased melting due to reduced ice surface albedo or decreased melting due to ice cap insulation in response to tephra deposition following volcanic eruptions, processes that are not resolved with once or twice-yearly stake measurements.
Sikring af risikovirksomheder
Nu skal risikovirksomheder udføre en sårbarhedsvurdering. Det er en følge af regeringens terrorhandlingsplan. En vejledning har netop været i høring.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Statistics and Data Analysis
Authors: Hedlund, F. H. (Intern)
Pages: 22-25
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Dansk Kemi
Volume: 98
Issue number: 6/7
ISSN (Print): 0011-6335
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Web of Science (2007): Indexed yes
Web of Science (2004): Indexed yes
Original language: English
Electronic versions:
2017_06_Dkemi_Sikring_af_risikovirksomheder.pdf
Source: PublicationPreSubmission
Source-ID: 133000165
Publication: Communication – Journal article – Annual report year: 2017

Simulating clinical studies of the glucoregulatory system: in vivo meets in silico
In this report we use a validated model of the glucoregulatory system including effects of insulin and glucagon for simulation studies in seven type 1 diabetes patients. Using simulations, we replicate the results from a clinical study investigating the effect of micro-doses of glucagon on glucose metabolism at varying ambient insulin levels. The report compares in vivo and in silico results head-to-head, and discusses similarities and differences. We design and simulate simple studies to emphasize the implications of some glucoregulatory dynamics which are ignored in most previous clinical studies: the effect of discontinuing insulin and glucose infusions prior to glucagon administration, the delayed effect of insulin, timing of data sampling, and carryover effects from multiple subcutaneous doses of glucagon. We also use simulations to discuss two hypotheses of how insulin and glucagon might interact in influencing the glucose response. Following the simulations we propose a study design that potentially could explore if the hypotheses are true or false.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Dynamical Systems, Copenhagen University Hospital, Zealand Pharma A/S, University of Copenhagen
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Number of pages: 35
Publication date: 2017

Publication information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Original language: English
Number: 01
ISSN: 1601-2321
Simulation Approach for Timing Analysis of Genetic Logic Circuits

Constructing genetic logic circuits is an application of synthetic biology in which parts of the DNA of a living cell are engineered to perform a dedicated Boolean function triggered by an appropriate concentration of certain proteins or by different genetic components. These logic circuits work in a manner similar to electronic logic circuits, but they are much more stochastic and hence much harder to characterize. In this article, we introduce an approach to analyze the threshold value and timing of genetic logic circuits. We show how this approach can be used to analyze the timing behavior of single and cascaded genetic logic circuits. We further analyze the timing sensitivity of circuits by varying the degradation rates and concentrations. Our approach can be used not only to characterize the timing behavior but also to analyze the timing constraints of cascaded genetic logic circuits, a capability that we believe will be important for design automation in synthetic biology.
Singular limit analysis of a model for earthquake faulting
In this paper we consider the one dimensional spring-block model describing earthquake faulting. By using geometric singular perturbation theory and the blow-up method we provide a detailed description of the periodicity of the earthquake episodes. In particular, the limit cycles arise from a degenerate Hopf bifurcation whose degeneracy is due to an underlying Hamiltonian structure that leads to large amplitude oscillations. We use a Poincar'e compactification to study the system near infinity. At infinity the critical manifold loses hyperbolicity with an exponential rate. We use an adaptation of the blow-up method to recover the hyperbolicity. This enables the identification of a new attracting manifold that organises the dynamics at infinity. This in turn leads to the formulation of a conjecture on the behaviour of the limit cycles as the time-scale separation increases. We provide the basic foundation for the proof of this conjecture and illustrate our findings with numerics.
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.411 SNIP 1.316
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.167 SNIP 1.36
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.34 SNIP 1.292
Scopus rating (2007): SJR 1.274 SNIP 1.375
Scopus rating (2006): SJR 1.192 SNIP 1.257
Scopus rating (2005): SJR 1.066 SNIP 1.3
Scopus rating (2004): SJR 0.996 SNIP 1.193
Scopus rating (2003): SJR 1.106 SNIP 1.269
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.207 SNIP 1.232
Scopus rating (2001): SJR 1.213 SNIP 1.169
Scopus rating (2000): SJR 1.491 SNIP 1.271
Scopus rating (1999): SJR 1.556 SNIP 1.497
Original language: English
Singular perturbation, Hamiltonian systems, Rate and state friction, Blowup, Earthquake dynamics, Poincaré compactification
Electronic versions:
Earthquake_Final_Nonlinearity
Links:
http://arxiv.org/abs/1603.02448
Source: PublicationPreSubmission
Source-ID: 122107982
Publication: Research - peer-review › Journal article – Annual report year: 2016

Site Monitoring with Synthetic Aperture Radar Satellite Imagery
Based on a statistical test for the equality of polarimetric matrices following the complex Wishart distribution and a factorization of the test statistic, change analysis in a time series of multi-look polarimetric SAR data in variance-covariance or polarimetric matrix representation is carried out. The test statistic and its factorization detect if and when change(s) occur. This paper provides a short explanation of the method, describes available software, and gives examples of potential applications for site monitoring.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Research Center Jülich GmbH
Authors: Canty, M. J. (Ekstern), Nielsen, A. A. (Intern)
Number of pages: 6
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 39th ESARDA Symposium on Safeguards and Nuclear Non-Proliferation
Publisher: ESARDA Joint Research Centre
Main Research Area: Technical/natural sciences
Conference: 39th ESARDA Symposium on Safeguards and Nuclear Non-Proliferation, Düsseldorf, Germany, 16/05/2017 - 16/05/2017
Electronic versions:
ESARDApaper2017.pdf
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

skoleklima.dk – A platform to monitor air quality and thermal comfort in classrooms, developed for teachers and students

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Høje Taastrup Kommune, Københavns Universitet
Smart Grid Communication Comparison: Distributed Control Middleware and Serialization Comparison for the Internet of Things

To solve the problems caused by intermittent renewable energy production, communication between Distributed Energy Resources (DERs) and system operators is necessary. The communication middleware and serialization used for communication are essential to ensure delivery of the messages within the required timeframe, to provide the necessary ancillary services to the power grid. This paper shows that there are better alternatives to using Web Services and XMPP as middleware and that there are better alternatives than using XML for serialization. The paper also gives guidance at choosing the best communication middleware and serialization format/library, aided by the authors' earlier work, which investigates the performance and characteristics of communication middleware and serialization independently. Given the performance criteria of the paper, ZeroMQ, YAMI4, and ICE are the middleware that performs the best, and ProtoBuf (ProtoStuff), and ProtoStuff are the serialization that performs the best.
**Smart Grid Serialization Comparison**

Communication between DERs and System Operators is required to provide Demand Response and solve some of the problems caused by the intermittency of much Renewable Energy. An important part of efficient communication is serialization, which is important to ensure a high probability of delivery within a given timeframe, especially in the context of the Internet of Things, using low-bandwidth data connections and constrained devices. The paper shows that there are better alternatives than XML & JAXB and gives guidance in choosing the most appropriate serialization format and library depending on the context.

**Smart grid serialization comparison: Comparison of serialization for distributed control in the context of the Internet of Things**

Communication between DERs and System Operators is required to provide Demand Response and solve some of the problems caused by the intermittency of much Renewable Energy. An important part of efficient communication is serialization, which is important to ensure a high probability of delivery within a given timeframe, especially in the context of the Internet of Things, using low-bandwidth data connections and constrained devices. The paper shows that there are better alternatives than XML & JAXB and gives guidance in choosing the most appropriate serialization format and library depending on the context.
Social disparities in the prevalence of multimorbidity - A register-based population study: A register-based population study

Prevalences of multimorbidity vary between European studies and several methods and definitions are used. In this study we examine the prevalence of multimorbidity in relation to age, gender and educational attainment and the association between physical and mental health conditions and educational attainment in a Danish population. A cross-sectional design was used to study the prevalence of multimorbidity, defined as two or more chronic conditions, and of comorbid physical and mental health conditions across age groups and educational attainment levels among 1,397,173 individuals aged 16 years and older who lived in the Capital Region of Denmark on January 1st, 2012. After calculating prevalence, odds ratios for multimorbidity and mental health conditions were derived from logistic regression on gender, age, age squared, education and number of physical conditions (only for odds ratios for mental health conditions). Odds ratios for having multimorbidity and mental health conditions for each variable were adjusted for all other variables. Multimorbidity prevalence was 21.6%. Half of the population aged 65 and above had multimorbidity, and prevalence was inversely related to educational attainment: 26.9% (95% CI, 26.8-26.9) among those with lower secondary education versus 13.5% (95% CI, 13.5-13.6) among people with postgraduate education. Adjusted odds ratios for multimorbidity were 0.50 (95% CI, 0.49-0.51) for people with postgraduate education, compared to people with lower secondary education. Among all population members, 4.9% (95% CI, 4.9-4.9) had both a physical and a mental health condition, a proportion that increased to 22.6% of people with multimorbidity. Physical and mental health comorbidity was more prevalent in women (6.33%; 95% CI, 6.3-6.4) than men (3.34%; 95% CI, 3.3-3.4) and approximately 50 times more prevalent among older persons than younger ones. Physical and mental health comorbidity was also twice as prevalent among people with lower secondary education than among those with postgraduate education. The presence of a mental health condition was strongly associated with the number of physical conditions; those with five or more physical conditions had an adjusted odds ratio for a mental health condition of 3.93 (95% CI, 3.8-4.1), compared to those with no physical conditions. Multimorbidity prevalence and patterns in the Danish population are comparable to those of other European populations. The high prevalence of mental and physical health conditions highlights the need to ensure that healthcare systems deliver care that takes physical and mental comorbidity into account. Further, the higher prevalence of multimorbidity among persons with low educational attainment emphasizes the importance of having a health care system providing care that is beneficial to all regardless of socioeconomic status.
Social Fingerprinting: detection of spambot groups through DNA-inspired behavioral modeling

Spambot detection in online social networks is a long-lasting challenge involving the study and design of detection techniques capable of efficiently identifying ever-evolving spammers. Recently, a new wave of social spambots has emerged, with advanced human-like characteristics that allow them to go undetected even by current state-of-the-art algorithms. In this paper, we show that efficient spambots detection can be achieved via an in-depth analysis of their collective behaviors exploiting the digital DNA technique for modeling the behaviors of social network users. Inspired by its biological counterpart, in the digital DNA representation the behavioral lifetime of a digital account is encoded in a sequence of characters. Then, we define a similarity measure for such digital DNA sequences. We build upon digital DNA and the similarity between groups of users to characterize both genuine accounts and spambots. Leveraging such characterization, we design the Social Fingerprinting technique, which is able to discriminate among spambots and genuine accounts in both a supervised and an unsupervised fashion. We finally evaluate the effectiveness of Social Fingerprinting and we compare it with three state-of-the-art detection algorithms. Among the peculiarities of our approach is the possibility to apply off-the-shelf DNA analysis techniques to study online users behaviors and to efficiently rely on a limited number of lightweight account characteristics.
SOOA: Exploring Special On-Off Attacks on Challenge-Based Collaborative Intrusion Detection Networks

The development of collaborative intrusion detection networks (CIDNs) aims to enhance the performance of a single intrusion detection system (IDS) through communicating and collecting information from other IDS nodes. To defend CIDNs against insider attacks, trust-based mechanisms are crucial for evaluating the trustworthiness of a node. In the literature, challenge-based trust mechanisms are well established to identify malicious nodes by identifying the deviation between challenges and responses. However, such mechanisms rely on two major assumptions, which may result in a weak threat model and render CIDNs still vulnerable to advanced insider attacks in a practical deployment. In this paper, our motivation is to investigate the effect of On-Off attacks on challenge-based CIDNs. In particular, as a study, we explore a special On-Off attack (called SOOA), which can keep responding normally to one node while acting abnormally to another node. In the evaluation, we explore the attack performance under simulated CIDN environments. Experimental results indicate that our attack can interfere the effectiveness of trust computation for CIDN nodes.
Space-Efficient Re-Pair Compression

Re-Pair [5] is an effective grammar-based compression scheme achieving strong compression rates in practice. Let \( n, \sigma, \) and \( d \) be the text length, alphabet size, and dictionary size of the final grammar, respectively. In their original paper, the authors show how to compute the Re-Pair grammar in expected linear time and \( 5n + 4\sigma^2 + 4d + \sqrt{n} \) words of working space on top of the text. In this work, we propose two algorithms, improving on the space of their original solution.

Our model assumes a memory word of \( \lceil \log_2 n \rceil \) bits and a re-writable input text composed by \( n \) such words. Our first algorithm runs in expected \( O(n/\varepsilon) \) time and uses \((1+\varepsilon)n+\sqrt{n}\) words of space on top of the text for any parameter \( 0 < \varepsilon \leq 1 \) chosen in advance. Our second algorithm runs in expected \( O(n \log n) \) time and improves the space to \( n + \sqrt{n} \) words.

Spanning quadrangulations of triangulated surfaces

In this paper we study alternating cycles in graphs embedded in a surface. We observe that 4-vertex-colorability of a triangulation on a surface can be expressed in terms of spanning quadrangulations, and we establish connections between spanning quadrangulations and cycles in the dual graph which are noncontractible and alternating with respect to a perfect matching. We show that the dual graph of an Eulerian triangulation of an orientable surface other than the...
sphere has a perfect matching \( M \) and an \( M \)-alternating noncontractible cycle. As a consequence, every Eulerian triangulation of the torus has a nonbipartite spanning quadrangulation. For an Eulerian triangulation \( G \) of the projective plane the situation is different: If the dual graph \( G^* \) is nonbipartite, then \( G^* \) has no noncontractible alternating cycle, and all spanning quadrangulations of \( G \) are bipartite. If the dual graph \( G^* \) is bipartite, then it has a noncontractible, \( M \)-alternating cycle for some (and hence any) perfect matching, \( G \) has a bipartite spanning quadrangulation and also a nonbipartite spanning quadrangulation.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, California State University San Marcos
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Pages: 357-368
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**

Volume: 87
Issue number: 2
ISSN (Print): 0025-5858
Ratings:
- BFI (2018): BFI-level 1
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Scopus rating (2017): SNIP 0.963 SJR 0.439 CiteScore 0.42
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 0.39 SJR 0.228 SNIP 0.641
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 0.494 SNIP 1.063 CiteScore 0.54
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 0.624 SNIP 0.635 CiteScore 0.52
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 0.286 SNIP 0.468 CiteScore 0.34
- ISI indexed (2013): ISI indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 0.524 SNIP 1.274 CiteScore 0.49
- ISI indexed (2012): ISI indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 0.152 SNIP 0.52 CiteScore 0.21
- ISI indexed (2011): ISI indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 0.463 SNIP 0.984
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 0.193 SNIP 1.665
- BFI (2008): BFI-level 1
- Scopus rating (2008): SJR 0.277 SNIP 0.906
- Web of Science (2008): Indexed yes
- Scopus rating (2007): SJR 0.185 SNIP 0.849
- Scopus rating (2006): SJR 0.244 SNIP 0.474
- Scopus rating (2005): SJR 0.227 SNIP 0.539
- Scopus rating (2004): SJR 0.27 SNIP 0.23
- Scopus rating (2003): SJR 0.297 SNIP 0.701
- Scopus rating (2002): SJR 0.485 SNIP 0.455
- Scopus rating (2001): SJR 0.348 SNIP 0.731
- Scopus rating (2000): SJR 0.3 SNIP 0.996
SparseBeads data: benchmarking sparsity-regularized computed tomography

Sparsity regularization (SR) such as total variation (TV) minimization allows accurate image reconstruction in x-ray computed tomography (CT) from fewer projections than analytical methods. Exactly how few projections suffice and how this number may depend on the image remain poorly understood. Compressive sensing connects the critical number of projections to the image sparsity, but does not cover CT, however empirical results suggest a similar connection. The present work establishes for real CT data a connection between gradient sparsity and the sufficient number of projections for accurate TV-regularized reconstruction. A collection of 48 x-ray CT datasets called SparseBeads was designed for benchmarking SR reconstruction algorithms. Beadpacks comprising glass beads of five different sizes as well as mixtures were scanned in a micro-CT scanner to provide structured datasets with variable image sparsity levels, number of projections and noise levels to allow the systematic assessment of parameters affecting performance of SR reconstruction algorithms. Using the SparseBeads data, TV-regularized reconstruction quality was assessed as a function of numbers of projections and gradient sparsity. The critical number of projections for satisfactory TV-regularized reconstruction increased almost linearly with the gradient sparsity. This establishes a quantitative guideline from which one may predict how few projections to acquire based on expected sample sparsity level as an aid in planning of dose- or time-critical experiments. The results are expected to hold for samples of similar characteristics, i.e. consisting of few, distinct phases with relatively simple structure. Such cases are plentiful in porous media, composite materials, foams, as well as non-destructive testing and metrology. For samples of other characteristics the proposed methodology may be used to investigate similar relations.
Sparse identification of a predator-prey system from simulation data of a convection model

The use of low-dimensional dynamical systems as reduced models for plasma dynamics is useful as solving an initial value problem requires much less computational resources than fluid simulations. We utilize a data-driven modeling approach to identify a reduced model from simulation data of a convection problem. A convection model with a pressure source centered at the inner boundary models the edge dynamics of a magnetically confined plasma. The convection problem undergoes a sequence of bifurcations as the strength of the pressure source increases. The time evolution of the energies of the pressure profile, the turbulent flow, and the zonal flow capture the fundamental dynamic behavior of the full system. By applying the sparse identification of nonlinear dynamics (SINDy) method, we identify a predator-prey type dynamical system that approximates the underlying dynamics of the three energy state variables. A bifurcation analysis of the system reveals consistency between the bifurcation structures, observed for the simulation data, and the identified underlying system.

General information
State: Published
Sparse Probabilistic Parallel Factor Analysis for the Modeling of PET and Task-fMRI Data

Modern datasets are often multiway in nature and can contain patterns common to a mode of the data (e.g. space, time, and subjects). Multiway decomposition such as parallel factor analysis (PARAFAC) take into account the intrinsic structure of the data, and sparse versions of these methods improve interpretability of the results. Here we propose a variational Bayesian parallel factor analysis (VB-PARAFAC) model and an extension with sparse priors (SP-PARAFAC). Notably, our formulation admits time and subject specific noise modeling as well as subject specific offsets (i.e., mean values). We confirmed the validity of the models through simulation and performed exploratory analysis of positron emission tomography (PET) and functional magnetic resonance imaging (fMRI) data. Although more constrained, the proposed models performed similarly to more flexible models in approximating the PET data, which supports its robustness against noise. For fMRI, both models correctly identified task-related components, but were not able to segregate overlapping activations.

General information
State: Published
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Pages: 186-198
Publication date: 2017

Host publication information
Title of host publication: Medical Computer Vision and Bayesian and Graphical Models for Biomedical Imaging
Volume: 10081
Publisher: Springer
ISBN (Print): 9783319611877

Series: Lecture Notes in Computer Science
Volume: 10081
ISSN: 0302-9743
Main Research Area: Technical/natural sciences
Computer Science, Image Processing and Computer Vision, Health Informatics, Artificial Intelligence (incl. Robotics), Probability and Statistics in Computer Science, Math Applications in Computer Science, Pattern Recognition
DOIs:
10.1007/978-3-319-61188-4_17
Source: FindIt
Source-ID: 2372496650
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Sparse supervised principal component analysis (SSPCA) for dimension reduction and variable selection
Principal component analysis (PCA) is one of the main unsupervised pre-processing methods for dimension reduction. When the training labels are available, it is worth using a supervised PCA strategy. In cases that both dimension reduction and variable selection are required, sparse PCA (SPCA) methods are preferred. In this paper, a sparse supervised PCA (SSPCA) method is proposed for pre-processing. This method is appropriate especially in problems where, a high dimensional input necessitates the use of a sparse method and a target label is also available to guide the variable selection strategy. Such a method is valuable in many Engineering and scientific problems, when the number of training
samples is also limited. The Hilbert Schmidt Independence Criteria (HSIC) is used to form an objective based on
minimization of a loss function and an L1 norm is used for regularization of the Eigen vectors. While the proposed
objective function allows a sparse low rank solution for both linear and non-linear relationships between the input and
response matrices, other similar methods in this case are only based on a linear model. The objective is solved based on
penalized matrix decomposition (PMD) algorithm. We compare the proposed method with PCA, PMD-based SPCA and
supervised PCA. In addition, SSPCA is also compared with sparse partial least squares (SPLS), due to the similarity
between the two objective functions. Experimental results from the simulated as well as real data sets show that, SSPCA
provides an appropriate trade-off between accuracy and sparsity. Comparisons show that, in terms of sparsity, SSPCA
performs the highest level of variable reduction and also, in terms of accuracy it is one of the most successful methods.
Therefore, the Eigen vectors found by SSPCA can be used for feature selection in various high dimensional problems. ©
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General information
State: Published
Organisations: Statistics and Data Analysis, Department of Applied Mathematics and Computer Science , University of
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Number of pages: 10
Pages: 168-77
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Engineering Applications of Artificial Intelligence
Volume: 65
ISSN (Print): 0952-1976
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.677 SJR 0.874 CiteScore 3.75
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.74 SJR 0.999 SNIP 1.922
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.081 SNIP 2.151 CiteScore 3.51
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.12 SNIP 2.514 CiteScore 3.56
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.996 SNIP 2.324 CiteScore 3.19
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.021 SNIP 2.469 CiteScore 3
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.857 SNIP 2.284 CiteScore 2.81
ISI indexed (2011): ISI indexed yes
Scopus rating (2010): SJR 0.74 SNIP 2.068
Scopus rating (2009): SJR 0.606 SNIP 1.633
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.628 SNIP 1.687
Scopus rating (2007): SJR 0.559 SNIP 1.616
Scopus rating (2006): SJR 0.455 SNIP 1.656
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.305 SNIP 1.256
Scopus rating (2004): SJR 0.242 SNIP 0.93
Spatial bias and uncertainty in numerical weather predictions for urban runoff forecasts with long time horizons

Numerical Weather Predictions (NWP) can be used to forecast urban runoff with long lead times. However, NWP exhibit large spatial uncertainties and using forecasted precipitation directly above the catchment might therefore not be an ideal approach in an online setup. We use the Danish Meteorological Institute’s NWP ensemble and investigate a large spatial neighborhood around the catchment over a two-year period. When compared against in-sewer observations, runoff forecasts forced with precipitation from north-east of the catchment are most skillful. This highlights spatial biases in the coupled hydro-meteorological setup, which a forecaster should be aware of.

Spatial models for probabilistic prediction of wind power with application to annual-average and high temporal resolution data

Producing accurate spatial predictions for wind power generation together with a quantification of uncertainties is required to plan and design optimal networks of wind farms. Toward this aim, we propose spatial models for predicting wind power generation at two different time scales: for annual average wind power generation, and for a high temporal resolution (typically wind power averages over 15-min time steps). In both cases, we use a spatial hierarchical statistical model in which spatial correlation is captured by a latent Gaussian field. We explore how such models can be handled with stochastic partial differential approximations of Matérn Gaussian fields together with Integrated Nested Laplace Approximations. We demonstrate the proposed methods on wind farm data from Western Denmark, and compare the results to those obtained with standard geostatistical methods. The results show that our method makes it possible to obtain fast and accurate predictions from posterior marginals for wind power generation. The proposed method is applicable in scientific areas as diverse as climatology, environmental sciences, earth sciences and epidemiology.
Publication information
Journal: Stochastic Environmental Research and Risk Assessment
ISSN (Print): 1436-3240
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.173 SJR 1.096 CiteScore 2.57
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.54 SJR 1.219 SNIP 1.439
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.051 SNIP 1.015 CiteScore 1.74
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.021 SNIP 1.449 CiteScore 2.3
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.151 SNIP 1.612 CiteScore 2.49
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.326 SNIP 1.457 CiteScore 2.08
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.902 SNIP 1.153 CiteScore 1.56
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.807 SNIP 1.05
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.483 SNIP 0.801
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.603 SNIP 0.795
Scopus rating (2007): SJR 0.545 SNIP 0.894
Scopus rating (2006): SJR 0.558 SNIP 0.668
Scopus rating (2005): SJR 0.533 SNIP 0.635
Scopus rating (2004): SJR 0.547 SNIP 0.945
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.45 SNIP 0.596
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.605 SNIP 0.955
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.527 SNIP 0.751
Scopus rating (2000): SJR 0.474 SNIP 0.639
Scopus rating (1999): SJR 0.526 SNIP 0.663
Original language: English
Wind power, Spatial prediction , Latent Gaussian field, Integrated nested Laplace approximation
Electronic versions:
Lenzietal2016.pdf
Spatial noise-aware temperature retrieval from infrared sounder data

In this paper we present a combined strategy for the retrieval of atmospheric profiles from infrared sounders. The approach considers the spatial information and a noise-dependent dimensionality reduction approach. The extracted features are fed into a canonical linear regression. We compare Principal Component Analysis (PCA) and Minimum Noise Fraction (MNF) for dimensionality reduction, and study the compactness and information content of the extracted features. Assessment of the results is done on a big dataset covering many spatial and temporal situations. PCA is widely used for these purposes but our analysis shows that one can gain significant improvements of the error rates when using MNF instead. In our analysis we also investigate the relationship between error rate improvements when including more spectral and spatial components in the regression model, aiming to uncover the trade-off between model complexity and error rates.

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Universitat de Valencia
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Number of pages: 4
Pages: 17-20
Publication date: 2017

State estimation of the performance of gravity tables using multispectral image analysis

Gravity tables are important machinery that separate dense (healthy) grains from lighter (low yielding varieties) aiding in improving the overall quality of seed and grain processing. This paper aims at evaluating the operating states of such tables, which is a critical criterion required for the design and automation of the next generation of gravity separators. We present a method capable of detecting differences in grain densities, that as an elementary step forms the basis for a related optimization of gravity tables. The method is based on a multispectral imaging technology, capable of capturing differences in the surface chemistry of the kernels. The relevant micro-properties of the grains are estimated using a Canonical Discriminant Analysis (CDA) that segments the captured grains into individual kernels and we show that for wheat, our method correlates well with control measurements (R2 = 0.93).

State: Published
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Pages: 471-480
Statistical modelling of space-time processes with application to wind power.

Short-term wind power forecasts together with a quantification of uncertainties are required for the reliable operation of power systems with significant wind power penetration. A challenge for utilizing wind power as a source of energy is the intermittent and hardly predictable nature of wind. This thesis aims at contributing to the wind power literature by building and evaluating new statistical techniques for producing forecasts at multiple locations and lead times using spatio-temporal information. By exploring the features of a rich portfolio of wind farms in western Denmark, we investigate different types of models and provide several forms of predictions. Starting with spatial prediction, we then extend the methodology to spatio-temporal prediction of individual wind farms and aggregated wind power at monitored locations as well as at locations where recent observations are not available. We propose spatial models for predicting wind power generation at two different time scales: for annual average wind power generation and for a high temporal resolution (typically wind power averages over 15-min time steps). In both cases, we use a spatial hierarchical statistical model in which spatial correlation is captured by a latent Gaussian field. We explore how such models can be handled with stochastic partial differential approximations of Matérn Gaussian fields together with integrated nested Laplace approximations. We show that complex hierarchical spatial models are well suited for wind power data and provide results in reasonable computational time. Moreover, the hierarchical approach for obtaining predictions at a high temporal resolution is found to produce accurate predictions with improved performance compared to a standard geostatistical method at a small additional computational cost. The use of the integrated nested Laplace approximations is motivated by the desire to produce forecasts on large data sets with hundreds of locations, which is critical during periods of high wind penetration. Subsequently, the extension from spatial to spatio-temporal models is given. Three different hierarchical models are developed for obtaining probabilistic wind power forecasts. First, a time series model consisting of an autoregressive process with a location specific intercept is considered. This approach gives satisfactory results for individual forecasts but fails to generate calibrated aggregated forecasts. The second approach has a common intercept for all farms and a spatio-temporal model that varies in time with first order autoregressive dynamics and has spatially correlated innovations given by a zero mean Gaussian process. The third model, which also has a common intercept as well as an autoregressive process to capture the local variability and the spatio-temporal term from the second approach, is able to produce reliable individual and aggregated forecasts for multiple lead times. Finally, very-short-term wind power forecasting is considered. Probabilistic forecasts from 15 minutes up to two hours ahead are produced by using anisotropic spatio-temporal correlation models to account for the propagation of weather fronts and a transformed latent Gaussian field is used to accommodate the probability masses that occur in wind power distribution due to chains of zero measurements. Using what is called kriging equations, even the simplest proposed covariance model is able to produce calibrated spatio-temporal predictions of wind power production.
Statistik i gymnasiet
I forbindelse med den kommende gymnasireform skal der skrives nye læreplaner for blandt andet matematik. I den forbindelse skal det eksisterende statistikpensum i gymnasiet og undervisningen i statistik diskuteres. Dette dokument giver vores bud på, hvad man bør lægge vægt på i forbindelse med undervisningen i og brugen af statistik i gymnasiet, og tanken er, at dokumentet kan fungere som input til eventuelle ændringer i de kommende læreplaner

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Københavns Universitet
Authors: Ekstrøm, C. T. (Forskerdatabase), Hansen, E. (Ekstern), Brockhoff, P. B. (Intern)
Number of pages: 5
Pages: 14-20
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: LMKF-Bladet
Volume: 2017
Issue number: 2
ISSN (Print): 0906-0855
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: English
Electronic versions:
LMFK2017_paper1.pdf
Source: PublicationPreSubmission
Source-ID: 140538769
Publication: Communication › Journal article – Annual report year: 2017

Stochastic derivation and solution of simplified radiative transfer using the Fokker-Planck equation

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Neutrons and X-rays for Materials Physics, Technical University of Denmark
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Number of pages: 1
Publication date: 2017
Event: Poster session presented at IMA Conference on Inverse Problems from Theory to Application, Cambridge, United Kingdom.
Main Research Area: Technical/natural sciences
Electronic versions:
Kris_Xi_MK_poster.pdf
Source: PublicationPreSubmission
Source-ID: 140648950
Publication: Research - peer-review › Poster – Annual report year: 2017
Stochastic Greybox Modeling for Control of an Alternating Activated Sludge Process

We present a stochastic greybox model of a BioDenitro WWTP that can be used for short time horizon Model Predictive Control. The model is based on a simplified ASM1 model and takes model uncertainty into account. It estimates unmeasured state variables in the system, e.g., the inlet concentration or the sensor measurements in case of temporary sensor faults. This improves control performance without adding additional or redundant sensors. We fitted the parameters of the model to actual plant data and demonstrate the state estimation capabilities with this data set. The model now runs online at a WWTP in Denmark.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Department of Environmental Engineering, Urban Water Systems, Krüger A/S
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Number of pages: 9
Publication date: 2017

Publication information
Publisher: DTU Compute
Original language: English
Volume: 08
ISSN: 1601-2321
Main Research Area: Technical/natural sciences
WWTP, ASM1, Stochastic, Greybox, Alternating, BioDenitro
Electronic versions:
tr17_08_Halvgaard_R.pdf
Publication: Research › Report – Annual report year: 2017

Stochastic model of wind-fuel cell for a semi-dispatchable power generation

Hybrid systems are implemented to improve the efficiency of individual generation technologies by complementing each other. Intermittence is a challenge to overcome especially for renewable energy sources for electric generation, as in the case of wind power. This paper proposes a hybrid system as an approach for reducing and overcoming the volatility of wind power, by implementing storage technology, forecasts and predictive control. The proposed hybrid system, which is suitable for the distributed generation level, consists of a wind generator, an electrolyzer, hydrogen storage and a polymer electrolyte membrane fuel cell, which are embedded in one complete system with the wind power. This study uses historic wind speed data from Mexico; the forecasts are obtained using the recursive least square algorithm with a forgetting factor. The proposed approach provides probabilistic information for short-term wind power generation and electric generation as the outcome of the hybrid system. A method for a semi-dispatchable electric generation based on time series analysis is presented, and the implementation of wind power and polymer electrolyte membrane fuel cell models controlled by a model predictive control approach is developed.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Centre for IT-Intelligent Energy Systems in Cities, Universidad Nacional Autonoma de Mexico
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Pages: 139–148
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Applied Energy
Volume: 193
ISSN (Print): 0306-2619
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 8.44 SJR 3.162 SNIP 2.765
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 7.78 SJR 3.011 SNIP 2.61
Stochastic Programming for Fuel Supply Planning of Combined Heat and Power Plants

The consumption of biomass to produce power and heat has increased due to the carbon neutral policies. Combined heat and power (CHP) plants often combine biomass with other fuels, e.g., natural gas. The negotiation process for supply contracts involves many uncertainties due to the long planning horizon. The demand for biomass is uncertain, and heat demand and electricity prices vary during the planning period. We propose a method using stochastic optimization to support the biomass and natural gas supply planning for CHP plants including short-term decisions for optimal market participation.
Structural properties of recursively partitionable graphs with connectivity 2

A connected graph $G$ is said to be arbitrarily partitionable (AP for short) if for every partition $(n_1, \ldots, n_p)$ of $|V(G)|$ there exists a partition $(V_1, \ldots, V_p)$ of $V(G)$ such that each $V_i$ induces a connected subgraph of $G$ on $n_i$ vertices. Some stronger versions of this property were introduced, namely the ones of being online arbitrarily partitionable and recursively arbitrarily partitionable (OL-AP and R-AP for short, respectively), in which the subgraphs induced by a partition of $G$ must not only be connected but also fulfill additional conditions. In this paper, we point out some structural properties of OL-AP and R-AP graphs with connectivity 2. In particular, we show that deleting a cut pair of these graphs results in a graph with a bounded number of components, some of whom have a small number of vertices. We obtain these results by studying a simple class of 2-connected graphs called balloons.
**Succinct partial sums and fenwick trees**

We consider the well-studied partial sums problem in succinct space where one is to maintain an array of $n$ k-bit integers subject to updates such that partial sums queries can be efficiently answered. We present two succinct versions of the Fenwick Tree which is known for its simplicity and practicality. Our results hold in the encoding model where one is allowed to reuse the space from the input data. Our main result is the first that only requires $nk + o(n)$ bits of space while still supporting sum/update in $O(\log bn)$ time where $2 \leq b \leq \log^{O(1)} n$. The second result shows how optimal time for sum/update can be achieved while only slightly increasing the space usage to $nk + o(nk)$ bits. Beyond Fenwick Trees, the results are primarily based on bit-packing and sampling making them very practical and they also allow for simple optimal parallelization.

**Surfaces foliated by planar geodesics: a model for curved wood design**

Surfaces foliated by planar geodesics are a natural model for surfaces made from wood strips. We outline how to construct all solutions, and produce non-trivial examples, such as a wood-strip Klein bottle.
Synergies between energy supply networks

Energy system integration uses a whole-system approach to optimize the synergies between energy supply networks to facilitate and coordinate the grid integration of distributed energy resources while enabling the synergies and conflicts between the local distribution networks and the national level objectives to be understood and optimally coordinated. The latest research on the network coupling technologies analysis of synergies between energy supply networks and optimal use of synergies in network operation is discussed. A diagram on the possible interactions between different energy networks and integration of local renewables including solar energy wind geothermal waste heat and biomass is presented.
Synthesis of on-chip control circuits for mVLSI biochips

Microfluidic VLSI (mVLSI) biochips help perform biochemistry at miniaturized scales, thus enabling cost, performance and other benefits. Although biochips are expected to replace biochemical labs, including point-of-care devices, the off-chip pressure actuators and pumps are bulky, thereby limiting them to laboratory environments. To address this issue, researchers have proposed methods to reduce the number of off-chip pressure sources, through integration of on-chip pneumatic control logic circuits fabricated using three-layer monolithic membrane valve technology. Traditionally, mVLSI biochip physical design was performed assuming that all of the control logic is off-chip. However, the problem of mVLSI biochip physical design changes significantly, with introduction of on-chip control, since along with physical synthesis, we also need to (i) perform on/off-chip control partitioning, (ii) on-chip control circuit design and (iii) the integration of on-chip control in the placement and routing design tasks. In this paper we present a design methodology for logic synthesis and physical synthesis of mVLSI biochips that use on-chip control. We show how the proposed methodology can be successfully applied to generate biochip layouts with integrated on-chip pneumatic control.
System-Level Sensitivity Analysis of SiNW-bioFET-Based Biosensing Using Lockin Amplification

Although Silicon Nanowire biological Field-Effect Transistors (SiNW-bioFETs) have steadily demonstrated their ability to detect biological markers at ultra-low concentration, they have not yet translated into routine diagnostics applications. One of the challenges inherent to the technology is that it requires an instrumentation capable of recovering ultra-low signal variations from sensors usually designed and operated in a highly-resistive configuration. Often overlooked, the SiNWbioFET/instrument interactions are yet critical factors in determining overall system biodetection performances. Here, we carry out for the first time the system-level sensitivity analysis of a generic SiNW-bioFET model coupled to a custom-design instrument based on the lock-in amplifier. By investigating a large parametric space spanning over both sensor and instrumentation specifications, we demonstrate that systemwide investigations can be instrumental in identifying the design trade-offs that will ensure the lowest Limits-of-Detection. The generic character of our analytical model allows us to elaborate on the most general SiNW-bioFET/instrument interactions and their overall implications on detection performances. Our model can be adapted to better match specific sensor or instrument designs to either ensure that ultra-high sensitivity SiNW-bioFETs are coupled with an appropriately sensitive and noise-rejecting instrumentation, or to best tailor SiNW-bioFET design to the specifications of an existing instrument.
Taming Living Logic using Formal Methods

One of the goals of synthetic biology is to build genetic circuits to control the behavior of a cell for different application domains, such as medical, environmental, and biotech. During the design process of genetic circuits, biologists are often interested in the probability of a system to work under different conditions. Since genetic circuits are noisy and stochastic in nature, the verification process becomes very complicated. The state space of stochastic genetic circuit models is usually too large to be handled by classical model checking techniques. Therefore, the verification of genetic circuit models is usually performed by the statistical approach of model checking. In this work, we present a workflow for checking genetic circuit models using a stochastic model checker (Uppaal) and a stochastic simulator (D-VASim). We demonstrate with experimentations that the proposed workflow is not only sufficient for the model checking of genetic circuits, but can also be used to design the genetic circuits with desired timings.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering
Authors: Baig, H. (Intern), Madsen, J. (Intern)
Pages: 503–515
Tank für Überschusshefe versagt – mit katastrophalen Folgen

Ein großer Tank für Überschusshefe flog in die Luft und nur noch die Bodenplatte und der Tankinhalt blieben zurück.
Obwohl der Tank nicht für Überdruck ausgelegt war, wurde er auf "sehr geringem Überdruck" gehalten, um störende Schaumentwicklung zu verhindern. Der Brauerei waren die Gefahren durch Druckluft nicht bekannt. Der in diesem Artikel beschriebene Unfall soll aufzeigen, dass Vorsicht geboten ist, wenn ein ursprünglich für atmosphärischen Druck ausgelegter Tank auf Betrieb mit leichtem Überdruck abgeändert wird.

Test-Driven, Model-Based Systems Engineering.

Hearing systems have evolved over many years from simple mechanical devices (horns) to electronic units consisting of microphones, amplifiers, analog filters, loudspeakers, batteries, etc. Digital signal processors replaced analog filters to provide better performance and new features. Central processors were added to provide many functions for monitoring and controlling other parts of the devices. Hearing systems have thus evolved into complex embedded systems. Radio systems were added to allow hearing aids to communicate with accessories, auxiliary equipment, third-party products, etc. Many new features are enabled by such radio communication. Monitoring and controlling hearing aids from remote control devices or smart phones have been incorporated into several products. Direct audio streaming between hearing aids and dedicated streaming devices or smart phones is possible with some products. Also emerging are advanced features that are based on interactions with internet services, clouds, etc. Hearing systems are thus evolving into large and complex smart systems. Designing complex embedded systems or large smart systems is notoriously difficult. Many systems are still developed using document-based methods, where requirements and proposed architecture are described textually with the addition of a few figures and tables. Such documents cannot be subjected to testing, so it is impossible to predict the functionality and performance or even feasibility of the intended systems. Replacing documents with models have several advantages. Models can be simulated and analyzed such that functionality and performance can be predicted before any parts have been built. Potential flaws in the specification can therefore be corrected in early phases, which may reduce development effort and costs. This thesis concerns methods for identifying, selecting and implementing tools for various aspects of model-based systems engineering. A comprehensive method was proposed that include several novel
steps such as techniques for analyzing the gap between requirements and tool capabilities. The method was verified with good results in two case studies for selection of a traceability tool (single-tool scenario) and a set of modeling tools (multi-tool scenarios). Models must be subjected to testing to allow engineers to predict functionality and performance of systems. Test-first strategies are known to produce good results in software development. This thesis concerns methods for test-driven modeling of hearing systems. A method is proposed for test-driven modeling of embedded systems of medium complexity. It utilizes formal model checking to guarantee functionality and performance. Test-driven design space exploration is enabled by using statistical model checking to obtain estimates that are verified formally at the final stages of the method. The method was applied with good results to a case study, where two solutions to a design problem were developed and verified. Feasible ranges for critical parameters were identified. Both solution conformed to all requirements. Smart systems are typically too large and complex to be verified by formal model checking, and the research showed that statistical model checking in its current form cannot be used for verifying such systems. A new method is therefore proposed for test-driven modeling of smart systems. The method uses formal verification of basic interactions. Simulations are used for verifying the overall system. To predict performance for scenarios that are too large to be simulated, the method uses mathematical forecasting based on simulating series of smaller scenarios, fitting simulation results to estimator functions, and extrapolating beyond the simulated data set. Mathematical forecasting allowed us to predict the performance of system scenarios that were much too large to be simulated. Such performance estimates may be somewhat imprecise but are nevertheless valuable because they provide answers that cannot be obtained otherwise. The research has thus proposed and verified methods for selecting modeling tools and for test-driven systems modeling for the benefit of GN Hearing and other organizations involved in development of complex embedded systems of large smart systems.

Test-driven modeling and development of cloud-enabled cyber-physical smart systems

Embedded products currently tend to evolve into large and complex smart systems where products are enriched with services through clouds and other web technologies. The complex characteristics of smart systems make it very difficult to guarantee functionality, safety, security and performance. Using test-driven modeling (TDM) is likely to be the best way to design smart systems such that these qualities are ensured. However, the TDM methods that are applied to development of simpler systems do not scale to smart systems because the modeling technologies cannot handle the complexity and size of the systems. In this paper, we present a method for test-driven modeling that scales to very large and complex systems. The method uses a combination of formal verification of basic interactions, simulations of complex scenarios, and mathematical forecasting to predict system behavior and performance. We utilized the method to analyze, design and develop various scenarios for a cloud-enabled medical system. Our approach provides a versatile method that may be adapted and improved for future development of very large and complex smart systems in various domains.
There is ample evidence that the occipital cortex of congenitally blind individuals processes nonvisual information. It remains a debate whether the cross-modal activation of the occipital cortex is mediated through the modulation of preexisting corticocortical projections or the reorganisation of thalamocortical connectivity. Current knowledge on this topic largely stems from anatomical studies in animal models. The aim of this study was to test whether purported changes in thalamocortical connectivity in blindness can be revealed by tractography based on diffusion-weighted magnetic resonance imaging. To assess the thalamocortical network, we used a clustering method based on the thalamic white matter projections towards predefined cortical regions. Five thalamic clusters were obtained in each group representing their cortical projections. Although we did not find differences in the thalamocortical network between congenitally blind individuals, late blind individuals, and normal sighted controls, diffusion tensor imaging (DTI) indices revealed significant microstructural changes within thalamic clusters of both blind groups. Furthermore, we find a significant decrease in fractional anisotropy (FA) in occipital and temporal thalamocortical projections in both blind groups that were not captured at the network level. This suggests that plastic microstructural changes have taken place, but not in a degree to be reflected in the tractography-based thalamocortical network.
The (1+λ) evolutionary algorithm with self-adjusting mutation rate

We propose a new way to self-adjust the mutation rate in population-based evolutionary algorithms. Roughly speaking, it consists of creating half the offspring with a mutation rate that is twice the current mutation rate and the other half with half the current rate. The mutation rate is then updated to the rate used in that subpopulation which contains the best offspring. We analyze how the (1 + A) evolutionary algorithm with this self-adjusting mutation rate optimizes the OneMax test function. We prove that this dynamic version of the (1 + A) EA finds the optimum in an expected optimization time (number of fitness evaluations) of $O(nA/\log A + n \log n)$. This time is asymptotically smaller than the optimization time of the classic (1 + A) EA. Previous work shows that this performance is best-possible among all A-parallel mutation-based unbiased black-box algorithms. This result shows that the new way of adjusting the mutation rate can find optimal dynamic parameter values on the fly. Since our adjustment mechanism is simpler than the ones previously used for adjusting the mutation rate and does not have parameters itself, we are optimistic that it will find other applications.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, École Polytechnique
Authors: Doerr, B. (Ekstern), Witt, C. (Intern), Gießen, C. (Intern), Yang, J. (Ekstern)
Number of pages: 8
Pages: 1351-1358
Publication date: 2017

Host publication information

Title of host publication: Proceedings of 2017 Genetic and Evolutionary Computation Conference
Publisher: Association for Computing Machinery
ISBN (Print): 9781450349208
Main Research Area: Technical/natural sciences
Conference: The Genetic and Evolutionary Computation Conference (2017), Berlin, Germany, 15/07/2017 - 15/07/2017
Dynamic parameter control, Mutation, Runtime analysis, Optimization Techniques, Optimization, Adjustment mechanisms, Black box algorithms, Current mutations, Expected optimization time, Fitness evaluations, Run-time analysis, Evolutionary algorithms
Electronic versions:
1704.02191.pdf
DOIs:
10.1145/3071178.3071279
The Adjoint Method for Gradient-based Dynamic Optimization of UV Flash Processes
This paper presents a novel single-shooting algorithm for gradient-based solution of optimal control problems with vapor-liquid equilibrium constraints. Dynamic optimization of UV flash processes is relevant in nonlinear model predictive control of distillation columns, certain two-phase flow problems, and oil reservoir production with significant compositional and thermal effects. Gradients are computed with the adjoint method and we use various optimization software (fmincon, IPOPT, KNITRO, and NPSOL) for the numerical optimization. We present computational results for a non-ideal five-component flash process which demonstrate the importance of the optimization solver, the compiler, and the linear algebra software for the efficiency of dynamic optimization of UV flash processes.

The Bipolar Illness Onset study: research protocol for the BIO cohort study
Bipolar disorder is an often disabling mental illness with a lifetime prevalence of 1%-2%, a high risk of recurrence of manic and depressive episodes, a lifelong elevated risk of suicide and a substantial heritability. The course of illness is frequently characterised by progressive shortening of interepisode intervals with each recurrence and increasing cognitive dysfunction in a subset of individuals with this condition. Clinically, diagnostic boundaries between bipolar disorder and other psychiatric disorders such as unipolar depression are unclear although pharmacological and psychological treatment strategies differ substantially. Patients with bipolar disorder are often misdiagnosed and the mean delay between onset and diagnosis is 5-10 years. Although the risk of relapse of depression and mania is high it is for most patients impossible to predict and consequently prevent upcoming episodes in an individual tailored way. The identification of objective biomarkers can both inform bipolar disorder diagnosis and provide biological targets for the development of new and personalised treatments. Accurate diagnosis of bipolar disorder in its early stages could help prevent the long-term detrimental effects of the illness. The present Bipolar Illness Onset study aims to identify (1) a composite blood-based biomarker, (2) a composite electronic smartphone-based biomarker and (3) a neurocognitive and neuroimaging-based signature for bipolar disorder. The study will include 300 patients with newly diagnosed/first-episode bipolar disorder, 200 of their healthy siblings or offspring and 100 healthy individuals without a family history of affective disorder. All participants will be followed longitudinally with repeated blood samples and other biological tissues, self-monitored and automatically generated smartphone data, neuropsychological tests and a subset of the cohort with neuroimaging during a 5 to 10-year study period. The study has been approved by the Local Ethical Committee (H-7-2014-007) and the data agency, Capital Region of Copenhagen (RHP-2015-023), and the findings will be widely disseminated at international conferences and meetings including conferences for the International Society for Bipolar Disorders and the World Federation of Societies for Biological Psychiatry and in scientific peer-reviewed papers. NCT02888262.
The challenge of mapping the human connectome based on diffusion tractography

Tractography based on non-invasive diffusion imaging is central to the study of human brain connectivity. To date, the approach has not been systematically validated in ground truth studies. Based on a simulated human brain data set with ground truth tracts, we organized an open international tractography challenge, which resulted in 96 distinct submissions from 20 research groups. Here, we report the encouraging finding that most state-of-the-art algorithms produce tractograms containing 90% of the ground truth bundles (to at least some extent). However, the same tractograms contain many more invalid than valid bundles, and half of these invalid bundles occur systematically across research groups. Taken together, our results demonstrate and confirm fundamental ambiguities inherent in tract reconstruction based on orientation information alone, which need to be considered when interpreting tractography and connectivity results. Our approach provides a novel framework for estimating reliability of tractography and encourages innovation to address its current limitations.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics
Number of pages: 13
Publication date: 2017
The circle equation over finite fields

Interesting patterns in the geometry of a plane algebraic curve C can be observed when the defining polynomial equation is solved over the family of finite fields. In this paper, we examine the case of C the classical unit circle defined by the circle equation $x^2 + y^2 = 1$. As a main result, we establish a concise formula for the number of solutions to the circle equation over an arbitrary finite field. We also provide criteria for the existence of diagonal solutions to the circle equation. Finally, we give a precise description of how the number of solutions to the circle equation over a prime field grows as a function of the prime.
The Crossed Projection to the Striatum in Two Species of Monkey and in Humans: Behavioral and Evolutionary Significance

The corpus callosum establishes the anatomical continuity between the 2 hemispheres and coordinates their activity. Using histological tracing, single axon reconstructions, and diffusion tractography, we describe a callosal projection to the caudatus and putamen in monkeys and humans. In both species, the origin of this projection is more restricted than that of the ipsilateral projection. In monkeys, it consists of thin axons (0.4–0.6 μm), appropriate for spatial and temporal dispersion of subliminal inputs. For prefrontal cortex, contralateral minus ipsilateral delays to striatum calculated from axon diameters and conduction distance are <2 ms in the monkey and, by extrapolation, <4 ms in humans. This delay corresponds to the performance in Poffenberger’s paradigm, a classical attempt to estimate central conduction delays, with a neuropsychological task. In both species, callosal cortico-striatal projections originate from prefrontal, premotor, and motor areas. In humans, we discovered a new projection originating from superior parietal lobule, supramarginal, and superior temporal gyrus, regions engaged in language processing. This projection crosses in the isthmus the lesion of which was reported to dissociate syntax and prosody. The projection might originate from an overproduction of callosal projections in development, differentially pruned depending on species.
Publication information
Journal: Cerebral Cortex
Volume: 27
Issue number: 6
ISSN (Print): 1047-3211
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.633 SJR 3.892 CiteScore 5.87
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.5 SJR 4.103 SNIP 1.614
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 4.929 SNIP 1.872 CiteScore 6.68
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 4.887 SNIP 1.994 CiteScore 6.86
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 5.386 SNIP 1.899 CiteScore 7.26
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 5.077 SNIP 1.916 CiteScore 7.28
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 5.187 SNIP 1.893 CiteScore 7.2
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 5.074 SNIP 1.843
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 5.158 SNIP 1.896
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 4.992 SNIP 1.762
Scopus rating (2005): SJR 4.464 SNIP 1.773
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 4.128 SNIP 1.676
Scopus rating (2003): SJR 4.824 SNIP 1.887
Scopus rating (2002): SJR 4.666 SNIP 1.673
Scopus rating (2001): SJR 3.968 SNIP 1.876
Scopus rating (2000): SJR 3.708 SNIP 2.05
Scopus rating (1999): SJR 3.955 SNIP 2.182
Original language: English
Axons, Conduction delays, Corpus callosum, Diffusion tractography, Language
Electronic versions:
hkkr_rou_cps.pdf. Embargo ended: 02/12/2017
The Exact Limit of Some Cubic Towers
Recently, a new explicit tower of function fields was introduced by Bassa, Beelen, Garcia and Stichtenoth (BBGS). This resulted in currently the best known lower bound for Ihara’s constant in the case of non-prime finite fields. In particular over cubic fields, the tower’s limit is at least as good as Zink’s bound; i.e. $\lambda(BBGS/F_{q^3}) \geq 2(q^2 - 1)/(q + 2)$. In this paper, the exact value of $\lambda(BBGS/F_{q^3})$ is computed. We also settle a question stated by Ihara.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics
Authors: Anbar Meidl, N. (Intern), Beelen, P. (Intern), Nguyen, N. (Intern)
Number of pages: 17
Publication date: 2017

The Fine Structure of Herman Rings
We study the geometric structure of the boundary of Herman rings in a model family of Blaschke products of degree 3 (up to quasiconformal deformation). Shishikura’s quasiconformal surgery relates the Herman ring to the Siegel disk of a quadratic polynomial. By studying the regularity properties of the maps involved, we transfer McMullen’s results on the fine local geometry of Siegel disks to the Herman ring setting.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics, Universitat de Barcelona
Authors: Fagella, N. (Ekstern), Henriksen, C. (Intern)
Pages: 2381-2399
Publication date: 2017
Main Research Area: Technical/natural sciences
The GO-ACTIWE randomized controlled trial - An interdisciplinary study designed to investigate the health effects of active commuting and leisure time physical activity

Regular physical activity is efficacious for improving metabolic health in overweight and obese individuals, yet, many adults lead sedentary lives. Most exercise interventions have targeted leisure time, but physical activity also takes place in other domains of everyday life. Active commuting represents a promising alternative to increase physical activity, but it has yet to be established whether active commuting conveys health benefits on par with leisure time physical activity (LTPA).

A 6-month randomized controlled trial was designed to investigate the effects of increased physical activity in transport (bicycling) or leisure time domains (moderate or vigorous intensity endurance exercise). We included 188 overweight and class 1 obese sedentary women and men (20-45 years) of which 130 were randomized to either sedentary controls (n=18), active commuting (n=35) or moderate (n=39) or vigorous (n=38) intensity LTPA. At baseline and after 3 and 6 months, participants underwent a rigorous 3-day biomedical test regimen followed by free-living measurements. In a sub-sample, physical activity level and energy expenditure were monitored by means of personal assistive technology and the doubly labeled water technique. Additionally, the delivery, reception and routinization of the exercise regimens were investigated by ethnological fieldwork. One year after termination of the intervention, participants will be invited for a follow-up visit to investigate sustained health effects and continuous physical activity adherence. By combining biomedical, technological and humanistic approaches, we aim to understand the health benefits of physical activity in different domains of everyday life, as well as how to improve adherence to physical activity.
The Impact of a Sparse Migration Topology on the Runtime of Island Models in Dynamic Optimization

Island models denote a distributed system of evolutionary algorithms which operate independently, but occasionally share their solutions with each other along the so-called migration topology. We investigate the impact of the migration topology by introducing a simplified island model with behavior similar to (Formula presented.) islands optimizing the so-called Maze fitness function (Kötzing and Molter in Proceedings of parallel problem solving from nature (PPSN XII), Springer, Berlin, pp 113â€“122, 2012). Previous work has shown that when a complete migration topology is used, migration must not occur too frequently, nor too soon before the optimum changes, to track the optimum of the Maze function. We show that using a sparse migration topology alleviates these restrictions. More specifically, we prove that there exist choices of model parameters for which using a unidirectional ring of logarithmic diameter as the migration topology allows the model to track the oscillating optimum through nMaze-like phases with high probability, while using any graph of diameter less than (Formula presented.) for some sufficiently small constant (Formula presented.) results in the island model losing track of the optimum with overwhelming probability. Experimentally, we show that very frequent migration on a ring topology is not an effective diversity mechanism, while a lower migration rate allows the ring topology to track the optimum for a wider range of oscillation patterns. When migration occurs only rarely, we prove that dense migration topologies of small diameter may be advantageous. Combined, our results show that the sparse migration topology is able to track the optimum through a wider range of oscillation patterns, and cope with a wider range of migration frequencies.

General information
State: Published
Organisations: Algorithms and Logic, Department of Applied Mathematics and Computer Science
Authors: Lissovoi, A. (Intern), Witt, C. (Intern)
Number of pages: 24
Pages: 1-24
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Algorithmica
ISSN (Print): 0178-4617
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 1.27 SJR 0.56 SNIP 1.354
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.11 SJR 0.648 SNIP 1.184
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.739 SNIP 1.16 CiteScore 1.15
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.854 SNIP 1.197 CiteScore 1.2
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.952 SNIP 1.395 CiteScore 1.26
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.836 SNIP 1.204 CiteScore 0.99
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.848 SNIP 1.184 CiteScore 0.91
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
The impact of tool wear on the functionality of replicated polymer surface with micro structures

Wear happened frequently in the tooling process of mold for polymer production. The scope of this paper is to understand how the wear of the milling tool affected the function of the replicated polymer surface. This study is part of the process chain of fabrication of optical functional surfaces on polymer components. The aiming function of the surfaces is to maximize the reflectance from a certain viewing angle and direction, and minimize it from its horizontally orthogonal position, i.e. to maximize the contrast between two horizontally orthogonal view positions at the same inclination. A five-axis micro milling machine was employed to pattern the surface of a steel insert for subsequent polymer replication.

In order to conduct the study, 1200 pixels (0.8 x 0.8 mm²) was machined on the surface of a steel insert using the same mill tool (Ф0.5 mm, ARNO®); each of the pixels contains 16 ridges which is illustrated in figure 1 (a). The obtained surface structures were replicated using liquid silicon rubber (LSR). The mill tool was inspected by scanning electron microscope (SEM) before and after the machining. Noticeable wear was observed. The weight of the studied tool was measured before and after machining for comparison. The obtained surface features on the insert and the LSR replica were measured using a confocal 3D laser scanner. The reflectance of the surfaces on the LSR replica was evaluated using a gonioreflectometer[1]. The gonioreflectometer captured the images of every 100th pixel from all the viewing angles by rotating the sample holder and tilting the objective lens. The reflectance for each configuration were obtained via image processing tools.

Results in this study include: 1. Tool wear was visualized by SEM images, which is shown in figure 1 (b). 2. However, the weight decrease could not be detected due to lack of precision in the measurement. 3. The number of defects on the obtained surface structures increased significantly along with the process. 4. The reflectance of these pixels on the LSR replica decreased from the first machined one to the last one.

As a conclusion, the tool (Ф 0.5mm, ARNO®) used in this study worn after machining for approximately 100 pixels, considering the function loss of replica surface. Future work will be dedicated to the methods that can prolong the tool life.
The Internet of Hackable Things
The Internet of Things makes possible to connect each everyday object to the Internet, making computing pervasive like never before. From a security and privacy perspective, this tsunami of connectivity represents a disaster, which makes each object remotely hackable. We claim that, in order to tackle this issue, we need to address a new challenge in security: education.

General information
State: Published
Organisations: Copenhagen Center for Health Technology, Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, Örebro University, Innopolis University
Authors: Dragni, N. (Intern), Giaretta, A. (Ekstern), Mazzara, M. (Ekstern)
Number of pages: 12
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: ArXiv
Volume: 2017
Article number: 1707.08380
Original language: English
Electronic versions:
1707.08380.pdf
Source: FindIt
Source-ID: 2390595582
Publication: Research - peer-review › Journal article – Annual report year: 2017

The Interplay of Population Size and Mutation Probability in the (1+λ) EA on OneMax
The ((Formula presented.)) EA with mutation probability c / n, where (Formula presented.) is an arbitrary constant, is studied for the classical OneMax function. Its expected optimization time is analyzed exactly (up to lower order terms) as a function of c and (Formula presented.). It turns out that 1 / n is the only optimal mutation probability if (Formula presented.), which is the cut-off point for linear speed-up. However, if (Formula presented.) is above this cut-off point then the standard mutation probability 1 / n is no longer the only optimal choice. Instead, the expected number of generations is (up to lower order terms) independent of c, irrespectively of it being less than 1 or greater. The theoretical results are obtained by a careful study of order statistics of the binomial distribution and variable drift theorems for upper and lower bounds. Experimental supplements shed light on the optimal mutation probability for small problem sizes.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Authors: Gießen, C. (Intern), Witt, C. (Intern)
Pages: 587–609
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Algorithmica
Volume: 78
Issue number: 2
ISSN (Print): 0178-4617
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 1.27 SJR 0.56 SNIP 1.354
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.11 SJR 0.648 SNIP 1.184
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.739 SNIP 1.16 CiteScore 1.15
Web of Science (2015): Indexed yes
The missing link: Predicting connectomes from noisy and partially observed tract tracing data

Our understanding of the wiring map of the brain, known as the connectome, has increased greatly in the last decade, mostly due to technological advancements in neuroimaging techniques and improvements in computational tools to interpret the vast amount of available data. Despite this, with the exception of the C. elegans roundworm, no definitive connectome has been established for any species. In order to obtain this, tracer studies are particularly appealing, as these have proven highly reliable. The downside of tract tracing is that it is costly to perform, and can only be applied ex vivo. In this paper, we suggest that instead of probing all possible connections, hitherto unknown connections may be predicted from the data that is already available. Our approach uses a 'latent space model' that embeds the connectivity in an abstract physical space. Regions that are close in the latent space have a high chance of being connected, while regions far apart are most likely disconnected in the connectome. After learning the latent embedding from the connections that we did observe, the latent space allows us to predict connections that have not been probed previously. We apply the methodology to two connectivity data sets of the macaque, where we demonstrate that the latent space model is successful in predicting unobserved connectivity, outperforming two baselines and an alternative model in nearly all cases. Furthermore, we show how the latent spatial embedding may be used to integrate multimodal observations (i.e. anterograde and retrograde tracers) for the mouse neocortex. Finally, our probabilistic approach enables us to make explicit which connections are easy to predict and which prove difficult, allowing for informed follow-up studies.
The Modulation of Pain by Circadian and Sleep-Dependent Processes: A Review of the Experimental Evidence

This proceedings paper is the first in a series of three papers developing mathematical models for the complex relationship between pain and the sleep–wake cycle. Here, we briefly review what is known about the relationship between pain and the sleep–wake cycle in humans and laboratory rodents in an effort to identify constraints for the models. While it is well accepted that sleep behavior is regulated by a daily (circadian) timekeeping system and homeostatic sleep drive, the joint modulation of these two primary biological processes on pain sensitivity has not been considered. Under experimental conditions, pain sensitivity varies across the 24 h day, with highest sensitivity occurring during the evening in humans. Pain sensitivity is also modulated by sleep behavior, with pain sensitivity increasing in response to the build-up of homeostatic sleep pressure following sleep deprivation or sleep disruption. To explore the interaction between these two biological processes using modeling, we first compare the magnitude of their effects across a variety of experimental pain studies in humans. To do this comparison, we normalize the results from experimental pain studies relative to the range of physiologically meaningful stimulation levels. Following this normalization, we find that the estimated impact of the daily rhythm and of sleep deprivation on experimental pain measurements is surprisingly consistent across different pain modalities. We also review evidence documenting the impact of circadian rhythms and sleep deprivation on the neural circuitry in the spinal cord underlying pain sensation. The characterization of sleep-dependent and circadian influences on pain sensitivity in this review paper is used to develop and constrain the mathematical models introduced in the two companion articles.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, University of Michigan, Rensselaer Polytechnic Institute, Washington and Lee University, University of Alabama
Authors: Hagenauer, M. (Ekstern), Crodelle, J. (Ekstern), Piltz, S. H. (Intern), Toporikova, N. (Ekstern), Ferguson, P. (Ekstern), Booth, V. (Ekstern)
Number of pages: 21
Pages: 1-21
Publication date: 2017

Host publication information
Title of host publication: Women in Mathematics
Volume: 8
Publisher: Springer
ISBN (Print): 9783319603049

Series: Women in Mathematical Biology
Volume: 8
ISSN: 2364-5733
Main Research Area: Technical/natural sciences
Workshop: Research Collaboration Workshop for Women in Mathematical Biology, Knoxville, United States, 22/06/2015 - 22/06/2015
Mathematics, Physiological, Cellular and Medical Topics, Mathematical Modeling and Industrial Mathematics
DOIs: 10.1007/978-3-319-60304-9_1
Source: FindIt
Source-ID: 2373459130
Publication: Research - peer-review → Article in proceedings – Annual report year: 2017

The number of colorings of planar graphs with no separating triangles
A classical result of Birkhoff and Lewis implies that every planar graph with \( n \) vertices has at least \( 152n-1 \) distinct 5-vertex-colorings. Equality holds for planar triangulations with \( n-4 \) separating triangles. We show that, if a planar graph has no separating triangle, then it has at least \( (2+10-12)n \) distinct 5-vertex-colorings. A similar result holds for \( k \)-colorings for each fixed \( k \leq 5 \). Infinitely many planar graphs without separating triangles have less than \( 2.252n \) distinct 5-vertex-colorings. As an auxiliary result we provide a complete description of the infinite 6-regular planar triangulations.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Authors: Thomassen, C. (Intern)
Number of pages: 19
Pages: 615–633
Publication date: 2017
Main Research Area: Technical/natural sciences
The period adding and incrementing bifurcations: from rotation theory to applications

This survey article is concerned with the study of bifurcations of piecewise-smooth maps. We review the literature in circle maps and quasi-contractions and provide paths through this literature to prove sufficient conditions for the occurrence of two types of bifurcation scenarios involving rich dynamics. The first scenario consists of the appearance of periodic orbits whose symbolic sequences and ‘rotation’ numbers follow a Farey tree structure; the periods of the periodic orbits are given by consecutive addition. This is called the period adding bifurcation, and its proof relies on results for maps on the circle. In the second scenario, symbolic sequences are obtained by consecutive attachment of a given symbolic block and the periods of periodic orbits are incremented by a constant term. It is called the period incrementing bifurcation, in its proof relies on results for maps on the interval.

We also discuss the expanding cases, as some of the partial results found in the literature also hold when these maps lose contractiveness. The higher dimensional case is also discussed by means of quasi-contractions. We also provide applied examples in control theory, power electronics and neuroscience where these results can be applied to obtain precise descriptions of their dynamics.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics, Universidad Autonoma de Barcelona, Inria Sophia-Antipolis Research Center
Authors: Granados, A. (Intern), Alsedà, L. (Ekstern), Krupa, M. (Intern)
Pages: 225–292
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: S I A M Review
Volume: 59
Issue number: 2
ISSN (Print): 0036-1445
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 4.819 SJR 2.273 CiteScore 3.93
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.26 SJR 2.33 SNIP 3.542
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.607 SNIP 4.074 CiteScore 2.62
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.561 SNIP 5.029 CiteScore 3.7
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 3.51 SNIP 6.033 CiteScore 4.88
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 4.862 SNIP 10.356 CiteScore 8.78
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.939 SNIP 8.356 CiteScore 6.5
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Thermal stratification built up in hot water tank with different inlet stratifiers

Thermal stratification in a water storage tank can strongly increase the thermal performance of solar heating systems. Thermal stratification can be built up in a storage tank during charge, if the heated water enters through an inlet stratifier. Experiments with a test tank have been carried out in order to elucidate how well thermal stratification is established in the tank with differently designed inlet stratifiers under different controlled laboratory conditions. The investigated inlet stratifiers are from Solvis GmbH & Co KG and EyeCular Technologies ApS. The inlet stratifier from Solvis GmbH is a rigid plastic pipe with holes for each 30 cm. The holes are designed with flaps preventing counter flow into the pipe. The inlet stratifier from EyeCular Technologies ApS is made of a flexible polymer with openings all along the side and in the full length of the stratifier. The flexibility of the stratifier prevents counterflow. The tests have shown that both types of inlet stratifiers had an ability to create stratification in the test tank under the different test conditions. The stratifier from EyeCular Technologies ApS had a better performance at low flows of 1-2 l/min and the stratifier for Solvis GmbH & Co KG had a better performance at 4 l/min. In the intermediate charge test the stratifier from EyeCular Technologies ApS had a better performance in terms of maintaining the thermal stratification in the storage tank while charging with a relative low temperature. [All rights reserved Elsevier].

General information
State: Published
Organisations: Department of Civil Engineering, Section for Building Energy, Department of Applied Mathematics and Computer Science, Dynamical Systems
Authors: Dragsted, J. (Intern), Furbo, S. (Intern), Dannemand, M. (Intern), Bava, F. (Intern)
Number of pages: 12
Pages: 414-425
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Solar Energy
Volume: 147
ISSN (Print): 0038-092X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.791 SJR 1.615 CiteScore 4.89
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.52 SJR 1.504 SNIP 1.746
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.912 SNIP 2.085 CiteScore 4.61
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.962 SNIP 2.671 CiteScore 4.77
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.99 SNIP 2.85 CiteScore 4.44
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.605 SNIP 2.517 CiteScore 3.65
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.283 SNIP 2.178 CiteScore 3.19
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.369 SNIP 2.16
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.265 SNIP 2.158
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.684 SNIP 1.994
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.685 SNIP 2.085
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.594 SNIP 2.229
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.233 SNIP 1.601
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.523 SNIP 1.702
Scopus rating (2003): SJR 1.152 SNIP 1.423
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.331 SNIP 1.561
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.292 SNIP 1.277
Scopus rating (2000): SJR 0.77 SNIP 1.065
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.688 SNIP 1.253
Original language: English
Thermal stratification, Hot water tank, Inlet stratifiers, Laboratory tests
DOIs:
10.1016/j.solener.2017.03.008
Source: FindIt
Source-ID: 2356743409
Publication: Research - peer-review › Journal article – Annual report year: 2017
The role of gender in social network organization

The digital traces we leave behind when engaging with the modern world offer an interesting lens through which we study behavioral patterns as expression of gender. Although gender differentiation has been observed in a number of settings, the majority of studies focus on a single data stream in isolation. Here we use a dataset of high resolution data collected using mobile phones, as well as detailed questionnaires, to study gender differences in a large cohort. We consider mobility behavior and individual personality traits among a group of more than 800 university students. We also investigate interactions among them expressed via person-to-person contacts, interactions on online social networks, and telecommunication. Thus, we are able to study the differences between male and female behavior captured through a multitude of channels for a single cohort. We find that while the two genders are similar in a number of aspects, there are robust deviations that include multiple facets of social interactions, suggesting the existence of inherent behavioral differences. Finally, we quantify how aspects of an individual's characteristics and social behavior reveals their gender by posing it as a classification problem. We ask: How well can we distinguish between male and female study participants based on behavior alone? Which behavioral features are most predictive?

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, Technical University of Denmark
Authors: Psylla, I. (Ekstern), Sapiezynski, P. (Intern), Mones, E. (Intern), Jørgensen, S. L. (Intern)
Number of pages: 21
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information

Journal: PLoS One
Volume: 12
Issue number: 12
Article number: e0189873
ISSN (Print): 1932-6203
Ratings:

BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.01 SJR 1.164 SNIP 1.111
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.11 SJR 1.236 SNIP 1.101
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.427 SNIP 1.136 CiteScore 3.32
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.559 SNIP 1.148 CiteScore 3.54
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.772 SNIP 1.153 CiteScore 3.94
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.982 SNIP 1.156 CiteScore 4.15
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.425 SNIP 1.233 CiteScore 4.58
ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.705 SNIP 1.178
Web of Science (2010): Indexed yes
The square of a planar cubic graph is 7-colorable
We prove the conjecture made by G. Wegner in 1977 that the square of every planar, cubic graph is 7-colorable. Here, 7 cannot be replaced by 6.
The unitary extension principle on locally compact abelian groups

The unitary extension principle (UEP) by Ron and Shen yields conditions for the construction of a multi-generated tight wavelet frame for $L^2(\mathbb{R})$ based on a given refinable function. In this paper we show that the UEP can be generalized to locally compact abelian groups. In the general setting, the resulting frames are generated by modulates of a collection of functions; via the Fourier transform this corresponds to a generalized shift-invariant system. Both the stationary and the nonstationary case are covered. We provide general constructions, based on B-splines on the group itself as well as on characteristic functions on the dual group. Finally, we consider a number of concrete groups and derive explicit constructions of the resulting frames.
Threat detection of liquid explosives and precursors from their x-ray scattering pattern using energy dispersive detector technology

Energy dispersive X-ray diffraction (EDXRD) can be applied for identification of liquid threats in luggage scanning in security applications. To define the instrumental design, the framework for data reduction and analysis and test the performance of the threat detection in various scenarios, a flexible laboratory EDXRD test setup was build. A data set of
overall 570 EDXRD spectra has been acquired for training and testing of threat identification algorithms. The EDXRD data was acquired with limited count statistics and at multiple detector angles and merged after correction and normalization. Initial testing of the threat detection algorithms with this data set indicate the feasibility of detection levels of > 95 % true positive with < 6 % false positive alarms.

**General information**
State: Published
Organisations: Department of Physics, Neutrons and X-rays for Materials Physics, Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics
Authors: Kehres, J. (Intern), Olsen, U. L. (Intern), Lyksborg, M. (Intern)
Number of pages: 9
Publication date: 2017

**Host publication information**
Title of host publication: Proc. SPIE 10403, Infrared Remote Sensing and Instrumentation XXV
Volume: 10391
Publisher: SPIE - International Society for Optical Engineering
Article number: 1039302
Series: Proceedings of SPIE - International Society for Optical Engineering
ISSN: 0277-786X
Main Research Area: Technical/natural sciences
Conference: SPIE Optical Engineering + Applications, San Diego, United States, 06/08/2017 - 06/08/2017
Threat detection, Liquid threats, LAGs, EDXRD
Electronic versions:
Untitiled.pdf
DOIs: 10.1117/12.2274519
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

**Tight bounds for top tree compression**
We consider compressing labeled, ordered and rooted trees using DAG compression and top tree compression. We show that there exists a family of trees such that the size of the DAG compression is always a logarithmic factor smaller than the size of the top tree compression (even for an alphabet of size 1). The result settles an open problem from Bille et al. (Inform. and Comput., 2015).

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Technical University of Denmark
Authors: Bille, P. (Intern), Fernstrøm, F. (Ekstern), Gørtz, I. L. (Intern)
Pages: 97-102
Publication date: 2017

**Host publication information**
Title of host publication: String Processing and Information Retrieval
Publisher: Springer
Series: Lecture Notes in Computer Science
Volume: 10508
ISSN: 0302-9743
Main Research Area: Technical/natural sciences
Conference: 24th International Symposium on String Processing and Information Retrieval, SPIRE 2017, Palermo, Italy, 26/09/2017 - 26/09/2017
DOIs: 10.1007/978-3-319-67428-5_9
Source: FindIt
Source-ID: 2391550550
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

**Time dependent policy-based access control**
Access control policies are essential to determine who is allowed to access data in a system without compromising the data’s security. However, applications inside a distributed environment may require those policies to be dependent on the actual content of the data, the flow of information, while also on other attributes of the environment such as the time. In this paper, we use systems of Timed Automata to model distributed systems and we present a logic in which one can
express time-dependent policies for access control. We show how a fragment of our logic can be reduced to a logic that current model checkers for Timed Automata such as UPPAAL can handle and we present a translator that performs this reduction. We then use our translator and UPPAAL to enforce time-dependent policy-based access control on an example application from the aerospace industry.

**General information**

State: Published
Organizations: Department of Applied Mathematics and Computer Science, Formal Methods
Authors: Vasilikos, P. (Intern), Nielson, F. (Intern), Nielson, H. R. (Intern)
Number of pages: 18
Publication date: 2017
Conference: 24th International Symposium on Temporal Representation and Reasoning, Mons, Belgium, 16/10/2017 - 16/10/2017
BFI conference series: International Symposium on Temporal Representation and Reasoning (5000492)
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Leibniz International Proceedings in Informatics
Volume: 90
ISSN (Print): 1868-8969
Ratings:
- Scopus rating (2017): CiteScore 0.85 SJR 0.363 SNIP 0.77
- Scopus rating (2016): CiteScore 0.73 SJR 0.862 SJR 0.613
- Scopus rating (2015): SJR 0.607 SNIP 0.892
- Scopus rating (2014): SJR 0.656 SNIP 0.918
- Scopus rating (2013): SJR 0.845 SNIP 0.915
- ISI indexed (2013): ISI indexed no
- Scopus rating (2012): SJR 0.872 SNIP 1.073
- ISI indexed (2012): ISI indexed no
- Scopus rating (2011): SJR 0.734 SNIP 1.033
- ISI indexed (2011): ISI indexed no
- Scopus rating (2010): SJR 0.681 SNIP 1.25
- Scopus rating (2009): SJR 0.12 SNIP 0.136
Original language: English

**Electronic versions:**
LIPIcs_TIME_2017_21.pdf
DOIs:
10.4230/LIPIcs.TIME.2017.21
Source: FindIt
Source-ID: 2392096119
Publication: Research - peer-review › Conference article – Annual report year: 2017

**Time-space trade-offs for lempel-ziv compressed indexing**

Given a string S, the compressed indexing problem is to preprocess S into a compressed representation that supports fast substring queries. The goal is to use little space relative to the compressed size of S while supporting fast queries. We present a compressed index based on the Lempel-Ziv 1977 compression scheme. Let n, and z denote the size of the input string, and the compressed LZ77 string, respectively. We obtain the following time-space trade-offs. Given a pattern string P of length m, we can solve the problem in (i) O (m + occ lg lg n) time using O(z lg(n/z) lg lg z) space, or (ii) O (m (1 + lg z/lg(n/z)) lg lg(n/z)) time using O(z lg (n/z)) space, for any 0 < <1. In particular, (i) improves the leading term in the query time of the previous best solution from O(m lg m) to O(m) at the cost of increasing the space by a factor lg z. Alternatively, (ii) matches the previous best space bound, but has a leading term in the query time of O(m(1 + lg z/lg(n/z))). However, for any polynomial compression ratio, i.e., z = O(n(1-δ)), for constant δ > 0, this becomes O(m). Our index also supports extraction of any substring of length ℓ in O(ℓ + lg(n/z)) time. Technically, our results are obtained by novel extensions and combinations of existing data structures of independent interest, including a new batched variant of weak prefix search.

**General information**
Timing analysis of rate-constrained traffic in TTEthernet using network calculus

TTEthernet is a deterministic, synchronized and congestion-free network protocol based on the Ethernet standard and compliant with the ARINC 664p7 standard network. It supports safety-critical real-time applications by offering different traffic classes: static time-triggered (TT) traffic, rate-constrained (RC) traffic with bounded end-to-end latencies and best-effort traffic, for which no guarantees are provided. TTEthernet uses three integration policies for sharing the network among the traffic classes: shuffling, preemption and timely block. In this paper, we propose an analysis based on network calculus (NC) to determine the worst-case end-to-end delays of RC traffic in TTEthernet. The main contribution of this paper is capturing the effects of all the integration policies on the latency bounds of RC traffic using NC, and the consideration of relative frame offsets of TT traffic to reduce the pessimism of the RC analysis. The proposed analysis is evaluated on several test cases, including realistic applications (e.g., Orion Crew Exploration Vehicle), and compared to related works.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Beihang University
Authors: Zhao, L. (Ekstern), Pop, P. (Intern), Li, Q. (Ekstern), Chen, J. (Ekstern), Xiong, H. (Ekstern)
Number of pages: 34
Pages: 254-287
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information

Journal: Real-Time Systems
Volume: 53
ISSN (Print): 0922-6443
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 2.237 SJR 0.257 CiteScore 2.28
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.26 SJR 0.392 SNIP 1.703
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.407 SNIP 1.904 CiteScore 1.85
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.448 SNIP 1.674 CiteScore 1.72
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.504 SNIP 1.509 CiteScore 1.59
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.362 SNIP 1.173 CiteScore 1.31
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.517 SNIP 1.82 CiteScore 2.2
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.455 SNIP 1.561
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 0.463 SNIP 1.918
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.536 SNIP 1.898
Scopus rating (2007): SJR 0.475 SNIP 1.5
Scopus rating (2006): SJR 0.535 SNIP 1.242
Scopus rating (2005): SJR 0.568 SNIP 1.981
Scopus rating (2004): SJR 0.482 SNIP 1.85
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.895 SNIP 1.756
Scopus rating (2002): SJR 0.504 SNIP 1.004
Scopus rating (2001): SJR 0.668 SNIP 1.066
Scopus rating (2000): SJR 0.256 SNIP 1.127
Scopus rating (1999): SJR 0.244 SNIP 1.266
Original language: English
TTEthernet, Timing analysis, Network calculus, Upper bound, Delay
DOIs:
10.1007/s11241-016-9265-0
Source: FindIt
Source-ID: 2350904487
Publication: Research - peer-review › Journal article – Annual report year: 2017

Timing organization of a real-time multicore processor
Real-time systems need a time-predictable computing platform. Computation, communication, and access to shared resources needs to be time-predictable. We use time division multiplexing to statically schedule all computation and communication resources, such as access to main memory or message passing over a network-on-chip. We use time-driven communication over an asynchronous network-on-chip to enable time division multiplexing even in a globally asynchronous, locally synchronous multicore architecture. Using time division multiplexing at all levels of the architecture yields in a time-predictable multicore processor where we can statically analyze the worst-case execution time of tasks.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering
Authors: Schoeberl, M. (Intern), Sparsø, J. (Intern)
Pages: 89-92
Publication date: 2017

Host publication information
Title of host publication: 2017 New Generation of CAS
Publisher: IEEE
ISBN (Print): 9781509064472
To be active through indoor-climbing: an exploratory feasibility study in a group of children with cerebral palsy and typically developing children

Background: Cerebral Palsy (CP) is the most common cause of motor disabilities in children and young adults and it is also often associated with cognitive and physiological challenges. Climbing requires a multifaceted repertoire of movements, participants at all levels of expertise may be challenged functionally and cognitively, making climbing of great potential interest in (re)habilitation settings. However, until now only few research projects have investigated the feasibility of climbing as a potential activity for heightening physical activity in children with CP and the possible beneficial effects of climbing activities in populations with functional and/or cognitive challenges. The aim of this study was therefore to test the feasibility of an intensive 3 weeks indoor-climbing training program in children with CP and typically developing (TD) peers. In addition we evaluated possible functional and cognitive benefits of 3 weeks of intensive climbing training in 11 children with cerebral palsy (CP) aged 11-13 years and six of their TD peers.

Method: The study was designed as a feasibility and interventional study. We evaluated the amount of time spent being physically active during the 9 indoor-climbing training sessions, and climbing abilities were measured. The participants were tested in a series of physiological, psychological and cognitive tests: two times prior to and one time following the training in order to explore possible effects of the intervention.

Results: The children accomplished the training goal of a total of nine sessions within the 3-week training period. The time of physical activity during a 2:30 h climbing session, was comparably high in the group of children with CP and the TD children. The children with CP were physically active on average for almost 16 h in total during the 3 weeks. Both groups of participants improved their climbing abilities, the children with CP managed to climb a larger proportion of the tested climbing route at the end of training and the TD group climbed faster. For the children with CP this was accompanied by significant improvements in the Sit-to-stand test (p <0.01), increased rate of force development in the least affected hand during an explosive pinch test and increased muscular coherence during a pinch precision test (p <0.05). We found no improvements in maximal hand or finger strength and no changes in psychological well-being in any of the groups.

Conclusions: These findings show that it is possible to use climbing as means to make children with CP physically active. The improved motor abilities obtained through the training is likely reflected by increased synchronization between cortex and muscles, which results in a more efficient motor unit recruitment that may be transferred to daily functional abilities.
Tomographic image reconstruction using training images

We describe and examine an algorithm for tomographic image reconstruction where prior knowledge about the solution is available in the form of training images. We first construct a non-negative dictionary based on prototype elements from the training images; this problem is formulated within the framework of sparse learning as a regularized non-negative matrix factorization. Incorporating the dictionary as a prior in a convex reconstruction problem, we then find an approximate solution with a sparse representation in the dictionary. The dictionary is applied to non-overlapping patches of the image, which reduces the computational complexity compared to previous formulations. Computational experiments clarify the choice and interplay of the model parameters and the regularization parameters, and we show that in few-projection low-dose settings our algorithm is competitive with total variation regularization and tends to include more texture and more correct edges.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Fingerprint Cards AB
Authors: Soltani, S. (Ekstern), Andersen, M. S. (Intern), Hansen, P. C. (Intern)
Pages: 243-258
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Computational and Applied Mathematics
Volume: 313
Tomographic Reconstruction Methods for Decomposing Directional Components

X-ray computed tomography technique has many different practical applications. In this paper, we propose two new reconstruction methods that can decompose objects at the same time. By incorporating direction information, the proposed methods can decompose objects into various directional components. Furthermore we propose a method to obtain the direction information in the objects directly from the measured sinogram data. We demonstrate the proposed
methods on simulated and real samples to show their practical applicability. The numerical results show the differences between the two methods and effectiveness as dealing with fibre-crack decomposition problem.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing
Authors: Kongskov, R. D. (Intern), Dong, Y. (Intern)
Number of pages: 15
Publication date: 2017

**Publication information**
Publisher: Technical University of Denmark (DTU)
Original language: English
Volume: 04
ISSN: 1601-2321
Main Research Area: Technical/natural sciences
Electronic versions: tr17_04_Dong_Y.pdf
Publication: Research › Report – Annual report year: 2017

**Topological bifurcations in the evolution of coherent structures in a convection model**
Blob filaments are coherent structures in a turbulent plasma flow. Understanding the evolution of these structures is important to improve magnetic plasma confinement. Three state variables describe blob filaments in a plasma convection model. A dynamical systems approach analyzes the evolution of these three variables. A critical point of a variable defines a feature point for a region where that variable is significant. For a range of Rayleigh and Prandtl numbers, the bifurcations of the critical points of the three variables are investigated with time as the primary bifurcation parameter. Bifurcation curves separate the parameter planes into regions with different critical point configurations for the state variables. For Prandtl number equal to 1, the number of critical points of each state variable increases with increasing Rayleigh number. For Rayleigh number equal to 104, the number of critical points is the greatest for Prandtl numbers of magnitude 100.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Mathematics, Plasma Physics and Fusion Energy, Department of Physics
Authors: Dam, M. (Intern), Rasmussen, J. J. (Intern), Naulin, V. (Intern), Brøns, M. (Intern)
Number of pages: 7
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Physics of Plasmas
Volume: 24
Issue number: 8
Article number: 082301
ISSN (Print): 1070-664X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.682 SJR 0.576 CiteScore 1.17
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.08 SJR 0.999 SNIP 1.052
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.874 SNIP 0.908 CiteScore 1.02
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.153 SNIP 1.195 CiteScore 1.69
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Topological fluid mechanics of the formation of the Kármán-vortex street

We explore the two-dimensional flow around a circular cylinder with the aim of elucidating the changes in the topology of the vorticity field that lead to the formation of the Kármán vortex street. Specifically, we analyse the formation and disappearance of extremal points of vorticity, which we consider to be feature points for vortices. The basic vortex creation mechanism is shown to be a topological cusp bifurcation in the vorticity field, where a saddle and an extremum of the vorticity are created simultaneously. We demonstrate that vortices are first created approximately 100 diameters downstream of the cylinder, at a Reynolds number, ReK, which is slightly larger than the critical Reynolds number, Recrit∼46, at which the flow becomes time periodic. For Re slightly above ReK, the newly created vortices disappear again a short distance further downstream. As is further increased, the points of creation and disappearance move rapidly upstream and downstream, respectively, and the Kármán vortex street persists over increasingly large streamwise distances.
Total Variation Based Parameter-Free Model for Impulse Noise Removal

We propose a new two-phase method for reconstruction of blurred images corrupted by impulse noise. In the first phase, we use a noise detector to identify the pixels that are contaminated by noise, and then, in the second phase, we reconstruct the noisy pixels by solving an equality constrained total variation minimization problem that preserves the exact values of the noise-free pixels. For images that are only corrupted by impulse noise (i.e., not blurred) we apply the semismooth Newton's method to a reduced problem, and if the images are also blurred, we solve the equality constrained reconstruction problem using a first-order primal-dual algorithm. The proposed model improves the computational efficiency (in the denoising case) and has the advantage of being regularization parameter-free. Our numerical results suggest that the method is competitive in terms of its restoration capabilities with respect to the other two-phase methods.

Towards characterizing and reducing artifacts caused by varying projection truncation

General information
Towards effective and robust list-based packet filter for signature-based network intrusion detection: an engineering approach

Network intrusion detection systems (NIDSs) which aim to identify various attacks, have become an essential part of current security infrastructure. In particular, signature-based NIDSs are being widely implemented in industry due to their low rate of false alarms. However, the signature matching process is a big challenge for these systems, in which the cost is at least linear to the size of an input string. As a result, overhead packets will be a major issue for practical usage, where the incoming packets exceed the maximum capability of an intrusion detection system (IDS). To mitigate this problem, packet filtration is a promising solution to reduce unwanted traffic. Motivated by this, in this work, a list-based packet filter was designed and an engineering method of combining both blacklist and whitelist techniques was introduced. To further secure such filters against IP spoofing attacks, a lightweight but efficient IP verification mechanism was developed. In the evaluation, a list-based packet filter was deployed in both simulated and real network environments under honest and dishonest scenarios. Experimental results demonstrate that the developed list-based packet filter is effective in traffic filtration as well as workload reduction, and is robust against IP spoofing attacks.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science , Cyber Security, University of Hong Kong
Authors: Meng, W. (Intern), Li, W. (Ekstern), Kwok, L. F. (Ekstern)
Number of pages: 12
Pages: 204-215
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Transactions - Hong Kong Institution of Engineers
Volume: 24
Issue number: 4
ISSN (Print): 2326-3733
Ratings:
Scopus rating (2017): SJR 0.158 SNIP 0.275
Scopus rating (2016): SNIP 0.473 SJR 0.171
Scopus rating (2015): SNIP 0.208 SJR 0.158
Scopus rating (2014): SNIP 0.3 SJR 0.106
Scopus rating (2013): SNIP 0.205 SJR 0.114
Scopus rating (2012): SNIP 0.106 SJR 0.109
Scopus rating (2011): SNIP 0.143 SJR 0.119
Scopus rating (2010): SNIP 0.22 SJR 0.118
Scopus rating (2009): SNIP 0.241 SJR 0.17
Scopus rating (2008): SNIP 0.225 SJR 0.148
Scopus rating (2007): SNIP 0.144 SJR 0.154
Scopus rating (2006): SNIP 0.373 SJR 0.222
Scopus rating (2005): SNIP 0.346 SJR 0.223
Scopus rating (2004): SNIP 0.263 SJR 0.254
Scopus rating (2003): SNIP 0.27 SJR 0.289
Scopus rating (2002): SNIP 0.378 SJR 0.139
Scopus rating (2001): SNIP 0.433 SJR 0.166
Scopus rating (2000): SNIP 0.291 SJR 0.129
Towards Effective Trust-Based Packet Filtering in Collaborative Network Environments

Overhead network packets are a big challenge for intrusion detection systems (IDSs), which may increase system burden, degrade system performance, and even cause the whole system collapse, when the number of incoming packets exceeds the maximum handling capability. To address this issue, packet filtration is considered as a promising solution, and our previous research efforts have proven that designing a trust-based packet filter was able to refine unwanted network packets and reduce the workload of a local IDS. With the development of Internet cooperation, collaborative intrusion detection environments (e.g., CIDNs) have been developed, which allow IDS nodes to collect information and learn experience from others. However, it would not be effective for the previously built trust-based packet filter to work in such a collaborative environment, since the process of trust computation can be easily compromised by insider attacks. In this paper, we adopt the existing CIDN framework and aim to apply a collaborative trust-based approach to reduce unwanted packets. More specifically, we develop a collaborative trust-based packet filter, which can be deployed in collaborative networks and be robust against typical insider attacks (e.g., betrayal attacks). Experimental results in various simulated and practical environments demonstrate that our filter can perform effectively in reducing unwanted traffic and can defend against insider attacks through identifying malicious nodes in a quick manner, as compared to similar approaches.
Towards enhancing click-draw based graphical passwords using multi-touch behaviours on smartphones

Graphical passwords (GPs) are recognised as one of the potential alternatives in addressing the limitations in conventional text-based password authentication. With the rapid development of mobile devices (i.e., the increase of computing power), GP-based systems have already been implemented not only on PCs, but also on smartphones to authenticate legitimate users and detect impostors. However, as compared to common computers, we identify that users are able to perform some distinct actions like multi-touch on smartphones. The multi-touch is a distinguished feature on current smartphones and its impact on graphical password creation is an important topic in the literature. In this paper, our interest is to investigate the influence of multi-touch behaviours on users’ habit in creating graphical passwords, especially on click-draw based GPs (shortly CD-GPS) on mobile devices. In the evaluation, we develop a multi-touch enabled CD-GPS on smartphones and conduct two major experiments with a total of 90 participants. The study results indicate that participants are more likely to use multi-touch features to create their secrets, and multi-touch can make a positive impact on creating graphical passwords (i.e., offering higher success rates and less time consumption).

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cyber Security, City University of Hong Kong, University of Texas at San Antonio
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Pages: 213-229
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Computers & Security
Volume: 65
ISSN (Print): 0167-4048
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.86 SJR 0.684 SNIP 2.158
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.59 SJR 0.815 SNIP 2.158
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.819 SNIP 2.346 CiteScore 3.03
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.641 SNIP 2.133 CiteScore 2.39
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.697 SNIP 2.601 CiteScore 2.48
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.68 SNIP 2.475 CiteScore 2.56
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Towards industry strength mapping of AUTOSAR automotive functionality on multicore architectures: work in progress

The automotive electronic architectures have moved from federated architectures, where one function is implemented in one ECU (Electronic Control Unit), to distributed architectures, consisting of several multicore ECUs. In addition, multicore ECUs are being adopted because of better performance, cost, size, fault-tolerance and power consumption. Automotive manufacturers use AUTomotive Open System ARchitecture (AUTOSAR) as the standardized software architecture for ECUs. With AUTOSAR, the functionality is modeled as a set of software components composed of subtasks, called runnables. In this paper we propose an approach for the automatic software functionality assignment to multicore distributed architectures, implemented as a software tool. The AUTOMAP, decides: the (i) mapping of software components to multicore ECUs, (ii) the assignment of runnables to the ECU cores, (iii) the clustering of runnables into tasks and (iv) the mapping of tasks to "OS-Applications", such that timing and mapping constraints are satisfied. AUTOMAP has been developed to handle large industrialized use cases, fine-grained realistic mapping and timing constraints, and to produce outputs that support the system engineer in the mapping task. We have successfully evaluated AUTOMAP on several realistic use cases from Volvo Trucks.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, Copenhagen Center for Health Technology, Technical University of Denmark
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Number of pages: 2
Publication date: 2017

Host publication information
Title of host publication: CASES '17 Proceedings of the 2017 International Conference on Compilers, Architectures and Synthesis for Embedded Systems Companion
Publisher: Association for Computing Machinery
ISBN (Electronic): 978-1-4503-5184-3
BFI conference series: International Conference on Compilers, Architecture, and Synthesis for Embedded Systems (5000398)
Main Research Area: Technical/natural sciences
Conference: 2017 International Conference on Compilers, Architectures and Synthesis for Embedded Systems Companion, Seoul, Korea, Democratic People's Republic of, 15/10/2017 - 15/10/2017
DOIs: 10.1145/3125501.3125623
Towards Plug-n-Play robot guidance: Advanced 3D estimation and pose estimation in Robotic applications

Robots are a key technology in the quest for higher productivity in Denmark and Europe. Robots have existed in many years as a part of production lines where they have solved monotonous and repetitive task in mass production industries. Typical the programming of these robots are handled by engineers with special knowledge who have often raised the price for using robots to a given production task. If robots have to be applicable for small and medium sized enterprises where production task often changes and batch sizes are below 50 products it is necessary that the staff is capable of re-programming the robot by themselves.

During the last five years a number of collaborative robots are introduced on the marked e.g. Universal Robot, which enables a production worker to program the robot to solve simple tasks. With the collaborative robot the production worker is able to make the robot grind, mill, weld and move objects, which are physical located at the same positions. In order to place objects in the same position each time, custom-made mechanical fixtures and aligners are constructed to ensure that objects are not moving. It is expensive to design and build these fixtures and it is difficult to quickly change to a novel task. In some cases where objects are placed in bins and boxes it is not possible to position the objects in the same location each time.

To avoid designing expensive mechanical solutions and to be able to pick objects from boxes and bins, a sensor is necessary to guide the robot. Today, primarily 2D vision systems are applied in industrial robotics, which are in-flexible and hard to program for the production workers. Smart cameras, which are easier to re-configure and program to detect objects exist. However, computing the correct position such that a robot can move to this position is still a challenge which requires calibration processes. Moreover, the ability to make the solution robust such that it is running 24/7 in a production is demanding and requires the right skills. Basically, the vision part of a flexible automation solution is difficult to manage for a production worker while the robot motion programming is easily handled with the new collaborative robots. This thesis deals with robot vision technologies and how these are made easier for production workers program in order to get robots to recognize and compute the position of objects in the industry.

This thesis investigates and discusses methods to encapsulate a 2D vision system into a framework in order to make changes in production task easier. The framework is presented in [Contribution B] and [Contribution C] and demonstrates how re-configuration of vision systems is made easier but in the same time reviles some of the fundamental problems that exist by observing a tree dimensional world through a two dimensional vision system. This requires a calibration procedure every time in order to convert 2D to 3D, which still is a cumbersome process for a production worker.

For this reason, the rest of the thesis investigates and discusses how 3D computer vision techniques can ease the problem of recognizing and computing the position of objects. In [Contribution D] a small lightweight 3D sensor is presented. The 3D sensor has a size that makes it suitable for tool mounting at a collaborative robot. It is based on structured light principles and 3D estimation techniques, which enables fast and accurate acquisition of point clouds of low textured and reflective industrial objects.

In [Contribution E] a 3D vision system for easy learning of 3D models is presented. The system creates a 3D model of the object by scanning it from three views. Then the object acts as a reference model in the system when new instances of the object have to be located in the scene. With this approach fast re-configuration is possible. In [Contribution F] a new dataset for 3D object recognition and an evaluation of state-of-the-art local features for object recognition are presented. The contribution shows as expected that state-of-the-art 3D object recognition algorithms are not good enough to locate industrial objects with few local shape features on the surface.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics
Authors: Sølund, T. (Intern), Aanæs, H. (Intern)
Number of pages: 191
Publication date: 2017

Publication information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Original language: English
Series: DTU Compute PHD-2016
Number: 424
ISSN: 0909-3192
Main Research Area: Technical/natural sciences
Electronic versions:
Towards Statistical Trust Computation for Medical Smartphone Networks Based on Behavioral Profiling
Due to the popularity of mobile devices, medical smartphone networks (MSNs) have been evolved, which become an emerging network architecture in healthcare domain to improve the quality of service. There is no debate among security experts that the security of Internet-enabled medical devices is woefully inadequate. Although MSNs are mostly internally used, they still can leak sensitive information under insider attacks. In this case, there is a need to evaluate a node’s trustworthiness in MSNs based on the network characteristics. In this paper, we focus on MSNs and propose a statistical trust-based intrusion detection mechanism to detect malicious nodes in terms of behavioral profiling (e.g., camera usage, visited websites, etc.). Experimental results indicate that our proposed mechanism is feasible and promising in detecting malicious nodes under medical environments.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cyber Security, Hong Kong Polytechnic University
Authors: Meng, W. (Intern), Au, M. H. (Ekstern)
Pages: 152–159
Publication date: 2017

Host publication information
Title of host publication: IFIPTM 2017: Trust Management XI
Publisher: Springer
Series: IFIP Advances in Information and Communication Technology
Volume: 505
ISSN: 1868-4238
Main Research Area: Technical/natural sciences
Conference: 11th IFIP WG 11.11 International Conference on Trust Management, Gothenburg, Sweden, 12/06/2017 - 12/06/2017
Emerging network, Medical smartphone network, Intrusion detection, Insider attack, Statistical trust computation
DOI: 10.1007/978-3-319-59171-1_12
Source: PublicationPreSubmission
Source-ID: 133143481
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Tracing Knowledge Transfer from Universities to Industry: A Text Mining Approach
This paper identifies transferred knowledge between universities and the industry by proposing the use of a computational linguistic method. Current research on university-industry knowledge exchange relies often on formal databases and indicators such as patents, collaborative publications and license agreements, to assess the contribution to the socioeconomic surrounding of universities. We, on the other hand, use the texts from university abstracts to identify university knowledge and compare them with texts from firm webpages. We use these text data to identify common key words and thereby identify overlapping contents among the texts. As method we use a well-established word ranking method from the field of information retrieval term frequency-inverse document frequency (TFIDF) to identify commonalities between texts from university. In examining the outcomes of the TFIDF statistic we find that several websites contain very related and partly even traceable content from the university. The results show that university research is represented in the websites of industrial partners. We propose further improvements to enhance the results and potential areas for future implementation. This paper is the first step to enable the identification of common knowledge and knowledge transfer via text mining to increase its measurability.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Department of Management Engineering, Technology and Innovation Management
Authors: Woltmann, S. (Intern), Alkærsg, L. (Intern)
Number of pages: 7
Transformations Based on Continuous Piecewise-Affine Velocity Fields

We propose novel finite-dimensional spaces of well-behaved transformations. The latter are obtained by (fast and highly-accurate) integration of continuous piecewise-affine velocity fields. The proposed method is simple yet highly expressive, effortlessly handles optional constraints (e.g., volume preservation and/or boundary conditions), and supports convenient modeling choices such as smoothing priors and coarse-to-fine analysis. Importantly, the proposed approach, partly due to its rapid likelihood evaluations and partly due to its other properties, facilitates tractable inference over rich transformation spaces, including using Markov-Chain Monte-Carlo methods. Its applications include, but are not limited to: monotonic regression (more generally, optimization over monotonic functions); modeling cumulative distribution functions or histograms; time-warping; image warping; image registration; real-time diffeomorphic image editing; data augmentation for image classifiers. Our GPU-based code is publicly available.
Transitions from Trees to Cycles in Adaptive Flow Networks

Transport networks are crucial to the functioning of natural and technological systems. Nature features transport networks that are adaptive over a vast range of parameters, thus providing an impressive level of robustness in supply. Theoretical and experimental studies have found that real-world transport networks exhibit both tree-like motifs and cycles. When the network is subject to load fluctuations, the presence of cyclic motifs may help to reduce flow fluctuations and, thus, render supply in the network more robust. While previous studies considered network topology via optimization principles, here, we take a dynamical systems approach and study a simple model of a flow network with dynamically adapting weights (conductances). We assume a spatially non-uniform distribution of rapidly fluctuating loads in the sinks and investigate what network configurations are dynamically stable. The network converges to a spatially non-uniform stable configuration composed of both cyclic and tree-like structures. Cyclic structures emerge locally in a transcritical bifurcation as the amplitude of the load fluctuations is increased. The resulting adaptive dynamics thus partitions the network into two distinct regions with cyclic and tree-like structures. The location of the boundary between these two regions is determined by the amplitude of the fluctuations. These findings may explain why natural transport networks display cyclic structures in the micro-vascular regions near terminal nodes, but tree-like features in the regions with larger veins.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Universitat de les Illes Balears
Authors: Martens, E. A. (Intern), Klemm, K. (Ekstern)
Number of pages: 10
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Frontiers of Physics
Volume: 5
Article number: 62
ISSN (Print): 2095-0462
Transport or Store? Synthesizing Flow-based Microfluidic Biochips using Distributed Channel Storage

Flow-based microfluidic biochips have attracted much attention in the EDA community due to their miniaturized size and execution efficiency. Previous research, however, still follows the traditional computing model with a dedicated storage unit, which actually becomes a bottleneck of the performance of biochips. In this paper, we propose the first architectural synthesis framework considering distributed storage constructed temporarily from transportation channels to cache fluid samples. Since distributed storage can be accessed more efficiently than a dedicated storage unit and channels can switch between the roles of transportation and storage easily, biochips with this distributed computing architecture can achieve a higher execution efficiency even with fewer resources. Experimental results confirm that the execution efficiency of a bioassay can be improved by up to 28% while the number of valves in the biochip can be reduced effectively.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, Technical University of Munich, Tsinghua University
Authors: Liu, C. (Ekstern), Li, B. (Ekstern), Yao, H. (Ekstern), Pop, P. (Intern), Ho, T. (Ekstern), Schlichtmann, U. (Ekstern)
Number of pages: 6
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 54th ACM/EDAC/IEEE Design Automation Conference (DAC)
Volume: 128280
Publisher: IEEE
ISBN (Electronic): 978-1-4503-4927-7
Main Research Area: Technical/natural sciences
Conference: 54th ACM/EDAC/IEEE Design Automation Conference, Austin, United States, 18/06/2017 - 18/06/2017
DOIs:
10.1145/3061639.3062334
Source: FindIt
Source-ID: 2372119520
Publication: Research › Article in proceedings – Annual report year: 2018
Trellis plots as visual aids for analyzing split plot experiments
The analysis of split plot experiments can be challenging due to a complicated error structure resulting from restrictions on complete randomization. Similarly, standard visualization methods do not provide the insight practitioners desire to understand the data, think of explanations, generate hypotheses, build models, or decide on next steps. This article demonstrates the effective use of trellis plots in the preliminary data analysis for split plot experiments to address this problem. Trellis displays help to visualize multivariate data by allowing for conditioning in a general way. They can also be used after the statistical analysis for verification, clarification, and communication.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Celgene Corporation
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Pages: 211-225
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Quality Engineering
Volume: 29
Issue number: 2
ISSN (Print): 0898-2112
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.969 SJR 0.804 CiteScore 1.15
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.31 SJR 0.974 SNIP 1.142
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.578 SNIP 1.124 CiteScore 0.83
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.412 SNIP 0.813 CiteScore 0.61
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.495 SNIP 1.025 CiteScore 0.71
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.436 SNIP 1.135 CiteScore 0.68
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.626 SNIP 0.998 CiteScore 0.68
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.555 SNIP 0.892
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.406 SNIP 0.709
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.54 SNIP 0.844
Scopus rating (2007): SJR 0.293 SNIP 0.569
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.383 SNIP 1.079
Scopus rating (2005): SJR 0.555 SNIP 1.114
Scopus rating (2004): SJR 0.246 SNIP 0.573
Scopus rating (2003): SJR 0.658 SNIP 0.809
Twisted Reed-Solomon Codes

We present a new general construction of MDS codes over a finite field $\mathbb{F}_q$. We describe two explicit subclasses which contain new MDS codes of length at least $q/2$ for all values of $q \geq 11$. Moreover, we show that most of the new codes are not equivalent to a Reed-Solomon code.

Two-Point Codes for the Generalised GK curve

We improve previously known lower bounds for the minimum distance of certain two-point AG codes constructed using a Generalized Giulietti–Korchmaros curve (GGK). Castellanos and Tizziotti recently described such bounds for two-point codes coming from the Giulietti–Korchmaros curve (GK). Our results completely cover and in many cases improve on their results, using different techniques, while also supporting any GGK curve. Our method builds on the order bound for AG codes: to enable this, we study certain Weierstrass semigroups. This allows an efficient algorithm for computing our improved bounds. We find several new improvements upon the MinT minimum distance tables.
Two subgroups of antipsychotic-naive, first-episode schizophrenia patients identified with a Gaussian mixture model on cognition and electrophysiology

Deficits in information processing and cognition are among the most robust findings in schizophrenia patients. Previous efforts to translate group-level deficits into clinically relevant and individualized information have, however, been non-successful, which is possibly explained by biologically different disease subgroups. We applied machine learning algorithms on measures of electrophysiology and cognition to identify potential subgroups of schizophrenia. Next, we explored subgroup differences regarding treatment response. Sixty-six antipsychotic-naive first-episode schizophrenia patients and sixty-five healthy controls underwent extensive electrophysiological and neurocognitive test batteries. Patients were assessed on the Positive and Negative Syndrome Scale (PANSS) before and after 6 weeks of monotherapy with the relatively selective D2 receptor antagonist, amisulpride (280.3±159 mg per day). A reduced principal component space based on 19 electrophysiological variables and 26 cognitive variables was used as input for a Gaussian mixture model to identify subgroups of patients. With support vector machines, we explored the relation between PANSS subscores and the identified subgroups. We identified two statistically distinct subgroups of patients. We found no significant baseline psychopathological differences between these subgroups, but the effect of treatment in the groups was predicted with an accuracy of 74.3% (P=0.003). In conclusion, electrophysiology and cognition data may be used to classify subgroups of schizophrenia patients. The two distinct subgroups, which we identified, were psychopathologically inseparable before treatment, yet their response to dopaminergic blockade was predicted with significant accuracy. This proof of principle encourages further endeavors to apply data-driven, multivariate and multimodal models to facilitate progress from symptom-based psychiatry toward individualized treatment regimens.

General information
State: Published
Organisations: Copenhagen Center for Health Technology, Department of Applied Mathematics and Computer Science, Cognitive Systems, University of Copenhagen
Authors: Bak, N. (Ekstern), Ebdrup, B. (Ekstern), Oranje, B. (Ekstern), Fagerlund, B. (Ekstern), Jensen, M. H. (Ekstern), Düring, S. W. (Ekstern), Nielsen, M. Ø. (Ekstern), Glenthøj, B. Y. (Ekstern), Hansen, L. K. (Intern)
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Translational Psychiatry
Volume: 7
Issue number: 4
Article number: e1087
ISSN (Print): 2158-3188
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): CiteScore 4.86 SJR 2.495 SNIP 1.147
Web of Science (2017): Indexed Yes
Scopus rating (2016): CiteScore 4.38 SJR 2.84 SNIP 1.007
Web of Science (2016): Indexed yes
Scopus rating (2015): SJR 3.169 SNIP 1.273 CiteScore 5.61
Web of Science (2015): Indexed yes
Scopus rating (2014): SJR 3.189 SNIP 1.31 CiteScore 5.74
Scopus rating (2013): SJR 2.206 SNIP 1.18 CiteScore 4.54
Scopus rating (2012): SJR 0.718 SNIP 0.479 CiteScore 1.95
Original language: English
Electronic versions:

Unidirectional Fibre Composite Characterisation from X-ray Tomography

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Department of Wind Energy, Composites and Materials Mechanics, Statistics and Data Analysis, University of Manchester
Unified quantum theory of elastic and inelastic atomic scattering from a physisorbed monolayer solid

A unified quantum theory of the elastic and inelastic scattering of low energy He atoms by a physisorbed monolayer solid in the one-phonon approximation is given. It uses a time-dependent wave packet with phonon creation and annihilation components and has a self-consistent feedback between the wave functions for elastic and inelastic scattered atoms. An attenuation of diffraction scattering by inelastic processes thus is inherent in the theory. The atomic motion and monolayer vibrations in the harmonic approximation are treated quantum mechanically and unitarity is preserved. The evaluation of specific one-phonon events includes contributions from diffuse inelastic scattering in other phonon modes. Effects of thermally excited phonons are included using a mean field approximation. The theory is applied to an incommensurate Xe/Pt(111) monolayer (incident energy $E_i = 4-16$ meV), a commensurate Xe/graphite monolayer ($E_i \approx 64$ meV), and an incommensurate Xe/Cu(001) monolayer ($E_i \approx 8$ meV). The monolayers are very corrugated targets and there are transient closed diffraction and inelastic channels in the calculations. In many cases, the energy gain events have strengths comparable to the energy loss events.
Unique Crystal Orientation of Poly(ethylene oxide) Thin Films by Crystallization Using a Thermal Gradient

Poly(ethylene oxide), (PEO), thin films of different thicknesses (220, 450, and 1500 nm) and molecular masses (4000, 8000, and 20000 g/mol) have been fabricated by spin-coating of methanol solutions onto glass substrates. All these samples have been recrystallized from the melt using a directional thermal gradient technique. Millimeter-size domains with crystallites uniformly, oriented in the direction of the thermal gradient are observed. Furthermore, the crystallites size and orientation distribution are enhanced (e.g., increases and decreases, respectively) when film thickness is decreased, ultimately leading to a single-crystal-like behavior for 220 nm thick PEO films of mass 8000 g/mol. Interestingly, this fine microstructure is partially retained after melting and subsequent-cooling back to ambient temperature for the highest molecular weight polymer allowing, in this particular case, to significantly decrease the distribution of crystal orientation obtained after crystallization using the thermal gradient technique.
Unraveling fermentation data – a Novozymes case study

Industrial fermentation processes are monitored using a variety of sensors. Typically, measurements are taken throughout the entire production process. Production may be carried out under supervision of different operators (operator variation), on different sites (global variation), in different buildings and/or in different tanks (local variation). However, up to now processes are mainly controlled according to traditional recipes and experience.

Upper bounds on the runtime of the univariate marginal distribution algorithm on OneMax

A runtime analysis of the Univariate Marginal Distribution Algorithm (UMDA) is presented on the OneMax function for wide ranges of the parameters μ and λ. If μ ≥ c log n for some constant c > 0 and λ = (1 + O(1))μ, a general bound O(μn) on the expected runtime is obtained. This bound crucially assumes that all marginal probabilities of the algorithm are confined to the interval [1/n, 1 - 1/n]. If μ ≥ c'√n log n for a constant c' > 0 and λ = (1 + O(1))μ, the behavior of the algorithm changes and the bound on the expected runtime becomes O (μ√n), which typically even holds if the borders on the marginal probabilities are omitted. The results supplement the recently derived lower bound Ω (μ√n) by Krejca and Witt (FOGA 2017) and turn out as tight for the two very different values μ = c log n and p = c'√n log n. They also improve the previously best known upper bound O(n log n log log n) by Dang and Lehre (GECCO 2015).

Urban runoff forecasting with ensemble weather predictions

This research shows how ensemble weather forecasts can be used to generate urban runoff forecasts up to 53 hours into the future. The results highlight systematic differences between ensemble members that needs to be accounted for when
these forecasts are used in practice.

**General information**

State: Published
Organisations: Department of Environmental Engineering, Urban Water Systems, Department of Applied Mathematics and Computer Science, Dynamical Systems
Number of pages: 2
Publication date: 2017
Main Research Area: Technical/natural sciences

**User-friendly simultaneous tomographic reconstruction and segmentation with class priors**

Simultaneous Reconstruction and Segmentation (SRS) strategies for computed tomography (CT) present a way to combine the two tasks, which in many applications traditionally are performed as two successive and separate steps. A combined model has a potentially positive effect by allowing the two tasks to influence one another, at the expense of a more complicated algorithm. The combined model increases in complexity due to additional parameters and settings requiring tuning, thus complicating the practical usability. This paper takes it outset in a recently published variational algorithm for SRS. We propose a simplification that reduces the number of required parameters, and we perform numerical experiments investigating the effect and the conditions under which this approach is feasible.

**General information**

State: Published
Authors: Kjer, H. M. (Intern), Dong, Y. (Intern), Hansen, P. C. (Intern)
Pages: 260-270
Publication date: 2017

**Host publication information**

Title of host publication: Proceedings of 6th International Conference on Scale Space and Variational Methods in Computer Vision
Volume: 10302
Publisher: Springer
ISBN (Print): 9783331958770
Series: Lecture Notes in Computer Science
Volume: 10302
ISSN: 0302-9743
Main Research Area: Technical/natural sciences
Conference: Sixth International Conference on Scale Space and Variational Methods in Computer Vision, Kolding, Denmark, 04/06/2017 - 04/06/2017
DOIs:
10.1007/978-3-319-58771-4_21
Source: FindIt
Source-ID: 2371235649
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

**Using a finite element pediatric hip model in clinical 2 evaluation - a feasibility study**

The paper describe a method to construct a finite element model of the hip joint of a child based on clinical recorded CT data. A model which can be used for diagnostic aid and pre-operative surgical evaluation. First part of this development is a feasibility study of this method. A scan of the asymptomatic left hip of a 10-year-old girl with a dysplastic right hip was used. Cartilage was not visible why it was modeled as an interaction with constant thickness between two surfaces. For every point on the acetabular and femoral bone surfaces, the shortest distance to the other surface was used to calculate the resulting stress in the normal direction. At a load of 233% BW the model predicted peak pressures in the hip joint of 9.7-13.8 MPa and an area in contact of 351-405 mm2. Experimental validation using the hip joint of a child was not ethical viable. Instead, our results were compared to previous published experimental studies and computational models investigating the adult hip joint. Good correlation between the current model and previous models were found. The current case specific modeling technique may be a useful complement to the previously developed hip models.
Using data- and network science to reveal iterations and phase-transitions in the design process
Understanding the role of iterations is a prevalent topic in both design research and design practice. Furthermore, the increasing amount of data produced and stored by companies leaves traces and enables the application of data science to learn from past design processes. In this article, we analyse a documentlog to show the temporal evolution of a real design process of a power plant by using exploratory data analysis and network analysis. We show how the iterative nature of the design process is reflected in archival data and how one might re-construct the design process, involving iterations between many parties, including the client, external consultants, suppliers, and designers. We also show how people use different representations during the design process and how this is associated with a design phase-transition in the process. Finally, we relate our findings with the literature on iterations and discuss implications for research and practice with application to project management and process modelling.

Using OR + AI to Predict the Optimal Production of Offshore Wind Parks: A Preliminary Study
In this paper we propose a new use of Machine Learning together with Mathematical Optimization. We investigate the question of whether a machine, trained on a large number of optimized solutions, can accurately estimate the value of the optimized solution for new instances. We focus on instances of a specific problem, namely, the offshore wind farm layout optimization problem. In this problem an offshore site is given, together with the wind statistics and the characteristics of
the turbines that need to be built. The optimization wants to determine the optimal allocation of turbines to maximize the park power production, taking the mutual interference between turbines into account. Mixed Integer Programming models and other state-of-the-art optimization techniques, have been developed to solve this problem. Starting with a dataset of 2000+ optimized layouts found by the optimizer, we used supervised learning to estimate the production of new wind parks. Our results show that Machine Learning is able to well estimate the optimal value of offshore wind farm layout problems.

General information
State: Published
Organisations: Department of Management Engineering, Management Science, Operations Research, Department of Applied Mathematics and Computer Science, Cognitive Systems
Authors: Fischetti, M. (Intern), Fraccaro, M. (Intern)
Pages: 203-211
Publication date: 2017

Host publication information
Title of host publication: Optimization and Decision Science: Methodologies and Applications,
Volume: 217
Publisher: Springer
ISBN (Print): 9783319673073

Series: Optimization and Decision Science: Methodologies and Applications
Volume: 217
Main Research Area: Technical/natural sciences
Conference: International Conference on Optimization and Decision Science, 04/09/2017 - 04/09/2017
Mathematics, Optimization, Operations Research/Decision Theory, Big Data/Analytics, Machine learning, Mixed integer linear programming, Wind energy
DOIs:
10.1007/978-3-319-67308-0_21
Source: FindIt
Source-ID: 2392751809
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

UV imaging of Multiple Unit Pellet System (MUPS) tablets: A case study of acetylsalicylic acid stability
The applicability of multispectral ultraviolet (UV) imaging in combination with multivariate image analysis was investigated to monitor API degradation within multiple unit pellet system (MUPS) tablets during storage. For this purpose, acetylsalicylic acid (ASA) layered pellets were coated with Eudragit® RL PO and compressed to MUPS tablets. These tablets were stored under four different conditions with different levels of relative humidity (0 and 75%) and temperature (21 and 40 °C) and analysed at seven storage time points (0, 15, 40, 140, 165, 265, and 330 d). The UV imaging results for estimation of the salicylic acid (SA) concentration as degradation product of ASA in the tablets were compared to the SA concentration measured by high performance liquid chromatography with a partial least squares regression resulting in an RMSEP of 4.86% and an R² of 0.9812. The estimation of the SA concentration based on mean UV reflectance spectra was possible even through the coating of the API pellets and at low concentration levels. In addition, the distribution of the SA concentration on the tablet surfaces for different storage time periods was visualized. UV imaging as fast and non-destructive method appears to offer significant potential for monitoring of API degradation during stability studies.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, University of Hamburg, University of Copenhagen
Authors: Novikova, A. (Ekstern), Carstensen, J. M. (Intern), Rades, T. (Ekstern), Leopold, C. S. (Ekster)
Pages: 447-453
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: European Journal of Pharmaceutics and Biopharmaceutics
Volume: 119
ISSN (Print): 0939-6411
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.67 SJR 1.342 SNIP 1.378
Validation of a Simulation Model Describing the Glucose-Insulin-Glucagon Pharmacodynamics in Patients with Type 1 Diabetes

Currently, no consensus exists on a model describing endogenous glucose production (EGP) as a function of glucagon concentrations. Reliable simulations to determine the glucagon dose preventing or treating hypoglycemia or to tune a dual-hormone artificial pancreas control algorithm need a validated glucoregulatory model including the effect of glucagon.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Dynamical Systems, Copenhagen Center for Health Technology, Center for Energy Resources Engineering, Copenhagen University Hospital, Zealand Pharma A/S, University of Copenhagen
Validation of a smartphone-based EEG among people with epilepsy: A prospective study

Our objective was to assess the ability of a smartphone-based electroencephalography (EEG) application, the Smartphone Brain Scanner-2 (SBS2), to detect epileptiform abnormalities compared to standard clinical EEG. The SBS2 system consists of an Android tablet wirelessly connected to a 14-electrode EasyCap headset (cost ∼ 300 USD). SBS2 and standard EEG were performed in people with suspected epilepsy in Bhutan (2014-2015), and recordings were interpreted by neurologists. Among 205 participants (54% female, median age 24 years), epileptiform discharges were detected on 14% of SBS2 and 25% of standard EEGs. The SBS2 had 39.2% sensitivity (95% confidence interval (CI) 25.8%, 53.9%) and 94.8% specificity (95% CI 90.0%, 97.7%) for epileptiform discharges with positive and negative predictive values of 0.71 (95% CI 0.51, 0.87) and 0.82 (95% CI 0.76, 0.89) respectively. 31% of focal and 82% of generalized abnormalities were identified on SBS2 recordings. Cohen's kappa (κ) for the SBS2 EEG and standard EEG for the epileptiform versus non-epileptiform outcome was κ = 0.40 (95% CI 0.25, 0.55). No safety or tolerability concerns were reported. Despite limitations in sensitivity, the SBS2 may become a viable supportive test for the capture of epileptiform abnormalities, and extend EEG access to new, especially resource-limited, populations at a reduced cost.
Validation of ecological state space models using the Laplace approximation

Many statistical models in ecology follow the state space paradigm. For such models, the important step of model validation rarely receives as much attention as estimation or hypothesis testing, perhaps due to lack of available algorithms and software. Model validation is often based on a naive adaptation of Pearson residuals, i.e. the difference between observations and posterior means, even if this approach is flawed. Here, we consider validation of state space models through one-step prediction errors, and discuss principles and practicalities arising when the model has been fitted with a tool for estimation in general mixed effects models. Implementing one-step predictions in the R package Template Model Builder, we demonstrate that it is possible to perform model validation with little effort, even if the ecological model is multivariate, has non-linear dynamics, and whether observations are continuous or discrete. With both simulated data, and a real data set related to geolocation of seals, we demonstrate both the potential and the limitations of the techniques. Our results fill a need for convenient methods for validating a state space model, or alternatively, rejecting it while indicating useful directions in which the model could be improved.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Department of Applied Mathematics and Computer Science
Authors: Thygesen, U. H. (Intern), Albertsen, C. M. (Intern), Berg, C. W. (Intern), Kristensen, K. (Intern), Nielsen, A. (Intern)
Pages: 317-339
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Environmental and Ecological Statistics
Volume: 24
Issue number: 2
ISSN (Print): 1352-8505
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
BFI (2015): BFI-level 1
BFI (2014): BFI-level 1
BFI (2013): BFI-level 1
BFI (2012): BFI-level 1
BFI (2011): BFI-level 1
BFI (2010): BFI-level 1
BFI (2009): BFI-level 1
BFI (2008): BFI-level 1
Original language: English
This paper presents a comparison between measured and simulated tower loads for the Danish offshore wind farm Nysted 2. Previously, only limited full scale experimental data containing tower load measurements have been published, and in many cases the measurements include only a limited range of wind speeds. In general, tower loads in wake conditions are very challenging to predict correctly in simulations. The Nysted project offers an improved insight to this field as six wind turbines located in the Nysted II wind farm have been instrumented to measure tower top and tower bottom moments. All recorded structural data have been organized in a database, which in addition contains relevant wind turbine SCADA data as well as relevant meteorological data - e.g. wind speed and wind direction - from an offshore mast located in the immediate vicinity of the wind farm. The database contains data from a period extending over a time span of more than 3 years. Based on the recorded data basic mechanisms driving the increased loading experienced by wind turbines operating in offshore wind farm conditions have been identified, characterized and modeled. The modeling is based on the Dynamic Wake Meandering (DWM) approach in combination with the state-of-the-art aeroelastic model HAWC2, and has previously as well as in this study shown good agreement with the measurements. The conclusions from the study have several parts. In general the tower bending and yaw loads show a good agreement between measurements and simulations. However, there are situations that are still difficult to match. One is tower loads of single-wake operation near rated ambient wind speed for single wake situations for spacing's around 7-8D. A specific target of the study was to investigate whether the largest tower fatigue loads are associated with a certain downstream distance. This has been identified in both simulations and measurements, though a rather flat optimum is seen in the measurements.
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**General information**
State: Published
Organisations: Department of Wind Energy, Wind turbine loads & control, Test and Measurements, Department of Applied Mathematics and Computer Science, Dynamical Systems
Authors: Larsen, T. J. (Intern), Larsen, G. C. (Intern), Pedersen, M. M. (Intern), Enevoldsen, K. (Intern), Madsen, H. A. (Intern)
Number of pages: 10
Publication date: 2017

**Publication information**
Media of output: Power Point Presentation
Original language: English
Volume: 854
Main Research Area: Technical/natural sciences
Electronic versions:
TJLarsen_ver_2.pdf
Publication: Research › Sound/Visual production (digital) – Annual report year: 2017

**Virtual reality inspection and painting with measured BRDFs**

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics
Authors: Dal Corso, A. (Intern), Stets, J. D. (Intern), Luongo, A. (Intern), Nielsen, J. B. (Intern), Frisvad, J. R. (Intern), Aanæs, H. (Intern)
Number of pages: 2
Publication date: 2017

**Host publication information**
Title of host publication: Proceedings of SA ’17 VR Showcase
Publisher: Association for Computing Machinery
Main Research Area: Technical/natural sciences
Electronic versions:
vrbrdf.pdf
DOIs:
10.1145/3139468.3139472
Source: PublicationPreSubmission
Source-ID: 140110400
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

**Visualization and labeling of point clouds in virtual reality**
We present a Virtual Reality (VR) application for labeling and handling point cloud data sets. A series of room-scale point clouds are recorded as a video sequence using a Microsoft Kinect. The data can be played and paused, and frames can be skipped just like in a video player. The user can walk around and inspect the data while it is playing or paused. Using the tracked hand-held controller, the user can select and label individual parts of the point cloud. The points are highlighted with a color when they are labeled. With a tracking algorithm, the labeled points can be tracked from frame to frame to ease the labeling process. Our sample data is an RGB point cloud recording of two people juggling with pins. Here, the user can select and label, for example, the juggler pins as shown in Figure 1. Each juggler pin is labeled with various colors to indicate different labels.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Massachusetts Institute of Technology
Visualization of and Software for Omnibus Test Based Change Detected in a Time Series of Polarimetric SAR Data

Based on an omnibus likelihood ratio test statistic for the equality of several variance-covariance matrices following the complex Wishart distribution and a factorization of this test statistic with associated p-values, change analysis in a time series of multilook polarimetric SAR data in the covariance matrix representation is carried out. The omnibus test statistic and its factorization detect if and when change occurs. Using airborne EMISAR and spaceborne RADARSAT-2 data this paper focuses on change detection based on the p-values, on visualization of change at pixel as well as segment level, and on computer software.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, National Space Institute, Microwaves and Remote Sensing, Research Center Jülich GmbH
Authors: Nielsen, A. A. (Intern), Conradsen, K. (Intern), Skriver, H. (Intern), Canty, M. J. (Ekstern)
Pages: 582-592
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Canadian Journal of Remote Sensing
Volume: 43
Issue number: 6
ISSN (Print): 1712-798X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.973 SJR 0.929 CiteScore 2.3
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.67 SJR 0.829 SNIP 0.882
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.942 SNIP 0.729 CiteScore 1.95
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.92 SNIP 1.084 CiteScore 1.53
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.853 SNIP 1.165 CiteScore 1.42
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.733 SNIP 1.069 CiteScore 1.04
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.612 SNIP 0.639 CiteScore 0.95
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Considerable progress regarding impact factors of process model understandability has been achieved. For example, it has been shown that layout features of process models have an effect on model understandability. Even so, it appears that our knowledge about the modeler’s behavior regarding the layout of a model is very limited. In particular, research focuses on the end product or the outcome of the process modeling act rather than the act itself. This paper extends existing research by opening this black box and introducing an enhanced technique enabling the visual analysis of the modeler’s behavior towards layout. We demonstrate examples showing that our approach provides valuable insights to better understand and support the creation of process models. Additionally, we sketch challenges impeding this support for future research.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Software and Process Engineering, University of Innsbruck, University of Haifa
Authors: Haisjackl, C. (Ekstern), Burattin, A. (Ekstern), Soffer, P. (Ekstern), Weber, B. (Intern)
Pages: 449-460
Publication date: 2017

**Host publication information**

Title of host publication: Business Process Management Workshops
Publisher: Springer
Editors: Dumas, M., Fantinato, M.
ISBN (Print): 978-3-319-58457-7

Series: Lecture Notes in Business Information Processing
Volume: 281
ISSN: 1865-1348
Main Research Area: Technical/natural sciences

Electronic versions:
2016_taproviz_1.pdf

DOIs:
10.1007/978-3-319-58457-7_33
Volume management for fault-tolerant continuous-flow microfluidics

Recent advancements in microfluidic biochips allow for easier and faster design and fabrication of increasingly complex biochips to replace conventional laboratories. A roadblock in the deployment of biochips however is their low reliability. Physical defects can be introduced during the fabrication process, and may lead to failure of the biochemical application. This can be costly because of the reduced manufacturing yield, the need to redo lengthy experiments, using expensive reagents, and can be safety-critical, e.g., in case of a cancer misdiagnosis. Researchers have started to propose fault models and test techniques for continuous flow biochips. Six typical defects: Block, leak, misalignment, faulty pumps, degradation of valves and dimensional errors have been identified. The resulting faults can be abstracted into blocks and leaks for simplicity. Both fault types can occur in the control-as well as the flow channel, some common causes being environmental particles, imperfections in molds or bubbles in the PDMS gel. While some faults may be detected before the execution of an application by introducing a test run, other faults occur only during runtime as a result of deterioration or caused by the applied pressure. If such a fault is detected during runtime, e.g. with a CCD camera, we propose a just in time solution that calculates and assigns fluid volumes to alternate components and routes allowing for the completion of the application despite the occurring fault.

Warum ist es so schwierig, die lateralen Gleisstörungen durch Messungen der Fahrzeugdynamik zu bestimmen

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems
Authors: Christiansen, L. E. (Intern), True, H. (Intern)
Number of pages: 133 - 139
Publication date: 2017
Conference: 44. Tagung „Moderne Schienenfahrzeuge“, Graz, Austria, 10/09/2017 - 10/09/2017
Main Research Area: Technical/natural sciences
Waste-aware fluid volume assignment for flow-based microfluidic biochips

Microfluidic biochips are replacing the conventional biochemical analysers integrating the necessary functions on chip. We are interested in Flow-Based Microfluidic Biochips (FBMB), where a continuous flow of liquid is manipulated using integrated microvalves. Using microvalves and channels, more complex Fluidic Units (FUs) such as switches, micropumps, mixers and separators can be constructed. When running a biochemical application on a FBMB, fluid volumes are dispensed from input reservoirs and used by the FUs. Given a biochemical application and a biochip, we are interested in determining the fluid volume assignment for each operation of the application, such that the FUs volume requirements are satisfied, while over- and underflow are avoided and the total volume of fluid used is minimized. We propose an algorithm for this fluid assignment problem. Compared to previous work, our method is able to minimize the fluid consumption through optimal fluid assignment and reuse of fluid waste. Due to the algorithm's low complexity, fluid requirements can also be calculated during runtime for error recovery or statically unknown cases.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science , Embedded Systems Engineering
Authors: Schneider, A. R. (Intern), Pop, P. (Intern), Madsen, J. (Intern)
Pages: 1-6
Publication date: 2017

Host publication information
Title of host publication: 2017 Symposium on Design, Test, Integration and Packaging of MEMS/MOEMS (DTIP)
Publisher: IEEE
ISBN (Print): 9781538629529
Series: 2017 Symposium on Design, Test, Integration and Packaging of Mem/moems (dtip)
Main Research Area: Technical/natural sciences
Conference: 2017 Symposium on Design, Test, Integration and Packaging of MEMS/MOEMS, Bordeaux, France, 29/05/2017 - 29/05/2017
Mixers, Biological system modeling, Detectors, Hardware, Microvalves, Fabrication
DOIs:
10.1109/DTIP.2017.7984507
Source: FindIt
Source-ID: 2372483122
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Wearable Gaze Trackers: Mapping Visual Attention in 3D

The study of visual attention in humans relates to a wide range of areas such as: psychology, cognition, usability, and marketing. These studies have been limited to fixed setups with respondents sitting in front of a monitor mounted with a gaze tracking device. The introduction of wearable mobile gaze trackers allows respondents to move freely in any real world 3D environment, removing the previous restrictions. In this paper we propose a novel approach for processing visual attention of respondents using mobile wearable gaze trackers in a 3D environment. The pipeline consists of 3 steps: modeling the 3D area-of-interest, positioning the gaze tracker in 3D space, and 3D mapping of visual attention. The approach is general, but as a case study we created 3D heat maps of respondents visiting supermarket shelves as well as finding their in-store movement relative to these shelves. The method allows for analysis across multiple respondents and to distinguish between phases of in-store orientation (far away) and product recognition/selection (up close) based on distance to shelves.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science , Image Analysis & Computer Graphics, Copenhagen Business School
Authors: Jensen, R. R. (Intern), Stets, J. D. (Intern), Suurmets, S. (Forskerdatabase), Clement, J. (Forskerdatabase), Aanæs, H. (Intern)
Pages: 66-76
Publication date: 2017

Host publication information
Title of host publication: Image Analysis
Publisher: Springer
ISBN (Print): 978-3-319-59125-4
Series: Lecture Notes in Computer Science
Volume: 10269
ISSN: 0302-9743
Main Research Area: Technical/natural sciences
Conference: 20th Scandinavian Conference on Image Analysis, Tromsø, Norway, 12/06/2017 - 12/06/2017
Whole-brain functional connectivity predicted by indirect structural connections

Modern functional and diffusion magnetic resonance imaging (fMRI and dMRI) provide data from which macro-scale networks of functional and structural whole brain connectivity can be estimated. Although networks derived from these two modalities describe different properties of the human brain, they emerge from the same underlying brain organization, and functional communication is presumably mediated by structural connections. In this paper, we assess the structure-function relationship by evaluating how well functional connectivity can be predicted from structural graphs. Using high-resolution whole brain networks generated with varying density, we contrast the performance of several non-parametric link predictors that measure structural communication flow. While functional connectivity is not well predicted directly by structural connections, we show that superior predictions can be achieved by taking indirect structural pathways into account. In particular, we find that the length of the shortest structural path between brain regions is a good predictor of functional connectivity in sparse networks (density less than one percent), and that this improvement comes from integrating indirect pathways comprising up to three steps. Our results support the existence of important indirect relationships between structure and function, extending beyond the immediate direct structural connections that are typically investigated.

Why Do We Fall Into Sync with Others? Interpersonal Synchronization and the Brain's Optimization Principle

Spontaneous interpersonal synchronization of rhythmic behavior such as gait or clapping is a ubiquitous phenomenon in human interactions, and is potentially important for social relationships and action understanding. Although several authors have suggested a role of the mirror neuron system in interpersonal coupling, the underlying brain mechanisms are not well understood. Here we argue that more general theories of neural computations, namely predictive coding and the Free Energy Principle, could explain interpersonal coordination dynamics. Each brain minimizes coding costs by reducing the mismatch between the representations of observed and own motor behavior. Continuous mutual prediction and alignment result in an overall minimization of free energy, thus forming a stable attractor state.
Why is it so difficult to determine the lateral Position of the Rails by a Measurement of the Motion of an Axle on a moving Vehicle?

Several attempts of measuring the exact location of the rails by the use of ordinary vehicles have been made. While the method works reasonably well in the vertical direction, the results of the lateral measurements made with different vehicles are so widely scattered that it is virtually impossible to draw any conclusions. We may therefore ask: does a wheel set follow the track disturbances exactly? In this article we investigate the lateral dynamics of a half-car vehicle model with two-axle bogies running on a rigid tangent track with sinusoidal lateral disturbances of the rails. The wavelength, the amplitude and the phase between the rail disturbances are varied. Two different vehicle speeds are investigated. One speed is under and the other above the vehicle critical speed. In the article we show examples of axle motions that do not follow the track disturbances in phase, amplitude or period or several of these together. The results are discussed, and we must conclude that it is in general impossible to determine the track geometry from the motion of a wheel set.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems
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Number of pages: 13
Publication date: 2017

Host publication information
Title of host publication: Proceedings of First International Conference on Rail Transportation 2017
Main Research Area: Technical/natural sciences
Conference: First International Conference on Rail Transportation 2017, Chengdu, China, 10/07/2017 - 10/07/2017
Train-Track Interaction, Railway Vehicle Dynamics, Vehicle-Track coupled Dynamics
Electronic versions:
Working Memory Modulation of Frontoparietal Network Connectivity in First-Episode Schizophrenia

Working memory (WM) impairment is regarded as a core aspect of schizophrenia. However, the neural mechanisms behind this cognitive deficit remain unclear. The connectivity of a frontoparietal network is known to be important for subserving WM. Using functional magnetic resonance imaging, the current study investigated whether WM-dependent modulation of effective connectivity in this network is affected in a group of first-episode schizophrenia (FES) patients compared with similarly performing healthy participants during a verbal n-back task. Dynamic causal modeling (DCM) of the coupling between regions (left inferior frontal gyrus (IFG), left inferior parietal lobe (IPL), and primary visual area) identified in a psychophysiological interaction (PPI) analysis was performed to characterize effective connectivity during the n-back task. The PPI analysis revealed that the connectivity between the left IFG and left IPL was modulated by WM and that this modulation was reduced in FES patients. The subsequent DCM analysis confirmed this modulation by WM and found evidence that FES patients had reduced forward connectivity from IPL to IFG. These findings provide evidence for impaired WM modulation of frontoparietal effective connectivity in the early phase of schizophrenia, even with intact WM performance, suggesting a failure of context-sensitive coupling in the schizophrenic brain.

General Information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, Central South University, University College London
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Number of pages: 10
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication Information
Journal: Cerebral Cortex
ISSN (Print): 1047-3211
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.633 SJR 3.892 CiteScore 5.87
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.5 SJR 4.103 SNIP 1.614
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 4.929 SNIP 1.872 CiteScore 6.68
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 4.887 SNIP 1.994 CiteScore 6.86
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 5.386 SNIP 1.899 CiteScore 7.26
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 5.077 SNIP 1.916 CiteScore 7.28
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 5.187 SNIP 1.893 CiteScore 7.2
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 5.074 SNIP 1.843
BFI (2009): BFI-level 2
Dynamic causal modeling, Dysconnection hypothesis, Functional magnetic resonance imaging, n-back

Electronic versions:
bhx050.pdf
DOIs:
10.1093/cercor/bhx050

Bibliographical note
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Source: FindIt
Source-ID: 2355767644
Publication: Research - peer-review › Journal article – Annual report year: 2017

Workload impact of automated image analysis and deep learning on manual screening of sentinel node biopsies in breast cancer

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science
Authors: Thagaard, J. (Intern), Kristensson, M. (Intern)
Pages: S297
Publication date: 2017
Conference: 29th European Congress of Pathology, Amsterdam, Netherlands, 02/09/2017 - 02/09/2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Virchows Archiv
Volume: 471
Article number: E-PS-02-014
ISSN (Print): 0945-6317
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.012 SJR 1.207 CiteScore 2.6
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.46 SJR 1.16 SNIP 1.049
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.192 SNIP 1.099 CiteScore 2.55
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.282 SNIP 1.16 CiteScore 2.65
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.237 SNIP 1.163 CiteScore 2.77
ISI indexed (2013): ISI indexed yes

BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.168 SNIP 1.271 CiteScore 2.68
ISI indexed (2012): ISI indexed yes

BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.177 SNIP 1.199 CiteScore 2.55
ISI indexed (2011): ISI indexed yes

BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.064 SNIP 1.08
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.008 SNIP 1.137
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.945 SNIP 0.854
Scopus rating (2007): SJR 0.952 SNIP 0.926
Scopus rating (2006): SJR 0.949 SNIP 1.04
Scopus rating (2005): SJR 0.842 SNIP 1.056
Scopus rating (2004): SJR 1.009 SNIP 1.211
Scopus rating (2003): SJR 0.905 SNIP 1.111
Scopus rating (2002): SJR 0.788 SNIP 0.932
Scopus rating (2001): SJR 0.722 SNIP 0.997
Scopus rating (2000): SJR 0.778 SNIP 0.971
Scopus rating (1999): SJR 0.795 SNIP 0.985

Original language: English
Source: FindIt
Source-ID: 2390779806
Publication: Research - peer-review › Conference abstract in journal – Annual report year: 2017

剩余酵母罐出现故障-灾难性的后果
建议慎重: 一个盛放剩余酵母的大罐子飞向空中，只剩下底板和罐子中的内容物质，虽然罐子不是针对过压设计的，但它也处于“非常低的过压”下，以防形成过多的泡沫。啤酒厂不清楚压缩空气的危害，本文描述的事故应该告诉人们，如果原本针对大气压力设计的罐子改用在轻微过压环境中，必须特别谨慎。

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Statistics and Data Analysis, COWI A/S
Authors: Hedlund, F. H. (Intern), Selig, R. S. (Ekstern)
Pages: 9-11
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Brauwelt International
Volume: 2
ISSN (Print): 0934-9340
Original language: Chinese
Source: PublicationPreSubmission
Source-ID: 131572047
Publication: Research - peer-review › Journal article – Annual report year: 2017

Digital image analysis outperforms manual biomarker assessment in breast cancer
In the spectrum of breast cancers, categorization according to the four gene expression-based subtypes 'Luminal A,' 'Luminal B,' 'HER2-enriched,' and 'Basal-like' is the method of choice for prognostic and predictive value. As gene expression assays are not yet universally available, routine immunohistochemical stains act as surrogate markers for these subtypes. Thus, congruence of surrogate markers and gene expression tests is of utmost importance. In this study, 3 cohorts of primary breast cancer specimens (total n=436) with up to 28 years of survival data were scored for Ki67, ER, PR, and HER2 status manually and by digital image analysis (DIA). The results were then compared for sensitivity and specificity for the Luminal B subtype, concordance to PAM50 assays in subtype classification and prognostic power. The
DIA system used was the Visiopharm Integrator System. DIA outperformed manual scoring in terms of sensitivity and specificity for the Luminal B subtype, widely considered the most challenging distinction in surrogate subclassification, and produced slightly better concordance and Cohen’s k agreement with PAM50 gene expression assays. Manual biomarker scores and DIA essentially matched each other for Cox regression hazard ratios for all-cause mortality. When the Nottingham combined histologic grade (Elston-Ellis) was used as a prognostic surrogate, stronger Spearman’s rank-order correlations were produced by DIA. Prognostic value of Ki67 scores in terms of likelihood ratio χ² (LR χ²) was higher for DIA that also added significantly more prognostic information to the manual scores (LR-Δχ²). In conclusion, the system for DIA evaluated here was in most aspects a superior alternative to manual biomarker scoring. It also has the potential to reduce time consumption for pathologists, as many of the steps in the workflow are either automatic or feasible to manage without pathological expertise.

Graph reconstruction with a betweenness oracle

Graph reconstruction algorithms seek to learn a hidden graph by repeatedly querying a blackbox oracle for information about the graph structure. Perhaps the most well studied and applied version of the problem uses a distance oracle, which can report the shortest path distance between any pair of nodes. We introduce and study the betweenness oracle, where bet(a, m, z) is true iff m lies on a shortest path between a and z. This oracle is strictly weaker than a distance oracle, in the sense that a betweenness query can be simulated by a constant number of distance queries, but not vice versa. Despite this, we are able to develop betweenness reconstruction algorithms that match the current state of the art for distance reconstruction, and even improve it for certain types of graphs. We obtain the following algorithms: 1. Reconstruction of general graphs in O(n²) queries 2. Reconstruction of degree-bounded graphs in \(\tilde{O}(n^{3/2})\) queries 3. Reconstruction of geodetic degree-bounded graphs in \(O(n)\) queries In addition to being a fundamental graph theoretic problem with some natural applications, our new results shed light on some avenues for progress in the distance reconstruction problem.
Restructuring of workflows to minimise errors via stochastic model checking: An automated evolutionary approach

This article presents a framework for the automated restructuring of stochastic workflows to reduce the impact of faults. The framework allows for the modelling of workflows by means of a formalised subset of the BPMN workflow language. We extend this modelling formalism to describe faults and incorporate an intention preserving stochastic semantics able to model both probabilistic- and non-deterministic behaviour.

Stochastic model checking techniques are employed to generate the state-space of a given workflow. Possible improvements obtained by restructuring are measured by employing the framework’s capacity for tracking real-valued quantities associated with states and transitions of the workflow. The space of possible restructurings of a workflow are explored by means of an evolutionary algorithm, where the goals for improvement are defined in terms of optimising quantities, typically employed to model resources, associated with a workflow.

The approach is fully automated and only the modelling of the production workflows, potential faults and the expression of the goals require manual input. We present the design of a software tool implementing this framework and explore the practical utility of this approach through an industrial case study in which the risk of production failures and their impact are reduced by restructuring the workflow.
3-D printed sensing patches with embedded polymer optical fibre Bragg gratings

The first demonstration of a polymer optical fibre Bragg grating (POFBG) embedded in a 3-D printed structure is reported. Its cyclic strain performance and temperature characteristics are examined and discussed. The sensing patch has a repeatable strain sensitivity of 0.38 pm/µε. Its temperature behaviour is unstable, with temperature sensitivity values varying between 30-40 pm/°C.
Aberrant neural signatures of decision-making: Pathological gamblers display cortico-striatal hypersensitivity to extreme gambles

Pathological gambling is an addictive disorder characterized by an irresistible urge to gamble despite severe consequences. One of the hallmarks of pathological gambling is maladaptive and highly risky decision-making, which has been linked to dysregulation of reward-related brain regions such as the ventral striatum. However, previous studies have produced contradictory results regarding the implication of this network, revealing either hypo- or hypersensitivity to monetary gains and losses. One possible explanation is that the gambling brain might be misrepresenting the benefits and costs when weighting the potential outcomes, and not the gains and losses per se. To address this issue, we investigated whether pathological gambling is associated with abnormal brain activity during decisions that weight the utility of possible gains against possible losses. Pathological gamblers and healthy human subjects underwent functional magnetic resonance imaging while they accepted or rejected mixed gain/loss gambles with fifty-fifty chances of winning or losing. Contrary to healthy individuals, gamblers showed a U-shaped response profile reflecting hypersensitivity to the most appetitive and most aversive bets in an executive cortico-striatal network including the dorsolateral prefrontal cortex and caudate nucleus. This network is concerned with the evaluation of action-outcome contingencies, monitoring recent actions and anticipating their consequences. The dysregulation of this specific network, especially for extreme bets with large potentials consequences, offers a novel understanding of the neural basis of pathological gambling in terms of deficient associations between gambling actions and their financial impact.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, Copenhagen University Hospital, Copenhagen Business School
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Pages: 342-352
Publication date: 2016
Main Research Area: Technical/natural sciences
**Publication information**

<table>
<thead>
<tr>
<th>Journal</th>
<th>Neuroimage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume</td>
<td>128</td>
</tr>
<tr>
<td>ISSN (Print)</td>
<td>1053-8119</td>
</tr>
</tbody>
</table>

**Ratings:**

- BFI (2018): BFI-level 2
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 2
- Scopus rating (2017): CiteScore 6.15 SJR 3.679 SNIP 1.806
- Web of Science (2017): Indexed Yes
- BFI (2016): BFI-level 2
- Scopus rating (2016): CiteScore 6.31 SJR 3.967 SNIP 1.759
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 2
- Scopus rating (2015): SJR 4.583 SNIP 1.852 CiteScore 6.71
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 2
- Scopus rating (2014): SJR 4.323 SNIP 2.03 CiteScore 6.9
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 2
- Scopus rating (2013): SJR 4.489 SNIP 2.028 CiteScore 7.06
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 2
- Scopus rating (2012): SJR 4.026 SNIP 1.972 CiteScore 6.86
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 2
- Scopus rating (2011): SJR 3.728 SNIP 1.818 CiteScore 6.31
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 2
- Scopus rating (2010): SJR 3.654 SNIP 1.869
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 2
- Scopus rating (2009): SJR 3.954 SNIP 1.899
- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 2
- Scopus rating (2008): SJR 4.196 SNIP 1.771
- Web of Science (2008): Indexed yes
- Web of Science (2007): Indexed yes
- Scopus rating (2006): SJR 3.467 SNIP 1.94
- Web of Science (2006): Indexed yes
- Scopus rating (2005): SJR 3.78 SNIP 1.921
- Web of Science (2005): Indexed yes
- Scopus rating (2004): SJR 3.481 SNIP 1.803
- Web of Science (2004): Indexed yes
- Scopus rating (2003): SJR 2.003 SNIP 1
- Web of Science (2003): Indexed yes
- Scopus rating (2002): SJR 0.696 SNIP 0.404
- Web of Science (2002): Indexed yes
- Scopus rating (2001): SJR 0.528 SNIP 0.262
- Web of Science (2001): Indexed yes
Accurate continuous geographic assignment from low- to high-density SNP data

**Motivation:** Large-scale genotype datasets can help tracking the dispersal patterns of epidemiological outbreaks and predicting the geographic origins of individuals. This shows direct applications in forensics for profiling both victims and criminals, and in wildlife management, where poaching hotspot areas can be located. Such approaches, however, require fast and accurate geographical assignment methods.

**Results:** We introduce a novel statistical method for geopositioning individuals of unknown origin from genotypes. Our method is based on a geostatistical model trained with a dataset of georeferenced genotypes. Statistical inference under this model can be implemented within the theoretical framework of Integrated Nested Laplace Approximation (INLA), which represents one of the major recent breakthroughs in statistics, devoid of Monte Carlo simulations. We compare the performance of our method and SPA in a simulation framework. We highlight the accuracy and limits of continuous spatial assignment methods at various scales by analyzing genotype datasets from a diversity of species, including Florida scrub jay birds Aphelocoma coerulescens, Arabidopsis thaliana and humans, representing 41 to 197,146 SNPs. Our method appears to be best tailored for the analysis of medium-size datasets (a few tens of thousands of loci), such as reduced-representation sequencing data that become increasingly available in ecology.
A Comparison of Dynamics in Two Models for the Spread of a Vector-Borne Disease

In 2007, bluetongue virus (BTV) was introduced to both Denmark (DK) and the United Kingdom (UK). For this reason, simulation models were built to predict scenarios for future incursions. The DK and UK models have a common description of within-herd dynamics, but differ greatly in their descriptions of between-herd spread, one using an explicit representation of vector dispersal, the other a transmission kernel. Here, we compare model predictions for the dynamics of bluetongue in the UK, based on the 2007 incursion and vaccination rollout in 2008. We demonstrate how an agent-based model shows greater sensitivity to the level of vaccine uptake and has lower variability compared with a kernel-based model. However, a model using a transmission kernel requires less detailed data and is often faster.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, National Veterinary Institute, The Pirbright Institute
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Pages: 215-223
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Transboundary and Emerging Diseases
Volume: 63
Issue number: 2
ISSN (Print): 1865-1674
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
Active Appearance Segmentation for Intensity Inhomogeneity in Light Sheet Fluorescence Microscopy

Active Appearance Models (AAM) are used for annotating or segmenting shapes in biomedical images. Performance relies heavily on the image data used to train the AAM. In this paper we improve the generalization properties of the model by making it robust to slowly varying spatial intensity inhomogeneities which are often seen in Light Sheet Fluorescence Microscopy (LSFM) images. This robustness is achieved by modelling the appearance of an image as a regularized Normalized Gradient Field (rNGF). We perform two experiments to challenge the model. First it is tested using a repeated leave-one-out approach on images with minimal imperfections where the left out images are corrupted by a simulated bias field and segmented using the AAM. Secondly we test the model on LSFM images with common acquisition problems. In
both experiments the proposed approach outperforms the often used AAM implementation based on Sum of Squared Differences.

Active Fault Detection Based on a Statistical Test
In this paper active fault detection of closed loop systems using dual Youla-Jabr-Bongiorno-Kucera (YJBK) parameters is presented. Until now all detector design for active fault detection using the dual YJBK parameters has been based on CUSUM detectors. Here a method for design of a matched filter detector is proposed instead, based upon the Neyman-Pearson criterion for optimal detector design. Furthermore alternative ways to design the excitation signal which relates to indirect identification methods are presented. Examples are given on detection of actuator faults using a simulated gas bearing for both one and multiple possible parametric faults.

Active vibration-based SHM system: demonstration on an operating Vestas V27 wind turbine
This study presents a system that is able to detect defects like cracks, leading/trailing edge opening or delamination of at least 15 cm size, remotely, without stopping the wind turbine. The system is vibration-based: mechanical energy is artificially introduced by means of an electromechanical actuator, whose plunger periodically hits the blade. The induced vibrations propagate along the blade and are picked up by an array of accelerometers. The vibrations in mid-range frequencies are utilized: this range is above the frequencies excited by blade-wind interaction, ensuring a good signal-to-noise ratio. At the same time, the corresponding wavelength is short enough to deliver required damage detection resolution and long enough to be able to propagate the entire blade length.

The paper demonstrates the system on a 225 kW Vestas V27 wind turbine. One blade of the wind turbine was equipped
with the system and a 3.5 month monitoring campaign was conducted while the turbine was operating normally. During the campaign, a defect – a trailing edge opening – was artificially introduced into the blade and its size was gradually increased from the original 15 cm to 45 cm.

Using an unsupervised learning algorithm, we were able to detect even the smallest amount of damage while the wind turbine was operating under different weather conditions. The paper provides the detailed information about the instrumentation and the measurement campaign and explains the damage detection algorithm.

**General information**

**State:** Published  
**Organisations:** Department of Applied Mathematics and Computer Science, Cognitive Systems, Brüel & Kjær A/S  
**Authors:** Tcherniak, D. (Ekstern), Mølgaard, L. L. (Intern)  
**Number of pages:** 10  
**Publication date:** 2016

**Host publication information**

**Title of host publication:** Proceedings of the 8th European Workshop On Structural Health Monitoring (EWSHM 2016)  
**Publisher:** NDT.net  
**Main Research Area:** Technical/natural sciences  
**Conference:** 8th European Workshop On Structural Health Monitoring (EWSHM 2016), Bilbao, Spain, 05/07/2016 - 05/07/2016  
**Wind turbines, Blade damage, Actuator, Accelerometers**

**Electronic versions:**  
**32_Tcherniak.pdf**  
Source: PublicationPreSubmission  
**Source-ID:** 127762821  
**Publication: Research - peer-review › Article in proceedings – Annual report year: 2016**

**Adaptable AES implementation with power-gating support**

In this paper, we propose a reconfigurable design of the Advanced Encryption Standard capable of adapting at run-Time to the requirements of the target application. Reconfiguration is achieved by activating only a specific subset of all the instantiated processing elements. Further, we explore the effectiveness of power gating and clock gating methodologies to minimize the energy consumption of the processing elements not involved in computation.

**General information**

**State:** Published  
**Organisations:** Department of Applied Mathematics and Computer Science, Cyber Security, University of Cagliari, ALaRI - USI, University of Sassari  
**Authors:** Banik, S. (Intern), Bogdanov, A. (Intern), Fanni, T. (Ekstern), Sau, C. (Ekstern), Raffo, L. (Ekstern), Palumbo, F. (Ekstern), Regazzoni, F. (Ekstern)  
**Pages:** 331-334  
**Publication date:** 2016

**Host publication information**

**Title of host publication:** Proceedings of the ACM International Conference on Computing Frontiers (CF ’16)  
**Publisher:** Association for Computing Machinery  
**ISBN (Print):** 978-1-4503-4128-8  
**BFI conference series:** ACM International Conference on Computing Frontiers (5010518)  
**Main Research Area:** Technical/natural sciences  
**Conference:** ACM International Conference on Computing Frontiers (CF 2016), Como, Italy, 16/05/2016 - 16/05/2016  

**DOIs:**  
10.1145/2903150.2903488  
Source: FindIt  
**Source-ID:** 2306998280  
**Publication: Research - peer-review › Article in proceedings – Annual report year: 2016**

**Adaptive robust polynomial regression for power curve modeling with application to wind power forecasting**

Wind farm power curve modeling, which characterizes the relationship between meteorological variables and power production, is a crucial procedure for wind power forecasting. In many cases, power curve modeling is more impacted by the limited quality of input data rather than the stochastic nature of the energy conversion process. Such nature may be due the varying wind conditions, aging and state of the turbines, etc. And, an equivalent steady-state power curve, estimated under normal operating conditions with the intention to filter abnormal data, is not sufficient to solve the problem because of the lack of time adaptivity. In this paper, a refined local polynomial regression algorithm is proposed to yield an adaptive robust model of the time-varying scattered power curve for forecasting applications. The time adaptivity of the
algorithm is considered with a new data-driven bandwidth selection method, which is a combination of pilot estimation based on blockwise least-squares parabolic fitting and the probability integral transform. The regression model is then extended to a more robust one, in which a new dynamic forgetting factor is defined to make the estimator forget the out-of-date data swiftly and also achieve a better trade-off between robustness against noisy data and time adaptivity. A case study based on a real-world dataset validates the properties of the proposed regression method. Results show that the new method could flexibly respond to abnormal data at different lead times and has better performance than common benchmarks for short-term forecasting.

**General information**

**State:** Published

**Organisations:** Department of Applied Mathematics and Computer Science, Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, Tsinghua University

**Authors:** Xu, M. (Ekstern), Pinson, P. (Intern), Lu, Z. (Ekstern), Qiao, Y. (Ekstern), Min, Y. (Ekstern)

**Number of pages:** 16

**Pages:** 2321–2336

**Publication date:** 2016

**Main Research Area:** Technical/natural sciences

**Publication information**

**Journal:** Wind Energy

**Volume:** 19

**Issue number:** 12

**ISSN (Print):** 1095-4244

**Ratings:**

BFI (2018): BFI-level 2

Web of Science (2018): Indexed yes

BFI (2017): BFI-level 2

Scopus rating (2017): CiteScore 3.18 SJR 1.051 SNIP 1.834

Web of Science (2017): Indexed yes

BFI (2016): BFI-level 2

Scopus rating (2016): CiteScore 3.37 SJR 1.079 SNIP 2.316

Web of Science (2016): Indexed yes

BFI (2015): BFI-level 2

Scopus rating (2015): SJR 1.201 SNIP 2.165 CiteScore 3.06

Web of Science (2015): Indexed yes

BFI (2014): BFI-level 2

Scopus rating (2014): SJR 1.209 SNIP 3.688 CiteScore 3.42

Web of Science (2014): Indexed yes

BFI (2013): BFI-level 2

Scopus rating (2013): SJR 1.235 SNIP 2.486 CiteScore 2.75

ISI indexed (2013): ISI indexed yes

Web of Science (2013): Indexed yes

BFI (2012): BFI-level 2

Scopus rating (2012): SJR 1.062 SNIP 2.297 CiteScore 2.36

ISI indexed (2012): ISI indexed yes

Web of Science (2012): Indexed yes

BFI (2011): BFI-level 2

Scopus rating (2011): SJR 0.892 SNIP 2.582 CiteScore 2.49

ISI indexed (2011): ISI indexed yes

Web of Science (2011): Indexed yes

BFI (2010): BFI-level 2

Scopus rating (2010): SJR 1.364 SNIP 2.026

Web of Science (2010): Indexed yes

BFI (2009): BFI-level 2

Scopus rating (2009): SJR 0.885 SNIP 1.439

Web of Science (2009): Indexed yes

BFI (2008): BFI-level 2

Scopus rating (2008): SJR 0.743 SNIP 1.555
Adaptive Test Schemes for Control of Paratuberculosis in Dairy Cows

Paratuberculosis is a chronic infection that in dairy cattle causes reduced milk yield, weight loss, and ultimately fatal diarrhea. Subclinical animals can excrete bacteria (Mycobacterium avium ssp. paratuberculosis, MAP) in feces and infect other animals. Farmers identify the infectious animals through a variety of test-strategies, but are challenged by the lack of perfect tests. Frequent testing increases the sensitivity but the costs of testing are a cause of concern for farmers. Here, we used a herd simulation model using milk ELISA tests to evaluate the epidemiological and economic consequences of continuously adapting the sampling interval in response to the estimated true prevalence in the herd. The key results were that the true prevalence was greatly affected by the hygiene level and to some extent by the test-frequency. Furthermore, the choice of prevalence that will be tolerated in a control scenario had a major impact on the true prevalence in the normal hygiene setting, but less so when the hygiene was poor. The net revenue is not greatly affected by the test-strategy, because of the general variation in net revenues between farms. An exception to this is the low hygiene herd, where frequent testing results in lower revenue. When we look at the probability of eradication, then it is correlated with the testing frequency and the target prevalence during the control phase. The probability of eradication is low in the low hygiene herd, and a test-and-cull strategy should probably not be the primary strategy in this herd. Based on this study we suggest that, in order to control MAP, the standard Danish dairy farm should use an adaptive strategy where a short sampling interval of three months is used when the estimated true prevalence is above 1%, and otherwise use a long sampling interval of one year.

General information
State: Published
Organisations: National Veterinary Institute, Section for Epidemiology, Department of Applied Mathematics and Computer Science, Dynamical Systems, University of Copenhagen
Authors: Kirkeby, C. T. (Intern), Græsbøll, K. (Intern), Nielsen, S. S. (Ekstern), Christiansen, L. E. (Intern), Toft, N. (Intern), Hisham Beshara Halasa, T. (Intern)
Number of pages: 13
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: PLoS One
Volume: 11
Issue number: 12
Article number: e0167219
ISSN (Print): 1932-6203
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.01 SJR 1.164 SNIP 1.111
A Data-Driven Bidding Model for a Cluster of Price-Responsive Consumers of Electricity

This paper deals with the market-bidding problem of a cluster of price-responsive consumers of electricity. We develop an inverse optimization scheme that, recast as a bilevel programming problem, uses price-consumption data to estimate the complex market bid that best captures the price-response of the cluster. The complex market bid is defined as a series of marginal utility functions plus some constraints on demand, such as maximum pick-up and drop-off rates. The proposed modeling approach also leverages information on exogenous factors that may influence the consumption behavior of the cluster, e.g., weather conditions and calendar effects. We test the proposed methodology for a particular application: forecasting the power consumption of a small aggregation of households that took part in the Olympic Peninsula project. Results show that the price-sensitive consumption of the cluster of flexible loads can be largely captured in the form of a complex market bid, so that this could be ultimately used for the cluster to participate in the wholesale electricity market.

General information
State: Published
A Framework for Dynamically-Loaded Hardware Library (HLL) in FPGA Acceleration

Hardware acceleration is often used to address the need for speed and computing power in embedded systems. FPGAs always represented a good solution for HW acceleration and, recently, new SoC platforms extended the flexibility of the FPGAs by combining on a single chip both high-performance CPUs and FPGA fabric.

The aim of this work is the implementation of hardware accelerators for these new SoCs. The innovative feature of these accelerators is the on-the-fly reconfiguration of the hardware to dynamically adapt the accelerator's functionalities to the current CPU workload. The realization of the accelerators preliminarily requires also the profiling of both the SW (ARM CPU + NEON Units) and HW (FPGA) performance, an evaluation of the partial reconfiguration times and the development of an applicationspecific IP-cores library.

This paper focuses on the profiling aspect of both the SW and HW implementation of the same operations, using arithmetic routines (BLAS) as the reference point for benchmarking, and presents a comparison of the results in terms of speed, power consumption and resources utilization.

A framework for geometry acquisition, 3-D printing, simulation, and measurement of head-related transfer functions with a focus on hearing-assistive devices

Individual head-related transfer functions (HRTFs) are essential in applications like fitting hearing-assistive devices (HADs) for providing accurate sound localization performance. Individual HRTFs are usually obtained through intricate acoustic measurements. This paper investigates the use of a three-dimensional (3D) head model for acquisition of individual HRTFs. Two aspects were investigated: whether a 3D-printed model can replace measurements on a human listener and whether numerical simulations can replace acoustic measurements. For this purpose, HRTFs were acoustically measured for four human listeners and for a 3D printed head model of one of these listeners. Further, HRTFs were simulated by applying the finite element method to the 3D head model. The monaural spectral features and spectral distortions were very similar between re-measurements and between human and printed measurements, however larger deviations were observed between measurement and simulation. The binaural cues were in agreement among all HRTFs.
of the same listener, indicating that the 3D model is able to provide localization cues potentially accessible to HAD users. Hence, the pipeline of geometry acquisition, printing, and acoustic measurements or simulations, seems to be a promising step forward towards in-silico design of HADs.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Copenhagen Center for Health Technology, Austrian Academy of Sciences, Oticon A/S, Eriksholm Research Centre
Authors: Harder, S. (Intern), Paulsen, R. R. (Intern), Larsen, M. (Ekstern), Laugesen, S. (Ekstern), Mihocic, M. (Ekstern), Majdak, P. (Ekstern)
Pages: 39-46
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Computer-Aided Design
Volume: 75-76
ISSN (Print): 0010-4485
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.11 SJR 1.025 SNIP 2.273
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.57 SJR 0.884 SNIP 2.073
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.003 SNIP 2.436 CiteScore 2.61
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.273 SNIP 2.999 CiteScore 2.67
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.035 SNIP 2.811 CiteScore 2.31
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.948 SNIP 2.412 CiteScore 1.82
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.702 SNIP 2.472 CiteScore 2.3
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.844 SNIP 2.463
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.917 SNIP 2.093
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.014 SNIP 2.531
Scopus rating (2007): SJR 0.952 SNIP 2.375
Scopus rating (2006): SJR 1.266 SNIP 2.607
Scopus rating (2005): SJR 1.073 SNIP 2.347
Scopus rating (2004): SJR 1.197 SNIP 2.456
Scopus rating (2003): SJR 1.484 SNIP 2.043
Scopus rating (2002): SJR 1.027 SNIP 2.382
Scopus rating (2001): SJR 1.28 SNIP 2.506
Scopus rating (2000): SJR 1.118 SNIP 1.973
Scopus rating (1999): SJR 1.039 SNIP 1.999
A Framework for Organization-Aware Agents: JAAMAS Extended Abstract
This short paper introduces and summarizes the AORTA reasoning framework that can be integrated into BDI-agents to enable organizational decision-making. This work has recently been published in the Journal of Autonomous Agents and Multi-Agent Systems (JAAMAS), as [3].

A generative model for segmentation of tumor and organs-at-risk for radiation therapy planning of glioblastoma patients
We present a fully automated generative method for simultaneous brain tumor and organs-at-risk segmentation in multimodal magnetic resonance images. The method combines an existing whole-brain segmentation technique with a spatial tumor prior, which uses convolutional restricted Boltzmann machines to model tumor shape. The method is not tuned to any specific imaging protocol and can simultaneously segment the gross tumor volume, peritumoral edema and healthy tissue structures relevant for radiotherapy planning. We validate the method on a manually delineated clinical data set of glioblastoma patients by comparing segmentations of gross tumor volume, brainstem and hippocampus. The preliminary results demonstrate the feasibility of the method.
A Generative Probabilistic Model and Discriminative Extensions for Brain Lesion Segmentation - With Application to Tumor and Stroke

We introduce a generative probabilistic model for segmentation of brain lesions in multi-dimensional images that generalizes the EM segmenter, a common approach for modelling brain images using Gaussian mixtures and a probabilistic tissue atlas that employs expectation-maximization (EM), to estimate the label map for a new image. Our model augments the probabilistic atlas of the healthy tissues with a latent atlas of the lesion. We derive an estimation algorithm with closed-form EM update equations. The method extracts a latent atlas prior distribution and the lesion posterior distributions jointly from the image data. It delineates lesion areas individually in each channel, allowing for differences in lesion appearance across modalities, an important feature of many brain tumor imaging sequences. We also propose discriminative model extensions to map the output of the generative model to arbitrary labels with semantic and biological meaning, such as "tumor core" or "fluid-filled structure", but without a one-to-one correspondence to the hypo- or hyper-intense lesion areas identified by the generative model. We test the approach in two image sets: the publicly available BRATS set of glioma patient scans, and multimodal brain images of patients with acute and subacute ischemic stroke. We find the generative model that has been designed for tumor lesions to generalize well to stroke images, and the extended discriminative-discriminative model to be one of the top ranking methods in the BRATS evaluation.
A global approach for sparse representation of uncertainty in Life Cycle Assessments of waste management systems

Purpose: Identification of key inputs and their effect on results from Life Cycle Assessment (LCA) models is fundamental. Because parameter importance varies greatly between cases due to the interaction of sensitivity and uncertainty, these features should never be defined a priori. However, exhaustive parametrical uncertainty analyses may potentially be complicated and demanding, both with analytical and sampling methods. Therefore, we propose a systematic method for selection of critical parameters based on a simplified analytical formulation that unifies the concepts of sensitivity and
uncertainty in a Global Sensitivity Analysis (GSA) framework. Methods: The proposed analytical method based on the calculation of sensitivity coefficients (SC) is evaluated against Monte Carlo sampling on traditional uncertainty assessment procedures, both for individual parameters and for full parameter sets. Three full-scale waste management scenarios are modelled with the dedicated waste LCA model EASETech and a full range of ILCD recommended impact categories. Common uncertainty ranges of 10 % are used for all parameters, which we assume to be normally distributed. The applicability of the concepts of additivity of variances and GSA is tested on results from both uncertainty propagation methods. Then, we examine the differences in discernibility analyses results carried out with varying numbers of sampling points and parameters. Results and discussion: The proposed analytical method complies with the Monte Carlo results for all scenarios and impact categories, but offers substantially simpler mathematical formulation and shorter computation times. The coefficients of variation obtained with the analytical method and Monte Carlo differ only by 1 %, indicating that the analytical method provides a reliable representation of uncertainties and allows determination of whether a discernibility analysis is required. The additivity of variances and the GSA approach show that the uncertainty in results is determined by a limited set of important parameters. The results of the discernibility analysis based on these critical parameters vary only by 1 % from discernibility analyses based on the full set, but require significantly fewer Monte Carlo runs. Conclusions: The proposed method and GSA framework provide a fast and valuable approximation for uncertainty quantification. Uncertainty can be represented sparsely by contextually identifying important parameters in a systematic manner. The proposed method integrates with existing step-wise approaches for uncertainty analysis by introducing a global importance analysis before uncertainty propagation.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics
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Pages: 378-394
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: International Journal of Life Cycle Assessment
Volume: 21
Issue number: 3
ISSN (Print): 0948-3349
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.71 SJR 1.268 SNIP 1.454
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.43 SJR 1.386 SNIP 1.517
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.53 SNIP 1.579 CiteScore 3.49
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.726 SNIP 1.78 CiteScore 3.65
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.672 SNIP 1.978 CiteScore 3.35
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.529 SNIP 1.707 CiteScore 2.89
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.595 SNIP 1.737 CiteScore 2.82
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
A Hardware Framework for on-Chip FPGA Acceleration

In this work, we present a new framework to dynamically load hardware accelerators on reconfigurable platforms (FPGAs). Provided a library of application-specific processors, we load on-the-fly the specific processor in the FPGA, and we transfer the execution from the CPU to the FPGA-based accelerator. Results show that significant speed-up can be obtained by the proposed acceleration framework on system-on-chips where reconfigurable fabric is placed next to the CPUs. The speed-up is due to both the intrinsic acceleration in the application-specific processors, and to the increased parallelism.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, University of Roma 'Tor Vergata'
Authors: Lomuscio, A. (Ekstern), Cardarilli, G. C. (Ekstern), Nannarelli, A. (Intern), Re, M. (Ekstern)
Number of pages: 4
Publication date: 2016

Host publication information
Title of host publication: Proceedings of the 15th International Symposium on Integrated Circuits (ISIC 2016)
Publisher: IEEE
ISBN (Print): 978-1-4673-9019-4
Main Research Area: Technical/natural sciences
DOIs:
A herd- and cow-specific decision support tool for control of mastitis

**General information**

State: Published  
Organisations: National Veterinary Institute, Section for Epidemiology, Department of Applied Mathematics and Computer Science, Dynamical Systems, University of Copenhagen  
Authors: Gussmann, M. K. (Intern), Kirkeby, C. T. (Intern), Græsbøll, K. (Intern), Christiansen, L. E. (Intern), Nielsen, S. S. (Ekstern), Toft, N. (Intern), Hisham Beshara Halasa, T. (Intern)  
Number of pages: 1  
Publication date: 2016  
Event: Poster session presented at SVEPM, Elsinore, Denmark.  
Main Research Area: Technical/natural sciences  
Electronic versions: Gussmann_Maya.pdf  
Source: PublicationPreSubmission  
Source-ID: 127804108  
Publication: Research - peer-review › Poster – Annual report year: 2016

A Hierarchical Algorithm for Integrated Scheduling and Control With Applications to Power Systems

The contribution of this paper is a hierarchical algorithm for integrated scheduling and control via model predictive control of hybrid systems. The controlled system is a linear system composed of continuous control, state, and output variables. Binary variables occur as scheduling decisions in the optimal control problem (OCP). The scheduling decisions are made on a slow time scale compared with the system dynamics. This gives rise to a temporal separation of the scheduling and control variables in the OCP. Accordingly, the proposed hierarchical algorithm consists of two optimization levels. The upper level (scheduling level) solves a mixed-integer linear program (MILP) with a low frequency. The lower level (control level) solves an LP with a high frequency. The main advantage of the proposed approach is that it requires online solution of an LP rather than an MILP. Simulations based on a power portfolio case study show that the hierarchical algorithm reduces the computation to solve the OCP by several orders of magnitude. The improvement in computation time is achieved without a significant increase in the overall cost of operation.

**General information**

State: Published  
Organisations: Scientific Computing, Department of Applied Mathematics and Computer Science  
Authors: Sokoler, L. E. (Intern), Dinesen, P. J. (Intern), Jørgensen, J. B. (Intern)  
Pages: 590-9  
Publication date: 2016  
Main Research Area: Technical/natural sciences  
Publication Information:  
Journal: IEEE Transactions on Control Systems Technology  
Volume: 25  
Issue number: 2  
ISSN (Print): 1063-6536  
Ratings:  
BFI (2018): BFI-level 2  
Web of Science (2018): Indexed yes  
BFI (2017): BFI-level 2  
Scopus rating (2017): CiteScore 5.89 SJR 1.832 SNIP 2.728  
Web of Science (2017): Indexed Yes  
BFI (2016): BFI-level 2  
Scopus rating (2016): CiteScore 5.17 SJR 1.655 SNIP 2.643  
Web of Science (2016): Indexed yes  
BFI (2015): BFI-level 2  
Scopus rating (2015): SJR 1.966 SNIP 2.798 CiteScore 4.72  
Web of Science (2015): Indexed yes  
BFI (2014): BFI-level 2
AIF-u: Set-Based Protocol Abstraction with Countable Families

Abstraction based approaches like ProVerif are very efficient in protocol verification, but have a limitation in dealing with stateful protocols. A number of extensions have been proposed to allow for a limited amount of state information while not destroying the advantages of the abstraction method. However, the extensions proposed so far can only deal with a finite amount of state information. This can in many cases make it impossible to formulate a verification problem for an unbounded number of agents (and one has to rather specify a fixed set of agents). Our work shows how to overcome this limitation by abstracting state into countable families of sets. We can then formalize a problem with unbounded agents, where each agent maintains its own set of keys. Still, our method does not lose the benefits of the abstraction approach, in particular, it translates a verification problem to a set of first-order Horn clauses that can then be efficiently verified with tools like ProVerif.
A Large-Scale 3D Object Recognition dataset

This paper presents a new large scale dataset targeting evaluation of local shape descriptors and 3D object recognition algorithms. The dataset consists of point clouds and triangulated meshes from 292 physical scenes taken from 11 different views; a total of approximately 3204 views. Each of the physical scenes contain 10 occluded objects resulting in a dataset with 32040 unique object poses and 45 different object models. The 45 object models are full 360 degree models which are scanned with a high precision structured light scanner and a turntable. All the included objects belong to different geometric groups; concave, convex, cylindrical and flat 3D object models. The object models have varying amount of local geometric features to challenge existing local shape feature descriptors in terms of descriptiveness and robustness. The dataset is validated in a benchmark which evaluates the matching performance of 7 different state-of-the-art local shape descriptors. Further, we validate the dataset in a 3D object recognition pipeline. Our benchmark shows as expected that local shape feature descriptors without any global point relation across the surface have a poor matching performance with flat and cylindrical objects. It is our objective that this dataset contributes to the future development of next generation of 3D object recognition algorithms. The dataset is public available at http://roboimagedata.compute.dtu.dk/.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Danish Technological Institute, University of Southern Denmark
Authors: Selund, T. (Ekstern), Glent Buch, A. (Ekstern), Krüger, N. (Ekstern), Aanæs, H. (Intern)
Number of pages: 10
Publication date: 2016
connection with the category of simplicial pairs become apparent when the topology is analyzed using homological algebra. A topological ranking is developed that measures the ability of the network to stay path-connected. Combined with the analysis of cover ideals of hypergraphs, the topological ranking demonstrates the non-trivial decisions that needs to be considered in system design. All the methods developed here have an underlying common structure, namely that they all appear at solution sets for systems of polynomials. These solution sets are called algebraic varieties.

**General information**

**State:** Published
**Organisations:** Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources, Department of Applied Mathematics and Computer Science, Cognitive Systems, Software and Process Engineering
**Authors:** Aabrandt, A. (Intern), Træholt, C. (Intern), Hansen, V. L. (Intern), Poulsen, B. (Intern)
**Number of pages:** 123
**Publication date:** 2016

**Publication information**

**Publisher:** Technical University of Denmark, Department of Electrical Engineering
**Original language:** English
**Main Research Area:** Technical/natural sciences
**Electronic versions:**

Algebraic Varieties and System Design.pdf

**Relations**

**Projects:**
Algebraic Varieties and System Design
**Publication:** Research › Ph.D. thesis – Annual report year: 2017

**Algorithms and Methods for High-Performance Model Predictive Control**

The goal of this thesis is to investigate algorithms and methods to reduce the solution time of solvers for Model Predictive Control (MPC). The thesis is accompanied with an open-source toolbox for High-Performance implementation of solvers for MPC (HPMPC), that contains the source code of all routines employed in the numerical tests. The main focus of this thesis is on linear MPC problems.

In this thesis, both the algorithms and their implementation are equally important. About the implementation, a novel implementation strategy for the dense linear algebra routines in embedded optimization is proposed, aiming at improving the computational performance in case of small matrices. About the algorithms, they are built on top of the proposed linear algebra, and they are tailored to exploit the high-level structure of the MPC problems, with special care on reducing the computational complexity.

**General information**

**State:** Published
**Organisations:** Department of Applied Mathematics and Computer Science, Scientific Computing, Copenhagen Center for Health Technology, Center for Energy Resources Engineering
**Authors:** Frison, G. (Intern), Jørgensen, J. B. (Intern)
**Number of pages:** 324
**Publication date:** 2016

**Publication information**

**Place of publication:** Kgs. Lyngby
**Publisher:** Technical University of Denmark (DTU)
**Original language:** English
**Series:** DTU Compute PHD-2015
**Number:** 402
**ISSN:** 0909-3192
**Main Research Area:** Technical/natural sciences
**Electronic versions:**

phd402_Frison_G.pdf
**Publication:** Research › Ph.D. thesis – Annual report year: 2016

**Algorithms for Simultaneous Padé Approximations**

We describe how to solve simultaneous Padé approximations over a power series ring $K[[x]]$ for a field $K$ using $O(n^{\omega - 1})$ operations in $K$, where $d$ is the sought precision and $nS$ is the number of power series to approximate. We develop two algorithms using different approaches. Both algorithms return a reduced sub-bases that generates the complete set of solutions to the input approximations problem that satisfy the given degree constraints. Our results are made possible by recent breakthroughs in fast computations of minimal approximant bases and Hermite Padé approximations.
A locally adaptive normal distribution

The multivariate normal density is a monotonic function of the distance to the mean, and its ellipsoidal shape is due to the underlying Euclidean metric. We suggest to replace this metric with a locally adaptive, smoothly changing (Riemannian) metric that favors regions of high local density. The resulting locally adaptive normal distribution (LAND) is a generalization of the normal distribution to the "manifold" setting, where data is assumed to lie near a potentially low-dimensional manifold embedded in RD. The LAND is parametric, depending only on a mean and a covariance, and is the maximum entropy distribution under the given metric. The underlying metric is, however, non-parametric. We develop a maximum likelihood algorithm to infer the distribution parameters that relies on a combination of gradient descent and Monte Carlo integration. We further extend the LAND to mixture models, and provide the corresponding EM algorithm. We demonstrate the efficiency of the LAND to fit non-trivial probability distributions over both synthetic data, and EEG measurements of human sleep.

A MAC Mode for Lightweight Block Ciphers

Lightweight cryptography strives to protect communication in constrained environments without sacrificing security. However, security often conflicts with efficiency, shown by the fact that many new lightweight block cipher designs have
block sizes as low as 64 or 32 bits. Such low block sizes lead to impractical limits on how much data a mode of operation can process per key. MAC (message authentication code) modes of operation frequently have bounds which degrade with both the number of messages queried and the message length. We present a MAC mode of operation, LightMAC, where the message length has no effect on the security bound, allowing an order of magnitude more data to be processed per key. Furthermore, LightMAC is incredibly simple, has almost no overhead over the block cipher, and is parallelizable. As a result, LightMAC not only offers compact authentication for resource-constrained platforms, but also allows high-performance parallel implementations. We highlight this in a comprehensive implementation study, instantiating LightMAC with PRESENT and the AES. Moreover, LightMAC allows flexible trade-offs between rate and maximum message length. Unlike PMAC and its many derivatives, LightMAC is not covered by patents. Altogether, this makes it a promising authentication primitive for a wide range of platforms and use cases.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cyber Security, KU Leuven, NTT Corporation
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Pages: 43-59
Publication date: 2016

Host publication information
Title of host publication: Revised Selected Papers of the 23rd International Conference on Fast Software Encryption (FSE 2016)
Publisher: Springer
ISBN (Print): 978-3-662-52992-8

Series: Lecture Notes in Computer Science
Volume: 9783
ISSN: 0302-9743
BFI conference series: International Conference on Fast Software Encryption (5000118)
Main Research Area: Technical/natural sciences
Conference: 23rd International Conference on Fast Software Encryption (FSE 2016), Bochum, Germany, 20/03/2016 - 20/03/2016

Lightweight, MAC, LightMAC, Message length, Birthday bound, Integrity, Verification
Electronic versions:
Luykx_et_al_A_MAC_Mode_for_Lightweight_Block_Ciphers.pdf. Embargo ended: 20/07/2017
DOI: 10.1007/978-3-662-52993-5_3
Source: FindIt
Source-ID: 2307542633
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

A Matter of Words: NLP for Quality Evaluation of Wikipedia Medical Articles
Automatic quality evaluation of Web information is a task with many fields of applications and of great relevance, especially in critical domains, like the medical one. We move from the intuition that the quality of content of medical Web documents is affected by features related with the specific domain. First, the usage of a specific vocabulary (Domain Informativeness); then, the adoption of specific codes (like those used in the infoboxes of Wikipedia articles) and the type of document (e.g., historical and technical ones). In this paper, we propose to leverage specific domain features to improve the results of the evaluation of Wikipedia medical articles, relying on Natural Language Processing (NLP) and dictionaries-based techniques. The results of our experiments confirm that, by considering domain-oriented features, it is possible to improve existing solutions, mainly with those articles that other approaches have less correctly classified.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, IIT-CNR
Authors: Cozza, V. (Ekstern), Petrocchi, M. (Ekstern), Spognardi, A. (Intern)
Number of pages: 9
Pages: 448-456
Publication date: 2016

Host publication information
Title of host publication: Web Engineering : 16th International Conference, ICWE 2016, Lugano, Switzerland, June 6-9, 2016. Proceedings
Publisher: Springer
ISBN (Print): 978-3-319-38790-1
An Adaptive Middleware for Improved Computational Performance

The performance improvements in computer systems over the past 60 years have been fueled by an exponential increase in energy efficiency. In recent years, the phenomenon known as the end of Dennard's scaling has slowed energy efficiency improvements — but improving computer energy efficiency is more important now than ever. Traditionally, most improvements in computer energy efficiency have come from improvements in lithography — the ability to produce smaller transistors — and computer architecture - the ability to apply those transistors efficiently. Since the end of scaling, we have seen diminishing returns from developments in lithography and modern computer architectures are so complicated requiring significant programming effort to exploit efficiently — software developers undertaking such a task will need all the help they can get, in order to keep the programming effort down.

In this thesis we champion using software to improve energy efficiency — in particular we develop guidelines for reasoning and evaluating software performance on modern computers, and a middleware that has been designed for modern computers, improving computational performance both in terms of energy and execution time. Our middleware consists of a new power manager, synchronization libraries using hardware transactional memory (for locks, barriers, and task synchronization), and two concurrent map data structures, which can be deployed in computer systems with little to no effort. At a fundamental level, we are improving computational performance by exploiting modern hardware features, such as dynamic voltage-frequency scaling and transactional memory. Adapting software is an iterative process, requiring that we continually revisit it to meet new requirements or realities; a time consuming process which we hope to simplify by analyzing the realities of modern computers, and providing guidelines explaining how to get the most performance out of them.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Language-Based Technology, Embedded Systems Engineering
Authors: Bonnichsen, L. F. (Intern), Probst, C. W. (Intern), Karlsson, S. (Intern)
Number of pages: 134
Publication date: 2016

Publication information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Original language: English
Series: DTU Compute PHD-2015
Number: 390
ISSN: 0909-3192
Main Research Area: Technical/natural sciences
Electronic versions:
phd390_Bonnichsen_L_net.pdf

Relations
Projects:
An Adaptive Middleware for Improved Computational Performance
Publication: Research › Ph.D. thesis – Annual report year: 2016
Analysis of Ant Colony Optimization and Population-Based Evolutionary Algorithms on Dynamic Problems

This thesis presents new running time analyses of nature-inspired algorithms on various dynamic problems. It aims to identify and analyse the features of algorithms and problem classes which allow efficient optimization to occur in the presence of dynamic behaviour. We consider the following settings:

\(\lambda\)-MMAS on Dynamic Shortest Path Problems. We investigate how increasing the number of ants simulated per iteration may help an ACO algorithm to track optimum in a dynamic problem. It is shown that while a constant number of ants per-vertex is sufficient to track some oscillations, there also exist more complex oscillations that cannot be tracked with a polynomial-size colony.

MMAS and \((\mu+1)\) EA on Maze We analyse the behaviour of a \((\mu + 1)\) EA with genotype diversity on a dynamic fitness function Maze, extended to a finite-alphabet search space. We prove that the \((\mu + 1)\) EA is able to track the dynamic optimum for finite alphabets up to size \(\mu\), while MMAS is able to do so for any finite alphabet size.

Parallel Evolutionary Algorithms on Maze. We prove that while a \((1 + \lambda)\) EA is unable to track the optimum of the dynamic fitness function Maze for offspring population size up to \(\lambda = O(n1-\varepsilon)\), a simple island model with \(\Omega(\log n)\) islands is able to do so if the migration interval is chosen appropriately.

Migration Topology in Island Models. We investigate the impact of the migration topology on the performance of an island model optimizing a Maze-like dynamic function, demonstrating that in some cases, a less-dense migration topology is preferable to a complete migration topology.

\((1+1)\) EA on Generalized Dynamic OneMax. We analyze the \((1 + 1)\) EA on dynamically changing OneMax, re-proving known results on first hitting times using modern drift analysis, and providing a new anytime analysis showing how closely the EA can track the dynamically moving optimum over time. These results are also extended to a finite-alphabet search space.

General information
State: Published
Organizations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Authors: Lissovoi, A. (Intern), Witt, C. (Intern)
Number of pages: 130
Publication date: 2016

Publication information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark, Transport
Original language: English
Series: DTU Compute PHD-2016
Number: 404
ISSN: 0909-3192
Main Research Area: Technical/natural sciences
Electronic versions:
phd404_Lissovoi_A.pdf
Publication: Research › Ph.D. thesis – Annual report year: 2016

Analysis of farm specific risk factors for Campylobacter colonization of broilers in six European countries

This study presents on-farm risk factors for the colonization of broiler flocks with Campylobacter based on comparable data from six European countries: Denmark, the Netherlands, Norway, Poland, Spain, and the UK. The study includes explanatory variables from a large questionnaire concerning production, farm management procedures and farm conditions, climate data on mean temperature, sunshine hours, and precipitation, as well as data on Campylobacter status of broiler flocks. All together the study comprises data from more than 6000 flocks. The data were analysed using a generalized linear model. Due to a large number of parameters, some collinearity and relatively many missing values, the model was analysed by a method using all available cases at each step in the modelling process. The modelling process includes backwards elimination and forward selection. Several approaches were furthermore explored by applying different strategies for categorizing explanatory variables and for selecting and eliminating variables in the model.

Despite national differences in broiler production, common risk factors for Campylobacter colonization of broiler flocks were identified across all six countries. These were generally related to inadequate biosecurity. Identified risk factors were: broiler houses older than 15 years, absence of anterooms and barriers in each house, shared tools between houses, long downtime, and drinker systems with bells or cups. Also, the risk of broiler flocks becoming colonized with Campylobacter was clearly affected by country. In descending order, broiler flocks were more likely to be colonized in Poland, the UK, Spain, the Netherlands, Denmark and Norway due to country specific factors that could not be explained by the identified risk factors or any other variables from the questionnaire. The seasonality observed for prevalence values was described
by the monthly mean temperature reported in the study, i.e. the higher the temperature, the higher the prevalence of positive flocks.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, National Food Institute, Division of Risk Assessment and Nutrition, University of Liverpool, Universitat Autonoma de Barcelona, National Veterinary Research Institute, Norwegian Veterinary Institute, Utrecht University
Authors: Sommer, H. M. (Intern), Borck Høg, B. (Intern), Larsen, L. S. (Intern), Sørensen, A. I. V. (Intern), Williams, N. (Ekstern), Merga, J. Y. (Ekstern), Cerdà-Cuéllar, M. (Ekstern), Urdaneta, S. (Ekstern), Dolz, R. (Ekstern), Wieczorek, K. (Ekstern), Osek, J. (Ekstern), David, B. (Ekstern), Hofshagen, M. (Ekstern), Jonsson, M. (Ekstern), Wagenaar, J. A. (Ekstern), Bolder, N. (Ekstern), Rosenquist, H. (Intern)
Pages: 16-26
Publication date: 2016
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Microbial Risk Analysis
Volume: 2-3
ISSN (Print): 2352-3522
Ratings:
Scopus rating (2017): CiteScore 1.17
Original language: English
Campylobacter, Risk factors, Multinational, Broilers, Generalized linear model, Climate
DOI: 10.1016/j.mran.2016.06.002
Source: FindIt
Source-ID: 2305490929
Publication: Research - peer-review › Journal article – Annual report year: 2016

**Analysis of Security Protocols in Embedded Systems**

Embedded real-time systems have been adopted in a wide range of safety-critical applications—including automotive, avionics, and train control systems—where the focus has long been on safety (i.e., protecting the external world from the potential damage caused by the system) rather than security (i.e., protecting the system from the external world). With increased connectivity of these systems to external networks the attack surface has grown, and consequently there is a need for securing the system from external attacks. Introducing security protocols in safety critical systems requires careful considerations on the available resources, especially in meeting real-time and resource constraints, as well as cost and reliability requirements. For this reason many proposed security protocols in this domain have peculiar features, not present in traditional security literature.

In this thesis we tackle the problem of analysing security protocols in safety critical embedded systems from multiple perspectives, extending current state-of-the-art analysis techniques where the combination of safety and security hinders our efforts. Examples of protocols in automotive control systems will follow throughout the thesis. We initially take a combined perspective of the safety and security features, by giving a security analysis and a schedulability analysis of the embedded protocols, with intertwined considerations. Then we approach the problem of the expressiveness of the tools used in the analysis, extending saturation-based techniques for formal protocol verification in the symbolic model. Such techniques gain much of their efficiency by coalescing all reachable states into a single set of facts. However, distinguishing different states is a requirement for modelling the protocols that we consider. Our effort in this direction is to extend saturation-based techniques so that enough state information can be modelled and analysed. Finally, we present a methodology for proving the same security properties in the computational model, by means of typing protocol implementations.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Language-Based Technology
Authors: Bruni, A. (Intern), Nielson, F. (Intern), Nielson, H. R. (Intern)
Number of pages: 155
Publication date: 2016

**Publication information**
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Original language: English
Series: DTU Compute PHD-2016
An analytic mapping property of the Dirichlet-to-Neumann operator in Helmholtz boundary problems

The analytic version of microlocal analysis shows that if the boundary and the Dirichlet datum of a Helmholtz boundary value problem are real-analytic, then so is the corresponding Neumann datum. However, the domain of analytic continuation of the Neumann datum is, in general, unknown. We shall here relate, in terms of explicit estimates, the domains of analytic continuation of Dirichlet and Neumann boundary data for Helmholtz problems in two or more independent variables, and in neighbourhoods of planar pieces of the boundary. For this purpose, we shall characterise a special subspace of the standard pseudodifferential operators with real-analytic symbols, to which the Dirichlet-to-Neumann operator belongs. The result can be applied in the estimation of the domain of analytic continuation of solutions across planar pieces of the boundary.

An approach for activity-based DEVS model specification

Creation of DEVS models has been advanced through Model Driven Architecture and its frameworks. The overarching role of the frameworks has been to help develop model specifications in a disciplined fashion. Frameworks can provide intermediary layers between the higher level mathematical models and their corresponding software specifications from both structural and behavioral aspects. Unlike structural modeling, developing models to specify behavior of systems is known to be harder and more complex, particularly when operations with non-trivial control schemes are required. In this paper, we propose specifying activity-based behavior modeling of parallel DEVS atomic models. We consider UML activities and actions as fundamental units of behavior modeling, especially in the presence of recent advances in the UML 2.5 specifications. We describe in detail how to approach activity modeling with a set of elemental behavioral constructs for atomic DEVS model. We show how Activity models correspond to the atomic DEVS model using an exemplar. We also highlight the complementary roles of Activity and Statecharts models.
An Area-Efficient TDM NoC Supporting Reconfiguration for Mode Changes

This paper presents an area-efficient time-division-multiplexing (TDM) network-on-chip (NoC) intended for use in a multicore platform for hard real-time systems. In such a platform, a mode change at the application level requires the tear-down and set-up of some virtual circuits without affecting the virtual circuits that persist across the mode change. Our NoC supports such reconfiguration in a very efficient way, using the same resources that are used for transmission of regular data. We evaluate the presented NoC in terms of worst-case reconfiguration time, hardware cost, and maximum operating frequency. The results show that the hardware cost for an FPGA implementation of our architecture is a factor of 2.2 to 3.9 times smaller than other NoCs with reconfiguration functionalities, and that the worst-case time for a reconfiguration is shorter or comparable to those NoCs.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering
Authors: Sørensen, R. B. (Intern), Pezzarossa, L. (Intern), Sparsø, J. (Intern)
Number of pages: 4
Publication date: 2016

An Efficient Implementation of Partial Condensing for Nonlinear Model Predictive Control

Partial (or block) condensing is a recently proposed technique to reformulate a Model Predictive Control (MPC) problem into a form more suitable for structure-exploiting Quadratic Programming (QP) solvers. It trades off horizon length for input vector size, and this degree of freedom can be employed to find the best problem size for the QP solver at hand. This paper proposes a Hessian condensing algorithm particularly well suited for partial condensing, where a state component is retained as an optimization variable at each stage of the partially condensed MPC problem. The optimal input-horizon trade-off is investigated from a theoretical point of view (based on algorithms flop count) as well as by benchmarking (in practice, the performance of linear algebra routines for different matrix sizes plays a key role). Partial condensing can also be seen as a technique to replace many operations on small matrices with fewer operations on larger matrices, where linear algebra routines perform better. Therefore, in case of small-scale MPC problems, partial condensing can greatly improve performance beyond the flop count reduction.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, University of Freiburg
Authors: Frison, G. (Intern), Kouzoupis, D. (Ekstern), Jørgensen, J. B. (Intern), Diehl, M. (Ekstern)
Pages: 4457-4462
Publication date: 2016
An Efficient UD-Based Algorithm for the Computation of Maximum Likelihood Sensitivity of Continuous-Discrete Systems

This paper addresses maximum likelihood parameter estimation of continuous-time nonlinear systems with discrete-time measurements. We derive an efficient algorithm for the computation of the log-likelihood function and its gradient, which can be used in gradient-based optimization algorithms. This algorithm uses UD decomposition of symmetric matrices and the array algorithm for covariance update and gradient computation. We test our algorithm on the Lotka-Volterra equations. Compared to the maximum likelihood estimation based on finite difference gradient computation, we get a significant speedup without compromising the numerical accuracy.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Dynamical Systems
Authors: Boiroux, D. (Intern), Juhl, R. (Intern), Madsen, H. (Intern), Jørgensen, J. B. (Intern)
Pages: 3048-3053
Publication date: 2016

An Ensemble Nonlinear Model Predictive Control Algorithm in an Artificial Pancreas for People with Type 1 Diabetes

This paper presents a novel ensemble nonlinear model predictive control (NMPC) algorithm for glucose regulation in type 1 diabetes. In this approach, we consider a number of scenarios describing different uncertainties, for instance meals or metabolic variations. We simulate a population of 9 patients with different physiological parameters and a time-varying insulin sensitivity using the Medtronic Virtual Patient (MVP) model. We augment the MVP model with stochastic diffusion terms, time-varying insulin sensitivity and noise-corrupted CGM measurements. We consider meal challenges where the uncertainty in meal size is ±50%. Numerical results show that the ensemble NMPC reduces the risk of hypoglycemia compared to standard NMPC in the case where the meal size is overestimated or correctly estimated at the expense of a slightly increased number of hyperglycemia. Therefore, ensemble MPC-based algorithms can improve the safety of the AP compared to the classical MPC-based algorithms.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Dynamical Systems
Pages: 2115-2120
Publication date: 2016

Anisotropic anti-resonant elements gives broadband single-mode low-loss hollow-core fibers

Hollow-core fibers with node-free anisotropic anti-resonant elements give broadband low-loss fibers that are also single-moded. At 1.06 μm silica-based fiber designs show higher-order-mode extinction-ratio >1000 and losses below 10 dB/km over a broad wavelength range.
Annealing effects on strain and stress sensitivity of polymer optical fibre based sensors

The annealing effects on strain and stress sensitivity of polymer optical fibre Bragg grating sensors after their photoinscription are investigated. PMMA optical fibre based Bragg grating sensors are first photo-inscribed and then they were placed into hot water for annealing. Strain, stress and force sensitivity measurements are taken before and after annealing. Parameters such as annealing time and annealing temperature are investigated. The change of the fibre diameter due to water absorption and the annealing process is also considered. The results show that annealing the polymer optical fibre tends to increase the strain, stress and force sensitivity of the photo-inscribed sensor.

General information
State: Published
Organisations: Fibers & Nonlinear Optics, Department of Photonics Engineering, Fiber Sensors and Supercontinuum Generation, Department of Informatics and Mathematical Modeling, Aston University, Universidad Politecnica de Valencia
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Number of pages: 7
Publication date: 2016

Host publication information
Title of host publication: Proceedings of the Spie
Publisher: SPIE - International Society for Optical Engineering
Article number: 98860V
ISBN (Print): 9781510601314
Series: Proceedings of S P I E - International Society for Optical Engineering
Volume: 9886
ISSN: 0277-786X
Main Research Area: Technical/natural sciences
Conference: Micro-Structured and Specialty Optical Fibres IV, Brussels, Belgium, 03/04/2016 - 03/04/2016
Fibre optic sensors; fibre gyros, Other fibre optical devices and techniques, Other heat and thermomechanical treatments, Optical polymers and other organic optical materials, Gratings, echelles, Optical fibre fabrication, cladding, splicing, joining , Optical fibre testing and measurement of fibre parameters, Fibre optic sensors, Optical materials, annealing, Bragg gratings, fibre optic sensors, optical fibre fabrication, optical fibre testing, optical polymers, strain sensitivity, stress sensitivity, polymer optical fibre Bragg grating sensors, PMMA optical fibre based Bragg grating sensors, hot water, strain measurement, stress measurement, force sensitivity measurement, annealing time, annealing temperature, fibre diameter , water absorption, photoinscribed sensor
Announcements to Attentive Agents

In public announcement logic it is assumed that all agents pay attention to the announcement. Weaker observational conditions can be modelled in action model logic. In this work, we propose a version of public announcement logic wherein it is encoded in the states of the epistemic model which agents pay attention to the announcement. This logic is called attention-based announcement logic. We give an axiomatization of the logic and prove that complexity of satisfiability is the same as that of public announcement logic, and therefore lower than that of action model logic. An attention-based announcement can also be described as an action model. We extend our logic by integrating attention change. Finally, we add the notion of common belief to the language, we exploit this to formalize the concept of joint attention, that has been widely discussed in the philosophical and cognitive science literature, and we provide a corresponding axiomatization. This axiomatization also employs the auxiliary notion of attention-based relativized common belief.
An omnibus likelihood test statistic and its factorization for change detection in time series of polarimetric SAR data

Based on an omnibus likelihood ratio test statistic for the equality of several variance-covariance matrices following the complex Wishart distribution with an associated p-value and a factorization of this test statistic, change analysis in a short sequence of multilook, polarimetric SAR data in the covariance matrix representation is carried out. The omnibus test statistic and its factorization detect if and when change(s) occur. The technique is demonstrated on airborne EMISAR L-band data but may be applied to Sentinel-1, Cosmo-SkyMed, TerraSAR-X, ALOS and RadarSat-2 or other dual- and quad/full-pol, and even single-pol data also.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, National Space Institute, Microwaves and Remote Sensing
Authors: Nielsen, A. A. (Intern), Conradsen, K. (Intern), Skriver, H. (Intern)
Pages: 316-319
Publication date: 2016

Host publication information
Title of host publication: Proceedings of the 2016 Conference on Big Data From Space (BiDS '16)
Publisher: Publications Office of the European Union
Main Research Area: Technical/natural sciences
Conference: Conference on Big Data from Space (BiDS'16), Santa Cruz de Tenerife, Spain, 15/03/2016 - 15/03/2016
Electronic versions: BiDS2016imm6927.pdf
LBNA27775ENN.pdf
DOIs:
10.2788/854791
Source: PublicationPreSubmission
Source-ID: 127710219
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

An open-source thermodynamic software library
This is a technical report which accompanies the article "An open-source thermodynamic software library" which describes an efficient Matlab and C implementation for evaluation of thermodynamic properties. In this technical report we present the model equations, that are also presented in the paper, together with a full set of first and second order derivatives with respect to temperature and pressure, and in cases where applicable, also with respect to mole numbers. The library is based on parameters and correlations from the DIPPR database and the Peng-Robinson and the Soave-Redlich-Kwong
An optimized outlier detection algorithm for jury-based grading of engineering design projects

This work characterizes and optimizes an outlier detection algorithm to identify potentially invalid scores produced by jury members while grading engineering design projects. The paper describes the original algorithm and the associated adjudication process in detail. The impact of the various conditions in the algorithm on the false positive and false negative rates is explored. A response surface design is performed to optimize the algorithm using a data set from Fall 2010. Finally, the results are tested against a data set from Fall 2011. It is shown that all elements of the original algorithm (the base rule and the three additional conditions) play a role in the algorithm's performance and should be included in the algorithm. Because there is significant interaction between the base rule and the additional conditions, many acceptable combinations that balance the FPR and FNR can be found, but no true optimum seems to exist. The performance of the best optimizations and the original algorithm are similar. Therefore, it should be possible to choose new coefficient values for jury populations in other cultures and contexts logically and empirically without a full optimization as long as the algorithm assumptions are valid and the limitations for its use are well understood.
An Organic Mixed Ion-Electron Conductor for Power Electronics

A mixed ionic–electronic conductor based on nanofibrillated cellulose composited with poly(3,4-ethylenedioxythiophene):poly(styrene-sulfonate) along with high boiling point solvents is demonstrated in bulky electrochemical devices. The high electronic and ionic conductivities of the resulting nanopaper are exploited in devices which exhibit record values for the charge storage capacitance (1F) in supercapacitors and transconductance (1S) in electrochemical transistors.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Department of Energy Conversion and Storage, Imaging and Structural Analysis, Linköping University, Innventia AB, University of Kentucky, KTH - Royal Institute of Technology
Number of pages: 9
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Advanced Science
Volume: 3
Issue number: 2
A Note on Powers in Finite Fields

The study of solutions to polynomial equations over finite fields has a long history in mathematics and is an interesting area of contemporary research. In recent years the subject has found important applications in the modelling of problems from applied mathematical fields such as signal analysis, system theory, coding theory and cryptology. In this connection it is of interest to know criteria for the existence of squares and other powers in arbitrary finite fields. Making good use of polynomial division in polynomial rings over finite fields, we have examined a classical criterion of Euler for squares in odd prime fields, giving it a formulation which is apt for generalization to arbitrary finite fields and powers. Our proof uses algebra rather than classical number theory, which makes it convenient when presenting basic methods of applied algebra in the classroom.
Antiresonant hollow core fiber with seven nested capillaries

We report an antiresonant hollow core fiber formed of 7 non-touching capillaries with inner tubes. The fiber has a core diameter of ∼33μm and a core wall of ∼780nm of thickness. We demonstrate robust single mode operation at 1064nm and broad transmission bandwidth.

General information

State: Published
Organisations: Department of Photonics Engineering, Ultrafast Infrared and Terahertz Science, Department of Informatics and Mathematical Modeling, Fiber Sensors and Supercontinuum Generation, Department of Applied Mathematics and Computer Science, Risø National Laboratory for Sustainable Energy, University of Central Florida
Pages: 402-3
Publication date: 2016

Host publication information

Title of host publication: Proceedings of 2016 IEEE Photonics Conference
Publisher: IEEE
ISBN (Print): 978-1-5090-1906-9
Series: 2016 IEEE Photonics Conference (ipc)
Main Research Area: Technical/natural sciences
Conference: 2016 IEEE Photonics Conference, Waikoloa Beach, HI, United States, 02/10/2016 - 02/10/2016
Optical fiber communication, Optimized production technology, Loss measurement, Electron tubes, Propagation losses, Optical fiber losses, Optical fibre fabrication, cladding, splicing, joining, Optical propagation, dispersion and attenuation in fibres, Optical communication devices, equipment and systems, Fibre optics, Optical communication, optical fibre cladding, optical fibre communication, optical fibre losses, antiresonant hollow core fiber, nested capillaries, robust single mode operation, broad transmission bandwidth, fiber fabrication, propagation loss
Electronic versions:
2016_IEEE_Photonics.pdf
DOIs:
10.1109/IPCon.2016.7831157
Source: FindIt
Source-ID: 2351617100
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, Department of Applied Mathematics and Computer Science, Dynamical Systems
Authors: Ordoudis, C. (Intern), Pinson, P. (Intern), Morales González, J. M. (Intern), Zugno, M. (Intern)
Number of pages: 5
Publication date: 2016

Publication information
Publisher: Technical University of Denmark (DTU)
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
An_Updated_Version_of_the_IEEE_RTS_24Bus_System_for_Electricity_Market_an....pdf
SingleAreaRTS96
Publication: Research - peer-review › Report – Annual report year: 2016

A Parametric Abstract Domain for Lattice-Valued Regular Expressions
We present a lattice-valued generalization of regular expressions as an abstract domain for static analysis. The parametric abstract domain rests on a generalization of Brzozowski derivatives and works for both finite and infinite lattices. We develop both a co-inductive, simulation algorithm for deciding ordering between two domain elements and a widening operator for the domain. Finally we illustrate the domain with a static analysis that analyses a communicating process against a lattice-valued regular expression expressing the environment’s network communication.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Formal Methods
Authors: Midtgaard, J. (Intern), Nielson, F. (Intern), Nielson, H. R. (Intern)
Pages: 338-360
Publication date: 2016

Host publication information
Title of host publication: Proceedings of the 23rd International Symposium on Static Analysis (SAS 2016)
Publisher: Springer
Editor: Rival, X.
ISBN (Print): 978-3-662-53412-0
ISBN (Electronic): 978-3-662-53413-7
Series: Lecture Notes in Computer Science
Volume: 9837
ISSN: 0302-9743
BFI conference series: Static Analysis Symposium (5000234)
Main Research Area: Technical/natural sciences
Electronic versions:
paper_33.pdf. Embargo ended: 01/09/2017
Source: PublicationPreSubmission
Source-ID: 126132373
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

A patch-based pseudo-CT approach for MRI-only radiotherapy in the pelvis
In radiotherapy based only on magnetic resonance imaging (MRI), knowledge about tissue electron densities must be derived from the MRI. This can be achieved by converting the MRI scan to the so-called pseudo-computed tomography (pCT). An obstacle is that the voxel intensities in conventional MRI scans are not uniquely related to electron density. The authors previously demonstrated that a patch-based method could produce accurate pCTs of the brain using conventional T1-weighted MRI scans. The method was driven mainly by local patch similarities and relied on simple affine registrations between an atlas database of the co-registered MRI/CT scan pairs and the MRI scan to be converted. In this study, the authors investigate the applicability of the patch-based approach in the pelvis. This region is challenging for a method based on local similarities due to the greater inter-patient variation. The authors benchmark the method against a baseline pCT strategy where all voxels inside the body contour are assigned a water-equivalent bulk density. Furthermore, the authors implement a parallelized approximate patch search strategy to speed up the pCT generation time to a more
clinically relevant level. The data consisted of CT and $T_1$-weighted MRI scans of 10 prostate patients. pCTs were generated using an approximate patch search algorithm in a leave-one-out fashion and compared with the CT using frequently described metrics such as the voxel-wise mean absolute error ($\text{MAE}_{\text{vox}}$) and the deviation in water-equivalent path lengths. Furthermore, the dosimetric accuracy was tested for a volumetric modulated arc therapy plan using dose–volume histogram (DVH) point deviations and γ-index analysis. The patch-based approach had an average $\text{MAE}_{\text{vox}}$ of 54 HU; median deviations of less than 0.4% in relevant DVH points and a γ-index pass rate of 0.97 using a 1%/1 mm criterion. The patch-based approach showed a significantly better performance than the baseline water pCT in almost all metrics. The approximate patch search strategy was 70x faster than a brute-force search, with an average prediction time of 20.8 min. The authors showed that a patch-based method based on affine registrations and $T_1$-weighted MRI could generate accurate pCTs of the pelvis. The main source of differences between pCT and CT was positional changes of air pockets and body outline.

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, University of Copenhagen
Authors: Andreasen, D. (Intern), Van Leemput, K. (Intern), Edmund, J. M. (Ekstern)
Number of pages: 11
Pages: 4742-4752
Publication date: 2016
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Medical Physics
Volume: 43
Issue number: 8
ISSN (Print): 0094-2405
Ratings:
  - BFI (2018): BFI-level 1
  - Web of Science (2018): Indexed yes
  - BFI (2017): BFI-level 1
  - Scopus rating (2017): SNIP 1.348 SJR 1.289 CiteScore 2.58
  - Web of Science (2017): Indexed Yes
  - BFI (2016): BFI-level 1
  - Scopus rating (2016): CiteScore 2.46 SJR 0.74 SNIP 1.309
  - Web of Science (2016): Indexed yes
  - BFI (2015): BFI-level 1
  - Scopus rating (2015): SJR 0.622 SNIP 1.542 CiteScore 2.63
  - Web of Science (2015): Indexed yes
  - BFI (2014): BFI-level 1
  - Scopus rating (2014): SJR 0.598 SNIP 1.598 CiteScore 2.79
  - Web of Science (2014): Indexed yes
  - BFI (2013): BFI-level 1
  - Scopus rating (2013): SJR 0.643 SNIP 1.763 CiteScore 3.17
  - ISI indexed (2013): ISI indexed yes
  - Web of Science (2013): Indexed yes
  - BFI (2012): BFI-level 1
  - Scopus rating (2012): SJR 0.546 SNIP 1.807 CiteScore 3.08
  - ISI indexed (2012): ISI indexed yes
  - Web of Science (2012): Indexed yes
  - BFI (2011): BFI-level 1
  - Scopus rating (2011): SJR 0.612 SNIP 1.605 CiteScore 3.03
  - ISI indexed (2011): ISI indexed yes
  - Web of Science (2011): Indexed yes
  - BFI (2010): BFI-level 1
  - Scopus rating (2010): SJR 0.623 SNIP 1.709
  - Web of Science (2010): Indexed yes
  - BFI (2009): BFI-level 1
  - Scopus rating (2009): SJR 0.621 SNIP 2.005
A Pin-Count Reduction Algorithm for Flow-Based Microfluidic Biochips

Microfluidic biochips are replacing the conventional biochemical analyzers integrating the necessary functions on-chip. We are interested in flow-based biochips, where a continuous flow of liquid is manipulated using integrated microvalves, controlled from external pressure sources via off-chip control pins. Recent research has addressed the physical design of such biochips. However, such research has so far ignored the pin-count, which rises with the increase in the number of microvalves. Given a biochip architecture and a biochemical application, we propose an algorithm for reducing the number of control pins required to run the application. The proposed algorithm has been evaluated using several benchmarks.

Application of Economic MPC to Frequency Control in a Single-Area

This paper presents a novel model predictive control scheme for frequency control in a single-area power system. The proposed controller provides set-point corrections to the system power generators, based on the solution to an optimal control problem. The optimal control problem directly incorporates the cost of operation into its objective function. A trade-off parameter is used to balance set-point tracking and cost minimization. Simulations based on a Faroe Islands case study show that the proposed approach reduces cost of operation by almost an order of magnitude, compared to both set-point based model predictive control as well as conventional frequency-based PI-control.
Application of the Continuous-Discrete Extended Kalman Filter for Fault Detection in Continuous Glucose Monitors for Type 1 Diabetes

The purpose of this study is the online detection of faults and anomalies of a continuous glucose monitor (CGM). We simulated a type 1 diabetes patient using the Medtronic virtual patient model. The model is a system of stochastic differential equations and includes insulin pharmacokinetics, insulin-glucose interaction, and carbohydrate absorption. We simulated and detected two types of CGM faults, i.e., spike and drift. A fault was defined as a CGM value in any of the zones C, D, and E of the Clarke error grid analysis classification. Spike was modelled by a binomial distribution, and drift was modelled by a Gaussian random walk. We used a continuous-discrete extended Kalman filter for the fault detection, based on the statistical tests of the filter innovation and the 90-min prediction residuals of the sensor measurements. The spike detection had a sensitivity of 93% and a specificity of 100%. Also, the drift detection had a sensitivity of 80% and a specificity of 85%. Furthermore, with 100% sensitivity the proposed method was able to detect if the drift overestimates or underestimates the interstitial glucose concentration.

Approaches for Accommodating Demand Response in Operational Problems and Assessing its Value

This thesis deals with the development of operational models of demand response and the evaluation of this novel resource within existing frameworks for power system dispatch and market clearing.

Increasing shares of power generation from variable renewable sources, and climate change policies that discourage the use of fossil fuel intensive power plants, are among the factors that are currently driving the evolution of power systems towards greater flexibility. Activating the latent flexibility of electricity consumption through demand response can contribute towards facilitating this evolution. However, before the necessary investments can be made to establish and operate this novel resource, its value must be determined.
As with all current power system resources, if distributed demand response is deployed on a large scale it will be required to interface with the power system and market operators through established frameworks. Such frameworks are not suited to interaction with large numbers of individual flexible loads, so it is necessary to establish a representation of their aggregated flexibility that can be effectively communicated to system and market operators. In this thesis we introduce the concept of a saturation curve, which represents the flexibility offered by a broad class of flexible loads capable of providing load shifting demand response: thermal-electric loads such as refrigeration and heating. From this saturation curve we extract dispatch and market offering structures for demand response that respect the physical characteristics and constraints of the individual flexible loads within an aggregate population, while being limited in complexity to that allowable within current operational power system frameworks.

An evaluation of demand response must consider both the social welfare value it generates by reducing overall power system operation costs, and the commercial value it can accrue by participating in competitive electricity markets. Social welfare value provides an indicator of the viability of any new power system resource, but does not guarantee that the necessary investments will be made to establish and operate the resource. A positive commercial assessment will signal to investors that the resource can offer a return on their investment, and that it can thrive in a competitive environment. We consider both the social welfare and commercial value of demand response in this thesis, by simulating the deployment of our specialised operational models of demand response within power system dispatch frameworks and by developing innovative trading strategies for demand response on the day-ahead and intraday markets.

We find through the combined modelling and analysis contained in this thesis that the value offered by demand response is very low under current power system conditions, and when it is restricted to operating within existing operational frameworks. Prices and costs on the studied power systems are insufficient to allow demand response to generate significant value or revenue through energy arbitrage or load curtailment. This does not rule out that there maybe certain power systems, or sections thereof, that are currently experiencing sufficient resource scarcity to result in a favourable environment for the successful implementation of demand response. At the current time however, our research finds that the outlook for the widespread deployment of demand response is poor.
A Process Framework for Designing Software Reference Architectures for Providing Tools as a Service

Software Reference Architecture (SRA), which is a generic architecture solution for a specific type of software systems, provides foundation for the design of concrete architectures in terms of architecture design guidelines and architecture elements. The complexity and size of certain types of software systems need customized and systematic SRA design and evaluation methods. In this paper, we present a software Reference Architecture Design process Framework (RAdEF) that can be used for analysis, design and evaluation of the SRA for provisioning of Tools as a Service as part of a cloud-enabled workSPACE (TSPACE). The framework is based on the state of the art results from literature and our experiences with designing software architectures for cloud-based systems. We have applied RAdEF SRA design two types of TSPACE: software architecting TSPACE and software implementation TSPACE. The presented framework emphasizes on keeping the conceptual meta-model of the domain under investigation at the core of SRA design strategy and use it as a guiding tool for design, evaluation, implementation and evolution of the SRA. The framework also emphasizes to consider the nature of the tools to be provisioned and underlying cloud platforms to be used while designing SRA. The framework recommends adoption of the multi-faceted approach for evaluation of SRA and quantifiable measurement scheme to evaluate quality of the SRA. We foresee that RAdEF can facilitate software architects and researchers during design, application and evaluation of a SRA and its instantiations into concrete software systems.

General information
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Pages: 111-126
Publication date: 2016

Host publication information
Title of host publication: Proceedings of the 17th International Conference on Product-Focused Software Process Improvement (PROFES 2016)
Publisher: Springer
ISBN (Print): 978-3-319-49093-9
ISBN (Electronic): 978-3-319-49094-6

Series: Lecture Notes in Computer Science
Volume: 10027
ISSN: 0302-9743
Main Research Area: Technical/natural sciences
Cloud Computing, Software Reference Architecture (SRA), Tools as a Service (TaaS), Architecture Design, Architecture evaluation

Electronic versions:
ChauhanBabarProbst_AProcessFrameworkForDesigningSoftwareReferenceArchitecturesForProvidingToolsAsAService.pdf
DOIs: 10.1007/978-3-319-49094-6_8
Source: PublicationPreSubmission
Source-ID: 127557178
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

Archetypal Analysis for Modeling Multisubject fMRI Data

Functional magnetic resonance imaging (fMRI) is widely used to measure brain function during various cognitive states. However, it remains a challenge to obtain low-rank models of functional networks in fMRI that have interpretable latent features and generalize across groups of subjects, due to significant intersubject variability in the signal structure and noise. Group-level modeling is typically performed using component decompositions such as independent component analysis (ICA), which represent data as a linear combination of latent brain patterns, or using clustering models, where data are assumed to be generated by a set of ‘prototype’ time series. Archetypal analysis (AA) provides a promising alternative, combining the advantages of component-model flexibility with highly interpretable latent ‘archetypes’ (similar to cluster-model prototypes). To date, AA has not been applied to group-level fMRI; a major limitation is that it does not generalize to multi-subject datasets, which may have significant variations in blood oxygenation-level-dependent signal and heteroscedastic noise. We develop multi-subject AA (MS-AA), which accounts for group-level data by assuming that archetypal temporal profiles have a common latent generator across subjects, ensuring that the temporal components are derived from a consistent set of brain regions. In addition, the model accounts for noise heteroscedasticity by modeling subject- and voxel-specific noise variance. This provides a novel approach to group-level modeling and an alternative to preexisting methods that account for inter-subject variability by extracting individual maps as a postprocessing step (e.g., dual-regression ICA), or assuming spatial dependency of maps across subjects (e.g., independent vector analysis). MS-AA shows robust performance when modelling archetypes for a motor task experiment. The procedure extracts a ‘seed
map’ across subjects, used to provide brain parcellations with subject-specific temporal profiles. Our approach thus decomposes multisubject fMRI data into distinct interpretable component archetypes that may help to model both consistent group-level measures of fMRI data and individual variability.

**General information**

State: Published
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Pages: 1160-1171
Publication date: 2016
Main Research Area: Technical/natural sciences

**Publication information**
Journal: IEEE Journal on Selected Topics in Signal Processing
Volume: 10
Issue number: 7
ISSN (Print): 1932-4553
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 2.977 SJR 1.331 CiteScore 6.96
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): SJR 1.217 SNIP 2.64 CiteScore 6.24
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.312 SNIP 2.455 CiteScore 5
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.266 SNIP 3.157 CiteScore 4.71
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.059 SNIP 3.924 CiteScore 5.97
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.758 SNIP 3.814 CiteScore 5.18
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.837 SNIP 3.22 CiteScore 5.47
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.041 SNIP 3.052
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.929 SNIP 3.881
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.1 SNIP 2.086
Original language: English
Archetypal analysis (AA), Functional magnetic resonance imaging (fMRI), Heteroscedastic noise, Multi-subject/group analysis, Principal convex hull
DOI:
10.1109/JSTSP.2016.2595103
Source: FindIt
Source-ID: 2346010402
Publication: Research - peer-review » Journal article – Annual report year: 2016

**Architecture Synthesis for Cost-Constrained Fault-Tolerant Flow-based Biochips**

In this paper, we are interested in the synthesis of fault-tolerant architectures for flow-based microfluidic biochips, which use microvalves and channels to run biochemical applications. The growth rate of device integration in flow-based microfluidic biochips is scaling faster than Moore’s law. This increase in fabrication complexity has led to an increase in
defect rates during the manufacturing, thereby motivating the need to improve the yield, by designing these biochips such that they are fault tolerant. We propose an approach based on a Greedy Randomized Adaptive Search Procedure (GRASP) for the synthesis of fault-tolerant biochip architectures. Our approach optimizes the introduction of redundancy within a given unit cost budget, such that, the biochemical application can successfully complete its execution within its deadline, even in the presence of faults, and the yield is maximized. The proposed algorithm has been evaluated using several benchmarks and compared to the results of a Simulated Annealing metaheuristic.

Argo: A Real-Time Network-on-Chip Architecture With an Efficient GALS Implementation

In this paper, we present an area-efficient, globally asynchronous, locally synchronous network-on-chip (NoC) architecture for a hard real-time multiprocessor platform. The NoC implements message-passing communication between processor cores. It uses statically scheduled time-division multiplexing (TDM) to control the communication over a structure of routers, links, and network interfaces (NIs) to offer real-time guarantees. The area-efficient design is a result of two contributions: 1) asynchronous routers combined with TDM scheduling and 2) a novel NI microarchitecture. Together they result in a design in which data are transferred in a pipelined fashion, from the local memory of the sending core to the local memory of the receiving core, without any dynamic arbitration, buffering, and clock synchronization. The routers use two-phase bundled-data handshake latches based on the Mousetrap latch controller and are extended with a clock gating mechanism to reduce the energy consumption. The NIs integrate the direct memory access functionality and the TDM schedule, and use dual-ported local memories to avoid buffering, flow-control, and synchronization. To verify the design, we have implemented a 4 x 4 bitorus NoC in 65-nm CMOS technology and we present results on area, speed, and energy consumption for the router, NI, NoC, and postlayout.
A robust WENO scheme for nonlinear waves in a moving reference frame

For robust nonlinear wave simulation in a moving reference frame, we recast the free surface problem in Hamilton-Jacobi form and propose a Weighted Essentially Non-Oscillatory (WENO) scheme to automatically handle the upwinding of the convective term. A new automatic procedure for deriving the linear WENO weights based on a Taylor series expansion is introduced. A simplified smoothness indicator is proposed and is shown to perform well. The scheme is combined with high-order explicit Runge-Kutta time integration and a dissipative Lax-Friedrichs-type flux to solve for nonlinear wave propagation in a moving frame of reference. The WENO scheme is robust and less dissipative than the equivalent order upwind-biased finite difference scheme for all ratios of frame of reference to wave propagation speed tested. This provides the basis for solving general nonlinear wave-structure interaction problems at forward speed.

General information
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Concurrent data structures synchronized with locks do not scale well with the number of threads. As more scalable alternatives, concurrent data structures and algorithms based on widely available, however advanced, atomic operations have been proposed. These data structures allow for correct and concurrent operations without any locks. In this paper, we present a new fully lock-free open addressed hash table with a simpler design than prior published work. We split hash table insertions into two atomic phases: first inserting a value ignoring other concurrent operations, then in the second phase resolve any duplicate or conflicting values.

Our hash table has a constant and low memory usage that is less than existing lock-free hash tables at a fill level of 33% and above. The hash table exhibits good cache locality. Compared to prior art, our hash table results in 16% and 15% fewer L1 and L2 cache misses respectively, leading to 21% fewer memory stall cycles. Our experiments show that our hash table scales close to linearly with the number of threads and outperforms, in throughput, other lock-free hash tables by 19%.
A self-calibrating robot based upon a virtual machine model of parallel kinematics

A delta-type parallel kinematics system for Additive Manufacturing has been created, which through a probing system can recognise its geometrical deviations from nominal and compensate for these in the driving inverse kinematic model of the machine. Novelty is that this model is derived from a virtual machine of the kinematics system, built on principles from geometrical metrology. Relevant mathematically non-trivial deviations to the ideal machine are identified and decomposed into elemental deviations. From these deviations, a routine is added to a physical machine tool, which allows it to recognise its own geometry by probing the vertical offset from tool point to the machine table, at positions in the horizontal plane. After automatic calibration the positioning error of the machine tool was reduced from an initial error after its assembly of ±170 µm to a calibrated error of ±3 µm. Excelling by speed, the calibration was executed in less than 3 min.
A Software Managed Stack Cache for Real-Time Systems

In a real-time system, the use of a scratchpad memory can mitigate the difficulties related to analyzing data caches, whose behavior is inherently hard to predict. We propose to use a scratchpad memory for stack allocated data. While statically allocating stack frames for individual functions to scratchpad memory regions aids predictability, it is limited to non-recursive programs and static allocation has to take different calling contexts into account. Using a stack cache that dynamically spills data to and fills data from external memory avoids these problems, while its simple design allows for efficiently deriving worst-case bounds through static analysis.

In this paper we present the design and implementation of software managed caching of stack allocated data in a scratchpad memory. We demonstrate a compiler-aided implementation of a stack cache using the LLVM compiler framework and report on its efficiency. Our evaluation encompasses stack management overhead and impact on worst-case execution time analysis. The state-of-the-art worst-case execution time analysis tool aIT is able to correctly classify all stack cache accesses as accesses to the scratchpad memory.

A Spectral Geometrical Model for Compton Scatter Tomography Based on the SSS Approximation

The forward model of single scatter in the Positron Emission Tomography for a detector system possessing an excellent spectral resolution under idealized geometrical assumptions is investigated. This model has the form of integral equations describing a flux of photons emanating from the same annihilation event and undergoing a single scattering at a certain angle. The equations for single scatter calculation are derived using the Single Scatter Simulation approximation. We show that the three-dimensional slice-by-slice filtered backprojection algorithm is applicable for scatter data inversion provided some assumptions on the attenuation map are justified.
Aspects of the Tutte polynomial
This thesis studies various aspects of the Tutte polynomial, especially focusing on the Merino-Welsh conjecture.

We write $T(G;x,y)$ for the Tutte polynomial of a graph $G$ with variables $x$ and $y$. In 1999, Merino and Welsh conjectured that if $G$ is a loopless 2-connected graph, then

$$T(G;1,1) \leq \max\{T(G;2,0), T(G;0,2)\}.$$ 

The three numbers, $T(G;1,1)$, $T(G;2,0)$ and $T(G;0,2)$ are respectively the numbers of spanning trees, acyclic orientations and totally cyclic orientations of $G$.

First, I extend Negami’s splitting formula to the multivariate Tutte polynomial. Using the splitting formula, Thomassen and I found a lower bound for the number of spanning trees in a $k$-edge-connected graph. Our bound is tight for $k$ even, but for $k$ odd we give a slightly better lower bound which we believe is not tight. We prove that the minimum number of spanning trees in a 3-edge-connected graph with $n$ vertices is, not surprisingly, significantly smaller than the minimum number of spanning trees in a 4-edge-connected graph. However, we conjecture that the minimum number of spanning trees of a 5-edge-connected graph is actually obtained by a 6-edge-connected graph asymptotically.

Thomassen proved the following partial result for the Merino-Welsh conjecture. Assume the graph $G$ is loopless, bridgeless and has $n$ vertices and $m$ edges.

If $m \leq 1.066 n$ then $T(G;1,1) \leq T(G;2,0)$.
If $m \geq 4(n-1)$ then $T(G;1,1) \leq T(G;0,2)$.

I improve in this thesis Thomassen’s result as follows:

If $m \leq 1.29(n-1)$ then $T(G;1,1) \leq T(G;2,0)$.
If $m \geq 3.58(n-1)$ and $G$ is 3-edge-connected then $T(G;1,1) \leq T(G;0,2)$.

Strengthening Thomassen’s idea that acyclic orientations dominate spanning trees in sparse graphs, I conjecture that the ratio $T(G;2,0)/T(G;1,1)$ increases as $G$ gets sparser. To support this conjecture, I prove a variant of the conjecture for series-parallel graphs.

The Merino-Welsh conjecture has a stronger version claiming that the Tutte polynomial is convex on the line segment between $(2,0)$ and $(0,2)$ for loopless 2-connected graphs. Chavez-Lomeli et al. proved that this holds for coloopless paving matroids, and I provide a shorter proof of their theorem. I also prove it for minimally 2-edge-connected graphs. As a general statement for the convexity of the Tutte polynomials, I show that the Tutte polynomial of a sparse paving matroid is almost surely convex in the first quadrant. In contrast, I conjecture that the Tutte polynomial of a sparse paving matroid with fixed rank is almost never convex in the first quadrant.

The following multiplicative version of the Merino-Welsh conjecture was considered by Noble and Royle:

$$T(G;1,1)2 \leq T(G;2,0) T(G;0,2).$$

Noble and Royle proved that this multiplicative version holds for series-parallel graphs, using a computer algorithm that they designed. Using a property of the splitting formula which I found, I improve their algorithm so that it is applicable to the class of graphs with bounded treewidth (or pathwidth). As an application, I verify that the multiplicative version holds for graphs with pathwidth at most 3.
Assessing Levels of Attention Using Low Cost Eye Tracking

The emergence of mobile eye trackers embedded in next generation smartphones or VR displays will make it possible to trace not only what objects we look at but also the level of attention in a given situation. Exploring whether we can quantify the engagement of a user interacting with a laptop, we apply mobile eye tracking in an in-depth study over 2 weeks with nearly 10,000 observations to assess pupil size changes, related to attentional aspects of alertness, orientation and conflict resolution. Visually presenting conflicting cues and targets we hypothesize that it's feasible to measure the allocated effort when responding to confusing stimuli. Although such experiments are normally carried out in a lab, we have initial indications that we are able to differentiate between sustained alertness and complex decision making even with low cost eye tracking "in the wild". From a quantified self perspective of individual behavioural adaptation, the correlations between the pupil size and the task dependent reaction time and error rates may longer term provide a foundation for modifying smartphone content and interaction to the users perceived level of attention.

General information
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Pages: 409-420
Publication date: 2016

Host publication information
Title of host publication: Proceedings of the 10th International Conference on Universal Access in Human-Computer Interaction (UAHCI 2016) : Part I
Publisher: Springer
ISBN (Print): 978-3-319-40249-9
ISBN (Electronic): 978-3-319-40250-5

Series: Lecture Notes in Computer Science
Volume: 9737
ISSN: 0302-9743
Main Research Area: Technical/natural sciences
Conference: 10th International Conference on Universal Access in Human-Computer Interaction (UAHCI 2016), Toronto, Canada, 17/07/2016 - 17/07/2016
Eye tracking, Attention network
Electronic versions:
chp_10.1007_978_3_319_40250_5_39.pdf
DOIs:
10.1007/978-3-319-40250-5_39
Source: FindIt
Source-ID: 2307018292
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

Assessment of healthy diets and physical activity: A study of differences between health professionals and lay people

General information
State: Published
Organisations: National Food Institute, Division of Risk Assessment and Nutrition, Department of Applied Mathematics and Computer Science
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Number of pages: 88
Publication date: 2016
Assessment of Rotationally-Invariant Clustering Using Streamlet Tractography

We present a novel visualisation-based strategy for the assessment of a recently proposed clustering technique for raw DWI volumes which derives rotationally-invariant metrics to classify voxels. The validity of the division of all brain tissue voxels into such classes was assessed using the recently developed streamlets visualisation technique, which aims to represent brain fibres by collections of many short streamlines. Under the assumption that streamlines seeded in a cluster should stay within it, we were able to assess how well perceptual tracing could occur across the boundaries of the clusters.

Associations between health, management and antimicrobial use in Danish swine and veal calves

We present a novel visualisation-based strategy for the assessment of a recently proposed clustering technique for raw DWI volumes which derives rotationally-invariant metrics to classify voxels. The validity of the division of all brain tissue voxels into such classes was assessed using the recently developed streamlets visualisation technique, which aims to represent brain fibres by collections of many short streamlines. Under the assumption that streamlines seeded in a cluster should stay within it, we were able to assess how well perceptual tracing could occur across the boundaries of the clusters.
A stabilised nodal spectral element method for fully nonlinear water waves

We present an arbitrary-order spectral element method for general-purpose simulation of non-overturning water waves, described by fully nonlinear potential theory. The method can be viewed as a high-order extension of the classical finite element method proposed by Cai et al. (1998) [5], although the numerical implementation differs greatly. Features of the proposed spectral element method include: nodal Lagrange basis functions, a general quadrature-free approach and gradient recovery using global L2 projections. The quartic nonlinear terms present in the Zakharov form of the free surface conditions can cause severe aliasing problems and consequently numerical instability for marginally resolved or very steep waves. We show how the scheme can be stabilised through a combination of over-integration of the Galerkin projections and a mild spectral filtering on a per element basis. This effectively removes any aliasing driven instabilities while retaining the high-order accuracy of the numerical scheme. The additional computational cost of the over-integration is found insignificant compared to the cost of solving the Laplace problem. The model is applied to several benchmark cases in two dimensions. The results confirm the high order accuracy of the model (exponential convergence), and demonstrate the potential for accuracy and speedup. The results of numerical experiments are in excellent agreement with both analytical and experimental results for strongly nonlinear and irregular dispersive wave propagation. The benefit of using a high-order – possibly adapted – spatial discretisation for accurate water wave propagation over long times and distances is particularly attractive for marine hydrodynamics applications.

General information
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Pages: 1-21
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Computational Physics
Volume: 318
ISSN (Print): 0021-9991
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.85 SJR 2.047 CiteScore 3.23
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.12 SJR 2.049 SNIP 1.818
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.054 SNIP 1.929 CiteScore 2.92
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.103 SNIP 2.164 CiteScore 3.12
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.156 SNIP 2.389 CiteScore 3.3
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
A Stack Cache for Real-Time Systems

Real-time systems need time-predictable computing platforms to allow for static analysis of the worst-case execution time. Caches are important for good performance, but data caches are hard to analyze for the worst-case execution time. Stack allocated data has different properties related to locality, lifetime, and static analyzability of access addresses compared to static or heap allocated data. Therefore, caching of stack allocated data benefits from having its own cache.

In this paper we present a cache architecture optimized for stack allocated data. This cache is additional to the normal data cache. As stack allocated data has a high locality, even a small stack cache gives a high hit rate. A stack cache added to a write-through data cache considerably improves the performance, while a stack cache compared to the write-back cache has about the same average case performance.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, Technical University of Denmark
A Survey of Man in the Middle Attacks

The Man-In-The-Middle (MITM) attack is one of the most well known attacks in computer security, representing one of the biggest concerns for security professionals. MITM targets the actual data that flows between endpoints, and the confidentiality and integrity of the data itself. In this paper, we extensively review the literature on MITM to analyse and categorize the scope of MITM attacks, considering both a reference model, such as the open systems interconnection (OSI) model, as well as two specific widely used network technologies, i.e., GSM and UMTS. In particular, we classify MITM attacks based on several parameters, like location of an attacker in the network, nature of a communication channel, and impersonation techniques. Based on an impersonation techniques classification, we then provide execution steps for each MITM class. We survey existing countermeasures and discuss the comparison among them. Finally, based on our analysis, we propose a categorisation of MITM prevention mechanisms, and we identify some possible directions for future research.

General information

State: Published
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Pages: 2027-2051
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information

Journal: IEEE Communications Surveys and Tutorials
Volume: 18
Issue number: 3
ISSN (Print): 1553-877X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 11.681 SJR 3.661 CiteScore 26.26
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 23.8 SJR 3.494 SNIP 11.502
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.992 SNIP 9.768 CiteScore 16.88
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 3.403 SNIP 8.638 CiteScore 13.78
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.433 SNIP 8.508 CiteScore 11.14
A tensor-based dictionary learning approach to tomographic image reconstruction

We consider tomographic reconstruction using priors in the form of a dictionary learned from training images. The reconstruction has two stages: first we construct a tensor dictionary prior from our training data, and then we pose the reconstruction problem in terms of recovering the expansion coefficients in that dictionary. Our approach differs from past approaches in that (a) we use a third-order tensor representation for our images and (b) we recast the reconstruction problem using the tensor formulation. The dictionary learning problem is presented as a non-negative tensor factorization problem with sparsity constraints. The reconstruction problem is formulated in a convex optimization framework by looking for a solution with a sparse representation in the tensor dictionary. Numerical results show that our tensor formulation leads to very sparse representations of both the training images and the reconstructions due to the ability of representing repeated features compactly in the dictionary.
A theory of solving TAP equations for Ising models with general invariant random matrices

We consider the problem of solving TAP mean field equations by iteration for Ising models with coupling matrices that are drawn at random from general invariant ensembles. We develop an analysis of iterative algorithms using a dynamical functional approach that in the thermodynamic limit yields an effective dynamics of a single variable trajectory. Our main novel contribution is the expression for the implicit memory term of the dynamics for general invariant ensembles. By subtracting these terms, that depend on magnetizations at previous time steps, the implicit memory terms cancel making the iteration dependent on a Gaussian distributed field only. The TAP magnetizations are stable fixed points if a de Almeida–Thouless stability criterion is fulfilled. We illustrate our method explicitly for coupling matrices drawn from the random orthogonal ensemble.

General information
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Number of pages: 24
Publication date: 2016
Atomic-AES: A compact implementation of the AES encryption/decryption core

The implementation of the AES encryption core by Moradi et al. at Eurocrypt 2011 is one of the smallest in terms of gate area. The circuit takes around 2400 gates and operates on an 8 bit datapath. However this is an encryption only core and unable to cater to block cipher modes like CBC and ELMd that require access to both the AES encryption and decryption modules. In this paper we look to investigate whether the basic circuit of Moradi et al. can be tweaked to provide dual functionality of encryption and decryption (ENC/DEC) while keeping the hardware overhead as low as possible. As a result, we report an 8-bit serialized AES circuit that provides the functionality of both encryption and decryption and occupies around 2645 GE with a latency of 226 cycles. This is a substantial improvement over the next smallest AES ENC/DEC circuit (Grain of Sand) by Feldhofer et al. which takes around 3400 gates but has a latency of over 1000 cycles for both the encryption and decryption cycles.

Atomic Stretch: Optimally bounded real-time stretching and beyond

Atomic Stretch is a plugin for your preferred Adobe video editing tool, allowing real-time smooth and optimally bounded retargetting from and to any aspect ratio. The plugin allows preserving of high interest pixels through a protected region, attention redirection through color-modification, countering barrel effects through vertical stretching, and tracking of targets of interest.
Attack tree analysis for insider threats on the IoT using Isabelle

The Internet-of-Things (IoT) aims at integrating small devices around humans. The threat from human insiders in "regular" organisations is real; in a fully-connected world of the IoT, organisations face a substantially more severe security challenge due to unexpected access possibilities and information flow. In this paper, we seek to illustrate and classify insider threats in relation to the IoT (by ‘smart insiders’), exhibiting attack vectors for their characterisation. To model the attacks we apply a method of formal modelling of Insider Threats in the interactive theorem prover Isabelle. On the classified IoT attack examples, we show how this logical approach can be used to make the models more precise and to analyse the previously identified Insider IoT attacks using Isabelle attack trees.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Formal Methods, Middlesex University, University of Oxford
Authors: Kammüller, F. (Ekstern), Nurse, J. R. C. (Ekstern), Probst, C. W. (Intern)
Number of pages: 13
Pages: 234-246
Publication date: 2016

Host publication information
Volume: 9750
Publisher: Springer
Editor: Tryfonas, T.
ISBN (Print): 978-3-319-39380-3
ISBN (Electronic): 978-3-319-39381-0

Series: Lecture Notes in Computer Science
ISSN: 0302-9743
BFI conference series: Human-Computer Interaction International Conference (5000411)
Main Research Area: Technical/natural sciences
DOIs: 10.1007/978-3-319-39381-0_21
Source: FindIt
Source-ID: 2307015849
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

A two-stage model of rough-interface scattering for embedded nano-structures

We decompose scattering by nanostructures on rough substrates into two surface transfer functions: one heuristic, computed for the bare substrate from experimental BRDF data, and the other sparse and constructed for nanostructures on smooth surfaces. We explore numerically the performance and the commutativity of this approach.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Scientific Computing, Neutrons and X-rays for Materials Physics, Danish Fundamental Metrology
Authors: Karamehmedovic, M. (Intern), Hansen, P. E. (Ekstern)
Number of pages: 2
Publication date: 2016

Host publication information
Title of host publication: Proceedings of European Optical Society Annual Meeting (EOSAM 2016)
Autoencoding beyond pixels using a learned similarity metric

We present an autoencoder that leverages learned representations to better measure similarities in data space. By combining a variational autoencoder (VAE) with a generative adversarial network (GAN) we can use learned feature representations in the GAN discriminator as basis for the VAE reconstruction objective. Thereby, we replace element-wise errors with feature-wise errors to better capture the data distribution while offering invariance towards e.g. translation. We apply our method to images of faces and show that it outperforms VAEs with element-wise similarity measures in terms of visual fidelity. Moreover, we show that the method learns an embedding in which high-level abstract visual features (e.g. wearing glasses) can be modified using simple arithmetic.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Cognitive Systems, Twitter, Cambridge, MA, usa, University of Copenhagen
Authors: Larsen, A. B. L. (Intern), Sønderby, S. K. (Ekstern), Larochelle, H. (Ekstern), Winther, O. (Intern)
Number of pages: 9
Publication date: 2016

Automatic Functionality Assignment to AUTOSAR Multicore Distributed Architectures

The automotive electronic architectures have moved from federated architectures, where one function is implemented in one ECU (Electronic Control Unit), to distributed architectures, where several functions may share resources on an ECU. In addition, multicore ECUs are being adopted because of better performance, cost, size, fault-tolerance and power consumption. In this paper we present an approach for the automatic software functionality assignment to multicore distributed architectures. We consider that the systems use the AUTomotive Open System ARchitecture (AUTOSAR). The functionality is modeled as a set of software components composed of subtasks, called runnables, in AUTOSAR terminology. We have proposed a Simulated Annealing metaheuristic optimization that decides: the (i) mapping of software components to multicore ECUs, (ii) the assignment of runnables to the ECU cores, (iii) the clustering of runnables into tasks and (iv) the mapping of tasks to “OS-Applications” (used to isolate mixed safety-criticality functions). We are interested to determine an implementation such that (1) the mapping constraints are satisfied, (2) the runnables are schedulable and (3) they are spatially and temporally isolated if they have different safety-criticality levels, (4) the overall communication bandwidth is minimized and (5) the utilization of the cores and ECUs is balanced. The proposed approach was evaluated on three realistic case studies.

General information
State: Published
Organisations: Department of Chemical and Biochemical Engineering, Copenhagen Center for Health Technology, Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, Volvo Group Trucks Technology
Authors: Maticu, F. (Intern), Pop, P. (Intern), Axbrink, C. (Ekstern), Islam, M. (Ekstern)
Automatic measurement of orbital volume in unilateral coronal synostosis

Premature fusion of the coronal suture on one side of the calvaria (unilateral coronal synostosis, UCS) results in asymmetric craniofacial development and the deformation of the orbits. Often this necessitates surgery, where CT scanning is employed to obtain measures of the bony orbit. These measures are typically computed by guided procedures that require expert time. We propose a method with higher degree of automation based on finding an optimal smooth closed surface. CT scans of 17 infants with UCS are included in our experimental validation, where we compare our method to expert guided segmentations. We obtain similar measures, as well as high Dice scores, compared to the experts. The run time for the proposed approach with a prototype implementation is around 3 minutes on a standard laptop, making the method suitable for rapid evaluation of orbital volume in UCS.

Automatic Model Generation Framework for Computational Simulation of Cochlear Implantation

Recent developments in computational modeling of cochlear implantation are promising to study in silico the performance of the implant before surgery. However, creating a complete computational model of the patient's anatomy while including an external device geometry remains challenging. To address such a challenge, we propose an automatic framework for the generation of patient-specific meshes for finite element modeling of the implanted cochlea. First, a statistical shape model is constructed from high-resolution anatomical μCT images. Then, by fitting the statistical model to a patient's CT image, an accurate model of the patient-specific cochlea anatomy is obtained. An algorithm based on the parallel transport frame is employed to perform the virtual insertion of the cochlear implant. Our automatic framework also incorporates the surrounding bone and nerve fibers and assigns constitutive parameters to all components of the finite element model. This model can then be used to study in silico the effects of the electrical stimulation of the cochlear implant. Results are shown on a total of 25 models of patients. In all cases, a final mesh suitable for finite element simulations was obtained, in an
average time of 94 s. The framework has proven to be fast and robust, and is promising for a detailed prognosis of the cochlear implantation surgery.
Autorotation: Invited Comment
A continuous autorotation vector field along a framed space curve is defined, which describes the rotational progression of the frame. We obtain an exact integral for the length of the autorotation vector. This invokes the infinitesimal rotation vector of the frame progression and the unit vector field for the corresponding autorotation vector field. For closed curves we define an autorotation number whose integer value depends on the starting point of the curve. Upon curve deformations, the autorotation number is either constant, or can make a jump of (multiples of) plus-minus two, which corresponds to a change in rotation of multiples of 4π. The autorotation number is therefore not topologically conserved under all transformations. We discuss this within the context of generalised inflection points and of frame revisit points. The results may be applicable to physical systems such as polymers, proteins, and DNA. Finally, turbulence is discussed in the light of autorotation, as is the Philippine wine dance, the Dirac belt trick, and the 4π cycle of the flying snake.

General information
State: Published
Organisations: Department of Micro- and Nanotechnology, Theoretical Biophysics, Department of Applied Mathematics and Computer Science, Mathematics
Authors: Bohr, J. (Intern), Markvorsen, S. (Intern)
Number of pages: 9
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Physica Scripta
Volume: 91
Issue number: 2
Article number: 023005
ISSN (Print): 0281-1847
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.14
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.84
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 0.64
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 0.62
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 0.61
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 0.67
ISI indexed (2012): ISI indexed no
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 0.85
Auxiliary Deep Generative Models

Deep generative models parameterized by neural networks have recently achieved state-of-the-art performance in unsupervised and semi-supervised learning. We extend deep generative models with auxiliary variables which improves the variational approximation. The auxiliary variables leave the generative model unchanged but make the variational distribution more expressive. Inspired by the structure of the auxiliary variable we also propose a model with two stochastic layers and skip connections. Our findings suggest that more expressive and properly specified deep generative models converge faster with better results. We show state-of-the-art performance within semi-supervised learning on MNIST (9.96%), SVHN (16.61%) and NORB (9.40%) datasets.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, University of Copenhagen
Authors: Maaløe, L. (Intern), Sønderby, C. K. (Ekstern), Sønderby, S. K. (Ekstern), Winther, O. (Intern)
Number of pages: 9
Publication date: 2016

Host publication information

Title of host publication: Proceedings of the 33rd International Conference on Machine Learning
Series: JMLR: Workshop and Conference Proceedings
Volume: 48
ISSN: 1938-7228
Main Research Area: Technical/natural sciences
Conference: 33rd International Conference on Machine Learning (ICML 2016), New York, United States, 19/06/2016 - 19/06/2016
Electronic versions:
1602.05473v1.pdf
1602.05473.pdf
Links:
Source: PublicationPreSubmission
Source-ID: 121202973
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

Avionics Applications on a Time-Predictable Chip-Multiprocessor

Avionics applications need to be certified for the highest criticality standard. This certification includes schedulability analysis and worst-case execution time (WCET) analysis. WCET analysis is only possible when the software is written to be WCET analyzable and when the platform is time-predictable. In this paper we present prototype avionics applications that have been ported to the time-predictable T-CREST platform. The applications are WCET analyzable, and T-CREST is
supported by the aiT WCET analyzer. This combination allows us to provide WCET bounds of avionic tasks, even when executing on a multicore processor.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, GMV
Authors: Rocha, A. (Ekstern), Silva, C. (Ekstern), Sørensen, R. B. (Intern), Sparsø, J. (Intern), Schoeberl, M. (Intern)
Pages: 777-785
Publication date: 2016

**Host publication information**
Title of host publication: Proceedings of the 24th Euromicro International Conference on Parallel, Distributed, and Network-Based Processing (PDP 2016)
Publisher: IEEE
ISBN (Print): 978-1-4673-8775-0
Main Research Area: Technical/natural sciences
Conference: 24th Euromicro International Conference on Parallel, Distributed, and Network-Based Processing (PDP 2016), Heraklion, Crete, Greece, 17/02/2016 - 17/02/2016
DOIs: 10.1109/PDP.2016.36
Source: FindIt
Source-ID: 277386326
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

**A zero-free interval for chromatic polynomials of graphs with 3-leaf spanning trees**
It is proved that if G is a graph containing a spanning tree with at most three leaves, then the chromatic polynomial of G has no roots in the interval (1,t1], where t1≈1.2904 is the smallest real root of the polynomial (t-2)5x4(t-1)x(t-2)x(t-1)x. We also construct a family of graphs containing such spanning trees with chromatic roots converging to t1 from above. We employ the Whitney 2-switch operation to manage the analysis of an infinite class of chromatic polynomials.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Authors: Perrett, T. (Intern)
Pages: 2706-2714
Publication date: 2016
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Discrete Mathematics
Volume: 339
Issue number: 11
ISSN (Print): 0012-365X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.227 SJR 0.851 CiteScore 0.77
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.72 SJR 0.877 SNIP 1.034
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.877 SNIP 1.133 CiteScore 0.64
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.974 SNIP 1.206 CiteScore 0.68
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.931 SNIP 1.229 CiteScore 0.74
ISI indexed (2013): ISI indexed yes
Chromatic polynomial, Zero-free interval, Spanning tree, Splitting-closed

Bayesian latent feature modeling for modeling bipartite networks with overlapping groups

Bi-partite networks are commonly modelled using latent class or latent feature models. Whereas the existing latent class models admit marginalization of parameters specifying the strength of interaction between groups, existing latent feature models do not admit analytical marginalization of the parameters accounting for the interaction strength within the feature representation. We propose a new binary latent feature model that admits analytical marginalization of interaction strengths such that model inference reduces to assigning nodes to latent features. We propose a constraint inspired by the notion of community structure such that the edge density within groups is higher than between groups. Our model further assumes that entities can have different propensities of generating links in one of the modes. The proposed framework is contrasted on both synthetic and real bi-partite networks to the infinite relational model and the infinite Bernoulli mixture model. We find that the model provides a new latent feature representation of structure while in link-prediction performing close to existing models. Our current extension of the notion of communities and collapsed inference to binary latent feature representations in bipartite networks provides a new framework for accounting for structure in bipartite networks using binary latent feature representations providing interpretable representations that well characterize structure as quantified by link prediction.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, Technical University of Denmark
Authors: Jørgensen, P. H. (Ekstern), Mørup, M. (Intern), Schmidt, M. N. (Intern), Herlau, T. (Intern)
Number of pages: 6
Bayesian leave-one-out cross-validation approximations for Gaussian latent variable models

The future predictive performance of a Bayesian model can be estimated using Bayesian cross-validation. In this article, we consider Gaussian latent variable models where the integration over the latent values is approximated using the Laplace method or expectation propagation (EP). We study the properties of several Bayesian leave-one-out (LOO) cross-validation approximations that in most cases can be computed with a small additional cost after forming the posterior approximation given the full data. Our main objective is to assess the accuracy of the approximative LOO cross-validation estimators. That is, for each method (Laplace and EP) we compare the approximate fast computation with the exact brute force LOO computation. Secondarily, we evaluate the accuracy of the Laplace and EP approximations themselves against a ground truth established through extensive Markov chain Monte Carlo simulation. Our empirical results show that the approach based upon a Gaussian approximation to the LOO marginal distribution (the so-called cavity distribution) gives the most accurate and reliable results among the fast methods.
Bayesian longitudinal segmentation of hippocampal substructures in brain MRI using subject-specific atlases

The hippocampal formation is a complex, heterogeneous structure that consists of a number of distinct, interacting subregions. Atrophy of these subregions is implied in a variety of neurodegenerative diseases, most prominently in Alzheimer’s disease (AD). Thanks to the increasing resolution of MR images and computational atlases, automatic segmentation of hippocampal subregions is becoming feasible in MRI scans. Here we introduce a generative model for dedicated longitudinal segmentation that relies on subject-specific atlases. The segmentations of the scans at the different time points are jointly computed using Bayesian inference. All time points are treated the same to avoid processing bias. We evaluate this approach using over 4700 scans from two publicly available datasets (ADNI and MIRIAD). In test–retest reliability experiments, the proposed method yielded significantly lower volume differences and significantly higher Dice overlaps than the cross-sectional approach for nearly every subregion (average across subregions: 4.5% vs. 6.5%, Dice overlap: 81.8% vs. 75.4%). The longitudinal algorithm also demonstrated increased sensitivity to group differences: in MIRIAD (69 subjects: 46 with AD and 23 controls), it found differences in atrophy rates between AD and controls that the cross sectional method could not detect in a number of subregions: right parasubiculum, left and right presubiculum, right subiculum, left dentate gyrus, left CA4, left HATA and right tail. In ADNI (836 subjects: 369 with AD, 215 with early cognitive impairment — eMCI — and 252 controls), all methods found significant differences between AD and controls, but the proposed longitudinal algorithm detected differences between controls and eMCI and differences between eMCI and AD that the cross sectional method could not find: left presubiculum, right subiculum, left and right parasubiculum, left and right HATA. Moreover, many of the differences that the cross-sectional method already found were detected with higher significance. The presented algorithm will be made available as part of the open-source neuroimaging package FreeSurfer.
Behavioral activities collected through smartphones and the association with illness activity in bipolar disorder

Smartphones are useful in symptom-monitoring in bipolar disorder (BD). Objective smartphone data reflecting illness activity could facilitate early treatment and act as outcome in efficacy trials. A total of 29 patients with BD presenting with moderate to severe levels of depressive and manic symptoms used a smartphone-based self-monitoring system during 12 weeks. Objective smartphone data on behavioral activities were collected. Symptoms were clinically assessed every second week using the Hamilton Depression Rating Scale and the Young Mania Rating Scale. Objective smartphone data correlated with symptom severity. The more severe the depressive symptoms (1) the longer the smartphone’s screen was "on"/day, (2) more received incoming calls/day, (3) fewer outgoing calls/day were made, (4) less answered incoming calls/day, (5) the patients moved less between cell towers IDs/day. Conversely, the more severe the manic symptoms (1) more outgoing text messages/day sent, (2) the phone calls/day were longer, (3) the fewer number of characters in incoming text messages/day, (4) the lower duration of outgoing calls/day, (5) the patients moved more between cell towers IDs/day. Further, objective smartphone data were able to discriminate between affective states. Objective smartphone data reflect illness severity, discriminates between affective states in BD and may facilitate the cooperation between patient and clinician.

General information
State: Published
Organisations: Copenhagen Center for Health Technology, Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, Psychiatric Center Copenhagen, Rigshospitalet, IT University of Copenhagen
Authors: Faurholt-Jepsen, M. (Ekstern), Vinberg, M. (Ekstern), Frost, M. (Ekstern), Debel, S. (Ekstern), Christensen, E. M. (Ekstern), Bardram, J. E. (Intern), Kessing, L. V. (Ekstern)
Number of pages: 15
Pages: 309–323
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Volume: 25
Issue number: 4
ISSN (Print): 1557-0657
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
Scopus rating (2017): SNIP 1.53 SJR 1.297 CiteScore 2.74
Web of Science (2017): Indexed Yes
Scopus rating (2016): CiteScore 3 SJR 1.645 SNIP 1.669
Scopus rating (2015): SJR 2.373 SNIP 1.774 CiteScore 4.09
Scopus rating (2014): SJR 2.448 SNIP 1.859 CiteScore 3.91
Scopus rating (2013): SJR 1.374 SNIP 1.663 CiteScore 3.34
Scopus rating (2012): SJR 1.673 SNIP 1.231 CiteScore 2.52
Scopus rating (2011): SJR 1.638 SNIP 1.406 CiteScore 2.95
Scopus rating (2010): SJR 1.713 SNIP 1.411
Scopus rating (2009): SJR 1.567 SNIP 1.174
Scopus rating (2008): SJR 0.823 SNIP 0.646
Scopus rating (2007): SJR 3.688 SNIP 2.294
Scopus rating (2006): SJR 2.924 SNIP 2.076
Scopus rating (2005): SJR 2.404 SNIP 1.845
Scopus rating (2004): SJR 1.126 SNIP 0.962
Scopus rating (2003): SJR 0.682 SNIP 0.551
Scopus rating (2002): SJR 0.734 SNIP 0.573
Scopus rating (2001): SJR 0.402 SNIP 0.392
Scopus rating (2000): SJR 0.94 SNIP 0.668
Scopus rating (1999): SJR 0.761 SNIP 0.872
Original language: English
Bipolar disorder, Smartphone, Illness activity, Automatically generated objective data, Objective outcome measure
DOIs:
10.1002/mpr.1502
Source: PublicationPreSubmission
Source-ID: 123340419
Publication: Research - peer-review › Journal article – Annual report year: 2016

Beskedent overtryk gav spektakulære følger

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Statistics and Data
Analysis, COWI A/S
Authors: Hedlund, F. H. (Intern)
Pages: 20-22
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Dansk Kemi
Volume: 97
Issue number: 4
ISSN (Print): 0011-6335
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Web of Science (2007): Indexed yes
Web of Science (2004): Indexed yes
Original language: Danish
Electronic versions:
Beskedent_overtryk_gav_spektakulaere_foelger.pdf
Links:

Bibliographical note
Source: PublicationPreSubmission
Source-ID: 123429792
Publication: Communication › Journal article – Annual report year: 2016

Projects:

SecClo Master's Programme in Security and Cloud Computing
Department of Applied Mathematics and Computer Science
Embedded Systems Engineering
Aalto University
Norwegian University of Science and Technology
KTH - Royal Institute of Technology
University of Tartu
Institut Eurecom
Period: 01/08/2018 → 31/07/2023
Number of participants: 1
Acronym: SecClo
Project participant:
Stassen, Flemming (Intern)

**Financing sources**
Source: Other public support (public)
Name of research programme: Erasmus+: Key Action 1 – Erasmus Mundus Joint Master Degrees (EMJMDs)
Amount: 2,955,000.00 Euro
Year of approval: 2018

**Distributed real-time data analytics**
Department of Applied Mathematics and Computer Science
Period: 01/07/2018 → 30/06/2021
Number of participants: 3
Phd Student:
Qian, Jia (Intern)
Supervisor:
Hansen, Lars Kai (Intern)
Main Supervisor:
Larsen, Jan (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Anden EU-finansiering
Project: PhD

**Pseudo - Differential operators for analytic boundary problems**
Department of Applied Mathematics and Computer Science
Period: 01/06/2018 → 31/05/2021
Number of participants: 3
Phd Student:
Winterrose, David Scott (Intern)
Supervisor:
Brander, David (Intern)
Main Supervisor:
Karamehmedovic, Mirza (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

**Synchronization patterns in neural networks**
Department of Applied Mathematics and Computer Science
Dynamical Systems
Period: 20/05/2018 → …
Number of participants: 1
Project participant:
Martens, Erik Andreas (Intern)

**Vascular network dynamics**
Department of Applied Mathematics and Computer Science
Dynamical Systems
Period: 20/05/2018 → …
Number of participants: 1
Project participant:
Martens, Erik Andreas (Intern)

Project

Smart Cities Accelerator
European Interreg Project with 6 municipality implementing the research findings of the CITIES project in cooperation with other universities in the area Copenhagen, Southern Sweden.

Centre for IT-Intelligent Energy Systems in Cities

Department of Civil Engineering

Department of Applied Mathematics and Computer Science

Department of Management Engineering
Period: 20/04/2018 → 20/07/2018
Number of participants: 3
Acronym: SCA
Project participant:
Heller, Alfred (Intern)
Nielsen, Per Sieverts (Intern)
Project Manager, academic:
Madsen, Henrik (Intern)

Design Toolbox for Personal Health Technology

Department of Applied Mathematics and Computer Science

Department of Management Engineering
Period: 01/02/2018 → 31/01/2021
Number of participants: 3
Phd Student:
Maharjan, Raju (Ekstern)
Supervisor:
Bækgaard, Per (Intern)
Main Supervisor:
Bardram, Jakob Eyvind (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

Intelligent Energy Management for Multi-family Buildings
This project will define, develop and demonstrate an Intelligent Energy Management for multi-family buildings. The project will propose the most cost-effective setup (based on easily installable wireless sensors and actuators) that is a good fit for both newly built as well as existing/under renovation multi-family buildings. The setup will include temperature sensors for measuring in-house temperature in the different apartments as well as the temperature of the water in the pipes of the water-carried heating installation in different parts of the building or in different units of the installation. The system will periodically collect values from temperature sensors and heat meters. This intelligent use of data will:
• ensure the most cost-effective setup for heating installations and maximum energy efficiency;
• Send alerts to the tenants about what they can do in order to minimize their energy bill;
• Notify the building administrators of potential problems with the heating installations (water-carried heating) in the system to allow them to react in due time

Department of Photonics Engineering
Networks Technology and Service Platforms
Department of Applied Mathematics and Computer Science
Dynamical Systems
Period: 01/01/2018 → 31/12/2019
Number of participants: 4
IoT, Building Energy
Project participant:
Yan, Ying (Intern)
Dittmann, Lars (Intern)
Cali, Davide (Intern)
Madsen, Henrik (Intern)

**Leak detection in water supply pipes using drone-borne sensor technology**
Identification of water leaks in distribution pipes with UAVs via microwave and thermal monitoring

Department of Environmental Engineering
Water Resources Engineering
National Space Institute
Geodesy
Department of Applied Mathematics and Computer Science
Image Analysis & Computer Graphics
DroneInspektion ApS
Drone Systems ApS
Aarhus Water
Solrød Vandværk
HOFOR A/S

VandCenter Syd
Period: 16/11/2017 → 30/06/2018
Number of participants: 4
Project participant:
Bandini, Filippo (Intern)
Jakobsen, Jakob (Intern)
Bauer-Gottwein, Peter (Intern)
Frisvad, Jeppe Revall (Intern)

**Electronic Outlook**
Research-based evaluation of human versus electronic outlook for ships’ navigation

Department of Applied Mathematics and Computer Science
Department of Electrical Engineering
Automation and Control
Period: 15/10/2017 → 30/09/2018
Number of participants: 2
Project ID: 56322
Project participant:
Blanke, Mogens (Intern)
Hansen, Søren (Intern)

**Democratizing energy markets through the introduction of innovative flexibility-based demand response tools and novel business and market models for energy cooperatives**
FLEXCoop aims at introducing a complete automated Demand Response framework and tool suite for residential electricity consumers. The end-to-end interoperable solution will enable consumer flexibility to be valorised in front of a range of possible users in order to fulfill different services to the grid. This framework will enable energy cooperatives to explore demand response business models and take the role of aggregators. The pilot participants are members of two
energy cooperatives located in the Netherlands and in Spain.

Dynamical Systems
Period: 01/10/2017 → 30/09/2019
Number of participants: 4
Acronym: FLEXCoop
Project participant:
Azar, Armin Ghasem (Intern)
Relan, Rishi (Intern)
Bacher, Peder (Intern)
Madsen, Henrik (Intern)

Big data at DHRTC
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Centre for oil and gas – DTU
Period: 15/09/2017 → 31/12/2017
Number of participants: 2
Project participant:
Jørgensen, Thomas Martini (Intern)
Schmidt, Karen Guldbæk (Intern)

Effective, Co-created and compliant ACM
The goal of the EcoKnow project is to develop world-leading solutions for the effective digitalization of knowledge work processes that empower caseworkers and citizens to plan evidence-based optimal process flows for the individual case, guaranteeing both efficiency and compliance with the law. EcoKnow brings together knowledge from leading national and international researchers, municipalities, representatives for case workers, key industrial partners, digitalisation consultants and lawyers, researching and developing methods for co-creation technologies for real-time analysis of process logs (process mining) and adaptive case management through a multi-disciplinary situated design process.

Software and Process Engineering
Period: 01/09/2017 → 31/08/2020
Number of participants: 3
Acronym: EcoKnow
Project participant:
Weber, Barbara (Intern)
Burattin, Andrea (Intern)
Abbad Andaloussi, Amine (Intern)

Smart innovation - Learningbank: Learning using VR
Digital Learning
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Learningbank
Period: 01/09/2017 → …
Number of participants: 2
Project participant:
Thyregod, Camilla (Intern)
Project Manager, academic:
Rootzén, Helle (Intern)
Cyber Resilience for the Shipping Industry (CyberShip)

The shipping industry has become more vulnerable to cyber-attacks in recent years, because of its dependence on information technology and increasingly complex networks. Cyber systems are incorporated into almost every facet of maritime operations, such as financial and human resources management, security systems, navigation (Global Navigation Satellite Systems (GNSS), Automatic Identification System (AIS), Electronic Chart Display Systems (ECDIS), etc.), communications, electronic certificates, cargo tracking, pre-arrival processing and other key systems and equipment. All maritime structures (including ships and offshore facilities) as well as the connected infrastructure (e.g. offices of shipping companies, ports etc) are vulnerable. Currently, the awareness regarding cyber security aspects is either at a very low level or completely disregarded. The issue of cyber security has been brought into the attention of the International Maritime Organization (IMO), and industry associations such as BIMCO and others. As a result of this guidelines for tackling cyber security problems have been developed. This project is aimed at providing shipping companies and regulators with a reference framework and decision support model to better cope with disruptions originating from a cyber-attack.

Department of Management Engineering

Management Science

Transport DTU

Operations Management

Department of Applied Mathematics and Computer Science

Cyber Security

Copenhagen Center for Health Technology

Period: 01/09/2017 → 31/08/2019

Number of participants: 5

Acronym: CyberShip

Project participant:

Psaraftis, Harilaos N. (Intern)
Jensen, Christian D. (Intern)
Sepúlveda Estay, Daniel Alberto (Intern)
Sahay, Rishikesh (Intern)

Project Manager, organisational:

Barfod, Michael Bruhn (Intern)

Relations

Publications:

Work Package 2 Report - Cyber resilience for the shipping industry

Project

Explainability of uncertainty for neutral networks

Department of Applied Mathematics and Computer Science

Period: 01/09/2017 → 31/08/2020

Number of participants: 3

Phd Student:

Rieger, Laura (Ekstern)

Supervisor:

Nielsen, Finn Årup (Intern)

Main Supervisor:

Hansen, Lars Kai (Intern)

Financing sources

Source: Internal funding (public)

Name of research programme: Institut stipendie (DTU)

Project: PhD

Smart Manufacturing Frameworks

Department of Applied Mathematics and Computer Science
Period: 01/09/2017 → 01/12/2020
Number of participants: 3
Phd Student:
Maier, Dana (Intern)
Supervisor:
Larsen, Jakob Eg (Intern)
Main Supervisor:
Bærentzen, Jakob Andreas (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Industrial PhD
Project: PhD

Real-Time Multicore Systems
Department of Applied Mathematics and Computer Science
Period: 15/08/2017 → 14/08/2020
Number of participants: 3
Phd Student:
Baris, Oktay (Ekstern)
Supervisor:
Sparsø, Jens (Intern)
Main Supervisor:
Schoeberl, Martin (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Systems Genomic and Transcriptomics approaches for simultaneous improvement of feed efficiency and production in Danish Pigs
Department of Applied Mathematics and Computer Science
Period: 01/08/2017 → 31/07/2019
Number of participants: 3
Phd Student:
Carmelo, Victor Adriano Okstoft (Intern)
Supervisor:
Ekstrøm, Claus Thorn (Ekstern)
Main Supervisor:
Kadarmideen, Haja (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Numerical modelling of near wellbore flow
Technical University of Denmark
Centre for oil and gas – DTU
Department of Applied Mathematics and Computer Science
Period: 01/07/2017 → 30/06/2020
Number of participants: 3
Phd Student:
Kadeethum, Teeratom (Intern)
Supervisor:
Salimzadeh, Saeed (Intern)
Genomics, epigenetic and metabolomics analysis of production and welfare in Danish cattle and pigs

Department of Applied Mathematics and Computer Science
Period: 15/06/2017 → 14/06/2019
Number of participants: 3
Phd Student:
Wang, Xiao (Intern)
Supervisor:  
Ekstrøm, Claus Thorn (Ekstern)
Main Supervisor: 
Kadarmideen, Haja (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

State-informed brain stimulation
In this project we are using a state-informed open-loop EEG-TMS setup to investigate whether the mean amplitude of the motor evoked potential (MEP), as evoked by single-pulse transcranial magnetic stimulation (TMS), depends on the endogenous brain state at the time of stimulation. More specifically, we have investigated the four phases of pericentral μ-oscillations (8-12Hz), which has been suggested to reflect different states of excitability.

Department of Applied Mathematics and Computer Science
Cognitive Systems
Period: 01/02/2017 → …
Number of participants: 1
Project participant:  
Krohne, Lærke Karen (Intern)
Project

IEA Task Material and component development for thermal storage systems
The aims of the project are within the IEA (International Energy Agency) SHC (Solar Heating & Cooling) Programme Task project "Material and component development for thermal storage systems" to develop economically attractive compact long term heat storages and to elucidate the suitability of the heat storages for different applications. The project is the Danish part of the IEA Task project "Material and component development for thermal storage systems". Work will be carried out in the following fields: Component development Application areas Numerical simulation methods The expert meetings of the project will be attended so that knowledge on the results of the international partners is achieved. The Danish activities is focused on development of inexpensive compact heat storages based on salt hydrates, on optimization of energy systems based on these heat storages and on the interplay between the systems and the future energy system. In cooperation with interested companies development work is carried out. Among other things a heat storage module based on sodium acetate trihydrate from Nilan A/S will be investigated by means of experiments. Further, a combined solar heating/heat pump system with a PCM heat storage will be investigated.

Department of Civil Engineering
Section for Building Energy
Department of Applied Mathematics and Computer Science
Nilan A/S
Period: 01/01/2017 → 31/12/2019
Number of participants: 4
PCM heat storage, supercooling, applications
Project participant:  
Furbo, Simon (Intern)
Engelmair, Gerald (Intern)
Dannemand, Mark (Intern)
Kong, Weiqiang (Intern)

Project

**Strengthen ISS Global A/S before negotiations through data analysis on Fleet LSI data**
Department of Applied Mathematics and Computer Science

**Statistics and Data Analysis**
**Period:** 01/01/2017 → 06/07/2017
**Number of participants:** 3
**Other:**
Samsøe, Pernille Lindvang (Ekstern)

**Supervisor:**
Thyregod, Camilla (Intern)

**Main Supervisor:**
Rootzén, Helle (Intern)

**Project**

**Statistics and Data Analytics on Smart Zero**
Department of Applied Mathematics and Computer Science
**Period:** 15/09/2016 → 14/09/2019
**Number of participants:** 2

**Phd Student:**
Wolf, Sebastian (Ekstern)

**Main Supervisor:**
Madsen, Henrik (Intern)

**Financing sources**
**Source:** Internal funding (public)
**Name of research programme:** Institut stipendie (DTU)
**Project:** PhD

**Cool PVT**
The aim is to develop PVT panels which can be used for heat and electricity production during daytime and for cooling during night time.

Differently designed PVT panels will be tested experimentally in laboratory test facilities

Department of Civil Engineering
Section for Building Energy
Department of Applied Mathematics and Computer Science
RACELL SAPHIRE Technologies ApS
COWI A/S

**Period:** 01/09/2016 → 31/12/2016
**Number of participants:** 2
**PVT panels, heating cooling**

**Project participant:**
Furbo, Simon (Intern)
Dannemand, Mark (Intern)

**Project**

**Human Behavior of Track Pilot**
Master Thesis Project

Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Dynamical Systems

FORCE Technology
Period: 29/08/2016 → 29/01/2017
Number of participants: 2
Time Series Analysis, Navigation, PID controller
Supervisor:
Poulsen, Niels Kjølstad (Intern)
Main Supervisor:
Stockmarr, Anders (Intern)
Project

Multivariate Time Series Modelling of Australian Data on Deaths from Homicide and Suicides
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Period: 22/08/2016 → 01/01/2017
Number of participants: 2
Time Series Analysis, Multivariate, MARIMA, Australia
Supervisor:
Spliid, Henrik (Intern)
Main Supervisor:
Stockmarr, Anders (Intern)
Project

NordSecMob Master's Programme in Security and Mobile Computing - 2 continuation
Department of Applied Mathematics and Computer Science
Embedded Systems Engineering
Aalto University
KTH - Royal Institute of Technology
Norwegian University of Science and Technology
University of Tartu
Period: 01/08/2016 → 31/07/2018
Number of participants: 1
Acronym: NordSecMob
Project participant:
Stassen, Flemming (Intern)
Project

SDE-modelling in CiTIES
Department of Applied Mathematics and Computer Science
Centre for IT-Intelligent Energy Systems in Cities
Period: 15/07/2016 → 13/11/2019
Number of participants: 4
Phd Student:
Junker, Rune Grønborg (Intern)
Supervisor:
Jørgensen, John Bagterp (Intern)
Thygesen, Uffe Høgsbro (Intern)
Main Supervisor:
Madsen, Henrik (Intern)

Financing sources
Source: Internal funding (public)
Characterizing Porous Tool Materials for Impulse Drying Technology

Department of Applied Mathematics and Computer Science
Department of Mechanical Engineering
Manufacturing Engineering
Period: 01/06/2016 → 01/07/2017
Number of participants: 1
Project participant:
Stolfi, Alessandro (Intern)

GÉANT Project
The GÉANT project is a truly Pan-European collaboration between 41 National Research and Education Networks and their joint organisations NORDUnet and GÉAN, placing Europe at the forefront of high performance networking and AAI.

Department of Applied Mathematics and Computer Science
Algorithms and Logic
Period: 01/05/2016 → 31/12/2018
Number of participants: 1
High speed networking
Acronym: GN4-2
Project participant:
Olesen, Dorte (Intern)

PVT/heat pump system
Measurements on a PVT/heat pump system are carried out in a laboratory test facility.

Department of Civil Engineering
Section for Building Energy
Department of Applied Mathematics and Computer Science
RACELL SAPHIRE Technologies ApS
COWI A/S
Period: 01/04/2016 → 31/07/2017
Number of participants: 3
PVT panels, heat pump, measurements
Project participant:
Furbo, Simon (Intern)
Dannemand, Mark (Intern)
Perers, Bengt (Intern)

Visualization, Analysis and Modelling of On-street Parking Data
Master project
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
EasyPark
Period: 01/04/2016 → 28/09/2016
Number of participants: 3
Project participant:
Notarangelo, Rosaria (Ekstern)
Supervisor:
Reducing the rate and duration of re-admission among patients with unipolar and bipolar disorder using smartphone-based monitoring and treatment

According to WHO, depression is becoming a leading cause of disability. The RADMIS project seeks to design smartphone-based monitoring and treatment technology for depressive patients. The goal is to establish the efficacy of this technology by measuring re-admission and clinical outcome.

Copenhagen Center for Health Technology
Department of Applied Mathematics and Computer Science
Embedded Systems Engineering
Cognitive Systems
Psychiatric Center Copenhagen, Rigshospitalet
Period: 01/03/2016 → 01/09/2019
Number of participants: 2
Acronym: RADMIS
Number of related Ph.D. students: 2
Project participant:
Bardram, Jakob Eyvind (Intern)
Winther, Ole (Intern)

Financing sources
Source: Public research programme (public)
Name of research programme: Innovation Fund Denmark
Web address: http://innovationsfonden.dk/en
Amount: 11,000,000.00 Danish Kroner
Year of approval: 2016

Operations and Maintenance Technology, CTR1
The objective of this programme is to develop a Water Management Plan that addresses both operational performance and process development/design aspects related to facilities.

A close collaboration between researchers and a small Norwegian start-up leads to a new product, the ‘AlarmTracker’, ready for the control rooms of oil and gas platforms in 2019. The device supports the operator in making the right decisions in abnormal situations. Its objective is to secure a steady production, leading to an expected five percent increase of oil production.

Centre for oil and gas – DTU
Department of Electrical Engineering
Statistics and Data Analysis
Aalborg University
Eldor Technology
Period: 15/02/2016 → 01/01/2020
Number of participants: 1
Acronym: CTR1
Number of related Ph.D. students: 5
Project participant:
Jørgensen, Thomas Martini (Intern)

3D imaging center
Department of Physics
Neutrons and X-rays for Materials Physics

Department of Applied Mathematics and Computer Science

Image Analysis & Computer Graphics

Department of Energy Conversion and Storage

Imaging and Structural Analysis

Electrofunctional materials

Centre for oil and gas – DTU

Period: 01/01/2016 → 01/01/2021

Number of participants: 14

Project participant:

Dahl, Anders Bjorholm (Intern)

Oddershede, Jette (Intern)

Trinderup, Camilla Himmelstrup (Intern)

Simonsen, Søren Bredmose (Intern)

Zheng, Yi (Intern)

Brink, Bastian (Intern)

Lauridsen, Torsten (Ekstern)

Thydén, Karl Tor Sune (Intern)

Sanna, Simone (Intern)

Baier, Sina (Intern)

Bentzen, Janet Jonna (Intern)

Christensen, Anders Nymark (Intern)

Project Manager, organisational:

Gundlach, Carsten (Intern)

Project Manager, academic:

Poulsen, Henning Friis (Intern)

Relations

Related projects:

Alliance for Imaging and Modelling of Energy Applications

Publications:

From concept to in vivo testing: Microcontainers for oral drug delivery

Scene reassembly after multimodal digitization and pipeline evaluation using photorealistic rendering

Graphite nodules in fatigue-tested cast iron characterized in 2D and 3D

In-Situ X-ray Tomography Study of Cement Exposed to CO2 Saturated Brine

Crack Tip Flipping under Mode I Tearing: Investigated by X-Ray Tomography

Powder embossing method for selective loading of polymeric microcontainers with drug formulation

High-Performance Microchanneled Asymmetric Gd0.1Ce0.9O1.95-δ-La0.6Sr0.4FeO3-δ-Based Membranes for Oxygen Separation

Characterization of graphite nodules in thick-walled ductile cast iron

Surface Detection using Round Cut

Microstructure and micromechanics of the heart urchin test from X-ray tomography

Synthesis and characterization of Fe–Ni/γ-Al2O3 egg-shell catalyst for H2 generation by ammonia decomposition

Project

Smart TSO-DSO interaction schemes, market architectures and ICT Solutions for the integration of ancillary services from demand side management and distributed generation

The project SmartNet aims at providing architectures for optimized interaction between TSOs and DSOs in managing the exchange of information for monitoring and for the acquisition of ancillary services (reserve and balancing, voltage regulation, congestion management) both at national level and in a cross-border context. Local needs for ancillary services in distribution systems are supposed to co-exist with system needs for balancing and congestion management. Resources located in distribution systems, like demand side management and distributed generation, are supposed to participate to the provision of ancillary services both locally and for the system in the context of competitive ancillary services markets.
Department of Applied Mathematics and Computer Science

Dynamical Systems
Period: 01/01/2016 → 31/12/2018
Number of participants: 5
Acronym: SmartNet
Project participant:
Azar, Armin Ghasem (Intern)
Madsen, Henrik (Intern)
Vardanyan, Yelena (Intern)
Ebrahimy, Razgar (Intern)
Dzamarija, Mario (Intern)

Optimisation of biodevice production
Master project
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Scandinavian Micro Biodevice ApS
Period: 01/01/2016 → 04/06/2016
Number of participants: 3
Project participant:
Rabøl, Mads Peter (Ekstern)
Supervisor: Thyregod, Camilla (Intern)
Main Supervisor: Clemmensen, Line Katrine Harder (Intern)

UAV Ground Control System
Development of a ground control system for a special purpose unmanned aerial vehicle
Department of Applied Mathematics and Computer Science
Embedded Systems Engineering
Authel Systems IVS
Period: 30/11/2015 → 01/03/2016
Number of participants: 4
Project participant:
Stassen, Flemming (Intern)
Farabi Khanghahi, Fatimeh (Ekstern)
Working partner: Steffensen, Rasmus (Ekstern)
Haaning, Christian (Ekstern)

Formalization of Algorithms and Logical inference Systems in Proof Assistants
Department of Mathematics
Period: 15/09/2015 → 14/09/2018
Number of participants: 4
Phd Student: Schlichtkrull, Anders (Intern)
Supervisor: Blanchette, Jasmin Christian (Ekstern)
Bolander, Thomas (Intern)
Main Supervisor: Villadsen, Jørgen (Intern)
**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

**Student based learning in multi-faceted learning communities**
Department of Applied Mathematics and Computer Science

Statistics and Data Analysis
- Period: 01/09/2015 → 31/12/2016
- Number of participants: 1
- Acronym: STUDeNT-learn

Project participant:
- Rootzén, Helle (Intern)

**ESS & MAX IV: Cross border science and society**
Workpackage: ESS & MAX IV: Cross border network and post graduate educational program

Department of Energy Conversion and Storage
Imaging and Structural Analysis
Department of Physics
Department of Applied Mathematics and Computer Science
University of Copenhagen
MaxLab
Lund University
Chalmers University of Technology
Malmö Högskola
European Spallation Source ESS AB
University of Oslo
University of Gothenburg
Aarhus University
- Period: 01/09/2015 → 31/08/2018
- Number of participants: 1
- X-ray synchrotron scattering, neutron scattering

Project participant:
- Kuhn, Luise Theil (Intern)

**Market Mechanisms for Integrated Energy Systems**
Centre for IT-Intelligent Energy Systems in Cities
Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets
Department of Applied Mathematics and Computer Science
Dynamical Systems
- Period: 01/07/2015 → 30/06/2018
- Number of participants: 3
- Phd Student:
  - Ordoudis, Christos (Intern)
**BIO-based PROduction: TOwards the next generation of optimized and sustainable processes**

Goal: The BIOPRO2 Strategic Research Center, sponsored by Innovation Fund Denmark (2015-2019) aims at being a world-class center in bio-based manufacturing process research, with focus on increasing and exploiting our process understanding in order to unlock the full potential of bio-based production processes. The scientific objectives of the Center are: (1) To investigate advanced sensors and chemometric methods to obtain more detailed real-time process information; (2) to develop advanced statistical methods to convert data into useful information; (3) to create interfaces to visualize data efficiently for different stakeholders; (4) to develop and calibrate mechanistic models for use in simulation / optimization studies; (5) to apply optimization and advanced control algorithms in order to steer bio-based manufacturing processes towards desired performance at a plant-wide level.

Based on the scientific results, additional objectives are: (1) To perform validation and proof-of-concept studies at pilot and full-scale with close collaboration between academic and industrial partners; (2) to promote bi-directional knowledge transfer between academia and industry.

Department of Chemical and Biochemical Engineering

Statistics and Data Analysis

University of Copenhagen

Period: 01/06/2015 → 01/06/2019

Number of participants: 1

Acronym: BIOPRO2

Project participant:

Jørgensen, Thomas Martini (Intern)

**Functional Connectivity during Theory of Mind and Empathy tasks, using Machine Learning in Subjects with Schizotypy**

Since the rethinking of schizophrenia as a neurodevelopmental disease, the importance of studying healthy subjects that have psychotic traits has become increasingly recognized. In earlier studies the degree of schizotypy (especially high social anhedonia (HSA)) has been identified as a predictor for development of schizophrenia. Furthermore, several studies have related early impairment in social cognition to the later functional outcome in patients with schizophrenia.

The aim of this study is to determine functional connectivity in subjects with schizotypy, and to investigate if the found connectivity networks can be used to classify subjects according to their degree of social anhedonia.

Department of Applied Mathematics and Computer Science

Cognitive Systems

Period: 01/06/2015 → …

Number of participants: 1

Project participant:

Krohne, Lærke Karen (Intern)

**Relations**

Publications:

Perspectives on Machine Learning for Classification of Schizotypy Using fMRI Data

Project

**EnergyLab Nordhavn - New Urban Energy Infrastructures**

Department of Electrical Engineering

Center for Electric Power and Energy

Distributed Energy Resources

Energy Analytics and Markets

Energy System Management
Department of Applied Mathematics and Computer Science
Department of Civil Engineering
Section for Building Energy
Section for Indoor Climate and Building Physics
Department of Mechanical Engineering
Thermal Energy
HOFOR A/S
Balslev Consulting Engineers A/S
METRO THERM A/S
ABB Group
Københavns Kommune
By og Havn
Radius Elnet

CleanCharge Solutions
Period: 01/04/2015 → 31/03/2019
Number of participants: 20
Acronym: ELN
Number of related Ph.D. students: 9
Project participant:
Hashemi Toghroljerdi, Seyedmostafa (Intern)
Østergaard, Jacob (Intern)
Træholt, Chresten (Intern)
Pinson, Pierre (Intern)
Mitridati, Lesia Marie-Jeanne Mariane (Intern)
Klyapovskiy, Sergey (Intern)
Le Ray, Guillaume (Intern)
Gjelaj, Marjan (Intern)
You, Shi (Intern)
Harrestrup, Maria (Intern)
Rode, Carsten (Intern)
Elinegaard, Brian (Intern)
Ommen, Torben Schmidt (Intern)
Foteinaki, Kyriaki (Intern)
Luc, Katarzyna Marta (Intern)
Pieper, Henrik (Intern)
Meessenburg, Wiebke (Intern)
Mitridati, Lesia Marie-Jeanne Mariane (Intern)
Le Ray, Guillaume (Intern)

Project Manager, organisational:
Greisen, Christoffer (Intern)

Relations
Activities:
Performance analysis of heat pumps utilizing different low temperature heat sources to supply district heating
Optimal usage of low temperature heat sources to supply district heating by heat pumps
Cost-Benefit Analysis of a Novel DC Fast-Charging Station with a Local Battery Storage for EVs
DC Fast-Charging Stations for EVs Controlled by a Local Battery Storage in Low Voltage Grids
Optimal Design of DC Fast-Charging Stations for EVs in Low Voltage Grids
Active and reactive power support of MV distribution systems using battery energy storage
Intelligent Quality Assessment of Railway Switches and Crossings

This project aims at significantly improving the safety, reliability and operational lifetime of the 3500 switches and crossings (S&Cs) in the Danish railway network. The project is a close cooperation between the Technical University of Denmark (DTU), the Danish rail infrastructure provider Rail Net Denmark and four affiliated European partners with significant expertise within this field. An inter-disciplinary scientific effort is employed to obtain enhanced rail transport reliability and regularity simultaneously with significant savings in S&Cs maintenance costs. The project results will make maintenance based on intelligent fault prediction tools, instead of the presently used regular planned inspections, and it will provide sophisticated tools to prevent hidden faults from developing to failure in the future. In a novel approach, the project will install state-of-the-art sensor technology in selected S&Cs and correlate dynamic parameters during train passage with static geometry data from conventional measurement vehicles. Monitoring of the dynamic responses will provide diagnosis of patterns that indicate when components or ballast begin to deviate from fully functional conditions. Modelling of dynamics will identify root causes to signs of degradation. Damage assessment of components identified by anomalous readings will be done by metallurgical examinations. Data and results will be processed by a holistic model that can produce Maintenance Performance Indicators (MPI) for the S&C condition. The correlation of sensor data to measuring vehicle data will allow existing data to be used reliably as input for the MPI model. It is expected that this project will enable optimisation of maintenance procedures, by which appropriate maintenance can be predicted in advance, thus avoiding unscheduled repairs and delays in the railway traffic.

Department of Wind Energy

Department of Electrical Engineering

Automation and Control

Department of Mechanical Engineering

Solid Mechanics

Department of Applied Mathematics and Computer Science

Statistics and Data Analysis

Banedanmark

Period: 01/03/2015 → 28/02/2019

Number of participants: 14

Acronym: INTELLISWITCH

Number of related Ph.D. students: 1

Project participant:

Galeazzi, Roberto (Intern)

Blanke, Mogens (Intern)

Hansen, Søren (Intern)

Barkhordari, Pegah (Intern)

Asadzadeh, Seyed Mohammad (Intern)

Santos, Ilmar (Intern)

Tejada, Alejandro de Miguel (Intern)

Danielsen, Hilmar Kjartansson (Intern)

Dhar, Somrita (Intern)

Ersbøll, Bjarne Kjær (Intern)

Kulahci, Murat (Intern)

Thyregod, Camilla (Intern)

Hovad, Emil (Intern)

Project Manager, academic:

Juul Jensen, Dorte (Intern)

Financing sources

Source: Public research council

Name of research programme: Innovationsfonden
Digital Factory
Collaboration with Odico APS and GXN. Constraint based design and rationalization for robotic hot-wire and hot-blade production of architectural formwork. Supported by Innovation Fund Denmark

Department of Applied Mathematics and Computer Science
Mathematics
Image Analysis & Computer Graphics
Period: 01/03/2015 → 15/12/2018
Number of participants: 4
Project participant:
Gravesen, Jens (Intern)
Bærentzen, Jakob Andreas (Intern)
Project Manager, organisational:
Brander, David (Intern)
Phd Student:
Fisker, Ann-Sofie (Intern)

Intelligent Quality Assessment of Railway Switches and Crossings (INTELLISWITCH)
Department of Electrical Engineering
Department of Mechanical Engineering
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Department of Wind Energy
Materials science and characterization
Banedanmark
Period: 01/03/2015 → 31/12/2019
Number of participants: 3
Project participant:
Thyregod, Camilla (Intern)
Ersbøll, Bjarne Kjær (Intern)
Project Manager, organisational:
Juul Jensen, Dorte (Intern)

Financing sources
Source: Public research council
Name of research programme: Innovation Fund Denmark
Amount: 12.70 Danish Kroner

Computational methods for wind-energy forecasting
Department of Applied Mathematics and Computer Science
Cognitive Systems
Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets
Period: 01/02/2015 → 29/02/2016
Number of participants: 3
Many researchers create tools that could be very valuable to a broader audience. Using them, however, is often impeded by the required expertise and/or effort.

This project aims at providing services to all of DTU Compute to help them make their tools and available to the world.

Our goal is to reach out to science and industry to promote the use of the tools and datasets we have created, and thus advance scientific progress at large and its economic dissemination. On a smaller scale, the individual stakeholders each will benefit in turn:

- Compute will benefit from increased visibility and newly established contacts and created collaboration opportunities.
- The sections will benefit by having more insight into the activities of other sections.
- Individual researchers can benefit by more citations and higher visibility.

Department of Applied Mathematics and Computer Science
Software and Process Engineering
Embedded Systems Engineering
Statistics and Data Analysis

Smart Innovation: Parking Guidance

Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
EasyPark
DTU Scion

Period: 01/01/2015 → 31/10/2016
Number of participants: 2
Project participant:
Thyregod, Camilla (Intern)
Non-Linear Temporal Machine Learning Models for Conditioning Monitoring in Large-Scale Solar Energy Systems
PhD project in cooperation with the Technical University of Denmark and GreenGo Energy. GreenGo Energy installs and operates photovoltaic systems for business, housing associations and public entities. The large number of condition monitoring sensors installed in all GreenGo Energy solar energy power plants generates terabyte data that are collected in a common cloud based solution. A global scale synchronized data acquisition system providing data with unprecedented precision, size, geographical diversity provides unique possibilities for big data modeling. A successful machine learning system build on top of the cloud solution will be able to detect many types of faults and wear characteristics. The scale of the data poses computational challenges and requires application and development of novel non-linear dynamical models that scale to large datasets. In the PhD project, Bayesian approaches to filtering will be investigated as well as deep learning methodologies for integration of high frequency heterogeneous sensor data. The service platform will integrate state-of-the-art fault diagnosis, and portfolio based service planning and execution automation.

Technical University of Denmark
Department of Applied Mathematics and Computer Science
Cognitive Systems
GreenGo Energy
Period: 15/12/2014 → 15/12/2017
Number of participants: 2
Project participant:
Winther, Ole (Intern)
Phd Student:
Maaløe, Lars (Intern)

Communication with Models
Department of Applied Mathematics and Computer Science
Software and Process Engineering
QualiWare ApS
Period: 01/10/2014 → 30/09/2017
Number of participants: 2
Project participant:
Störrle, Harald (Intern)
Phd Student:
Davidsen, Jóhan (Intern)

New X-ray Imaging Modalities for safe and high quality Food
The danish food industry is known for making high quality products. In order to maintain this reputation it is important to keep increasing the food safety and quality. The project runs from 2012 till the end of 2016 and is founded by The Danish Council for Strategic Research (now Innovation Fund Denmark).

Statistics and Data Analysis
University of Copenhagen
Teknologisk Institut
Period: 01/10/2014 → 01/10/2016
Number of participants: 1
Acronym: Nexim
Project participant:
Jørgensen, Thomas Martini (Intern)

PhD Project: Segmentation-Driven Tomographic Reconstruction
Computed tomography (CT) is a non-invasive technique for analyzing the interior of objects. The mathematical method of calculating the interior of an object is called reconstruction. A great variety of different reconstruction techniques exist. For this project the goal is to incorporate different forms of prior information into the reconstruction process to achieve results
with desired features for a subsequent segmentation. The CT problem is an ill-posed problem, which is a motivation for incorporation prior information, in order to regularize and stabilize the reconstructions. Prior information is based on what we perceive as expected and typical behavior for specific problems, for example an often-used prior for CT reconstructions is piecewise constancy of the solutions, which is utilized by for example Total Variation regularization. Incorporation of prior information in reconstructions is also a part of the overall theme for the ERC project “High-Definition Tomography”, which this project is a part of.

CT is typically used for analyzing biological objects, for medical imaging purposes, though in the research field of material science this has also become a highly used technique. For materials science a typical CT-investigation pipeline consist of four major stages: scanning, reconstruction, segmentation and analysis. Often the reconstruction is carried out by a simple filtered back projection method, whereas the segmentation stage consists of more advanced and computationally expensive methods.

In my project we aim to move the computational effort from the segmentation stage to the reconstruction stage. The reconstruction methods that primarily investigate are related to the variational methods. Prior information about the object we are scanning is used to regularize the reconstruction in order aid the following segmentation stage. Some regularization keywords that I have been working with are: Total Variation, Directional Total Variation, Total Generalized Variation, Mumford-Shah and Eulers Elastica.

Department of Applied Mathematics and Computer Science
Scientific Computing
\begin{itemize}
\item Period: 01/09/2014 → 31/08/2017
\item Number of participants: 3
\item Number of related Ph.D. students: 1
\end{itemize}
Project participant:
\begin{itemize}
\item Kongskov, Rasmus Dalgas (Intern)
\item Dong, Yiqiu (Intern)
\item Knudsen, Kim (Intern)
\end{itemize}

Benchmarking and extending models of real estate price prediction, under financial regulation requirements
Department of Applied Mathematics and Computer Science
Cognitive Systems
\begin{itemize}
\item National Institute of Aquatic Resources
\item Section for Marine Living Resources
\item Period: 01/09/2014 → 01/10/2017
\item Number of participants: 4
\end{itemize}
Project participant:
\begin{itemize}
\item Katossky, Arthur (Intern)
\item Thygesen, Uffe Høgsbro (Intern)
\item Dalhoff, Jakob (Ekstern)
\end{itemize}
Main Supervisor:
\begin{itemize}
\item Guillot, Gilles (Intern)
\end{itemize}
Project

Innovationsnetwork Smart Energy (CLEAN)
Innovation network under CLEAN for smart energy innovation activities.
Department of Civil Engineering
Section for Building Physics and Services
Department of Applied Mathematics and Computer Science
Centre for IT-Intelligent Energy Systems in Cities
\begin{itemize}
\item Period: 15/08/2014 → 31/12/2017
\item Number of participants: 2
\item Acronym: Inno-SE
\end{itemize}
Project participant:
\begin{itemize}
\item Heller, Alfred (Intern)
\end{itemize}
A bi-hormonal Artificial Pancreas based on an Ensemble Nonlinear Model Predictive Control Algorithm

Department of Applied Mathematics and Computer Science

Scientific Computing
Period: 01/08/2014 → 31/07/2017
Number of participants: 1
Project participant:
Boiroux, Dimitri (Intern)

IEA EBC Annex 67 - Energy Flexible Buildings
Energy flexibility in buildings will play an important role in facilitating energy systems based entirely on renewable energy sources. Flexibility is necessary to control the energy consumption to match the actual energy generation from various energy sources such as solar and wind power. However, there is lack of comprehensive knowledge about how much energy flexibility different building types and their usage may be able to offer to the future energy systems.

The aim of this project is to demonstrate how energy flexibility in buildings can provide generating capacity for energy grids, and to identify critical aspects and possible solutions to manage such flexibility. This knowledge is important in order to incorporate energy flexibility of buildings into future smart energy systems and to better accommodate renewable sources in energy systems. It is also important when developing the business case for using building energy flexibility within future systems to potentially reduce costly upgrades of energy distribution grids.

The project objectives are:
– development of common terminology, a definition of ‘energy flexibility in buildings’ and a classification method,
– investigation of user comfort, motivation and acceptance associated with the introduction of energy flexibility in buildings,
– investigation of the energy flexibility potential in different buildings and contexts, and development of design guidelines, control strategies and algorithms
– investigation of the aggregated energy flexibility of buildings and the potential effect on energy grids, and
– demonstration of energy flexibility through experimental and field studies.

Participants: Austria, Belgium, Denmark, France, Italy, the Netherlands, Norway, Portugal, Spain, Switzerland, United Kingdom

Centre for IT-Intelligent Energy Systems in Cities

Department of Civil Engineering

Department of Applied Mathematics and Computer Science
Period: 01/06/2014 → 01/06/2019
Number of participants: 4
Project ID: 26461
Project participant:
Heller, Alfred (Intern)
Madsen, Henrik (Intern)
Gianniou, Panagiota (Intern)
Foteinaki, Kyriaki (Intern)

Waste-2-Energy Smart Grid Upgrade

Department of Applied Mathematics and Computer Science

Dynamical Systems

Krüger A/S

Højteknologifonden
Period: 02/04/2014 → 02/04/2016
Number of participants: 2
WWTP, Smart Grid, MPC
**Alliance for Imaging and Modelling of Energy Applications**

The CINEMA research alliance will develop unique 3D micro-structural characterization methods, which make it possible to investigate components under realistic conditions and in real time. This will enable correlation between performance and local changes in the microstructure.

Department of Energy Conversion and Storage
Imaging and Structural Analysis

Department of Physics
Neutrons and X-rays for Materials Physics
Department of Wind Energy
Composites and Materials Mechanics
Department of Applied Mathematics and Computer Science
Image Analysis & Computer Graphics
Scientific Computing
Mixed Conductors
Statistics and Data Analysis

University of Copenhagen
Northwestern University
University of Manchester
MaxLab
LM Wind Power
Haldor Topsoe AS
Xnovo Technology ApS
Rockwool International
Amminex Emissions Technology A/S

Period: 01/01/2014 → 31/12/2018
Number of participants: 26
Acronym: CINEMA

Project participant:
Mikkelsen, Lars Pilgaard (Intern)
Sørensen, Bent F. (Intern)
Bowen, Jacob R. (Intern)
Kuhn, Luise Theil (Intern)
Larsen, Rasmus (Intern)
Hansen, Per Christian (Intern)
Frandsen, Henrik Lund (Intern)
Gundlach, Carsten (Intern)
Dahl, Anders Bjorholm (Intern)
Yang, Shu-Yi (Intern)
Poulsen, Stefan Othmar (Intern)
Lyckegaard, Allan (Intern)
Lauridsen, Erik Mejdal (Intern)
Sørensen, Henning Osholm (Ekstern)
Project Manager, organisational:
Sørensen, Hanne (Intern)
Phd Student:
Jespersen, Kristine Munk (Intern)
Beil, Johannes (Ekstern)
Andersen, Michael (Intern)
Emerson, Monica Jane (Intern)
De Angelis, Salvatore (Intern)
Birkelund, Klaus (Ekstern)
Jacobsen, Hjalte Sylvest (Intern)
Chapelle, Lucie (Intern)
Supervisor:
Frandsen, Henrik Lund (Intern)
Project Manager, academic:
Andreasen, Jens Wenzel (Intern)
Project Coordinator:
Poulsen, Henning Friis (Intern)

Relations
Activities:
DTU Energy Conversion 2nd International PhD Summer School
Wilson K. S. Chiu
High resolution ptychographic tomography of soft matter
Gerardina Carbone
Sample Design and Preparation Techniques for Dynamic Microstructural Studies of High Temperature Electrochemical Cells
DTU Energy Conversion 2nd International PhD Summer School
Publications:
Fatigue damage evolution in fibre composites for wind turbine blades
Micromechanical Time-Lapse X-ray CT Study of Fatigue Damage in Uni-Directional Fibre Composites
Improving organic tandem solar cells based on water-processed nanoparticles by quantitative 3D nanoimaging
Micromechanical Investigation of Fatigue Damage in Uni-Directional Fibre Composites
Dictionary Based Segmentation in Volumes
3D X-Ray Computed Tomography (XCT) of Fatigue Damage Evolution in UD Glass Fibre Composite
Enabling Flexible Polymer Tandem Solar Cells by 3D Ptychographic Imaging

PROActive INtegration of sustainable energy resources enabling active distribution networks
Department of Electrical Engineering
Center for Electric Power and Energy
Energy System Management
Department of Applied Mathematics and Computer Science
Software and Process Engineering
Period: 01/01/2014 → 31/12/2017
Number of participants: 4
Acronym: PROAIN
Project participant:
Petersen, Bo Søborg (Intern)
Poulsen, Bjarne (Intern)
Bindner, Henrik W. (Intern)
You, Shi (Intern)

Project
A wide range of research activities have arisen to support the Danish target of a 100% renewable energy system by 2050. Projects focused on individual aspects of the energy system, such as zero emissions buildings or intelligent power systems provide valuable insight, that facilitates flexibility throughout the energy system. CITIES will address this deficiency by establishing an integrated research centre covering all aspects of the energy system, including gas, power, district heating/cooling and biomass, and most importantly methods to forecast, control and optimize their interactions through the use of advanced ICT solutions.

The high densities of population, energy consumption, and energy and communications networks in cities offer the greatest potential for flexibility at the last cost, and the fact that cities account for 80% of global energy consumption and emissions [1] make the urban environment an ideal setting for energy systems integration research. CITIES will pioneer research into fully integrated city energy systems, building short-term operational models that feed longer term planning models, considering the spatiotemporal variations, interactions, dynamics and stochastics in the energy system. Low level models of system components will inform higher-level aggregate models employed in market and control framework design. The leading position of European academia and industry and the rapidly growing market for smart energy solutions indicates substantial scope for increased competitiveness and job creation within this field. CITIES will, in collaboration with its industrial and academic partners, conduct research with a view to developing tools for the implementation of integrated energy system solutions.
Starfish - power and management (Sæstjerner) (39087)
The overall objective of the project was to provide the scientific basis for management that can lead to the establishment of a commercial fishery of starfish (Asterias rubens) in primarily the Limfjorden, including Natura 2000 areas. The project background was the increasing prevalence of starfish that is both a threat to the mussel fishing and a potential source of income for fishing. In the project, the population of starfish and production was determined and analyzed and based on population stock estimates and stock modeling a total allowable quota of 10,000 tonnes annually was estimated as a conservative annual catch, which is considered sufficient to maintain a potential starfish meal industry. Effect of fishing was determined both for the population of starfish, the stock of mussels and benthic components like infauna and macroalgae. It was shown that using the starfish purse seine will have no or negligible effects on infauna and blue mussels. In terms of biodiversity and biomass of macroalgae, no significant effects of the purse seine, including a load of 300 tonnes of starfish in the net, could be detected. Torn of macro algae leafs were however detected in the purse seine after fishery over macro algae habitats and this was included in management advise on effects of starfish fisheries. A guide for management including recommendations on environmental impact and starfish populations were developed.

This project was coordinated by DTU Aqua.
The project was funded by the Danish Ministry of Food, Agriculture and Fisheries and the European Fisheries Fund (EFF).

National Institute of Aquatic Resources
Danish Shellfish Centre
Department of Applied Mathematics and Computer Science
Foreningen Muslingeerhvervet
Centraforeningen for Limfjorden
Period: 01/01/2014 → 30/06/2015
Number of participants: 6
Research areas: Shellfish and seaweed & Coastal Ecology & Marine Living Resources & Ecosystem based Marine Management
Project participant:
Nielsen, Carsten Fomsgaard (Intern)
Fitridge, Isla (Intern)
Saurel, Camille (Intern)
Thygesen, Uffe Høgsbro (Intern)
Gislason, Henrik (Intern)
Project Coordinator:
Petersen, Jens Kjerulf (Intern)
Project

Parallelization of vortex methods
Parallelization of vortex methods using GPU, openMP, MPI, AVX vectorization.
Department of Wind Energy
Aeroelastic Design

Department of Applied Mathematics and Computer Science

Period: 01/12/2013 → 01/04/2015
Number of participants: 2
Project participant:

Branlard, Emmanuel Simon Pierre (Intern)
Sørensen, Hans Henrik Brandenborg (Intern)

Project

iCull
Herd-specific economic decision tool for farmers.

National Veterinary Institute
Section for Epidemiology
Section for Veterinary Epidemiology and public sector consultancy
Department of Applied Mathematics and Computer Science

Dynamical Systems
Period: 01/11/2013 → 31/10/2015
Number of participants: 6
Acronym: iCull
Project ID: 23176
Project participant:

Kirkeby, Carsten Thure (Intern)
Græsbøll, Kaare (Intern)
Project Manager, organisational:
Toft, Nils (Intern)
Project Manager, academic:
Hisham Beshara Halasa, Tariq (Intern)
Christiansen, Lasse Engbo (Intern)
Saxmose, Søren (Ekstern)

Relations
Activities:
SVEPM Annual Meeting 2015
Simulation modelling of paratuberculosis within herds
iCULL – A herd-specific tool for financial evaluation of the impact of paratuberculosis
14th international symposium on veterinary epidemiology and economics

Project

Sizing of Microparticles from Angular Scattering Ratio
This was the pilot project for DTU Compute's 'Number Cruncher Bootcamps' initiative. The results were presented at DTU's first Foodtech Bazaar, held in Roskilde on October 30 2013.

Department of Applied Mathematics and Computer Science
Scientific Computing

Department of Physics

Dynamical Systems
Period: 22/10/2013 → 23/10/2013
Number of participants: 2
Project participant:

Karamehmedovic, Mirza (Intern)
Project Manager, academic:
Hjorth, Poul G. (Intern)
CITS - Copenhagen ITS
Vision: A Green and Smart City
Objective: Demonstrate urban wifi-localization potentials

Problems:
- Traffic congestion and safety
- Traffic information flow to user entities and humans
- Environmental challenges caused by transportation
- Lack of cooperative connection and information systems between: people, vehicles, goods, assets, infrastructure, businesses, and public sector entities
- Lack of integrated smart city traffic and transport management systems, including information flows and user-platforms

Potentials:
- Ubiquitous data collection in Smart City platform architecture based on a background technological infrastructure
- Real-time ITS services and approaches for providing seamless connectivity, interoperability, and secure flow of information across all stakeholders
- General Crowd Management - Methods, Technology (Management and flow description of humans, cars, trucks, goods, assets, etc., through smart-id tagging)
- Digital infrastructure of a localization system consisting of transmitters and sensors in streetlight platforms
- Performance of experimental demonstrations of techniques and systems, consisting of advanced crowd-management systems and next-generation localization technology in Smart City applications
- Large-scale demonstrations connected to the street lamp project of Copenhagen and through visualization of use scenarios

National Space Institute
Geodesy
Office for Innovation & Sector Services
Department of Applied Mathematics and Computer Science
Dynamical Systems
Department of Transport

Transport policy and behaviour
Period: 01/10/2013 → 31/05/2014
Number of participants: 5
Acronym: CITS
Project participant:
Starke, Jens (Intern)
Bacher, Peder (Intern)
Nielsen, Thomas Alexander Sick (Intern)

Overton Chabre Holm, David (Intern)
Project Manager, academic:
Høeg, Per (Intern)
Project

Computational Landscape Genomics
Department of Applied Mathematics and Computer Science
Cognitive Systems
Period: 01/10/2013 → …
Number of participants: 4
Project participant:
Guillot, Gilles (Intern)
**Sensometrics: Multivariate analysis and mapping of sensory and consumer data**

Department of Mathematics  
Period: 15/09/2013 → 25/07/2018  
Number of participants: 3  
PhD Student:  
Belmonte, Federica (Intern)  
Supervisor:  
Christensen, Rune Haubo Bojesen (Intern)  
Main Supervisor:  
Brockhoff, Per B. (Intern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Institut stipendie (DTU)  
Project: PhD

**Population structure**

Department of Applied Mathematics and Computer Science  
Cognitive Systems  
Period: 01/07/2013 → …  
Number of participants: 2  
Project participant:  
Guillot, Gilles (Intern)  
Orlando, Ludovic (Ekstern)  
Project

**Efficient Large-Scale Reservoir Simulation on Modern Many-Core Hardware**

Department of Mathematics  
Period: 01/04/2013 → 30/09/2016  
Number of participants: 7  
PhD Student:  
Christensen, Max la Cour (Intern)  
Supervisor:  
Glømborg, Stefan Lemvig (Intern)  
Main Supervisor:  
Engsig-Karup, Allan Peter (Intern)  
Examiner:  
Hesthaven, Jan (Intern)  
Hesthaven, Jan (Intern)  
Lukyanov, Alexander (Ekstern)  
Lukyanov, Alexander (Ekstern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: ErhvervsPhD-ordningen VTU  

**Relations**

Publications:  
Multilevel techniques for Reservoir Simulation  
Project: PhD
Integrated Approaches to Food Allergen and Allergy Risk Management

The project will

a. investigate how maternal diet and infant feeding practices (including weaning) modulate the patterns and prevalence of allergies across Europe.
b. Establish risk factors for the development of severe reactions to food and identify associated biomarkers
c. Develop a clinically-validated tiered risk assessment and evidence-based risk management approach for food allergens for allergens in the food chain
d. Develop clinically-relevant multi-analyte methods of analysis suited to allergen management across the food chain

DTU FOOD is actively involved in c. where we work with intake data for food allergy risk assessment and models for risk assessment together with DTU Compute

National Food Institute
Division of Toxicology and Risk Assessment
Division of Nutrition
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Period: 01/03/2013 → 28/02/2017
Number of participants: 4
Acronym: iFAAM
Project participant:
Madsen, Charlotte Bernhard (Intern)
Christensen, Tue (Intern)
Brockhoff, Per B. (Intern)
Project Manager, academic:
Mills, Clare (Ekstern)

BLADERUNNER - Large scale cost-effective robotic production of advanced formwork

Department of Mechanical Engineering
Manufacturing Engineering
Department of Applied Mathematics and Computer Science
Mathematics
Danish Technological Institute
Period: 01/03/2013 → 31/08/2016
Number of participants: 3
Acronym: BLADERUNNER
Project ID: 76421
Project participant:
Hattel, Jesper Henri (Intern)
Petkov, Kiril (Intern)
Gravesen, Jens (Intern)

Deep Belief Nets for Topic Modeling

Applying traditional collaborative filtering to digital publishing is challenging because user data is very sparse due to the high volume of documents relative to the number of users. Content based approaches, on the other hand, is attractive because textual content is often very informative. In this paper we describe large-scale content based collaborative filtering for digital publishing. To solve the digital publishing recommender problem we compare two approaches: latent Dirichlet allocation (LDA) and deep belief nets (DBN) that both find low-dimensional latent representations for documents. Efficient retrieval can be carried out in the latent representation. We work both on public benchmarks and digital media content provided by Issuu, an online publishing platform. This project also comes with a deep belief nets toolbox for topic modeling tailored towards performance evaluation of the DBN model and comparisons to the LDA model.

Department of Applied Mathematics and Computer Science
Early Detection of Markers for Neurodegenerative Diseases

Early diagnosis of neurodegenerative diseases is vital in order to provide treatment and inhibit progression at the early stages. In that relation, it has been suggested that the K-complex (KC) density in sleep EEG might be correlated with a predisposition for neurodegenerative diseases.

In order to be able to investigate such a correlation, it is necessary to have a functional and reliable KC detection algorithm, as manual KC annotation is an extensive job.

In this project we developed a semi-automatic K-Complex detection algorithm, using wavelet transformation to identify pseudo-K-Complexes and various feature thresholds to reject false positives.

The algorithm was trained and tested on sleep EEG from two databases to enhance its general applicability.

Department of Applied Mathematics and Computer Science

Computational statistical methods in evolutionary biology

Development of new models, algorithms and programs to analyze genetic variation with application in conservation biology, epidemiology and medicine.

Department of Informatics and Mathematical Modeling

Technology-supported Risk Estimation by Predictive Assessment of Socio-technical Security

Information security threats to organisations have changed completely over the last decade, due to the complexity and dynamic nature of infrastructures and attacks. Successful attacks cost society billions a year, impacting vital services and the economy. Examples include StuxNet, using infected USB sticks to sabotage nuclear plants, and the DigiNotar attack, using fake digital certificates to spy on website traffic. New attacks cleverly exploit multiple organisational vulnerabilities, involving physical security and human behaviour. Defenders need to make rapid decisions regarding which attacks to block, as both infrastructure and attacker knowledge change rapidly.

Current risk management methods provide descriptive tools for assessing threats by systematic brainstorming. Attack opportunities will be identified and prevented only if people can conceive them. In today’s dynamic attack landscape, this process is too slow and exceeds the limits of human imaginative capability. Emerging security risks demand tool support to predict, prioritise, and prevent complex attacks systematically. The TREsPASS project will make this possible, by building an “attack navigator”. This navigator makes it possible to say which attack opportunities are possible, which of
them are the most urgent, and which countermeasures are most effective. To this end, the project combines knowledge from technical sciences (how vulnerable are protocols and software), social sciences (how likely are people to succumb to social engineering), and state-of-the-art industry processes and tools. By integrating European expertise on socio-technical security into a widely applicable and standardised framework, TREsPASS will reduce security incidents in Europe, and allow organisations and their customers to make informed decisions about security investments. This increased resilience of European businesses both large and small is vital to safeguarding the social and economic prospects of Europe.

Department of Informatics and Mathematical Modeling

Computer Science and Engineering

Language-Based Technology
Period: 01/11/2012 → 31/10/2016
Number of participants: 1
Acronym: TREsPASS
Project participant:
Probst, Christian W. (Intern)

Financing sources
Source: EU research programme (public)
Name of research programme: FP7-ICT-2011-8
Year of approval: 2012

SafeCores InfinIT Mini Project
To investigate the business potential and technical feasibility of Safe Programmable Intellectual Property (IP) Cores

Department of Applied Mathematics and Computer Science

Embedded Systems Engineering

Department of Informatics and Mathematical Modeling

Embedded Systems Engineering

Siemens A/S

Confiware ApS

Danfoss A/S
Period: 01/06/2012 → 31/01/2013
Number of participants: 4
Acronym: SafeCores
Project participant:
Pop, Paul (Intern)
Todirica, Edward Alexandru (Intern)
Petersen, Bjarne (Ekstern)
Project Manager, academic:
Stassen, Flemming (Intern)

Financing sources
Source: Public research council
Name of research programme: InfinIT
Amount: 216,000.00 Danish Kroner
Year of approval: 2012
Source: Other private funding (private)
Name of research programme: Siemens A/S
Amount: 107,100.00 Danish Kroner
Year of approval: 2012
Source: Other private funding (private)
Name of research programme: Sauer-Danfoss
Amount: 48,000.00 Danish Kroner
Year of approval: 2012
Source: Other private funding (private)
Name of research programme: Confiware ApS
Amount: 85,200.00 Danish Kroner
Year of approval: 2012
**Functional Safety for Industrial Components**
To investigate the technical feasibility of Safe Programmable Intellectual Property (IP) Cores realized on safe FPGAs.

(Project mhp ansøgning om støtte under HTF-programmet)

Department of Applied Mathematics and Computer Science
Embedded Systems Engineering
Confiware ApS
Danfoss A/S
Siemens A/S

University of Southern Denmark
Period: 01/02/2012 → 31/01/2013
Number of participants: 4
Acronym: SafeCores
Project participant:
Stassen, Flemming (Intern)
Todirica, Edward Alexandru (Intern)
Pop, Paul (Intern)
Petersen, Bjarne (Intern)

**EERA DTOC: European Energy Research Alliance Design Tools for Offshore wind farm Clusters**
The project is funded by the EU – Seventh Framework Programme (FP7) – and runs from January 2012 to June 2015. It is coordinated by the Technical University of Denmark - DTU Wind Energy.

The EERA-DTOC project combines expertise to develop a multidisciplinary integrated software tool for an optimized design of offshore wind farms and clusters of wind farms.

Charlotte Bay Hasager is the daily manager of the project.
Peter Hauge Madsen is coordinator.

Department of Wind Energy
Meteorology
Department of Applied Mathematics and Computer Science
Wind Energy Systems
Aeroelastic Design
Risø National Laboratory for Sustainable Energy

Fluid Mechanics
Period: 01/01/2012 → 30/06/2015
Number of participants: 15
Offshore wind, wind clusters, design, optimization
Acronym: EERA-DTOC
Project participant:
Giebel, Gregor (Intern)
Réthoré, Pierre-Elouan (Intern)
Cutululis, Nicolaos Antonio (Intern)
Badger, Merete (Intern)
Hahmann, Andrea N. (Intern)
Peña, Alfredo (Intern)
Badger, Jake (Intern)
Volker, Patrick (Intern)
Karagali, Ioanna (Intern)
Maule, Petr (Intern)
vander Laan, Paul (Intern)
Cutululis, Nicolaos Antonio (Intern)
Hansen, Kurt Schaldemose (Intern)
Project Manager, academic:
Hasager, Charlotte Bay (Intern)
Project Coordinator:
Madsen, Peter Hauge (Intern)

Relations

Activities:
Ocean winds from satellites – applications for offshore wind energy

Publications:
Shadowing effects of offshore wind farms - an idealised mesoscale study
Energy Yield Prediction of Offshore Wind Farm Clusters at the EERA-DTOC European Project
EERA DTOC wake results offshore
EERA Design Tool for Offshore wind farm Cluster (DTOC)
Offshore winds mapped from satellite remote sensing
Wind Farm Wake: The Horns Rev Photo Case
Transmission of wave energy through an offshore wind turbine farm

Heat Storage in Hot Aquifers

Department of Civil Engineering
Section for Geotechnics and Geology
Center for Energy Resources Engineering
Department of Informatics and Mathematical Modeling
Scientific Computing
Period: 01/01/2012 → 28/02/2015
Number of participants: 3
Number of related Ph.D. students: 1
Project participant:
Rosenbrand, Esther (Intern)
Mosegaard, Klaus (Intern)
Project Manager, academic:
Fabricius, Ida Lykke (Intern)
Project

Back Scatter Interferometric Sensor for label-free medical diagnostic assays
Co-supervisor for Ph.D project carried out by Søren Jepsen at Department of Health Science and Technology, Aalborg University

Department of Applied Mathematics and Computer Science
Period: 01/08/2011 → 01/08/2014
Number of participants: 5
Number of related Ph.D. students: 1
Phd Student:
Jepsen, Søren Terpager (Ekstern)
Supervisor:
Jørgensen, Thomas Martini (Intern)
Trydahl, Torleif (Ekstern)
Sørensen, Henrik Schiøtt (Ekstern)
Main Supervisor:
Kristensen, Søren Risom (Ekstern)

Relations
DemTech: Trustworthy Democratic Technology

Over the last several decades, information technology has transformed the electoral process, which is perhaps the most foundational process upon which democratic societies are built. Computers are gradually replacing the manual parts of the democratic process. For example, rather than hand-counting a vote for days, Microsoft Excel is used to tally results. Or, more locally relevant, a UNIX program is used to compute the seat assignments to parties in parliament, as has been done since 1962 here in Denmark.

Some of these changes make the overall process more efficient or economical. However, there is a risk of the process becoming less trustworthy. The deployed technology tends to be complex, and is therefore prone to programming error and vulnerable to malicious attacks. This, in turn, has an adverse effect on the very foundations of democracy. Voters are less likely to trust the electoral process, which inevitably leads to lower voter participation and cynicism. Consequently, virtually all e-voting researchers, hackers, and activists are against the introduction of computers in the democratic process.

The hypothesis of this research project is the following: Is it possible to modernize the electoral process, while balancing the trust of the people on the trustworthiness of the deployed technology?

In order to provide evidence in support of (or to refute) this hypothesis, we propose to design a rigorous software engineering principle, which we call trust by design, that reproduces the trust-instilling elements of the conventional democratic process in the new electronic infrastructure of elections. Together with our industry partners Aion and Siemens, we will develop electronic election technology based on the trust by design principle. Finally, working with Århus, Copenhagen, and Frederiksberg Municipalities, we will empirically evaluate the technology in order to analyze the social, political, and cultural implications inherent in the digital transformation of the democratic process.

The result of this project will be a computational democratic process and a reference technology platform for electronic elections that e-voting researchers, hackers, and activists the world-over will either (a) acknowledge as being trustworthy, correct, and secure enough for certain kinds of elections, or (b) we will refute the hypothesis and permanently close the door on the use of computers in the democratic process.

Regardless of the outcome, this research will provide decision makers, in Denmark and elsewhere, important and invaluable insights for how to modernize the democratic process without jeopardizing our fundamental democratic principles.
Heat Storage in Hot Aquifers

In this project, we will develop new technology to improve planning of energy storage in geothermal reservoirs through high-quality experiments and modelling. Geothermal reservoirs have high temperature, so energy may be stored in these geological layers with minimal heat loss. The technology will be based on a multidisciplinary approach combining small scale geochemistry/rock physics with large scale seismic inversion and history matching of production data. The focus will be on Danish geothermal reservoirs, because heat storage is likely to be the missing link in planning sustainable energy production in Denmark, where several sources of energy should interplay. Energy sources as waste incineration and wind are not controlled by immediate energy demands. By storing energy at low heat loss in hot aquifers, we obtain an effective interplay between different sources of energy. Thereby, the degree of coverage with sustainable energy can increase at an acceptable cost. It is the right time to do this, because geothermal plants are presently being installed in Denmark. Thus, the cost of establishing heat storage in geothermal reservoirs is relatively small. The imminent question with respect to establishing heat storage in geothermal reservoirs is how the reservoirs will react to the introduction of water with a higher temperature than the natural as compared to effects of injecting cold water: How will the reservoir rock react chemically and mechanically, how will the heat and fluid distribute in the reservoir, what is the energy loss related to this storage method, and how will a potential change in water chemistry influence the operation abilities of the geothermal plant? We will evaluate the technology in an international context by collaborating with researchers working with geothermal reservoirs in other European countries.
Contact person:
Azaroual, Mohamed (Ekstern)
Sliaupa, Saulius (Ekstern)
Khan, Amir (Ekstern)
Magtengaard, Jesper (Ekstern)
Moe, Steffen (Ekstern)
Foged, Magnus (Ekstern)
Elleriis, Jan (Ekstern)
Andersen, Flemming (Ekstern)
Project participant:
Rosenbrand, Esther (Intern)
Holmstykke, Hanne Dahl (Ekstern)
Lopez, Simon (Ekstern)
Bickauskas, Giedrius (Ekstern)
Mahler, Allan (Ekstern)
Røgen, Birte (Ekstern)
Project Manager, organisational:
Fabricius, Ida Lykke (Intern)
Mosegaard, Klaus (Intern)
Kjøller, Claus (Ekstern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Forskningsrådene - Andre
Amount: 5,658,000.00 Danish Kroner
Project

Heat Storage in Hot Aquifers
Department of Civil Engineering
Section for Geotechnics and Geology
Center for Energy Resources Engineering
Department of Informatics and Mathematical Modeling
Scientific Computing
Department of Environmental Engineering
Period: 01/03/2011 → 28/02/2012
Number of participants: 4
Project participant:
Mosegaard, Klaus (Intern)
Kjøller, Claus (Intern)
Phd Student:
Rosenbrand, Esther (Intern)
Project Manager, academic:
Fabricius, Ida Lykke (Intern)

Control & Surveillance of Automated Production Steps (a part of the inSPIRe Food)
Summary of project: Automation of many manual operations in the food industry is difficult, because the criteria for
process control are often based on tacit knowledge of the operator. Our hypothesis is that a route to optimal automation of
such operations is to register how the trained process operator makes decisions from observations of the process and
combining this knowledge with predictive modelling of input/output of the process units.
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
National Food Institute
Symmetry Techniques in Differential Geometry
Joint project with Andrew Swann (Aarhus University) and Martin Svensson (USD).
The aim is to apply loop group techniques and moment map techniques to problems arising in differential geometry and mathematical physics.

FNU Grant
Department of Applied Mathematics and Computer Science
Mathematics
Period: 01/01/2011 → 31/12/2013
Number of participants: 3
Acronym: Symmetry Techniques
Project participant:
Brander, David (Intern)
Svensson, Martin (Ekstern)
Swann, Andrew (Ekstern)

Financing sources
Source: Public research council
Name of research programme: Danish Council for Independent Research - Natural Sciences
Amount: 669,600.00 Danish Kroner
Year of approval: 2010
Project

Multivariate Analysis Techniques for Optimal Vision Design
Department of Informatics and Mathematical Modeling
Period: 01/10/2010 → 10/01/2011
Number of participants: 3
Phd Student:
Mazzaretto, Andrea (Intern)
Supervisor:
Clemmensen, Line Katrine Harder (Intern)
Main Supervisor:
Ersbøll, Bjarne Kjær (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD
Computational statistical methods in population genetics
Department of Informatics and Mathematical Modeling
Period: 01/09/2010 → 31/08/2012
Number of participants: 0

Facial recognition
Department of Informatics and Mathematical Modeling
Period: 01/09/2010 → 26/02/2014
Number of participants: 5
Phd Student:
Fagertun, Jens (Intern)
Main Supervisor:
Paulsen, Rasmus Reinhold (Intern)
Examiner:
Clemmensen, Line Katrine Harder (Intern)
Cootes, Timothy F. (Ekstern)
Hansen, Dan Witzner (Intern)

Round-trip Engineering of Service-Oriented Architectures
Department of Informatics and Mathematical Modeling
Period: 01/09/2010 → 22/11/2013
Number of participants: 6
Phd Student:
Carvalho Quaresma, Jose Nuno (Intern)
Supervisor:
Nielsen, Flemming (Intern)
Main Supervisor:
Probst, Christian W. (Intern)
Examiner:
Dragoni, Nicola (Intern)
Gollmann, Dieter (Ekstern)
Kammüller, Florian (Ekstern)

Hyveldynamik og strømningstopologi
Department of Informatics and Mathematical Modeling
Period: 01/08/2010 → 22/11/2013
Number of participants: 5
Phd Student:
Andersen, Morten (Intern)
Main Supervisor:
Brøns, Morten (Intern)
Examiner:
Bohr, Tomas (Intern)
Kanso, Eva (Ekstern)
Stremler, Mark A. (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

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**Static Analysis for Model Checking**
Department of Informatics and Mathematical Modeling
Period: 01/08/2010 → 25/10/2013
Number of participants: 6
Phd Student:
Terepeta, Michal Tomasz (Intern)
Supervisor:
Nielsen, Flemming (Intern)
Main Supervisor:
Nielsen, Hanne Riis (Intern)
Examiner:
Mödersheim, Sebastian Alexander (Intern)
Cortesi, Agostino (Ekstern)
Jensen, Thomas (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

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**Construction and decoding of algebraic codes**
Department of Informatics and Mathematical Modeling
Period: 01/07/2010 → 30/09/2013
Number of participants: 6
Phd Student:
Rosenkilde, Johan Sebastian Heesemann (Intern)
Supervisor:
Høholdt, Tom (Intern)
Main Supervisor:
Beelen, Peter (Intern)
Examiner:
Geil, Hans Olav (Ekstern)
Augot, Daniel (Ekstern)
Bossert, Martin (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

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**Nysted 2, Wakes**
The objective of this project is on basis of simple turbine measurements in a wind farm to identify, model and verify the basic mechanisms driving the increased loading experienced by turbines operating in offshore Wind farm.

Department of Wind Energy
Aeroelastic Design
Department of Applied Mathematics and Computer Science
Test and Measurements

Grontmij A/S
Period: 01/06/2010 → 30/06/2014
Number of participants: 4
Acronym: 43026 4610-PSO
Project participant:
Pedersen, Mads Mølgaard (Intern)
Aagaard Madsen, Helge (Intern)
Larsen, Torben J. (Intern)

Project Centre for imaging food quality

Department of Informatics and Mathematical Modeling
Department of Photonics Engineering
Danisco AS
Arla Foods
Danish Technological Institute
NKT Photonics A/S
Videometer A/S

Centre for imaging food quality

Period: 01/06/2010 → 31/12/2014
Number of participants: 4
Acronym: CIFQ
Project participant:
Jørgensen, Thomas Martini (Intern)
Kamran, Faisal (Intern)

Project Manager, organisational:
Andersen, Peter E. (Intern)
Larsen, Rasmus (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Forskningsrådene - Andre
Amount: 20,000,000.00 Danish Kroner

Project Models for the energy performance of low-energy houses

Department of Informatics and Mathematical Modeling
Period: 01/05/2010 → 24/01/2014
Number of participants: 6
Phd Student:
Andersen, Philip Hvidthøft Delff (Intern)
Supervisor:
Rode, Carsten (Intern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Hattel, Jesper Henri (Intern)
Heiselberg, Per (Ekstern)
Roels, Staf (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
**Numerical Methods for Reservoir Simulation and Optimization**

Department of Informatics and Mathematical Modeling  
Period: 01/05/2010 → 25/04/2014  
Number of participants: 5  
Phd Student:  
Capolei, Andrea (Intern)  
Main Supervisor:  
Jørgensen, John Bagterp (Intern)  
Examiner:  
Poulsen, Niels Kjøløstad (Intern)  
Jansen, Jan Dirk (Ekstern)  
Knudsen, Jørgen K. H. (Ekstern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Institut stipendie (DTU)  
Project: PhD

**Scientific GPU Computing for PDE Solvers**

Department of Informatics and Mathematical Modeling  
Period: 01/05/2010 → 12/12/2013  
Number of participants: 6  
Phd Student:  
Glimberg, Stefan Lemvig (Intern)  
Supervisor:  
Dammann, Bernd (Intern)  
Main Supervisor:  
Engsig-Karup, Allan Peter (Intern)  
Examiner:  
Walther, Jens Honore (Intern)  
Cai, Xing (Ekstern)  
Olson, Luke (Ekstern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Forskningsrådsfinansiering  
Project: PhD

**Anatomical surface reconstruction and optimization**

Department of Informatics and Mathematical Modeling  
Period: 15/04/2010 → 30/08/2013  
Number of participants: 6  
Phd Student:  
Jensen, Rasmus Ramsbøl (Intern)  
Supervisor:  
Poel, Mike van der (Intern)  
Main Supervisor:  
Paulsen, Rasmus Reinhold (Intern)  
Examiner:  
Bærentzen, Jakob Andreas (Intern)  
Olsen, Ole Fogh (Ekstern)  
Reyes, Mauricio (Ekstern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Institut, samfinansiering
**Determination of magnetic resonance imaging biomarkers for multiple sclerosis treatment effects**

Department of Informatics and Mathematical Modeling  
Period: 01/04/2010 → 17/06/2013  
Number of participants: 7  
Phd Student:  
Lyksborg, Mark (Intern)  
Supervisor:  
Dyrby, Tim Bjørn (Intern)  
Siebner, Hartwig R. (Ekstern)  
Main Supervisor:  
Larsen, Rasmus (Intern)  
Examiner:  
Paulsen, Rasmus Reinhold (Intern)  
Jones, Derek K. (Ekstern)  
Westin, Carl-Fredrik (Ekstern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Institut, samfinansiering  
Project: PhD  

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**Large Scale Machine Learning in High-dimensional Data**

Department of Informatics and Mathematical Modeling  
Period: 01/04/2010 → 30/08/2013  
Number of participants: 5  
Phd Student:  
Hansen, Toke Jansen (Intern)  
Main Supervisor:  
Hansen, Lars Kai (Intern)  
Examiner:  
Winther, Ole (Intern)  
Kjær, Troels Wesenberg (Ekstern)  
Müller, Klaus-Robert (Ekstern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Institut stipendie (DTU)  
Project: PhD  

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**Matematisk modellering af membranseparation**

Department of Informatics and Mathematical Modeling  
Period: 01/04/2010 → 20/03/2014  
Number of participants: 7  
Phd Student:  
Vinther, Frank (Intern)  
Supervisor:  
Meyer, Anne S. (Intern)  
Sørensen, Mads Peter (Intern)  
Main Supervisor:  
Brøns, Morten (Intern)  
Examiner:  
Hassager, Ole (Intern)  
Davis, Robert H. (Ekstern)  
Jönsson, Ann-Sofi (Ekstern)
**Power Management for Refrigeration Systems**

Department of Informatics and Mathematical Modeling  
Period: 01/04/2010 → 24/05/2013  
Number of participants: 8  
PhD Student:  
Hovgaard, Tobias Gybel (Intern)  
Supervisor:  
Blanke, Mogens (Intern)  
Larsen, Lars F. S. (Ekstern)  
Skovrup, Morten Juel (Intern)  
Main Supervisor:  
Jørgensen, John Bagterp (Intern)  
Examiner:  
Poulsen, Niels Kjølstad (Intern)  
Mølbak, Tommy (Intern)  
Mørari, Manfred (Ekstern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Institut stipendie (DTU) Samf.  
Project: PhD

**Integrated Modeling of Oil Reservoirs - seismic and geostatistical analysis**

Department of Informatics and Mathematical Modeling  
Period: 01/03/2010 → 30/08/2013  
Number of participants: 6  
PhD Student:  
Lange, Katrine (Intern)  
Supervisor:  
Hansen, Per Christian (Intern)  
Stenby, Erling Halfdan (Intern)  
Main Supervisor:  
Mosegaard, Klaus (Intern)  
Examiner:  
Knudsen, Per (Intern)  
Kolbjørnsen, Odd (Ekstern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: ErhvervsPhD-ordningen VTU  
Project: PhD

**Specifying and verifying medical robotics software to ensure harmless operation**

Department of Informatics and Mathematical Modeling  
Period: 01/03/2010 → 24/06/2014  
Number of participants: 6  
PhD Student:  
Herbert, Luke Thomas (Intern)  
Supervisor:  
Hansen, Michael Reichhardt (Intern)  
Main Supervisor:  
Sharp, Robin (Intern)
Automated Image-Based Procedures for Radio-Therapy Treatment Evaluation and Daily Dose Re-Planning

Department of Informatics and Mathematical Modeling
Period: 01/01/2010 → 22/11/2013
Number of participants: 8
PhD Student:
Bjerre, Troels (Intern)
Supervisor:
Aznar, Marianne (Ekstern)
Rosenschöld, Per Munck af (Ekstern)
Specht, Lena (Ekstern)
Main Supervisor:
Larsen, Rasmus (Intern)
Examiner:
Van Leemput, Koen (Intern)
Ourselin, Sebastien (Ekstern)
Sarrut, David (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Central digraphs

Department of Mathematics

California State University
Period: 01/01/2010 → 01/01/2011
Number of participants: 2
Project participant:
Leander, Gregor (Intern)
Thomassen, Carsten (Intern)

Project

Cryptanalysis of Some Lightweight Symmetric Ciphers

Department of Informatics and Mathematical Modeling
Period: 01/01/2010 → 22/03/2013
Number of participants: 7
PhD Student:
Abdelraheem, Mohamed Ahmed A. M. A. (Intern)
Supervisor:
Leander, Gregor (Intern)
Zenner, Erik (Intern)
Main Supervisor:
Knudsen, Lars Ramkilde (Intern)
Examiner:
Rechberger, Christian (Intern)
Canteaut, Anne Michele (Intern)
Emulated power and radiance minimization for safer cellular phones with longer lasting batteries

Department of Informatics and Mathematical Modeling
Period: 01/01/2010 → 25/10/2013
Number of participants: 6
Phd Student:
Musiige, Deogratius (Intern)
Supervisor:
Mioc, Darka (Intern)
Main Supervisor:
Antón Castro, Francesc/François (Intern)
Examiner:
Merayo, José M.G. (Intern)
De La Cruz Blas, Carlos A. (Ekstern)
Prasad, Ramjee (Ekstern)

Impact of Stochastic Generation on Electricity Market Dynamics

Department of Informatics and Mathematical Modeling
Period: 01/01/2010 → 30/08/2013
Number of participants: 7
Phd Student:
Zugno, Marco (Intern)
Supervisor:
Morales González, Juan Miguel (Intern)
Madsen, Henrik (Intern)
Main Supervisor:
Pinson, Pierre (Intern)
Examiner:
Rasmussen, Kourosh Marjani (Intern)
Boomsma (fhv. Kristoffersen), Trine Krogh (Intern)
Hobbs, Benjamin F. (Ekstern)

Modelling spread of Bluetongue and other vector borne diseases in Denmark and evaluation of intervention strategies

Department of Informatics and Mathematical Modeling
Period: 01/01/2010 → 22/03/2013
Number of participants: 6
Phd Student:
Græsbøll, Kaare (Intern)
Supervisor:
Enøe, Claes (Intern)
Main Supervisor:
Christiansen, Lasse Engbo (Intern)
Examiner:
Thygesen, Uffe Høgsbro (Intern)
Konradsen, Flemming (Ekstern)
de Koeijer, Aline A. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Quantitative assessment of course evaluation
Department of Informatics and Mathematical Modeling
Period: 01/01/2010 → 20/03/2014
Number of participants: 5
Phd Student:
Sliusarenko, Tamara (Intern)
Main Supervisor:
Ersbøll, Bjarne Kjær (Intern)
Examiner:
Konradsen, Knut (Intern)
Adawi, Tom W (Ekstern)
Malmi, Lauri T. E. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Dimension reduction methods applied to mechanical systems
Department of Informatics and Mathematical Modeling
Period: 15/12/2009 → 20/03/2014
Number of participants: 7
Phd Student:
Elmegård, Michael (Intern)
Supervisor:
Evgrafov, Anton (Intern)
Thomsen, Jon Juel (Intern)
Main Supervisor:
Starke, Jens (Intern)
Examiner:
Hjorth, Poul G. (Intern)
Kerschen, Gaëtan (Ekstern)
Sieber, Jan (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Logics and models for stochastic analysis of information systems
Department of Informatics and Mathematical Modeling
Period: 01/11/2009 → 07/03/2013
Number of participants: 6
Phd Student:
Zeng, Kebin (Intern)
Supervisor:
Nielsen, Flemming (Intern)
Main Supervisor:
Nielsen, Bo Friis (Intern)
Examiner:
Zhang, Lijun (Intern)
Buchholz, Peter (Ekstern)
Hillston, Jane (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Statistisk modellering af marine økosystemer
Department of Informatics and Mathematical Modeling
Period: 01/11/2009 → 30/08/2013
Number of participants: 7
Phd Student:
Berg, Casper Willestofte (Intern)
Supervisor:
Nielsen, Anders (Intern)
Thygesen, Uffe Høgsbro (Intern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Andersen, Ken Haste (Intern)
Cadigan, Noel G. (Ekstern)
Nielsen, Søren F. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Adaptable communication middleware for network on a chip based multi core architectures
Department of Informatics and Mathematical Modeling
Period: 01/10/2009 → 09/04/2013
Number of participants: 3
Phd Student:
Passas, Stavros (Intern)
Supervisor:
Madsen, Jan (Intern)
Main Supervisor:
Karlsson, Sven (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Attacker Models for Ubiquitous Computing
Department of Informatics and Mathematical Modeling
Period: 01/10/2009 → 24/05/2013
Number of participants: 5
Phd Student:
Papini, Davide (Intern)
Supervisor:
Jensen, Christian D. (Intern)
Main Supervisor:
Sharp, Robin (Intern)
Examiner:
Mödersheim, Sebastian Alexander (Intern)
Skou, Arne Joachim (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

**Tomography with Prior Information**
Department of Informatics and Mathematical Modeling
Period: 01/10/2009 → 17/06/2013
Number of participants: 7
Phd Student:
Jørgensen, Jakob Sauer (Intern)
Supervisor:
Schmidt, Søren (Intern)
Sidky, Emil (Ekstern)
Main Supervisor:
Hansen, Per Christian (Intern)
Examiner:
Larsen, Rasmus Werner (Intern)
Arridge, Simon R. (Ekstern)
Siltanen, Samuli (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

**System-Level Design of Continuous Flow Microfluidic Biochips**
Department of Informatics and Mathematical Modeling
Period: 15/09/2009 → 07/03/2013
Number of participants: 6
Phd Student:
Minhass, Wajid Hassan (Intern)
Supervisor:
Madsen, Jan (Intern)
Main Supervisor:
Pop, Paul (Intern)
Examiner:
Nannarelli, Alberto (Intern)
Catthoor, Francky (Ekstern)
Chakrabarty, Krishnendu (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

**Nordic Master School in Innovative Information and Communication Technologies**
Department of Applied Mathematics and Computer Science
Embedded Systems Engineering
Period: 01/09/2009 → 31/08/2013
Number of participants: 1
Acronym: NMS iICT
Project participant:
Stassen, Flemming (Intern)

Financing sources
Source: Other public support (public)
Name of research programme: Nordplus framework programme
Web address: http://www.nordplusonline.org/
Amount: 298,124.00 Danish Kroner
Year of approval: 2009

Relations
Activities:
Nordic Master School in Innovative ICT (NMS iICT) (External organisation)

Nordplus Framework Programme for Higher Education
Nordic Master School in Innovative Information and Communication Technologies
Department of Applied Mathematics and Computer Science
Embedded Systems Engineering
Period: 01/09/2009 → 31/08/2013
Number of participants: 3
Acronym: NMS iICT
Project participant:
Stassen, Flemming (Intern)
Pop, Paul (Intern)
Madsen, Jan (Intern)

Relations
Activities:
Nordic Master School in Innovative ICT (NMS iICT) (External organisation)

Combined Techniques of Static Analysis and Model Checking
Department of Informatics and Mathematical Modeling
Period: 01/09/2009 → 22/11/2012
Number of participants: 6
Phd Student:
Zhang, Fuyuan (Intern)
Supervisor:
Nielsen, Hanne Riis (Intern)
Main Supervisor:
Nielsen, Flemming (Intern)
Examiner:
Probst, Christian W. (Intern)
Dam, Mads (Ekstern)
Huth, Michael (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Development and Application of Image Analysis and Multivariate Statistics in Industrial Aquaculture Feed Production
Department of Informatics and Mathematical Modeling
Period: 01/09/2009 → 22/11/2012
Number of participants: 6
Phd Student:
Ljungqvist, Martin Georg (Intern)
Supervisor:
Frosch, Stina (Intern)
Main Supervisor:
Ersbøll, Bjarne Kjær (Intern)
Examiner:
Conradsen, Knut (Intern)
Christensen, Lars Bager (Intern)
Misimi, Ekrem (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

**Knowledge Discovery in the Blogosphere**
Department of Informatics and Mathematical Modeling
Period: 01/09/2009 → 31/10/2011
Number of participants: 2
Phd Student:
Szewczyk, Marcin Marek (Intern)
Main Supervisor:
Hansen, Lars Kai (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

**Mathematical Road Models for the Traffic Speed Deflectometer**
Department of Informatics and Mathematical Modeling
Period: 01/09/2009 → 22/03/2013
Number of participants: 6
Phd Student:
Pedersen, Louis (Intern)
Supervisor:
Knudsen, Kim (Intern)
Main Supervisor:
Hjorth, Poul G. (Intern)
Examiner:
Markvorsen, Steen (Intern)
Baltzer, Susanne (Ekstern)
Piau, Jean-Michel (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

**Model Predictive Control algorithms for pen and pump insulin administration**
Department of Informatics and Mathematical Modeling
Period: 01/09/2009 → 22/11/2012
Number of participants: 7
Phd Student:
Boiroux, Dimitri (Intern)
Supervisor:
Madsen, Henrik (Intern)
Statistical inference methods for evolutionary biology

Mathematical Statistics

Department of Informatics and Mathematical Modeling

Period: 01/09/2009 → 31/08/2012
Number of participants: 1
Acronym: EMILE
Project ID: 15778
Project Manager, organisational:
Guillot, Gilles (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Concurrent Aero-Servo-Elastic analysis and Design of wind turbines

Department of Informatics and Mathematical Modeling

Period: 15/08/2009 → 07/03/2013
Number of participants: 6
Phd Student:
Mirzaei, Mahmood (Intern)
Supervisor:
Niemann, Hans Henrik (Intern)
Main Supervisor:
Poulsen, Niels Kjølstad (Intern)
Examiner:
Jørgensen, John Bagterp (Intern)
Bottasso, Carlo L. (Ekstern)
Stoustrup, Jakob (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

Methodology for combining sensory properties with additional information in consumer acceptance studies of food products

The project focuses on method development for better understanding of consumer acceptance of food products with added values related to health benefits, environment and user-friendliness. The main goal is to develop and make available statistical methods that can be used to identify the important factors for consumer acceptance, their interactions and their optimal combinations. This will be achieved through the following contents: 1) Statistical method development with focus on the combined use of experimental design and multivariate analysis 2) Development of an easy-to-use open source software package 3) Industry based method development, 4) writing scientific papers, giving courses and producing a PhD degree in Sensometrics. The industrial effect will be 1) lowering the costs of product development, 2) reduced product development time 3) higher hit rate of new products and 4) better predictions of product
potential. Since most relevant Danish and Norwegian stakeholders are participating together with an interested international network in Netherlands, Australia and South Africa, the project will add to the already ongoing process of turning Denmark and Norway into one of the major international players for handling sensory and consumer data.

Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

National Food Institute
Research Group for Bioactives – Analysis and Application
Period: 01/08/2009 → 30/04/2015
Number of participants: 3
Acronym: ConsumerCheck
Project participant:
Bruun Brockhoff, Per (Ekstern)
Kuznetsova, Alexandra (Intern)
Hyldig, Grethe (Intern)

Financing sources
Source: Private funding (private)
Name of research programme: FødevareErhverv
Amount: 7,663,135.00 Danish Kroner

Project
Analysis of SHA-3 hash function/Formal analysis of cryptographic hash functions
Cryptographic hash functions are one of the most important tools used in the design of efficient cryptographic protocols such as digital signatures that enable secure communications over the Internet. Cryptographic protocols are often proved secure assuming that the underlying hash functions are secure. Ever since the hash function SHA-1 has been adopted as the Federal Information Processing Standard (FIPS) by the NIST, U.S, it has been deployed in many provably secure cryptographic protocols. Security vulnerabilities that are exposed in SHA-1 and other standard hash functions have dramatically reduced our confidence in using current hash functions as secure mechanisms in the cryptographic protocols. In search of a secure hash function, NIST, U.S, initiated a global competition in 2007 to select a new hash function by 2012 which will be referred to as SHA-3. Many popular hash function constructions and those submitted to the SHA-3 competition are based on block ciphers. The goal of this research project is to carry out formal as well as concrete analysis of hash functions based on block ciphers thereby contributing to the understanding of the theory of hash functions and selection of SHA-3. This analysis will strengthen our confidence in proving the security of cryptographic protocols and later implement them using hash functions whose security is known. This project has been sponsored by the Danish Research Council for Independent Research (Technology and Production Sciences and Natural Sciences) under the grant numbered 274-09-0096.

Department of Mathematics
Period: 01/08/2009 → 31/07/2011
Number of participants: 2
Hash functions, cryptanalysis, design, SHA-3 and NIST
Project ID: 274-09-0096
Contact person:
Knudsen, Lars Ramkilde (Intern)
Project Manager, organisational:
Gauravaram, Praveen (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Forskningsrådene - Andre
Amount: 159,060,000.00 Danish Kroner

Project
Kernel Methods for Machine Learning with life-sciences applications
Department of Informatics and Mathematical Modeling
Period: 01/08/2009 → 30/08/2013
Number of participants: 6
PhD Student:
Abrahamsen, Trine Julie (Intern)
Planning and evaluation of radio-therapeutic treatment of head-and-neck cancer using PET/CT scanning

Department of Informatics and Mathematical Modeling
Period: 01/08/2009 → 19/12/2012
Number of participants: 7
Phd Student: Hollensen, Christian (Intern)
Supervisor: Højgaard, Liselotte (Intern)
Main Supervisor: Larsen, Rasmus (Intern)
Examiner: Paulsen, Rasmus Reinhold (Intern)
Ballester, Miguel A. G. (Ekstern)
Visvikis, Dimitris (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Static Analysis and Model Checking of Software Systems

Department of Informatics and Mathematical Modeling
Period: 01/08/2009 → 25/10/2012
Number of participants: 6
Phd Student: Filipiuk, Piotr (Intern)
Supervisor: Nielson, Flemming (Intern)
Main Supervisor: Nielson, Hanne Riis (Intern)
Examiner: Probst, Christian W. (Intern)
Schmidt, David A. (Ekstern)
Seidl, Helmut (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Systems neuroimaging: Modeling non-linear information processing networks

Department of Informatics and Mathematical Modeling
Period: 01/08/2009 → 01/11/2015
Number of participants: 2
Phd Student:
Klinkby, Kristian Tjalfe (Intern)
Main Supervisor:
Hansen, Lars Kai (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Indikatorer på det fejlfrie byggeri
Department of Management Engineering
Planning and Management of the Built Environment
Department of Informatics and Mathematical Modeling
Period: 01/07/2009 → 31/12/2012
Number of participants: 3
Project participant:
Jørgensen, Kirsten (Intern)
Schultz, Casper Siebken (Intern)
Bonke, Sten (Intern)
Project

Device Centric Authentication for Ubiquitous Computing
Department of Informatics and Mathematical Modeling
Period: 15/06/2009 → 28/09/2012
Number of participants: 6
Phd Student:
Ahmed, Naveed (Intern)
Supervisor:
Zenner, Erik (Intern)
Main Supervisor:
Jensen, Christian D. (Intern)
Examiner:
Knudsen, Lars Ramkilde (Intern)
Crampton, Jason (Ekstern)
Knapskog, Svein Johan (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Cognizant Hearing Aids
Department of Informatics and Mathematical Modeling
Period: 02/06/2009 → 21/09/2012
Number of participants: 5
Phd Student:
Karadogan, Seliz Gülzen (Intern)
Main Supervisor:
Larsen, Jan (Intern)
Examiner:
Winther, Ole (Intern)
Jensen, Søren Holdt (Intern)
Schuller, Björn Wolfgang (Ekstern)
Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Formal approaches for Aspect-Oriented Systems
Department of Informatics and Mathematical Modeling
Period: 01/06/2009 → 28/09/2012
Number of participants: 6
Phd Student:
Hernandez, Alejandro Mario (Intern)
Supervisor:
Nielsen, Hanne Riis (Intern)
Main Supervisor:
Nielsen, Flemming (Intern)
Examiner:
Probst, Christian W. (Intern)
De Nicola, Rocco (Ekstern)
Hankin, Chris (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Formal methods for design and simulation of embedded systems
Department of Informatics and Mathematical Modeling
Period: 01/06/2009 → 30/08/2013
Number of participants: 6
Phd Student:
Jakobsen, Mikkel Koefoed (Intern)
Supervisor:
Hansen, Michael Reichhardt (Intern)
Main Supervisor:
Madsen, Jan (Intern)
Examiner:
Dragoni, Nicola (Intern)
Plosila, Juha Petteri (Ekstern)
Vain, Jüri (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Stokastisk dynamisk modellering til kort-tidsregulering af glukose/insulin-metabolismen
Department of Informatics and Mathematical Modeling
Period: 01/06/2009 → 12/12/2013
Number of participants: 6
Phd Student:
Duun-Henriksen, Anne Katrine (Intern)
Supervisor:
Jensen, Peter Ruhdal (Intern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Christiansen, Lasse Engbo (Intern)
Andreassen, Steen (Ekstern)
Gabrielsson, Johan (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Surface Reconstruction of Coherent Deformable 3D Scans with Topological Recovery

Department of Informatics and Mathematical Modeling
Period: 01/05/2009 → 31/10/2010
Number of participants: 4
Phd Student:
Giotis, Nikolaos (Intern)
Supervisor:
Bærentzen, Jakob Andreas (Intern)
Paulsen, Rasmus Reinhold (Intern)
Main Supervisor:
Antón Castro, Francesc/François (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Towards the Interactive ESS-Food Catalogue

Department of Informatics and Mathematical Modeling
Period: 01/05/2009 → 24/08/2012
Number of participants: 7
Phd Student:
Laursen, Lasse Farnung (Intern)
Supervisor:
Bærentzen, Jakob Andreas (Intern)
Christensen, Lars Bager (Intern)
Main Supervisor:
Ersbøll, Bjarne Kjær (Intern)
Examiner:
Carstensen, Jens Michael (Intern)
Madsen, Claus Brøndsgaard (Ekstern)
Sramek, Milos (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Active learning in cognitive information processing systems

Department of Informatics and Mathematical Modeling
Period: 01/04/2009 → 19/04/2013
Number of participants: 6
Phd Student:
Jensen, Bjørn Sand (Intern)
Supervisor:
Hansen, Lars Kai (Intern)
Main Supervisor:
Larsen, Jan (Intern)
Examiner:
Winther, Ole (Intern)
Electrophysiological correlates of spatiotemporal attention in humans

Department of Informatics and Mathematical Modeling
Period: 01/04/2009 → 21/09/2012
Number of participants: 6
Phd Student:
Nielsen, Simon (Intern)
Supervisor:
Hansen, Lars Kai (Intern)
Main Supervisor:
Andersen, Tobias (Intern)
Examiner:
Mørup, Morten (Intern)
Kyllingsbæk, Søren (Intern)
Nieuwenstein, Mark R. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Equation-Free Analysis of Mechanical Vibrations

Mechanical vibrations are the cause of substantial operational and safety related problems with many mechanical systems of major importance, in particular in transportation, energy production, and industry. This project aims towards the development of new mathematical techniques to systematically investigate the dependence of vibrations on model parameters (e.g. bearing or material coefficients). To achieve this, equation-free techniques (also called coarse analysis) will be used which allow to obtain an understanding of the dynamic behaviour on a macroscopic scale by disregarding large amounts of unimportant information on the microscopic scale. The method fills the gap between time simulations of complex numerical models, such as nonlinear finite element models (FEM), and stability and bifurcation analyses with much simpler analytical models. The reason is that it enables such informative analyses directly on the complex microscopic models without the (often approximative) derivation of equations of motion on a macroscopic level. Due to the high-dimensional variable and parameter spaces and resulting computational costs, it is not possible to obtain similar information by direct simulations. The scientific goal is to clarify the potential of this approach within an important area of mechanics, rotating machinery (e.g. a turbocharger), where the detailed understanding of time dependent complex models play important roles in the design process.

Department of Mathematics
Department of Mechanical Engineering
Period: 01/04/2009 → 31/03/2012
Number of participants: 3
Project Manager, organisational:
Starke, Jens (Intern)
Santos, Ilmar (Intern)
Thomsen, Jon Juel (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Forskningsrådene - Andre
Amount: 4,500,000.00 Danish Kroner
Project

Iso-geometric analysis and shape optimization in electromagnetism

Department of Mathematics
Fluid Optimisation Workflows for Highly Effective Automotive Development Processes

The automotive industry has recently seen a paradigmatic shift from design processes based on physical prototypes to a computationally aided product development process (PDP) based on virtual prototypes. To maintain the competitiveness of European car manufacturers, a significant reduction of lead development time is required. The main potential for improvement lies in further exploitation of virtual development and especially in further automation of these virtual processes through optimal design techniques. Optimal design techniques are mature and are being used in structural mechanics in the automotive industry, as well as in computational fluid dynamics (CFD) in the aeronautical industry. However, this potential has not yet been realised for CFD in the automotive industry. To integrate these methods into workflows within the routine PDP, the project will make advances with adjoint sensitivity methods, mesh-based and CAD-based shape optimisation, high-Reynolds number topology optimisation. Complete CFD optimisation workflows, i.e. chains of optimisation techniques adapted to the automotive processes for the early as well as later stages of development will be integrated into the PDP. Aspects of process stability, data management, storage, numerical efficiency will be addressed in conjunction with an analysis of current PDP practices. The current practices of organising the PDP will be analysed, the areas of potential for optimisation workflows identified and where necessary alterations of the PDP will be made. Key use cases within the design process defined by the two car manufacturers in the project will be demonstrated and the resulting reduction in lead time will be validated. European SMEs play a leading role in developing the software tools for the PDP and in supporting the car manufacturers in implementing these tools in their PDPs. Three SMEs with a track record of working with the automotive industry are partners in the project.
Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Forsk. EU - Rammeprogram
Amount: 2,500,000.00 Danish Kroner

Iso-geometric analysis and shape optimization in fluid mechanics

Department of Mathematics
Period: 01/02/2009 → 30/04/2012
Number of participants: 6
Phd Student:
Nørtoft, Peter (Intern)
Supervisor:
Pedersen, Niels Leergaard (Intern)
Main Supervisor:
Gravesen, Jens (Intern)
Examiner:
Stolpe, Mathias (Intern)
Bazilevs, Yuri (Ekstern)
Jüttler, Bert (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)

Development of tools for logbook and VMS data analysis (38751)
Objectives and Background
The project “Development of tools for logbook and VMS data analysis” was an EU project under studies for carrying out the common fisheries policy (No MARE/2008/10 Lot2). The aim of the project was to develop a set of standard protocols for coupling and simultaneous analyses of EU fisheries logbook and VMS satellite vessel record data.

Tasks and Deliverables
The process began with the construction of standardized data formats for logbook (EFLALO) and VMS (TACSAT). The software for analyzing the data took the form of a fully documented package called vmstools, built using the freeware package, R (http://cran.rproject.org/). Once the data have been imported into R in the correct format, a series of R programs or ‘functions’, linked by ‘scripts’ enable all tasks necessary to be completed in a single software environment. The software can ‘clean’ data and format input data, estimate distances between VMS positions, and métiers can be identified objectively from species assemblages in catch data using multivariate statistical techniques.
We have included a range of complimentary methods for determining fishing activity from VMS position registrations. Positions at sea, for example, can be distinguished from vessels in harbor or erroneous positions on land. Position registrations of vessels actually fishing can be separated from those engaged in other activities (e.g. steaming) using their speed in conjunction with other information such as vessel size and gear being used.
Logbook and VMS data can be merged such that high-resolution spatial maps of catches of various commercial species can be generated. Individual vessel tracks can be reconstructed for more realism through different interpolation techniques (both linear and non-linear, i.e. using Hermite spline functions). Further, all the fishing activity indicators required under the Data Collection Framework can be calculated using vmstools. The package can also be used to explore the impact of different spatial (grid size) and temporal aggregations (month, quarterly, annual) which need to be explicitly considered.
when assessing fishing impact on the sea floor. There are also scripts for displaying results using Google Earth which is a useful aid for dissemination.

The combination of all these routines ‘under one roof’ permitted and permits the construction of ‘Regional’ databases (i.e. FishFrame developed by DTU Aqua - a regional database hosted by one of the project partners) and scripts to produce output suitable for this are included with the vmstools package.

As proof of concept, all analyses performed within each work package have been tested, using the vmstools package, against national datasets with contributions from the French, Danish, Irish, UK and Dutch institutes. As an example, FishFrame has been populated with Dutch and Danish combined VMS and logbook data for 2005-2009.

The project demonstrated emphatically that logbook and VMS data from disparate countries with often different data collection regimens can be combined and compared using generic tools and that the output can be sent to regional databases permitting more holistic assessments of fishing activity.

The project has built further on the networks and platforms produced under EU FP6 EFIMAS Project coordinated by DTU Aqua, and the DTU Aqua team associated with the project has produced several peer reviewed journal papers under Lot 2.

The project is coordinated by Institute for Marine Resources and Ecosystem Studies (IMARES), Wageningen UR, The Netherlands.

This project is funded by EU, Framework Programme 7.

Software Engineering
National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Wageningen IMARES
Cefas
IFREMER
Marine Scotland
Sea Fisheries Institute
Marine Institute
Period: 01/01/2009 → 31/12/2012
Number of participants: 5
Research areas: Fisheries Management & Marine Living Resources
Project participant:
Bastardie, Francois (Intern)
Ulrich, Clara (Intern)
Egekvist, Josefine (Intern)
Degel, Henrik (Intern)
Project Manager, academic:
Nielsen, J. Rasmus (Intern)

NonLinear modelling for energy systems
Department of Informatics and Mathematical Modeling
Period: 01/01/2009 → 22/03/2013
Number of participants: 6
Phd Student:
Trombe, Pierre-Julien (Intern)
Supervisor:
Pinson, Pierre (Intern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Larsen, Rasmus Werner (Intern)
Greiner, Martin O. W. (Ekstern)
Thorarinsdottir, Thordis L. (Ekstern)

Financing sources
Source: Internal funding (public)
**Computation of Superconducting Wind Turbine Generators**

Department of Mathematics  
Period: 15/12/2008 → 24/05/2012  
Number of participants: 8  
Phd Student:  
Rodriguez Zermeno, Victor Manuel (Intern)  
Supervisor:  
Anbarasu, Ramasamy (Ekstern)  
Kjær, Philip Carne (Ekstern)  
Pedersen, Niels Falsig (Intern)  
Main Supervisor:  
Sørensen, Mads Peter (Intern)  
Examiner:  
Engsig-Karup, Allan Peter (Intern)  
Campbell, Archibald M. (Ekstern)  
Grilli, Francesco (Ekstern)  

**Financing sources**  
Source: Internal funding (public)

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**Integrative multimodal brain imaging**

Department of Informatics and Mathematical Modeling  
Period: 15/12/2008 → 30/04/2012  
Number of participants: 6  
Phd Student:  
Rasmussen, Peter Mondrup (Intern)  
Supervisor:  
Lund, Torben E. (Ekstern)  
Madsen, Kristoffer Hougaard (Intern)  
Main Supervisor:  
Hansen, Lars Kai (Intern)  
Examiner:  
Larsen, Jan (Ekstern)  
Siebner, Hartwig R. (Ekstern)  

**Financing sources**  
Source: Internal funding (public)

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**Billeder som objektivt mål for fødevarekvalitet**

Department of Informatics and Mathematical Modeling  
Period: 01/12/2008 → 19/04/2013  
Number of participants: 7  
Phd Student:  
Møller, Flemming (Intern)  
Supervisor:  
Carstensen, Jens Michael (Intern)  
Olesen, Susanne K. (Ekstern)  
Main Supervisor:  
Larsen, Rasmus (Intern)  
Examiner:
Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

Cranio-facial growth modelling
Department of Informatics and Mathematical Modeling
Period: 01/12/2008 → 24/05/2013
Number of participants: 9
Phd Student:
Thorup, Signe Strann (Intern)
Supervisor:
Darvann, Tron Andre (Intern)
Hermann, Nuno (Ekstern)
Kreiborg, Sven (Ekstern)
Paulsen, Rasmus Reinhold (Intern)
Main Supervisor:
Larsen, Rasmus (Intern)
Examiner:
Ersbøll, Bjarne Kjær (Intern)
Rueckert, Daniel (Ekstern)
Østergaard, Lasse Riis (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Motion Correction on High resolution Brain PET Imaging
Department of Informatics and Mathematical Modeling
Period: 15/11/2008 → 20/01/2012
Number of participants: 8
Phd Student:
Olesen, Oline Vinter (Intern)
Supervisor:
Højgaard, Liselotte (Intern)
Paulsen, Rasmus Reinhold (Intern)
Roed, Bjarne (Ekstern)
Main Supervisor:
Larsen, Rasmus (Intern)
Examiner:
Conradsen, Knut (Intern)
Bentzen, Søren Møller (Ekstern)
Reyes, Mauricio (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Challenges to safety posed by outsourcing and sub-contracting of critical tasks
iNTeg-Risk - Early Recognition, Monitoring and Integrated Management of Emerging, New Technology related Risks
COWI partner med DTU, Henning Boje Andersen
Modeling and Forecasting for Optimal Participation of Renewable Energy in Deregulated Energy Markets

Department of Informatics and Mathematical Modeling
Period: 01/11/2008 → 24/08/2012
Number of participants: 7
PhD Student:
Jónsson, Tryggvi (Intern)
Supervisor:
Nielsen, Torben Skov (Intern)
Poulsen, Niels Kjølstad (Intern)
Main Supervisor:
Pinson, Pierre (Intern)
Examiner:
Kulahci, Murat (Intern)
McSharry, Patrick E. (Ekstern)
Meibom, Peter (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Post quantum cryptology

Department of Mathematics
Period: 01/11/2008 → 21/12/2011
Number of participants: 6
PhD Student:
Gauthier Umana, Valérie (Intern)
Supervisor:
Leander, Gregor (Intern)
Main Supervisor:
Knudsen, Lars Ramkilde (Intern)
Examiner:
Beelen, Peter (Intern)
Canteaut, Anne Michele (Intern)
Johansson, Thomas (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Sensometrics: Thurstonian and Statistical Models

Department of Informatics and Mathematical Modeling
Period: 01/11/2008 → 24/08/2012
Number of participants: 5
PhD Student:
Christensen, Rune Haubo Bojesen (Intern)
Main Supervisor:
Brockhoff, Per B. (Intern)
Mathematical methods in complex systems: International Toyota CRDL Workshop

The workshop is organized by the Technical University of Denmark (DTU) with organizers Jens Starke (DTU), Viktor Jirsa (CNRS) and Thomas Brenner (University of Marburg) in cooperation with Toyota Central R&D Labs. (TCRDL). This is the third workshop in a series. The first Toyota workshop was organized in 2006 in Denmark, the second in 2007 in Austria. The workshop concentrates on mathematics itself, neuro-science and economics. The invited talks should address these topics either directly or should discuss methods with potential applications. The workshop intends to bring together experts from theory and experiments/practice to provide in a close circle a platform for fruitful discussions and also possible cooperations. Program: Takahiro Shiga (Toyota CRDL, Japan): "Math for better Mobility", Gemma Calvert (Warwick, UK): "The application of cognitive neuroscience techniques to industry", Jonathan Rubin (Pittsburgh, USA): "Some insights into central pattern generator activity patterns", Giulio Bottazzi (Scuola Superiore Sant'Anna, Pisa, Italy): "Market Equilibria under Procedural Rationality", Hans Georg Bock (University of Heidelberg, Germany): "Efficient Methods for Parameter Estimation and Optimum Experimental Design for Dynamic Processes", James Lu (Austrian Academy of Sciences, Linz, Austria): "Inverse bifurcation analysis with sparsity-promoting regularization", Olivier Oullier (Marseille, France): "Non-equivalence between levels of description in social neuroeconomics", Yuri Gaididei (Kiev, Ukraine): "Complex spatiotemporal behavior in driven asymmetrically coupled nonlinear elements", Ioannis Kevrekidis (Princeton, USA): "Coarse graining and the acceleration of agent/network based computations", Mario Maggioni (Università Cattolica del Sacro Cuore, Italy): "Modelling firms clusters learning mechanism and transaction costs", Reinoud Bootsma (Marseille, France): "Information and dynamics in goal-directed action", Mads P. Sørensen (Technical University of Denmark): "Stochastic and coherent dynamics of single and coupled beta cells", Gustavo Deco (Barcelona, Spain): "Stochastic dynamics as a principle of perception", Edriss S. Titi (University of California, Irvine and Weizmann, USA): "Turbulence - a Paradigm of Complex System".

Department of Mathematics
Toyota Central Research and Development Lab
Period: 15/10/2008 → 17/10/2008
Number of participants: 1
Project participant: Starke, Jens (Intern)

Machine Learning and Signal Processing in Miniaturized Sensor for Explosive Detection

Department of Informatics and Mathematical Modeling
Period: 01/10/2008 → 17/06/2013
Number of participants: 5
Phd Student: Alstrom, Tommy Sonne (Intern)
Main Supervisor: Larsen, Jan (Intern)
Examiner: Hansen, Lars Kai (Intern)
Kidmose, Preben (Intern)
Mandic, Danilo P. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD
Model based analysis of ethnic differences in Type 2 diabetes
Department of Informatics and Mathematical Modeling
Period: 01/10/2008 → 24/08/2012
Number of participants: 7
Phd Student:
Møller, Jonas Bech (Intern)
Supervisor:
Ingwersen, Steen Hvass (Ekstern)
Overgaard, Rune Viig (Intern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Brockhoff, Per B. (Intern)
Jacqmin, Philippe (Ekstern)
Madsbad, Sten (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Models for efficient integration of solar energy
Department of Informatics and Mathematical Modeling
Period: 01/10/2008 → 24/08/2012
Number of participants: 6
Phd Student:
Bacher, Peder (Intern)
Supervisor:
Nielsen, Henrik Aalborg (Intern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Christiansen, Lasse Engbo (Intern)
Paisson, Olafur Petur (Intern)
Taboada, Maria Jose Jimenez (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Oprational Shape Descriptors
Department of Informatics and Mathematical Modeling
Period: 01/10/2008 → 21/12/2011
Number of participants: 7
Phd Student:
Welnicka, Katarzyna (Intern)
Supervisor:
Aanæs, Henrik (Intern)
Larsen, Rasmus (Intern)
Main Supervisor:
Bærentzen, Jakob Andreas (Intern)
Examiner:
Conradsen, Knut (Intern)
P. Kobbelt, Leif (Ekstern)
Østergaard, Lasse Riis (Ekstern)
Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

HEROS in mathematics - a new way of learning
Department of Mathematics
Department of Informatics and Mathematical Modeling
Period: 01/09/2008 → 31/08/2010
Number of participants: 3
Project participant:
Sendrup, Linda (Intern)
Schmidt, Karsten (Intern)
Project Manager, organisational:
Rootzén, Helle (Intern)

Financing sources
Source: Forskningsprojekter - Andre ministerier og styrelser
Name of research programme: Forskningsprojekter - Andre ministerier og styrelser
Amount: 3,122,478.00 Danish Kroner
Project

Mathematical modelling and analysis of marine ecological systems with stage structures and size spectres
Department of Mathematics
Period: 01/09/2008 → 23/02/2012
Number of participants: 7
Phd Student:
Zhang, Lai (Intern)
Supervisor:
Andersen, Ken Haste (Intern)
Thygesen, Uffe Høgsbro (Intern)
Main Supervisor:
Knudsen, Kim (Intern)
Examiner:
Starke, Jens (Intern)
25_NN_Studenter/Øvrige medarb. (Ekstern)
Delius, Gustav W. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Mining of Ship Operation Data for Energy Conservation
Department of Informatics and Mathematical Modeling
Period: 01/09/2008 → 11/04/2012
Number of participants: 6
Phd Student:
Petersen, Jóan Petur (Intern)
Supervisor:
Jacobsen, Danjal Jakup (Intern)
Main Supervisor:
Winther, Ole (Intern)
Examiner:
Larsen, Jan (Ekstern)
Bertram, Volker (Ekstern)
Ohlsson, Mattias (Ekstern)
Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

Analysis and Optimization of Embedded Systems
Department of Informatics and Mathematical Modeling
Period: 01/08/2008 → 30/11/2010
Number of participants: 3
Phd Student:
Saraswat, Prabhat Kumar (Intern)
Supervisor:
Madsen, Jan (Intern)
Main Supervisor:
Pop, Paul (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

E-learning project HEROS for first year math - new ways of learning
The aim of this project is to develop a new web based learning platform for the course Engineering Mathematics 1 – a platform which combines cutting edge e-learning materials and strategies with lectures, textbooks, weekly menus, and Maple demos. The main task is to further support the multifaceted architecture of the course while still keeping it clear cut and transparent. The idea is to make room within this architecture for several interlinked teaching styles and teaching materials and thus enhance the possibility for the individual student to find and operate his or her own most effective learning style. New “nonlinear” learning objects including text files, animations, video clips etc. will be developed and packed in order to create multiple entries into the process of understanding the key mathematical concepts.

Mathematical Statistics
Department of Informatics and Mathematical Modeling

Geometry
Department of Mathematics
LearningLab DTU

Administration
Period: 01/08/2008 → 31/07/2010
Number of participants: 4
Project ID: 15647
Project participant:
Markvorsen, Steen (Intern)
Schmidt, Karsten (Intern)
Sendrup, Linda (Intern)
Project Manager, organisational:
Rootzén, Helle (Intern)

Financing sources
Source: Forskningsprojekter - Andre ministerier og styrelser
Name of research programme: Forskningsprojekter - Andre ministerier og styrelser
Amount: 3,435,155.00 Danish Kroner

Post quantum cryptology : New Cryptology
Project with support from Villum Kann Rasmussen Fonden. In collaboration with Ivan Damgaard, Aarhus University

Department of Mathematics
Period: 01/08/2008 → 31/07/2012
Number of participants: 4
Project participant:
SHA-3 hash function

Standard hash functions are used for efficient and secure information processing in many commercial applications. In the wake of successful cryptanalysis of several standard hash functions and their impact on the security of the several information processing applications, National Institute of Standards and Technology (NIST), USA has announced an international public competition to select the most secure and efficient hash function as the Advanced Hash Standard which will be referred to as SHA-3. The SHA-3 hash function augments the current secure hash standard FIPS 180-2 issued by NIST in 2002 and can be directly substituted for the hash functions in the FIPS 180-2 standard in the applications. Rigorous analysis of AHS submissions is quite essential in eliminating ineffective proposals and consequently in successful completion of the competition to select a hash function standard that would be capable of protecting the sensitive information for a foreseeable future. This research project aims to contribute to the selection of the new hash standard by carrying out the Analysis of some of the latest hash function designs and their applications in addition to the analysis of some of the hash function submissions to the AHS.

Department of Informatics and Mathematical Modeling

Department of Mathematics
Period: 01/08/2008 → 31/07/2009
Number of participants: 2
Hash functions, cryptanalysis, design, Advanced Hash Standard and NIST
Project ID: 274-08-0052
Project Manager, organisational:
Gauravaram, Praveen (Intern)
Knudsen, Lars Ramkilde (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Forskningsrådene - Andre
Amount: 770,175.00 Danish Kroner
Project

Adaptability and Autonomy in Embedded Systems

Department of Informatics and Mathematical Modeling
Period: 01/06/2008 → 28/09/2011
Number of participants: 6
Phd Student:
Boesen, Michael Reibel (Intern)
Supervisor:
Pop, Paul (Intern)
Main Supervisor:
Madsen, Jan (Intern)
Examiner:
Sparsø, Jens (Intern)
Codinachs, David Merodio (Ekstern)
Tempesti, Gianluca (Ekstern)

Financing sources
Source:Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD
**Constructing IT and Healthcare**

Department of Informatics and Mathematical Modeling  
Period: 01/05/2008 → 01/05/2012  
Number of participants: 4  
Acronym: CITH-Co  
Project participant:  
Bansler, Jørgen P. (Intern)  
Kensing, Finn (Ekstern)  
Schmidt, Kjeld (Ekstern)  
Project Manager, organisational:  
Havn, Erling C. (Intern)  

**Financing sources**  
Source: Forsk. Andre statslige danske i øvrigt  
Name of research programme: Forsk. Andre statslige danske i øvrigt  
Amount: 7,882,969.00 Danish Kroner  

Diplomingeniøruddannelse i Sundhedsteknologi  
Udvikling af Diplomingeniøruddannelse i Sundhedsteknologi.  

Relations:  
Activities: Sundhedsteknologi - metoder, praksis og perspektiver  
Center for Bachelor of Engineering Studies  
Center for Information Technology and Electronics  
Department of Electrical Engineering  
Department of Applied Mathematics and Computer Science  
Center for Continuing Education  
Office for Study Programmes and Student Affairs  
Center for Business and Innovation  
Period: 01/05/2008 → 31/12/2012  
Number of participants: 13  
Sundhedsteknologi, Telemedicin, Nye teknologiske platforme  
Project participant:  
Sørensen, John Aasted (Intern)  
Baden-Kristensen, Keld (Intern)  
Holst-Christensen, Bo (Intern)  
Sørensen, John Kryger (Intern)  
Munck-Fairwood, Roger (Intern)  
Bechmann, Henrik (Intern)  
Hauge, Anders (Intern)  
Olesen, Per (Intern)  
Jeppesen, Lau (Ekstern)  
Tolstrup, Jytte (Ekstern)  
Pilegaard, Marianne (Ekstern)  
Working partner:  
Lausten, Anette Kjeldal (Ekstern)  
Besenbacher, Bente (Ekstern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Ingeniørhøjskolen i København  
Amount: 1,200,000.00 Danish Kroner  

Knowledge Discovery in Neuroinformatics
Department of Informatics and Mathematical Modeling
Period: 01/05/2008 → 30/11/2011
Number of participants: 5
Phd Student:
Wilkowski, Bartlomiej (Intern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Examiner:
Larsen, Jan (Ekstern)
Andreasen, Troels (Ekstern)
Honkela, Timo (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

New vision technology for multidimensional quality monitoring of food processes
Department of Informatics and Mathematical Modeling
Period: 01/05/2008 → 31/08/2011
Number of participants: 6
Phd Student:
Dissing, Bjørn Skovlund (Intern)
Supervisor:
Adler-Nissen, Jens (Intern)
Main Supervisor:
Ersbøll, Bjarne Kjær (Intern)
Examiner:
Jørgensen, Bo Munk (Intern)
Christensen, Lars Bager (Intern)
Parkkinen, Jussi (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Online CT-scanning af slagtesvin
Department of Informatics and Mathematical Modeling
Period: 01/05/2008 → 28/09/2011
Number of participants: 7
Phd Student:
Mosbech, Thomas Hammershaimb (Intern)
Supervisor:
Christensen, Lars Bager (Intern)
Larsen, Rasmus (Intern)
Main Supervisor:
Ersbøll, Bjarne Kjær (Intern)
Examiner:
Conradsen, Knut (Intern)
Brandt, Sami (Ekstern)
Bünger, Lutz (Ekstern)

Financing sources
Source: Internal funding (public)
Global Optimization for Topology Design of Metallic Microstrips – Numerical Experiments and Documentation

Department of Mathematics
Toyota Central Research & Development Laboratories, Inc.
Period: 01/04/2008 → 31/03/2009
Number of participants: 3
Project participant:
Nomura, Tsuyoshi (Ekstern)
Kawamoto, Atsushi (Ekstern)
Project Manager, organisational:
Stolpe, Mathias (Intern)

Solar/electric heating systems in the future energy system

The two most powerful renewable energy sources are solar and wind energy. It is expected that an increasing part of our electricity consumption in the future will be covered by wind farms. This will result in an increased number of windy periods with a surplus of electricity and thereby a low electricity price. A concept where individual solar heating systems optimised for making use of electricity produced by wind turbines in these periods can facilitate the introduction of wind energy in large scale into the energy system and thereby contribute to increasing the part of our energy consumption covered by renewable energy sources. The heat is produced by the solar heating system and by the electric heating element(s)/heat pump, which, if possible, only should be in operation in periods where the solar heating system cannot fully cover the heat demand and where the electricity price is low, e.g. in windy periods with a high electricity production from wind turbines. The unit is equipped with a smart heat storage (variable auxiliary volume) and a smart control system based on prognosis for the electricity price, the heat demand of the house, the solar heat production of the solar heating system and weather forecasts. The project will elucidate how best to design an individual heating unit for one family houses based on the above principles. It is also elucidated how suitable the heating unit is for the home owner and for our future energy system. Different designs of the heating unit and the control system will be investigated and the most promising solutions tested experimentally. It is expected that the heating unit is more cost efficient than traditional solar heating systems and that it can be an attractive alternative to oil- and natural gas boilers, both from an economy and environmental point of view.

Section for Building Physics and Services
Department of Civil Engineering
Department of Informatics and Mathematical Modeling
Department of Mathematics
ENFOR A/S
Danish Meteorological Institute
AllSun A/S
COWI A/S

Period: 01/04/2008 → 31/12/2011
Number of participants: 5
Project ID: 25869
Project participant:
Perers, Bengt (Intern)
Andersen, Elsa (Intern)
Fan, Jianhua (Intern)
Bacher, Peder (Intern)
Project Manager, organisational:
Furbo, Simon (Intern)

Financing sources
A Framework for Constraint-Programming based Configuration

Department of Informatics and Mathematical Modeling
Period: 01/03/2008 → 28/09/2011
Number of participants: 7
Phd Student:
Queva, Matthieu Stéphane Benoit (Intern)
Supervisor:
Clausen, Jens (Intern)
Ricci, Laurent (Ekstern)
Main Supervisor:
Probst, Christian W. (Intern)
Examiner:
Fischer, Paul (Intern)
Felfernig, Alexander (Ekstern)
Hotz, Lothar (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Preconditioned Iterative Solvers for Image Reconstructions

Department of Informatics and Mathematical Modeling
Period: 01/03/2008 → 30/11/2008
Number of participants: 2
Phd Student:
Nasar, Noreen (Intern)
Main Supervisor:
Hansen, Per Christian (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Machine Learning for Integrating Biological Data Across Experimental Technologies

Department of Informatics and Mathematical Modeling
Period: 15/02/2008 → 01/06/2011
Number of participants: 5
Phd Student:
Henao, Ricardo (Intern)
Main Supervisor:
Winther, Ole (Intern)
Examiner:
Hansen, Lars Kai (Intern)
Girolami, Mark (Ekstern)
Vehtari, Aki (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD
Probabilistic Methods for Biomedical Signals

Department of Informatics and Mathematical Modeling
Period: 15/02/2008 → 31/08/2011
Number of participants: 6
Phd Student:
Stahlhut, Carsten (Intern)
Supervisor:
Winther, Ole (Intern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Examiner:
Larsen, Jan (Ekstern)
Müller, Klaus-Robert (Ekstern)
Sörnmo, Leif (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

A Framework for Modeling, Simulation ans Design Space Exploration of Digital Microfluidic Biochips

Department of Informatics and Mathematical Modeling
Period: 01/02/2008 → 31/08/2011
Number of participants: 6
Phd Student:
Maftei, Elena (Intern)
Supervisor:
Madsen, Jan (Intern)
Main Supervisor:
Pop, Paul (Intern)
Examiner:
Nannarelli, Alberto (Intern)
Chakrabarty, Krishnendu (Ekstern)
Peng, Zebo (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

An open database of 3D scans of the human head, ear, and torso
The aim of this project is to generate a database of high-resolution 3D scans of the head and torso of humans. The data will be presented on a web-portal where software to view, manipulate and process the data is also available. The intended users of the data and tools are students and researches working with acoustical modelling. Specifically, the data can for example be used to optimise spatial perception in hearing aids, boom design for headsets, and simulating individual head related transfer functions. Mathematical modelling of the sound field surrounding the head is an emerging discipline that has shown promise to alleviate some of the difficulties in for example designing and testing the performance of new hearing aid designs. However, current state-of-the arts methods are mostly based on synthetic data and the results are therefore somewhat misleading. The lack of data is mainly due to the difficulty in acquiring real 3D data of the human head and torso. Especially, the 3D geometry of the human ear is very difficult to obtain using traditional 3D acquisition techniques like CT, MR, and laser scanning. Recently, the 3D Laboratory at the school of dentistry at the University of Copenhagen obtained a 3dMD cranial scanner by a donation from the Oticon Foundation. This scanner can be used to capture high quality 3D scans of the head, ear (pinna and part of concha), and torso of humans. The aim of this project is to use the scanner at the 3D laboratory to capture the torso and head geometry of a group of test persons. Furthermore, ear impressions should be taken and scanned so the final and merged data is a precise 3D presentation of torso, head, and the ear canal.

Department of Informatics and Mathematical Modeling
Period: 01/02/2008 → 01/03/2011
Number of participants: 1
Acronym: OpenHATS
Project Manager, organisational:
Paulsen, Rasmus Reinhold (Intern)

Financing sources
Source: Forsk. Private danske - Fonde
Name of research programme: Forsk. Private danske - Fonde
Amount: 1,000,000.00 Danish Kroner

Integrating Design Decision Management with Model-based Software Development
Department of Informatics and Mathematical Modeling
Period: 01/02/2008 → 01/06/2011
Number of participants: 6
Phd Student:
Könemann, Patrick (Intern)
Supervisor:
Baumeister, Hubert (Intern)
Main Supervisor:
Kindler, Ekkart (Intern)
Examiner:
Stöffle, Harald (Intern)
Babar, Muhammad Ali (Ekstern)
Paige, Richard F. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Analysis of Body-Vortex Interactions
Department of Mathematics
Period: 01/01/2008 → 30/03/2011
Number of participants: 6
Phd Student:
Pedersen, Johan Rønby (Intern)
Supervisor:
Aref, Hassan (Intern)
Main Supervisor:
Brøns, Morten (Intern)
Examiner:
Bohr, Tomas (Intern)
Eckhardt, Bruno (Ekstern)
Williamson, Charles H. K. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Cryptanalysis of Symmetric Cryptographic Algorithms by means of Numerical Methods
Department of Mathematics
Period: 01/01/2008 → 02/03/2011
Number of participants: 5
Phd Student:
Borghoff, Julia (Intern)
Main Supervisor:
Knudsen, Lars Ramkilde (Intern)
Examiner:
Beelen, Peter (Intern)
Johansson, Thomas (Ekstern)
Rijmen, Vincent (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Cryptanalysis of symmetric-key ciphers: by means of Numerical Methods

Department of Mathematics
Period: 01/01/2008 → 31/12/2010
Number of participants: 3
Project participant:
Borghoff, Julia (Intern)
Matusiewicz, Krystian (Intern)

Project Manager, organisational:
Knudsen, Lars Ramkilde (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 2,400,000.00 Danish Kroner
Project

Image Analysis of Food Quality

Department of Informatics and Mathematical Modeling
Period: 01/01/2008 → 28/09/2011
Number of participants: 7
Phd Student:
Arngren, Morten (Intern)
Supervisor:
Hansen, Per W. (Ekstern)
Larsen, Rasmus (Intern)
Main Supervisor:
Larsen, Jan (Intern)
Examiner:
Hansen, Lars Kai (Intern)
vanden Berg, Frans W.J. (Intern)
Dias, Jose M. Bioucas (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Landscape genetics methods in fresh water biology: Genestream

Department of Informatics and Mathematical Modeling
Portugal Science Foundation
Period: 01/01/2008 → 31/12/2010
Number of participants: 0
Project
Numerical Methods for Simulation and Optimization of Enhanced Oil Recovery Methods

Department of Informatics and Mathematical Modeling
Period: 01/01/2008 → 24/08/2012
Number of participants: 6
Phd Student:
Völcker, Carsten (Intern)
Supervisor:
Thomsen, Per Grove (Intern)
Main Supervisor:
Jørgensen, John Bagterp (Intern)
Examiner:
Engsig-Karup, Allan Peter (Intern)
Foss, Bjarne Anton (Ekstern)
Kristensen, Morten Rode (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Optimizing the control of foot-and-mouth disease in Denmark by simulation

Section for Veterinary Epidemiology and public sector consultancy
Division of Veterinary Diagnostics and Research
National Veterinary Institute
DTU Data Analysis
Department of Informatics and Mathematical Modeling
University of Copenhagen
University of California at Davis
Danish Veterinary and Food Administration
United States Department of Agriculture
Danish Meat Association

Danish Cattle Federation
Period: 01/01/2008 → 31/12/2011
Number of participants: 12
Project ID: 22314
Contact person:
Christiansen, Lasse Engbo (Intern)
Lund, Mogens (Ekstern)
Willeberg, Preben (Ekstern)
Mortensen, Sten (Ekstern)
Forde-Folle, Kimberly N. (Ekstern)
Boklund, Anette (Ekstern)
Nielsen, Jørgen (Ekstern)
Project participant:
Stockmarr, Anders (Intern)
Hansen, Henning Otte (Ekstern)
Carpenter, Tim (Ekstern)
Miller, Ryan (Ekstern)
Project Manager, organisational:
Enøe, Claes (Intern)

Financing sources
Source: Forskningsprojekter - Fødevareministeriet
Spanning trees in cubic graphs
The number of spanning trees, acyclic orientations, and totally cyclic orientations are examples of evaluations of the Tutte polynomial which plays a central role in statistical mechanics. In the present project we investigate a conjecture of Merino and Welsh on the interplay between these invariants.

Department of Mathematics
Technical University of Denmark
Period: 01/01/2008 → 31/12/2009
Number of participants: 2
Project participant:
Thomassen, Carsten (Intern)
Cameron, Peter (Ekstern)

Financing sources
Source: Forsk. Andre offentlige og private - Udenlandske
Name of research programme: Forsk. Andre offentlige og private - Udenlandske
Amount: 50,000.00 Danish Kroner
Project

A Flexible Audio SoC Design Methodology
Department of Informatics and Mathematical Modeling
Period: 01/12/2007 → 31/08/2011
Number of participants: 5
Phd Student:
Tranberg-Hansen, Anders Sejer (Intern)
Main Supervisor:
Madsen, Jan (Intern)
Examiner:
Pop, Paul (Intern)
Eles, Petru (Ekstern)
Lindwer, Menno (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

Power and Thermal Management of System-on-chips
Department of Informatics and Mathematical Modeling
Period: 15/10/2007 → 01/06/2011
Number of participants: 6
Phd Student:
Liu, Wei (Intern)
Supervisor:
Madsen, Jan (Intern)
Main Supervisor:
Nannarelli, Alberto (Intern)
Examiner:
Pop, Paul (Intern)
Alonso, David Atienza (Ekstern)
Tisserand, Arnaud (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
3D deformation of objects with singularities

Department of Informatics and Mathematical Modeling
Period: 01/10/2007 → 02/02/2011
Number of participants: 4
Phd Student:
Misztal, Marek Krzysztof (Intern)
Examiner:
Larsen, Rasmus Werner (Intern)
Bargteil, Adam W. (Ekstern)
Sørensen, Thomas Sangild (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Analysis and Modelling of Chain Data

Department of Informatics and Mathematical Modeling
Period: 01/10/2007 → 05/09/2014
Number of participants: 5
Phd Student:
Kotwa, Ewelina Katarzyna (Intern)
Main Supervisor:
Brockhoff, Per B. (Intern)
Examiner:
Kulahci, Murat (Intern)
Rinnan, Åsmund (Ekstern)
Westad, Frank Ove (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Globaliseringsmidler
Project: PhD

Formal Ontologies + Natural language semantics = Ontological semantics

Department of Informatics and Mathematical Modeling
Period: 01/10/2007 → 22/06/2011
Number of participants: 6
Phd Student:
Szymczak, Bartlomiej Antoni (Intern)
Supervisor:
Jensen, Per Anker (Ekstern)
Main Supervisor:
Nilsson, Jørgen Fischer (Ekstern)
Examiner:
Villadsen, Jørgen (Intern)
Dybkjær, Hans (Ekstern)
Lenci, Alessandro (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD
Global Optimization for Topology Design of Metallic Microstrips – Implementation and Numerical Experiments

Department of Mathematics
Toyota Central Research & Development Laboratories, Inc.
Period: 01/10/2007 → 31/03/2008
Number of participants: 3
Project participant:
Stolpe, Mathias (Intern)
Nomura, Tsuyoshi (Ekstern)
Kawamoto, Atsushi (Ekstern)

Financing sources
Source: Sam.arb.aftaler - Udenlandske offentlige og private
Name of research programme: Sam.arb.aftaler - Udenlandske offentlige og private
Amount: 75,000.00 Danish Kroner

Grey box Modelling of Hydraulic Systems

Department of Informatics and Mathematical Modeling
Period: 01/10/2007 → 23/02/2012
Number of participants: 6
Phd Student:
Thordarson, Fannar Órn (Ekstern)
Supervisor:
Madsen, Henrik (Intern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Poulsen, Niels Kjølstad (Intern)
Rasmussen, Michael Robdrup (Ekstern)
Willems, Patrick (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Periodic wavelet frames
External financed

Department of Mathematics
Period: 01/10/2007 → 12/07/2010
Number of participants: 2
Project participant:
Christensen, Ole (Intern)
Say Song, Goh (Ekstern)

Financing sources
Source: Udenfor rammen
Name of research programme: Undent
Amount: 40,000.00 Danish Kroner
Project

Topology Optimization for Crashworthiness Design Using Approximate Procedures

Department of Mathematics
Period: 15/09/2007 → 30/03/2011
Number of participants: 6
Phd Student:
Amir, Oded (Intern)
Supervisor:
Sigmund, Ole (Intern)
Main Supervisor:
Stolpe, Mathias (Intern)
Examiner:
Evgrafov, Anton (Intern)
Klarbring, Anders (Ekstern)
Lund, Erik (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Geometric Analysis: Classification Theory of Riemannian Submanifolds
The general purpose of this project is to study the influence of curvature on the properties of solutions of certain partial differential equations whose leading symbol is the Laplacian or the p-Laplacian. One key instrument is the curvature controlled comparison of solutions in a given Riemannian (sub-)space with the corresponding solutions in a tailor made model space.

Geometry
Department of Mathematics
Universitat Jaume I
Period: 01/09/2007 → 01/09/2010
Number of participants: 2
Submanifolds, extrinsic balls, radial convexity, radial tangency, mean exit time, isoperimetric inequalities, volume bounds, parabolicity
Project participant:
Markvorsen, Steen (Intern)
Project Manager, organisational:
Palmer, Vicente (Ekstern)

Financing sources
Source: Forsk. Andre offentlige og private - Udenlandske
Name of research programme: Forsk. Andre offentlige og private - Udenlandske
Amount: 288,000.00 Danish Kroner
Project

Qualitative and Quantitative Security Analyses for ZigBee Wireless Sensor Networks
Department of Informatics and Mathematical Modeling
Period: 01/09/2007 → 30/03/2011
Number of participants: 6
Phd Student:
Yuksel, Ender (Intern)
Supervisor:
Nielsen, Flemming (Intern)
Main Supervisor:
Nielsen, Hanne Riis (Intern)
Examiner:
Madsen, Jan (Intern)
Gilmore, Stephen (Ekstern)
Martinelli, Fabio (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD
Verification of Stochastic Process Calculi
Department of Informatics and Mathematical Modeling
Period: 01/09/2007 → 22/06/2011
Number of participants: 7
Phd Student:
Skrypnyuk, Nataliya (Intern)
Supervisor:
Nielson, Hanne Riis (Intern)
Seidl, Helmut (Ekstern)
Main Supervisor:
Nielson, Flemming (Intern)
Examiner:
Probst, Christian W. (Intern)
Hankin, Chris (Ekstern)
Hermanns, Holger (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Applications of and statistical inference for Multivariate Matrix Exponential Distributions
Department of Informatics and Mathematical Modeling
Period: 15/08/2007 → 30/03/2011
Number of participants: 6
Phd Student:
Esparza, Luz Judith R (Intern)
Supervisor:
Bladt, Mogens (Intern)
Main Supervisor:
Nielsen, Bo Friis (Intern)
Examiner:
Thygesen, Uffe Høgsbro (Intern)
Casale, Giuliano (Ekstern)
Telek, Miklós (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Modelling, Simulation and Optimization of Object-Gripping by Robots
Department of Mathematics
Period: 15/08/2007 → 31/12/2010
Number of participants: 3
Phd Student:
Duun, Marie Bro (Intern)
Supervisor:
Petersen, Henrik Gordon (Ekstern)
Main Supervisor:
Hjorth, Poul G. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD
3D Printing and Scanning
This project is concerned with the theory and practice of 3D printing and 3D scanning. The project is concretely based upon a donation of a Z450 3D Printer and a Roland LPX 60 scanner from DTU’s Strategic Fund. The purpose is two-fold: To study and optimize 3D color printing and 3D scanning procedures on these platforms and to develop corresponding new assets for teaching, research, and prototyping in mathematics/geometry and applications. Part of the project is to interchange ideas concerning these topics with colleagues from DTU Mechanical Engineering, Informatics, Civil Engineering, and Chemistry. The findings and productions from this project will tentatively be integrated into the activities organized around Matematicum, the mathematical Inspiratorium at DTU Mathematics, as well as into the relevant DTU courses e.g.: 01005 Mathematics 1, 01234 Differential Geometry with Applications, and 02585 Computational Geometry Processing.

Geometry

Department of Mathematics
Period: 01/08/2007 → 01/01/2010
Number of participants: 3
Project ID: Grant from DTU's Strategic Fund 2007
Project participant:
Gravesen, Jens (Intern)
Madsen, Poul-Erik (Intern)
Project Manager, organisational:
Markvorsen, Steen (Intern)

Financing sources
Source: Udenfor rammen
Name of research programme: Ukendt
Amount: 300,000.00 Danish Kroner

Estimation of Conditional densities for predictions in nonlinear stochastic processes - with applications to wind power systems

Department of Informatics and Mathematical Modeling
Period: 01/08/2007 → 12/12/2013
Number of participants: 6
Phd Student:
Tastu, Julija (Intern)
Supervisor:
Pinson, Pierre (Intern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Poulsen, Niels Kjølstad (Intern)
Kariniotakis, George (Ekstern)
Lindström, Erik (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

In Silico Models of Blood Coagulation

Department of Mathematics
Period: 01/08/2007 → 20/04/2011
Number of participants: 7
Phd Student:
Andersen, Nina Marianne (Intern)
Supervisor:
Ingwersen, Steen Hvass (Ekstern)
Olsen, Ole Hvilsted (Ekstern)
Main Supervisor:
Sørensen, Mads Peter (Intern)
In Silico Models of Blood Coagulation: Industrial ph.d. (Erhvervsforskere)

The overall objective is to develop an in silico model of the blood coagulation system that can be used as a tool for improving the understanding of coagulation processes and supporting the development of new haemostatic agents. The complexity of the modeled system range from systems modeling homogeneous solutions to systems which involve flow and activated surfaces.

Department of Mathematics

Novo Nordisk A/S
Period: 01/08/2007 → 31/07/2010
Number of participants: 3

Project participant:
Olsen, Ole Hvilsted (Ekstern)
Project Manager, organisational:
Serensen, Mads Peter (Intern)
Ingerwersen, Steen Hvass (Ekstern)

Financing sources
Source: Forskningsprojekter - Erhvervsforskere, VTU
Name of research programme: Forskningsprojekter - Erhvervsforskere, VTU
Amount: 1,340,000.00 Danish Kroner
Project

Homotopy based 3D reconstruction of water columns from 2D cross section acoustic data

Department of Informatics and Mathematical Modeling
Period: 15/07/2007 → 29/09/2010
Number of participants: 5
Phd Student:
Sharma, Ojaswa (Intern)
Supervisor:
Christensen, Niels Jørgen (Intern)
Main Supervisor:
Antón Castro, Francesc/François (Intern)
Examiner:
Hansen, Vagn Lundsgaard (Intern)
Sellarès, Joan Antoni (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Cognitive components for contextual search of music

Department of Informatics and Mathematical Modeling
Period: 01/07/2007 → 29/09/2010
Number of participants: 5
Phd Student:
Petersen, Michael Kai (Intern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Functional Materials with Embedded Nano and Micro Struktures
The Danish Research and Innovation Government Agency (Forsknings- og Innovationssstyrelsen) has granted the innovation consortium "Functional Materials with Embedded Nano and Micro Struktures" (FINST) about 6 Mkr for the development of measuring techniques for industrial components and surfaces, which are modified on the nano and micro meter scale. Advanced measuring techniques are a necessary requisite for controlling the functionality of products on this scale. The metrological challenge is to develop normals and to make procedures for traceability of nano and micro scale industrial products. Together with COM, DTU, Department of Mathematics, DTU, is involved in modeling of measuring techniques based on optical diffraction of laser light from nano structured surfaces. Numerical simulations will constitute an integral part of the functionality of the measuring instruments under development.

Danish Institute of Fundamental Metrology
Department of Micro- and Nanotechnology
Department of Mathematics
Department of Photonics Engineering
FORCE Technology
CemeCon Scandinavia A/S
Ignis Photonyx A/S
SCF Technologies A/S
University of Southern Denmark
Period: 01/07/2007 → 30/06/2010
Number of participants: 9
Nano technology, Mathematical modelling, Optics, Metrology
Acronym: FINST
Project participant:
Bundgaard, Ole (Ekstern)
Mikkelsen, Niels Jørgen (Ekstern)
Holst, Jesper (Ekstern)
Bilenberg, Brian (Ekstern)
Mateiu, Ramona (Ekstern)
Morgen, Per (Ekstern)
Sørensen, Mads Peter (Ekstern)
Mørk, Jesper (Ekstern)
Project Manager, organisational:
Hansen, Poul Erik (Intern)

Matematicum : The mathematical inspiratorium at DTU
This project is concerned with the theme of unfolding mathematical concepts and results for students and other mathematically curious visitors to Matematicum via hands-on experiments and stories. Each story and activity is ideally centered around a well-defined mathematical crux, which is then to be uncovered, unfolded, and applied to properly understand a given, otherwise non-obvious – or maybe even mysterious – phenomenon. For example: How can two circular rotations combine to give the linear motion of a pump? What are the rotors actually doing in the Enigma encryption machine? Why and how does a (good) boomerang return? How do we make a swarm of intercommunicating robots
collaborate to solve a given task? How do the ants find or construct their shortest pathways? Which roofs pick up the most solar energy throughout the year? Concerning content and development of concept (as of December 2007): The Matematicum at the Department of Mathematics is a room which has now been arranged to receive up to 15 visitors at a time. A boomerang ‘story’ and a robot swarming ‘story’ have been implemented and tested. A 3D printer and 3D scanner have been installed. The printer is in full operation and supplies concrete models of geometric shape and function such as minimal surfaces and ingenious pumps. A fume cupboard is being installed for proper and safe post-processing of the 3D-printed objects. An original three-rotor German military Enigma machine has been purchased. We expect it to become the essential central ‘object’ for great ‘stories’ and activities in the Matematicum concerning the history and development of modern cryptology. Matematicum was officially opened at a reception at DTU Mathematics on March 6th 2008.

Geometry

Department of Mathematics
Period: 01/07/2007 → 01/12/2009
Number of participants: 5
Mathematical Inspiratorium
Project ID: 10109
Project participant:
Henriksen, Christian (Intern)
Schmidt, Karsten (Intern)
Knudsen, Lars Ramkilde (Intern)
Starke, Jens (Intern)
Project Manager, organisational:
Markvorsen, Steen (Intern)

Financing sources
Source: Forskningsrådene - SNF
Name of research programme: Forskningsrådene - STVF
Amount: 282,000.00 Danish Kroner
Source: Fors. Private danske - Fonde
Name of research programme: Forsk. Private danske - Fonde
Amount: 100,000.00 Danish Kroner
Source: Udenfor rammen
Name of research programme: Ukendt
Amount: 500,000.00 Danish Kroner
Source: Uddannelse. Statslige. Andre statslige
Name of research programme: Uddannelse. Statslige. Andre statslige
Amount: 48,000.00 Danish Kroner

Statistical modelling of tagging data from marine animals

Department of Informatics and Mathematical Modeling
Period: 01/07/2007 → 02/02/2011
Number of participants: 6
Phd Student:
Pedersen, Martin Wæver (Intern)
Supervisor:
Thygesen, Uffe Høgsbro (Intern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Poulsen, Niels Kjølstad (Intern)
Huse, Geir (Ekstern)
Zucchini, Walter (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

3D Shape Modelling using High Level Descriptors
Aspects for security policies

Department of Informatics and Mathematical Modeling
Period: 01/06/2007 → 08/12/2010
Number of participants: 6
Phd Student:
Yang, Fan (Intern)
Supervisor:
Nielsen, Hanne Riis (Intern)
Main Supervisor:
Nielsen, Flemming (Intern)
Examiner:
Probst, Christian W. (Intern)
De Nicola, Rocco (Ekstern)
Südholt, Mario (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

A Systems Approach to Structure form Motion

Department of Informatics and Mathematical Modeling
Period: 01/06/2007 → 31/07/2009
Number of participants: 3
Phd Student:
Perfanov, Vesselin Kirilov (Intern)
Supervisor:
Aanaes, Henrik (Intern)
Main Supervisor:
Larsen, Rasmus (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Multi-material design optimization of composite structures

Department of Mathematics
Period: 01/06/2007 → 22/09/2010
Number of participants: 6
Phd Student: Munoz Queupumil, Eduardo Javier (Intern)
Supervisor: Lund, Erik (Ekstern)
Main Supervisor: Stolpe, Mathias (Intern)
Examiner: Høholdt, Tom (Intern)
Achtziger, Wolfgang (Intern)
Svanberg, Krister (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Model-based predictive control of wind turbines
Department of Informatics and Mathematical Modeling
Period: 15/05/2007 → 02/03/2011
Number of participants: 6
Phd Student: Henriksen, Lars Christian (Intern)
Supervisor: Hansen, Morten Hartvig (Intern)
Main Supervisor: Poulsen, Niels Kjølstad (Intern)
Examiner: Jørgensen, John Bagterp (Intern)
Engelen, T. G. van (Ekstern)
Per, Brath (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut/centerfinansieret
Project: PhD

Design of metamaterials
Metamaterials have interesting properties for wavepropagation and this project will investigate the use of topology optimization techniques for designing such materials and devices made from such materials.

Department of Mathematics
Department of Mechanical Engineering
Michigan State University
Period: 01/05/2007 → 31/12/2007
Number of participants: 3
Acronym: EDS
Project participant: Bendsøe, Martin P. (Intern)
Sigmund, Ole (Intern)
Diaz, Alejandro R. (Ekstern)

Financing sources
Source: Gaver, Private danske Fonde
Name of research programme: Gaver, Private danske Fonde
Amount: 80,000.00 Danish Kroner
Project
New vision technology for multidimensional quality monitoring of food processes

The trained process operator plays a key role in today’s food industry. His or her ability to judge processes such as continuous baking, roasting and frying processes by visual inspection is crucial. Automation has been slow due to inadequate technology. New forms of vision technology where the product is illuminated uniformly over a large area (50 cm²) and at specified wavelengths have the potential of matching much closer the visual judgement made by the trained process operator. The technology has proven its ability to difficult tasks in particle sorting and recent results indicate its large potential in food process control. The aim of the project is to investigate the potentials of this new vision technology and develop the technical/scientific basis for widespread use in process control of continuous baking, roasting and frying processes.

Division of Food Production Engineering
National Food Institute
Department of Systems Biology
Department of Informatics and Mathematical Modeling
Period: 15/03/2007 → 01/01/2012
Number of participants: 2

Project participant:
Adler-Nissen, Jens (Intern)
Project Manager, organisational:
Dissing, Bjørn Skovlund (Intern)

Automatic Quantitative Image Analysis of 3D Micrographs

Department of Informatics and Mathematical Modeling
Department of Energy Conversion and Storage
Imaging and Structural Analysis
Period: 01/03/2007 → 22/09/2010
Number of participants: 7
Phd Student:
Jørgensen, Peter Stanley (Intern)
Supervisor:
Bowen, Jacob R. (Intern)
Hansen, Karin Vels (Intern)
Main Supervisor:
Larsen, Rasmus (Intern)
Examiner:
Bærentzen, Jakob Andreas (Intern)
Barnett, Scott (Intern)
Østergaard, Lasse Riis (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Design of computer experiments
Department of Informatics and Mathematical Modeling
Period: 01/03/2007 → 08/12/2010
Number of participants: 6
Phd Student:
Dehlendorff, Christian (Intern)
Supervisor:
Kulahci, Murat (Intern)
Main Supervisor:
Andersen, Klaus Kaae (Intern)
Examiner:
Nielsen, Bo Friis (Intern)
Lophaven, Søren Nymand (Intern)
Tyssedal, John (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

An Investigation of Citizen ICT Safety and Security Awareness
Department of Informatics and Mathematical Modeling
Aarhus University
Danmarks IT-Center for Uddannelse og Forskning
Period: 01/02/2007 → 30/06/2009
Number of participants: 4
Acronym: CIT-AWARE
Project ID: 15545
Project participant:
Andersen, Preben (Ekstern)
Project Manager, organisational:
Sharp, Robin (Intern)
Gjedde, Lisa (Ekstern)
Meldgaard, Helle (Ekstern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Forskningsrådene - Andre
Amount: 1,999,999.00 Danish Kroner

PDE Control Mechanisms in Heterogeneous Media with Applications in Mathematical Bioscience
Department of Mathematics
Period: 01/02/2007 → 31/05/2009
Number of participants: 3
Phd Student:
Kaasen, Rune (Intern)
Online measurement of visual quality parameters after heat treatment

Many foodstuffs have the shape of small pieces or particles that are heat treated in continuous open processes (corn flakes e.g.). Such processes are monitored by trained process operators who visually evaluate the product quality. There is a great need to support the evaluations of the process operators with vision technological systems that quickly are able to reveal deviations from the desired visual quality and adjust the process hereafter. In the project a new advanced form of vision technology will be investigated, the device can because of its special design be expected to detect small differences in color and wrongly colored small particles. This vision technology differs from NIR (near infrared reflection) by giving detailed picture information and not just sporadic measurements. The aim is to obtain a robust, flexible vision technological solution that later can be implemented in different industrial food productions.
Wavelets in theory and practice
Department of Mathematics

Wavelets in theory and practice
Period: 01/01/2007 → 12/07/2011
Number of participants: 2
Project Manager, organisational:
Christensen, Ole (Intern)
Forster, Brigitte (Ekstern)

Financing sources
Source: Udenfor rammen
Name of research programme: Ukendt
Amount: 100,000.00 Danish Kroner

Global Optimization for Topology Design of Metallic Microstrips
Department of Mathematics

Toyota Central Research & Development Laboratories, Inc.
Period: 01/12/2006 → 31/03/2007
Number of participants: 3
Contact person:
Nymann, Camilla (Intern)
Project participant:
Stolpe, Mathias (Intern)
Nomura, Tsuyoshi (Ekstern)

Financing sources
Source: Sam.arb.aftaler - Udenlandske offentlige og private
Name of research programme: Sam.arb.aftaler - Udenlandske offentlige og private
Amount: 25,000.00 Danish Kroner

Decision Making and Uncertainty in Nonlinear Complex Systems : International Workshop in Helsingøer, Denmark
The workshop intends to promote the development and application of new methods for decision making and strategic planning in particular with respect to Uncertainty and Nonlinear Effects in Complex Systems through the discussion of a limited number of invited scientists with different research background from various fields. The invited talks address these topics either directly or discuss methods with potential applications thereby. Program: M. Makowski (IIASA): Certain decision-making for uncertain problems T. Brenner (MPI Jena): A stochastic model of industry location - The case of the automobile industry in Germany R. E. Wilson (Bristol): Road Traffic Modelling: Nonlinear Dynamics, Data, and Future Multiscale Directions J. Casti (Santa Fe/IIASA): Would-be worlds: Toward a theory of complex systems K. Sneppen (NBI): Communication and topology in networks M. Eiswirth (FHI Berlin): Stoichiometric network analysis M. Labbe (Université Libre de Bruxelles): Reliable communication network design: models and solution methods F. Schweitzer (ETH Zürich): The role of local effects in collective decision processes C. Siettos (National Technical University of Athens): Coarse-grained computations for agent-based market models: An equation-free approach to nonlinear analysis and control of complex systems G. Silverberg (UNU-MERIT/ University of Maastricht): What a Difference a Dimension Makes: Collective Search and "Rationality" in Complex Technology Spaces
Department of Mathematics

Toyota CRDL
Number of participants: 4
Project ID: 10097
Project Manager, organisational:
Starke, Jens (Intern)
Bendsøe, Martin P. (Intern)
Yamazaki, S. (Ekstern)
Kikuchi, N. (Ekstern)

Financing sources
Source: Forsk. Andre offentlige og private - Udenlandske
Name of research programme: Forsk. Andre offentlige og private - Udenlandske
Amount: 400,000.00 Danish Kroner

Ulineær optimal robust styring og vindmølle regulering
Department of Informatics and Mathematical Modeling
Period: 15/10/2006 → 29/09/2010
Number of participants: 5
Phd Student:
Thomsen, Sven Creutz (Intern)
Supervisor:
Niemann, Hans Henrik (Intern)
Main Supervisor:
Poulsen, Niels Kjølstad (Intern)
Examiner:
Jørgensen, John Bagterp (Intern)
Stoustrup, Jakob (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Network-on-chip: Applikationer og topologioptimering
Department of Informatics and Mathematical Modeling
Period: 01/10/2006 → 30/06/2010
Number of participants: 6
Phd Student:
Stuart, Matthias Bo (Intern)
Supervisor:
Nannarelli, Alberto (Intern)
Main Supervisor:
Sparsø, Jens (Intern)
Examiner:
Pop, Paul (Intern)
Jantsch, Axel (Ekstern)
Pimentel, Andrew David (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD
Nonlinear Stochastic Modelling of Antimicrobial resistance in Bacterial Populations

Department of Informatics and Mathematical Modeling
Period: 01/10/2006 → 30/06/2010
Number of participants: 6
Phd Student:
Philipsen, Kirsten Riber (Intern)
Supervisor:
Christiansen, Lasse Engbo (Intern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Molin, Søren (Intern)
Diekmann, Odo (Ekstern)
Ersbøll, Annette Kjær (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

PLATO-N : A PLAtform for Topology Optimisation incorporating Novel, Large-Scale, Free Material Optimisation and Mixed Integer Programming Methods

PLATO-N aims to overcome the limitations of current state-of-the-art topology optimisation tools in order to enable integration of optimisation assistance into the conceptual design process of the European aerospace industry. The following operational parameters, performance criteria and novel features are targeted: a) a reduction of turn-around time for practical solutions b) an increase of manageable problem size c) an increase in the number of manageable load cases d) consideration of composite materials, and post-processing tailored to exploit composite material features e) extension to multidisciplinary design criteria (stress, displacements, etc.) The strategic decisions that have been taken in terms of research goals are that: [1] The platform should be flexible with respect to the inclusion of new optimization algorithms and visualization tools, and it should provide a range of tools and modelling approaches geared to aeronautical needs. [2] The large-scale optimization algorithms should employ some form of algorithm based on a development of dedicated first-order methods. [3] The method should be extended to plate and shell problems and should be able to handle multiple objectives such as stiffness, vibration, and buckling problems. [4] An algorithm should be developed in order to handle local constraints. [5] Benchmark examples should be generated using mixed-integer convex models. [6] The results should be interpreted and visualized in a manner consistent with aerospace needs, e.g., shell structures using laminate lay-ups. [7] The platform should be tested on examples of industrial origin.

Department of Mathematics
Technion-Israel Institute of Technology
Universität Bayreuth
Friedrich-Alexander University Erlangen-Nuremberg
Academy of Sciences of the Czech Republic
Johannes Kepler University of Linz
Altair (UK) Ltd.
European Aeronautic Defence and Space Company
Airbus UK
Eurocopter
Period: 01/10/2006 → 30/09/2009
Number of participants: 4
Contact person:
Nymann, Camilla (Intern)
Project participant:
Stainko, Roman (Intern)
Project Manager, organisational:
Bendsøe, Martin P. (Intern)
Stolpe, Mathias (Intern)
Systemarkitekturer baseret på Network-on-Chip

Department of Informatics and Mathematical Modeling
Period: 01/10/2006 → 29/09/2010
Number of participants: 7
Phd Student:
Rasmussen, Morten Sleth (Intern)
Supervisor:
Karlsson, Sven (Intern)
Madsen, Jan (Intern)
Main Supervisor:
Sparsø, Jens (Intern)
Examiner:
Probst, Christian W. (Intern)
Grahn, Håkan (Ekstern)
Nurmi, Jari Antero (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie

Relations
Publications:
Support for Programming Models in Network-on-Chip-based Many-core Systems
Project: PhD

Wind Turbine with Trailing Edge Flaps for Load Alleviation

Department of Informatics and Mathematical Modeling
Period: 01/10/2006 → 30/06/2010
Number of participants: 8
Phd Student:
Andersen, Peter Bjørn (Intern)
Supervisor:
Bak, Christian (Intern)
Buhl, Thomas (Intern)
Gaunaa, Mac (Intern)
Main Supervisor:
Poulsen, Niels Kjølstad (Intern)
Examiner:
Knudsen, Torben (Ekstern)
Wedel-Heinen, Jens Jakob (Ekstern)
van Kuik, G. A. M. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Risø (Løn)
Project: PhD

Analysis and Optimization of Dynamical Processes on Networks

Dynamical processes on networks are relevant in many application areas like transportation networks, communication networks, economic networks and production networks in flexible manufacturing systems. It is a common aim in all these cases to better understand and finally optimize the corresponding dynamical processes and networks. In this regard, one major interest is the investigation of macroscopic pattern formation on the network structures. Examples for such patterns are technological propagation (traveling front) in economic networks or waves of traffic jams (traveling pulses) in transportation networks.
Department of Mathematics

Toyota CRDL
Period: 01/09/2006 → 31/08/2009
Number of participants: 2
Project ID: 10088
Project participant:
Berkemer, Rainer (Intern)
Project Manager, organisational:
Starke, Jens (Intern)

Financing sources
Source: Forsk. Andre offentlige og private - Udenlandske
Name of research programme: Forsk. Andre offentlige og private - Udenlandske
Amount: 2,162,400.00 Danish Kroner

Applied topological fluid mechanics: Bioreactors and bluff body wakes

Department of Mathematics
Monash University
Period: 01/09/2006 → 06/03/2007
Number of participants: 2
Contact person:
Hourigan, Kerry (Ekstern)
Project Manager, organisational:
Brøns, Morten (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 138,768.00 Danish Kroner

Approximate Inference for wireless Communications

Department of Informatics and Mathematical Modeling
Period: 01/09/2006 → 31/03/2010
Number of participants: 6
Phd Student:
Hansen, Morten (Intern)
Supervisor:
Christensen, Lars P.B. (Intern)
Main Supervisor:
Winther, Ole (Intern)
Examiner:
Larsen, Jan (Ekstern)
Jensen, Søren Holdt (Intern)
Mandic, Danilo P. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Classification of Meromorphic Vector Fields
A complex polynomial defines a holomorphic vector field in the complex plane. The quasi-conformal conjugacy class of the polynomial is completely determined by a combinatorial invariant. Furthermore, within each combinatorial class the polynomial is uniquely determined by a finite number (settled by the combinatorial class) of complex numbers. This fundamental classification of complex polynomial vector fields is proved using surgery. Further developments are to classify possible bifurcations, to understand the decomposition of parameter spaces due to the different combinatorial classes and the bifurcations among them, and also to extend to meromorphic vector fields arising from rational functions.
on the Riemann sphere.

Department of Mathematics
Period: 01/09/2006 → 31/08/2009
Number of participants: 3

Holomorphic Dynamical Systems
Project participant:
Dias, Kealey (Intern)
Henriksen, Christian (Intern)

Project Manager, organisational:
Branner, Bodil (Intern)

Financing sources
Source: Ph.d Central finansieret
Name of research programme: Ph.d Central finansieret
Amount: 115,000.00 Danish Kroner

Cognitive Components in Sound Streams
Department of Informatics and Mathematical Modeling
Period: 01/09/2006 → 21/04/2010
Number of participants: 7
Phd Student:
Petersen, Anders (Intern)
Supervisor:
Hansen, Lars Kai (Intern)
Kyllingsbæk, Søren (Intern)
Main Supervisor:
Andersen, Tobias (Intern)
Examiner:
Larsen, Jan (Ekstern)
Bundesen, Claus (Ekstern)
Logan, Gordon D. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD

DCAMM Research School : International Researcher Education Activities
The DCAMM International Graduate Research School is part of the activities of DCAMM, the Danish Center for Applied Mathematics and Mechanics. DCAMM is a framework for internationally oriented scientific collaboration between staff members at a number of departments at the Technical University of Denmark and Aalborg University. The Ph.D.-students of the School are members of DCAMM through the departments constituting DCAMM and they are enrolled in the relevant Ph.D. programmes at DTU and AAU. The School's role is to provide for an interdisciplinary framework for education of young researchers in an international research environment. An important activity of DCAMM and the Research School are the DCAMM SYMPOSIA. These are bi-annual 3 day workshops with presentations mostly by Ph.D. students and post.-docs. The School also maintains a programme of PH.D.-COURSES / ADVANCED SCHOOLS. These courses (2.5 to 5 ETCS) are typically held as short intensive courses of 5 to 9 working days, enabling participation by students from all DCAMM institutions, foreign students as well as participants from industry. The governing body of the School is the Scientific Council of DCAMM.

Department of Mathematics
Period: 01/09/2006 → 31/08/2011
Number of participants: 2
Project ID: 95-429-10091
Contact person:
Nymann, Camilla (Intern)
Project Manager, organisational:
Bendsøe, Martin P. (Intern)

Financing sources
**European Network of Funding Agencies - Coordination of National Complexity Research and Training Activities : EU contract no 036195**

Complexity and complex systems is an emergent and rapidly growing research field with a large technological potential, in which Europe has fostered scientific excellence with extensive collaboration across Europe and abroad. Based on the need to put stronger focus on this field and to further its high growth potential, 11 European Research Councils and Ministries initiated a consortium, in the form of a specific support action, aiming to establish the necessary environment for coordinating nationally strategically planned research activities.

Risø National Laboratory

Risø National Laboratory for Sustainable Energy

Department of Mathematics

Department of Physics

Period: 01/09/2006 → 31/08/2009

Number of participants: 6

Acronym: Complexity-NET

Project participant:

- Sørensen, Mads Peter (Intern)
- Mosekilde, Erik (Intern)
- Jensen, Mogens Hegh (Ekstern)
- Sørensen, Preben Graae (Ekstern)
- Sibani, Paolo (Ekstern)
- Project Manager, organisational:
  - Alstrøm, Preben (Ekstern)

**Financing sources**

Source: Forsk. EU - Andre EU-midler

Name of research programme: Forsk. EU - Andre EU-midler

Amount: 1,900,000.00 Danish Kroner

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**Meromorphic Vector Fields and Circle Packings**

Department of Mathematics

Period: 01/09/2006 → 10/02/2010

Number of participants: 6

Phd Student:

- Dias, Kealey (Intern)

Supervisor:

- Branner, Bodil (Intern)

Main Supervisor:

- Henriksen, Christian (Intern)

Examiner:

- Markvorsen, Steen (Intern)

- Epstein, Adam Lawrence (Ekstern)

- Petersen, Carsten Lunde (Intern)

**Financing sources**

Source: Internal funding (public)

Name of research programme: DTU-lønnet stipendie

Project: PhD

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**European Student Workshop on Mathematical Modelling in Industry and Commerce : ECMI Modelling Week**

The purpose of the student workshop is to train students in using mathematical modelling in development of technical systems and in economics. Project work was performed in groups of 5-6 students on industrial mathematics problems posed by supervisors from ECMI centers. Each group consists of an international mix of European and non-European students. The projects were concluded by oral presentations and written reports. The project was supported by the
ERASMUS Intensive Programme under the EU SOCRATES Programme. Grant agreement number: 29158-IC-1-2004-1-DK-ERASMUS-IPUC-1.

Department of Mathematics
Number of participants: 0
Project ID: 10076

Financing sources
Source: Uddannelse. EU. Andre EU-midler
Name of research programme: Uddannelse. EU. Andre EU-midler
Amount: 364,000.00 Danish Kroner

Call Center Capacity Planning
Department of Informatics and Mathematical Modeling
Period: 01/08/2006 → 31/03/2010
Number of participants: 6
Phd Student:
Nielsen, Thomas Bang (Intern)
Supervisor:
Iversen, Villy Bæk (Intern)
Main Supervisor:
Nielsen, Bo Friis (Intern)
Examiner:
Stolletz, Raik (Intern)
Borst, S.C. (Ekstern)
Nyberg, Christian (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnnet stipendie
Project: PhD

Identification of Ecological Thresholds of Sustainability in Marine Ecosystems
Department of Informatics and Mathematical Modeling
Period: 01/08/2006 → 25/05/2011
Number of participants: 6
Phd Student:
Møller, Jan Kloppenborg (Intern)
Supervisor:
Carstensen, Niels Jacob (Intern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Nielsen, Bo Friis (Intern)
Ditlevsen, Susanne (Ekstern)
Guttorp, Peter (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Intelligent Analysis and Compression of Multi-sensor Data
Department of Informatics and Mathematical Modeling
Period: 01/08/2006 → 01/06/2009
Number of participants: 3
Phd Student:
Francke, Mathias (Intern)
Supervisor: Hallundbæk, Jørgen (Ekstern)
Main Supervisor: Larsen, Jan (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

NordSecMob Master's Programme in Security and Mobile Computing
Department of Applied Mathematics and Computer Science
Embedded Systems Engineering
Aalto University
KTH - Royal Institute of Technology
Norwegian University of Science and Technology
University of Tartu
Period: 01/08/2006 → 31/07/2012
Number of participants: 1
Acronym: NordSecMob
Project participant: Stassen, Flemming (Intern)

Financing sources
Source: Public research council
Name of research programme: Nordplus
Amount: 151,000.00 Euro
Source: EU research programme (public)
Name of research programme: Erasmus Mundus
Amount: 4,844,000.00 Euro
Source: Unknown
Name of research programme: Tuition fees
Amount: 520,000.00 Euro

Second International Symposium on Bifurcations and Instabilities in Fluid Dynamics
Hydrodynamic stability is of fundamental importance in fluid dynamics and is a well-established subject of scientific investigation that continues to attract great interest of the fluid mechanics community. Hydrodynamic instabilities of prototypical character are, for example, the Rayleigh- Bénard, the Taylor-Couette, the Bénard-Marangoni, the Rayleigh-Taylor, and the Kelvin-Helmholtz instabilities. A fundamental understanding of various patterns of bifurcations such as identifying the most dominant mechanisms responsible for the instability threshold is also required if one is to design reliable and efficient industrial processes and applications, such as melting, mixing, crystal growth, coating, welding, flow re-attachment over wings, and others. The symposium aimed at bringing together scholars with mutual interest in computational, experimental, and theoretical methods for the analysis of bifurcation and instability phenomena in fluid dynamics. The conference took place 15-18 August 2006 with 40 participants. Proceedings will appear as a volume in Journal of Physics: Conference Series

Department of Mathematics
Department of Mechanical Engineering
Period: 01/08/2006 → 31/03/2007
Number of participants: 2
Acronym: BIFD2006
Project participant: Sørensen, Jens Nørkær (Intern)
Project Manager, organisational: Brøns, Morten (Intern)

Financing sources
Advanced Methods for Biological Shape Analysis

Department of Informatics and Mathematical Modeling
Number of participants: 6
Phd Student:
Hansen, Michael Sass (Intern)
Supervisor:
Ersbøll, Bjarne Kjær (Intern)
Main Supervisor:
Larsen, Rasmus (Intern)
Examiner:
Paarsen, Rasmus Reinhold (Intern)
Rueckert, Daniel (Ekstern)
Van Leemput, Koen (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Improved Statistical Analysis of Sleep EEG Data in Relation to Pharmacokinetics

Department of Informatics and Mathematical Modeling
Period: 01/07/2006 → 10/02/2010
Number of participants: 6
Phd Student:
Mortensen, Stig Bousgaard (Intern)
Supervisor:
Hougaard, Philip (Ekstern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Rootzén, Helle (Intern)
Jennum, Pouli (Ekstern)
Ryden, Tobias (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Predictive Tools for Designing new Insulins and Treatment Regimes

Department of Informatics and Mathematical Modeling
Period: 01/07/2006 → 16/12/2009
Number of participants: 7
Phd Student:
Klim, Søren (Intern)
Supervisor:
Ingwersen, Steen Hvass (Ekstern)
Kristensen, Niels Rode (Intern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Jørgensen, John Bagterp (Intern)
Gabrielsson, Johan (Ekstern)
Lavielle, Marc (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Tool Optimization for Welding Processes

Department of Mathematics
Period: 15/06/2006 → 10/02/2010
Number of participants: 7
PhD Student:
Larsen, Anders Astrup (Intern)
Supervisor:
Hattel, Jesper Henri (Intern)
Sigmund, Ole (Intern)
Main Supervisor:
Stolpe, Mathias (Intern)
Examiner:
Lindgren, Lars-Erik (Ekstern)
Duysinx, Pierre (Intern)
Lund, Erik (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

2+1 dimensional Topological Quantum Field Theories a la Yoshida

This project concerns the study of knots, links, and other low-dimensional objects. It is a mathematical project, but one of its central components is to develop techniques and mathematical quantities which are applicable to problems in modern biochemistry such as the investigation of mechanisms behind viruses (more of this below). The project involves the study of a certain family of link invariants called quantum invariants. The focus will be on obtaining a deeper knowledge about these invariants' ability to separate knots according to their topological type. To obtain such knowledge, research points in the direction that it is crucial to have a geometric understanding of quantum invariants. Today we are far from having such understanding. It is of crucial importance to know a given invariants ability to distinguish knot types if one wants to apply this invariant in an efficient way to biochemistry. There are different approaches to the quantum invariants. In this project we will focus on a new approach due to Tomoyoshi Yoshida, the Department of Mathematics at the Tokyo Institute of Technology, Japan. We believe for various technical reasons that his approach is particularly well suited to obtain a deeper geometric understanding of the quantum invariants. The complement of a given knot is the surrounding 3-dimensional space of the knot, i.e. the space left after removing a 'small' tubelike neighborhood of the knot. It turns out that we can study knots by studying their complements. Thus the study of knots can be seen as a part of the study of 3-dimensional spaces. So far Yoshida has constructed invariants of so-called closed 3-manifolds. Extensions of his theory are necessary to allow for boundaries which is necessary if we want to use his approach to study knots and 3-manifolds efficiently. Thus our first goal is to extend Yoshida's theory to a so-called 2+1 dimensional topological quantum field theory. Another goal is to calculate and geometrically interpret a certain asymptotic expansion of the invariants (the so-called large quantum level asymptotics). Certain calculations point in the direction that these asymptotics contain a wealth of geometric information about the quantum invariants. These results have led to a list of conjectures about these asymptotics. In the best case a full understanding of the large level asymptotics could give us a complete description of the quantum invariants ability to separate different knot types. Let us end by returning to viruses. Viruses attack cells in order to alter the DNA inside them. To do this, they bring closer certain parts of the DNA, then cut them and stick them back together differently in such a way that the molecule of DNA is transformed into a knot. One of the essential aspects of the struggle against viruses is to recognize the signature of different viruses by their effects on the DNA. One can characterize these effects by the topological (isotopy) type of knot which results from the action of the virus. But then it is necessary to be able to recognize the knot in question if one wants to find out which virus it is. The job is then to implement applications of suitable quantum invariants as knot detectors, but then it is crucial to know how good these invariants are as knot detectors. The project has received partial funding from the National Science Foundation (NSF) in USA, DMS-0604994.

Department of Mathematics
57th European Study Group with Industry

A Study Group is a forum where academic mathematicians work on problems directly related to industry. Workshops of this nature have taken place in Great Britain for a number of years, going back to 1963 when Prof. Alan Tayler started the Oxford Study Group with Industry. The coordination of Study Groups is now in the hands of European Consortium for Mathematics in Industry (ECMI), and the name is currently European Study Group with Industry (ESGI). At a meeting in 1997 of the ECMI Council it was decided that Study Groups should also be held outside Great Britain, and the first one of those was ESGI32 in Lyngby, Denmark. The format of a Study Group is a week long meeting (Monday - Friday) where a number of companies on the first day of the meeting each present a research problem they believe to be of a mathematical nature. Each such problem is taken up by a group of mathematicians who, together with the company representative, work towards the solution of the problem, through Thursday afternoon. Friday is used to present in a plenary session the results from each of the problem groups. The reasons for the continuing success of the Study Groups are simple: The industrial participants get, for a very modest sum, a highly qualified ‘think tank’ of mathematicians to focus on their particular research problem. Besides a full or partial resolution of the problem, the companies establish useful contacts with international researchers. The academics benefit from new ideas and challenges from the real world, providing inspiration for both education and their own research. The success criterion for a Study Group is that participating companies experience the meeting as useful and that it brings them a significant step closer to the resolution of their problem. For the Danish study groups we also have the goal that it will establish closer ties between Danish Industry and Danish mathematicians.

Department of Mathematics
University of Southern Denmark
Period: 01/05/2006 → 31/12/2006
Number of participants: 4
Acronym: ESGI57
Project ID: 10083
Project participant:
Gravesen, Jens (Intern)
Hjorth, Poul G. ( Intern)
Petersen, Henrik Gordon (Ekstern)
Willatzen, Morten (Ekstern)

Financing sources
Source: Udenfor rammen
Name of research programme: Ukendt
Amount: 60,000.00 Danish Kroner

Discrete Gabor systems and their applications

Department of Mathematics
Period: 01/05/2006 → 01/05/2008
Number of participants: 2
Project participant:
Christensen, Ole (Intern)
Kim, Rae Young (Ekstern)

Financing sources
Source: Udenfor rammen
Name of research programme: Ukendt
Amount: 50,000.00 Danish Kroner
Physical Models and Robust Estimation in Sensor Network Security

Department of Informatics and Mathematical Modeling
Period: 01/05/2006 → 31/08/2006
Number of participants: 2
Phd Student:
Rasmussen, Kasper Bonne (Intern)
Main Supervisor:
Madsen, Jan (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Shift-invariant systems and their duals

Department of Mathematics
Period: 01/05/2006 → 01/05/2007
Number of participants: 2
Project participant:
Christensen, Ole (Intern)
Sun, Wenchang (Ekstern)

Financing sources
Source: Udenfor rammen
Name of research programme: Ukendt
Amount: 20,000.00 Danish Kroner
Project

Evolution and adaptation of antimicrobial resistance in bacterial populations

It is generally believed that evolution of resistance occurs as a series of random single point mutations. However, we believe that emergence of new characters occurs as multiple mutations probably in sub-populations as a consequence of fluctuating stresses caused by lethal substances, such as antibiotics, and that these populations are so limited in size that the selection process is greatly affected by chance (stochastic). We will combine expertise in bacteriology, molecular biology, microbial epidemiology, mathematical modelling and phylogeny to study the evolution and adaptation of antimicrobial resistance in bacterial populations. Focus will be on resistance in staphylococci and Pseudomonas because of the major clinical problems with resistance in these bacteria. The results are expected to be useful in predicting appearance of new antimicrobial resistance problems, guide intervention strategies for the future, lead to new treatment strategies and possible also lead to industrial development of new biotechnologies based on evolutionary concepts.

Division of Microbiology and Risk Assessment
National Food Institute

Department of Informatics and Mathematical Modeling
University of Copenhagen
Period: 30/04/2006 → 31/03/2010
Number of participants: 11
Project participant:
Ingmer, Hanne (Ekstern)
Christensen, Henrik (Ekstern)
Ciofu, Oanu (Ekstern)
Andersen, Marianne T. (Ekstern)
Mandsberg, Lotte (Ekstern)
Jensen, Lars Bøg (Intern)
Hasman, Henrik (Intern)
Agersæ, Yvonne (Intern)
Madsen, Henrik (Ekstern)
Data-analyse i sparse, høj-dimensionale rum

Department of Informatics and Mathematical Modeling
Period: 01/04/2006 → 31/03/2010
Number of participants: 5
Phd Student:
Clemmensen, Line Katrine Harder (Intern)
Main Supervisor:
Ersbøll, Bjarne Kjær (Intern)
Examiner:
Larsen, Rasmus Werner (Intern)
Bigun, Josef (Ekstern)
Bro, Rasmus (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Methods for Investigation of QT Prolongations

Department of Informatics and Mathematical Modeling
Period: 01/04/2006 → 31/05/2010
Number of participants: 2
Phd Student:
Jónsdóttir, Anna Helga (Intern)
Main Supervisor:
Madsen, Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Search in Spoken Documents

Department of Informatics and Mathematical Modeling
Period: 01/04/2006 → 16/12/2009
Number of participants: 6
Phd Student:
Mølgaard, Lasse Lohilahti (Intern)
Supervisor:
Hansen, Lars Kai (Intern)
Main Supervisor:
Larsen, Jan (Intern)
Examiner:
Winther, Ole (Intern)
Andreasen, Troels (Ekstern)
Girolami, Mark (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD
Molecular Brain Imaging - New Data-analytic Strategies
Department of Informatics and Mathematical Modeling
Period: 15/03/2006 → 31/10/2007
Number of participants: 2
Phd Student:
Böðvarsson, Bjarni (Intern)
Main Supervisor:
Hansen, Lars Kai (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD

Data Assimilation in Marine Modelling
Department of Informatics and Mathematical Modeling
Period: 01/03/2006 → 25/11/2009
Number of participants: 6
Phd Student:
Frydendall, Jan (Intern)
Supervisor:
Sørensen, Jacob Viborg Tornfeldt (Intern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Poulsen, Niels Kjølstad (Intern)
Carstensen, Niels Jacob (Intern)
Heemink, Arnold Willem (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Programming Models and Tools for Intelligent Embedded Systems
Department of Informatics and Mathematical Modeling
Period: 01/03/2006 → 29/09/2010
Number of participants: 5
Phd Student:
Sørensen, Peter Verner Bojsen (Intern)
Main Supervisor:
Madsen, Jan (Intern)
Examiner:
Jensen, Christian D. (Intern)
Jerraya, Ahmed Amine (Ekstern)
Svensson, Bertil (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Automatisk kalibrering og attenuation korrektion i netværk af små vejrradar
Department of Informatics and Mathematical Modeling
Period: 01/02/2006 → 26/08/2009
Number of participants: 6
Phd Student:
Pedersen, Lisbeth (Intern)
Supervisor:
Jensen, Niels Einar (Ekstern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Mikkelsen, Peter Steen (Intern)
Overgaard, Søren (Ekstern)
Sempere-Torres, Daniel (Ekstern)

**Financing sources**
*Source: Internal funding (public)*
*Name of research programme: ErhvervsPhD-ordningen VTU*
*Project: PhD*

**Lighting Design and Real-time Global Illumination**
Department of Informatics and Mathematical Modeling
*Period: 01/02/2006 → 30/03/2011*
*Number of participants: 5*
Phd Student:
Kristensen, Anders Wang (Intern)
Main Supervisor:
Christensen, Niels Jørgen (Intern)
Examiner:
Bærentzen, Jakob Andreas (Intern)
Henriksen, Knud (Ekstern)
Myszkowski, Karol (Ekstern)

**Financing sources**
*Source: Internal funding (public)*
*Name of research programme: DTU-lønnet stipendie*
*Project: PhD*

**Graphs on higher surfaces**
This project is a collaboration between Dr. Ken-ichi Kawarabayashi, National Institute of Informatics, National Center of Science, Japan, and Professor Carsten Thomassen, DTU, concerning extendability of results on planar graphs to higher surfaces. The project is supported (in the form of travel expenses) by FNU (Rammebevilling i Diskret Matematik) and National Center of Science, Tokyo, Japan.

Department of Mathematics
National Institute of Informatics
*Period: 30/01/2006 → 31/12/2009*
*Number of participants: 1*
Project participant:
Thomassen, Carsten (Intern)

**Financing sources**
*Source: Udenfor rammen*
*Name of research programme: Ukendt*
*Amount: 60,000.00 Danish Kroner*

**Binary Curves of Genus 2**
Department of Mathematics
*Period: 01/01/2006 → 31/12/2006*
*Number of participants: 2*
Phd Student:
Birkner, Peter (Intern)
Main Supervisor:
Lange, Tanja (Intern)
Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

History of Mathematics
Planning and editing a volume on "History of Mathematics" for the monumental "Encyclopedia of Life Support Systems" (EOLSS), which is published under the auspices of UNESCO. Also author of a few of the articles. EOLSS attempts to forge pathways between disciplines in order to show their interdependence and helps foster the transdisciplinary aspects of the relationship between nature and human society. It deals in detail with interdisciplinary subjects, but it is also disciplinary as each major core subject is covered in great depth, by world experts.

LearningLab DTU
Technical Information Center of Denmark
Department of Mathematics
Period: 01/01/2006 → 31/12/2009
Number of participants: 1
Project Manager, organisational: Hansen, Vagn Lundsgaard (Intern)

Financing sources
Source: Uddannelse, udenlandske offentlige og private
Name of research programme: Uddannelse, udenlandske offentlige og private
Amount: 22,500.00 Danish Kroner

Innovative Joining Processes Applying Integrated Modelling
Advanced industrial product development is faced with steadily growing demands for joining new materials, often in dissimilar combinations, implying complicated joining problems. It is therefore imperative that manufacturing of joints in high tech products should be treated with scientific engineering methods. This is, however, seldom done to an extent justified by its importance. Although traditional arc welding processes have been subjected to numerical analysis of isolated problems such as temperature analysis, weld pool dynamics, microstructural evolution as well as transient and residual stress/strain and distortion analysis the idea of modeling with the aim of optimizing the entire process is still in its infancy state, and when it comes to more sophisticated processes like resistance welding (RW) and friction stir welding (FSW) even more basic numerical studies are in an early stage of development. Both of these processes need complex thermo-mechanical calculations, microstructural predictions as well as thorough analysis of large plastic deformations in order to predict weld strength and optimum welding parameters as well as final geometry. These problems are challenging and of multi-physics nature involving complex mechanisms comprising several cross-disciplinary areas such as materials science, thermodynamics, solid and fluid mechanics as well as process technology and applied numerical analysis. The objective of the present project is to develop advanced numerical models applicable for simulation of RW and FSW aiming at possible optimization of the entire processes. Focus will be set on overall numerical modelling strategies specific for each of the two welding processes as well as more detailed investigations of microstructures, mechanical properties, strength and weld quality.

Department of Management Engineering
Department of Mathematics
Department of Mechanical Engineering
Period: 01/01/2006 → 31/12/2009
Number of participants: 5
Acronym: INNOJoint
Project ID: 80700
Project participant:
Bay, Niels Oluf (Intern)
Somers, Marcel A. J. (Intern)
Project Manager, organisational:
Hattel, Jesper Henri (Intern)
Bendse, Martin P. (Intern)
Tvergaard, Viggo (Intern)

Financing sources
Source: Forskningsrådene - STVF
MECOBS- Modelling, Estimation and Control of Biotechnological Systems

Department of Mathematics
Period: 01/01/2006 → 31/12/2008
Number of participants: 1
Project Manager, organisational: Pedersen, Michael (Ekstern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 20,000,000.00 Danish Kroner

Multimodal Neuroaktivitetsanalyse

Department of Informatics and Mathematical Modeling
Period: 01/01/2006 → 21/12/2010
Number of participants: 6
PhD Student: Skimminge, Arnold Jesper Møller (Intern)
Supervisor: Baaré, William F. C. (Ekstern)
Main Supervisor: Larsen, Rasmus (Intern)
Examiner: Ersbøll, Bjarne Kjær (Intern)
Ashburner, John (Ekstern)
Østergaard, Lasse Riis (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD


Advanced industrial product development is faced with steadily growing demands for joining new materials, often in dissimilar combinations, implying complicated joining problems. It is therefore imperative that manufacturing of joints in high tech products should be treated with scientific engineering methods. This is, however, seldom done to an extent justified by its importance. Although traditional arc welding processes have been subjected to numerical analysis of isolated problems such as temperature analysis, weld pool dynamics, microstructural evolution as well as transient and residual stress/strain and distortion analysis the idea of modeling with the aim of optimizing the entire process is still in its infancy state, and when it comes to more sophisticated processes like resistance welding (RW) and friction stir welding (FSW) even more basic numerical studies are in an early stage of development. Both of these processes need complex thermo-mechanical calculations, microstructural predictions as well as thorough analysis of large plastic deformations in order to predict weld strength and optimum welding parameters as well as final geometry. These problems are challenging and of multi-physics nature involving complex mechanisms comprising several cross-disciplinary areas such as materials science, thermodynamics, solid and fluid mechanics as well as process technology and applied numerical analysis. The objective of the present project is to develop advanced numerical models applicable for simulation of RW and FSW aiming at possible optimization of the entire processes. Focus will be set on overall numerical modelling strategies specific for each of the two welding processes as well as more detailed investigations of microstructures, mechanical properties, strength and weld quality. The part of the project carried out at MAT is concerned with optimization of the welding processes using rational computational tools from optimal design and sensitivity analysis.

Department of Mathematics
Period: 01/01/2006 → 31/12/2009
Number of participants: 3
Acronym: INNOJOINT
Project ID: 95-429-10078
Project participant:
Bendsøe, Martin P. (Intern)
Bogomolny, Michael (Intern)
Larsen, Anders Astrup (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 1,871,000.00 Danish Kroner

The Virtual Slaughterhouse - Constructing a virtual Knife
Department of Informatics and Mathematical Modeling
Period: 01/01/2006 → 01/07/2009
Number of participants: 6
Phd Student:
Hansen, Mads Fogtmann (Intern)
Supervisor:
Christensen, Lars Bager (Intern)
Main Supervisor:
Larsen, Rasmus (Intern)
Examiner:
Nielsen, Allan Aasbjerg (Intern)
Bajcsy, Ruzena (Ekstern)
Modersitzki, Jan (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet

Topology Optimization Problems with Design-Dependent Sets of Constraints
Department of Mathematics
Period: 01/01/2006 → 30/06/2010
Number of participants: 7
Phd Student:
Schou, Marie-Louise Højlund (Intern)
Supervisor:
Evgrafov, Anton (Intern)
Sigmund, Ole (Intern)
Main Supervisor:
Stolpe, Mathias (Intern)
Examiner:
Jørgensen, John Bagterp (Intern)
Kocvara, Michal (Intern)
Svanberg, Krister (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie

Cryptographic Hash Functions
The aim of this project is to research cryptographic hash functions and their security, especially when such are used in digital signature protocols. Research will consist of both cryptanalysis and design of hash functions.

Department of Mathematics
Period: 01/12/2005 → 30/11/2008
Number of participants: 2
Project participant:
Thomsen, Søren Steffen (Intern)
Project Manager, organisational:
Knudsen, Lars Ramkilde (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 1,500,000.00 Danish Kroner

Project Kryptografiske hash-funktioner
Department of Mathematics
Period: 01/12/2005 → 27/02/2009
Number of participants: 5
Phd Student:
Thomsen, Søren Steffen (Intern)
Main Supervisor:
Knudsen, Lars Ramkilde (Intern)
Examiner:
Høholdt, Tom (Intern)
Johansson, Thomas (Ekstern)
Rijmen, Vincent (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Godkendelse og sporin af tømmerstokke ved 3D-billedbehandling
Department of Informatics and Mathematical Modeling
Period: 15/10/2005 → 27/05/2009
Number of participants: 7
Phd Student:
Dahl, Anders Bjorholm (Intern)
Supervisor:
Aanæs, Henrik (Intern)
Tarp-Johansen, Mads Jeppe (Ekstern)
Main Supervisor:
Ersbøll, Bjarne Kjær (Intern)
Examiner:
Hansen, Lars Kai (Intern)
Demirci, M. Fathi (Ekstern)
Sauter, Udo Hans (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Asynkrone Network-on-Chip
Department of Informatics and Mathematical Modeling
Period: 01/10/2005 → 31/07/2009
Number of participants: 2
Phd Student:
Stensgaard, Mikkel Bystrup (Intern)
Main Supervisor:
Sparsøe, Jens (Intern)
**Learning Based Compensation of Nonlinearities in Microspeakers**

Department of Informatics and Mathematical Modeling  
Period: 01/10/2005 → 15/04/2007  
Number of participants: 5  
PhD Student: Larsen, Allan Renneberg (Ekstern)  
Supervisor: Agerkvist, Finn T. (Intern)  
Munk, Steen M. (Intern)  
Rasmussen, Karsten Bo (Intern)  
Main Supervisor: Larsen, Jan (Intern)  

**Proceskapabilitet fra et industrielt perspektiv**

Department of Informatics and Mathematical Modeling  
Period: 01/10/2005 → 30/09/2010  
Number of participants: 6  
PhD Student: Windfeldt, Gitte Bjørg (Intern)  
Supervisor: Hartvig, Niels Væver (Ekstern)  
Main Supervisor: Rootzén, Helle (Intern)  
Examiner: Kulahci, Murat (Intern)  
Castagliola, Philippe (Ekstern)  
Thyregod, Peter (Intern)  

**Sensometri, Kvalitstssikring og optimal udnyttelse af sensoriske profil data**

Department of Informatics and Mathematical Modeling  
Period: 01/10/2005 → 31/01/2009  
Number of participants: 2  
PhD Student: Sommer, Niels Axel Bucumi (Intern)  
Main Supervisor: Brockhoff, Per B. (Intern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: DTU-lønnet stipendie  
Project: PhD
**Signalbehandling for proactive pervasive computing**

Department of Informatics and Mathematical Modeling  
Period: 01/10/2005 → 05/05/2009  
Number of participants: 5  
Phd Student:  
Nielsen, Andreas Brinch (Intern)  
Main Supervisor:  
Hansen, Lars Kai (Intern)  
Examiner:  
Larsen, Jan (Ekstern)  
Jensen, Søren Holdt (Intern)  
Oja, Erkki (Ekstern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: DTU-lønnet stipendie  
Project: PhD

**Logic-Based Solver Technology**

Department of Informatics and Mathematical Modeling  
Period: 15/09/2005 → 25/03/2009  
Number of participants: 5  
Phd Student:  
Zhang, Ye (Intern)  
Main Supervisor:  
Nielsen, Flemming (Intern)  
Examiner:  
Fischer, Paul (Intern)  
Hankin, Chris (Ekstern)  
Jensen, Thomas (Intern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Programbevilling  
Project: PhD

**Validation of Security Properties in Network Systems**

Department of Informatics and Mathematical Modeling  
Period: 15/09/2005 → 05/05/2009  
Number of participants: 6  
Phd Student:  
Nielsen, Christoffer Rosenkilde (Intern)  
Supervisor:  
Nielsen, Flemming (Intern)  
Main Supervisor:  
Nielsen, Hanne Riis (Intern)  
Examiner:  
Fischer, Paul (Intern)  
Mycroft, Alan (Ekstern)  
Viganò, Luca (Ekstern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: DTU-lønnet stipendie  
Project: PhD

**Digital Signatures**

Project to consider elliptic and hyperelliptic curve cryptography as an alternative to existing public-key systems.  
Investigation of the interplay between the public-key systems and hash functions to ensure good performance and
Department of Mathematics
Period: 01/09/2005 → 31/08/2008
Number of participants: 4
Project participant:
Lange, Tanja (Intern)
Thomsen, Søren Steffen (Intern)
Birkner, Peter (Intern)

Project Manager, organisational:
Knudsen, Lars Ramkilde (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 3,000,000.00 Danish Kroner


Mikro- og nanofluiders dynamik
Nonlinear acoustic wave phenomena, including shock waves, with relation to micro and nano fluids. Acoustic streaming.

Department of Mathematics
Period: 01/09/2005 → 31/08/2008
Number of participants: 1
Project participant:
Rasmussen, Anders Rønne (Intern)

Financing sources
Source: Ph.d Central finansieret
Name of research programme: Ph.d Central finansieret
Amount: 1,400,000.00 Danish Kroner

Mikro- og nanofluiders dynamik

Department of Mathematics
Period: 01/09/2005 → 26/08/2009
Number of participants: 5
Phd Student:
Rasmussen, Anders Rønne (Intern)
Supervisor:
Bruus, Henrik (Intern)
Main Supervisor:
Sørensen, Mads Peter (Intern)
Examiner:
Bohr, Tomas (Intern)
Jordan, Pedro M. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Numerisk approksimation af rand-kontrol problemer

Department of Mathematics
Number of participants: 7
Phd Student:
Mariegaard, Jesper Sandvig (Intern)
Supervisor:
Hansen, Per Christian (Intern)
Pedersen, Michael (Intern)
Main Supervisor:
Knudsen, Kim (Intern)
Examiner:
Sørensen, Mads Peter (Intern)
Hesthaven, Jan (Intern)
Hugger, Jens (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Læring og Interaktionsdesign af tekst input på mobile enheder
Department of Informatics and Mathematical Modeling
Period: 01/08/2005 → 01/07/2009
Number of participants: 6
Phd Student:
Proschowsky, Morten Smidt (Intern)
Supervisor:
Schultz, Nette (Intern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Examiner:
Larsen, Jan (Ekstern)
Dunlop, Mark (Ekstern)
Sikström, Sverker (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Lay-out design of advanced pump-heads
Department of Mathematics
Period: 01/08/2005 → 31/12/2005
Number of participants: 3
Project participant:
Schou, Marie-Louise Højlund (Intern)
Stolpe, Mathias (Intern)
Bendsøe, Martin P. (Intern)

Financing sources
Source: Indtægtsdækket virksomhed UK 90
Name of research programme: Indtægtsdækket virksomhed UK 90
Amount: 70,000.00 Danish Kroner
Project

Mean Distance, Curvature and Symmetry
We study measure theoretic metric invariants on metric spaces, with a view towards obtaining new invariants, which in combination can be powerful tools to describe the geometry of spaces/objects. An objective is to be able to describe the symmetry of an object via an invariant called symmetry ratio. A large range of metric spaces support these invariants. A fundamental idea in the project is to extend the classes of spaces, where it is possible to apply classical analysis tools by establishing a framework for translations and generalizations. In the other direction, we can also utilize this setup to get an influx of new ideas in the classical setting.

Department of Mathematics
Period: 01/08/2005 → 01/11/2007
Number of participants: 1
Project Manager, organisational:
Kokkendorff, Simon Lyngby (Intern)

Financing sources
Source: Forskningsrådene - SNF
Name of research programme: Forskningsrådene - STVF
Amount: 1,191,276.98 Danish Kroner

Probabilistic Methods in Multiple Target Tracking
Department of Informatics and Mathematical Modeling
Period: 01/08/2005 → 18/08/2010
Number of participants: 4
Phd Student:
Brink, Frederik Ettrup (Intern)
Supervisor:
Dall, Jørgen (Intern)
Tuxen, Fredrik (Ekstern)
Main Supervisor:
Hansen, Lars Kai (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU

Wavelet Frames in theory and Practice
Department of Mathematics
Period: 01/08/2005 → 05/11/2008
Number of participants: 5
Phd Student:
Lemvig, Jakob (Intern)
Main Supervisor:
Christensen, Ole (Intern)
Examiner:
Hansen, Per Christian (Intern)
Goh, Say Song (Ekstern)
Laugesen, Richard S. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnnet stipendie

CT Scanning and Automated Segmentation of Pig Bodies
Department of Informatics and Mathematical Modeling
Period: 01/07/2005 → 11/02/2009
Number of participants: 6
Phd Student:
Vester-Christensen, Martin (Intern)
Supervisor:
Christensen, Lars Bager (Intern)
Main Supervisor:
Larsen, Rasmus (Intern)
Examiner:
Nielsen, Allan Aasbjerg (Intern)
Allen, Paul (Ekstern)
Barillot, Christian (Ekstern)
Shape Analysis of the Dynamics of the Human Ear Canal

Department of Informatics and Mathematical Modeling
Period: 01/07/2005 → 30/01/2009
Number of participants: 7
PhD Student:
Darkner, Sune (Intern)
Supervisor:
Olsen, Ole Fogh (Ekstern)
Paulsen, Rasmus Reinhold (Intern)
Main Supervisor:
Larsen, Rasmus (Intern)
Examiner:
Carstensen, Jens Michael (Intern)
Ahlberg, Jørgen (Ekstern)
Lorenz, Cristian (Ekstern)

Financial sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Scientific Computing and Parallel Algorithms in Computational Nano science

Department of Informatics and Mathematical Modeling
Period: 15/04/2005 → 02/07/2008
Number of participants: 7
PhD Student:
Sørensen, Hans Henrik Brandenborg (Intern)
Supervisor:
Skelboe, Stig (Ekstern)
Stokbro, Kurt (Intern)
Main Supervisor:
Hansen, Per Christian (Intern)
Examiner:
Sørensen, Mads Peter (Intern)
Darve, Eric (Ekstern)
Wacker, Andreas (Ekstern)

Financial sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Optimal insulation problems
Two formulations for the design of the optimal insulation of a domain have been investigated by computational means. One method is in the format of a topology design problem of distributing insulating material in a domain surrounding a non-design domain that is heated by a given heat-source; this problem is treated in both a relaxed format as well as a penalized material format. The other approach deals with the optimal distribution of a thin layer of insulation on the boundary of the non-design domain; this problem is more in the realm of shape design, or rather, it is similar to optimal design of support conditions for structures. In both cases mathematical programming is used, but for the shape design case it is applied to the non-linear analysis problems that arise when the optimal design is explicitly solved for. The computational results illustrate the similarities and differences that result from the two approaches.

Department of Mathematics

Department of Informatics and Mathematical Modeling
Université Paris 13
Period: 01/04/2005 → 01/04/2010
Number of participants: 1
Project ID: 15407
Project Manager, organisational:
Haxthausen, Anne Elisabeth (Intern)

Financing sources
Source: Sam.arb.aftaler - Udenlandske offentlige og private
Name of research programme: Sam.arb.aftaler - Udenlandske offentlige og private
Amount: 27,248.00 Danish Kroner
Project

Self-Organising Distributed Control of a Distributed Energy System with a High Penetration of Renewable Energy
Department of Informatics and Mathematical Modeling
Period: 01/04/2005 → 17/02/2010
Number of participants: 8
Phd Student:
Gehrke, Oliver (Intern)
Supervisor:
Bindner, Henrik W. (Intern)
Madsen, Henrik (Intern)
Nielsen, Arne Hejde (Intern)
Main Supervisor:
Poulsen, Niels Kjølstad (Intern)
Examiner:
Lind, Morten (Intern)
Degner, Thomas (Ekstern)
McArthur, Stephen (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Risø (Løn)
Project: PhD

START - Application to EU-Aero : PLATO-N
Project for the coordination and compilation of a EU-Aero project on the optimal design of large-scale composite structures.

Department of Mathematics
Period: 01/04/2005 → 15/07/2005
Number of participants: 1
Project Manager, organisational:
Bendsøe, Martin P. (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 75,600.00 Danish Kroner
Project

Design of pump geometry
Analysis and design of some parts of a pump-system. Work resulted in a new geometry being applied by the company sponsoring the work.
Department of Mathematics
Period: 01/03/2005 → 31/05/2005
Number of participants: 5
Contact person:
Bendsøe, Martin P. (Intern)
Project participant:
Gravesen, Jens (Intern)
Røgen, Peter (Intern)
Markvorsen, Steen (Intern)
Stolpe, Mathias (Intern)

Financing sources
Source: Indtægtsdækket virksomhed UK 90
Name of research programme: Indtægtsdækket virksomhed UK 90
Amount: 72,500.00 Danish Kroner

Integration and Modeling of Medical Signals
Department of Informatics and Mathematical Modeling
Period: 01/03/2005 → 29/09/2008
Number of participants: 7
Phd Student:
Mørup, Morten (Intern)
Supervisor:
Arnfred, Sidse Marie (Ekstern)
Winther, Ole (Intern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Examiner:
Larsen, Jan (Ekstern)
Bro, Rasmus (Intern)
Müller, Klaus-Robert (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Matematisk Kodningsteori
Department of Mathematics
Period: 01/03/2005 → 31/03/2008
Number of participants: 7
Project participant:
Justesen, Jørn (Intern)
Topsøe, Flemming (Ekstern)
Harremoes, Peter (Ekstern)
Hansen, Johan P. (Ekstern)
Geil, Olav (Ekstern)
Thommesen, Christian (Ekstern)
Project Manager, organisational:
Høholdt, Tom (Intern)

Financing sources
Source: Forskningsrådene - SNF
Name of research programme: Forskningsrådene - STVF
Amount: 630,000.00 Danish Kroner
Project
Mathematical Coding Theory

Error-correcting codes are essential in modern communication systems. The codes are constructed and analysed using advanced mathematics in many different ways. The main purpose of this project is construction and analysis of optimal codes and their en- and decoding algorithms. CODES ON GRAPHS Graph based codes is a way to construct good codes with low decoding complexity. Most of the results however are asymptotic. We construct specific codes based on earlier results on concatenated codes and codes based on finite geometries. DECODING OF REED_SOLOMON CODES AND CONCATENATED CODES. New versions of decoding methods for Reed-Solomon codes give opportunities for correcting more errors than hitherto. We improve on these results. ALGEBRAIC GEOMETRY CODES Codes based on algebraic geometry can be shown to be better than the classical constructions. We construct and analyse some classes of AG-codes and their decoding algorithms.

Department of Mathematics

Department of Photonics Engineering

University of Copenhagen

Aalborg University

Period: 01/03/2005 → 28/02/2008
Number of participants: 7
Project ID: 10061
Project participant:
Justesen, Jørn (Intern)
Topsøe, Flemming (Ekstern)
Harremoes, Peter (Ekstern)
Hansen, Johan P. (Ekstern)
Geil, Olav (Ekstern)
Thommesen, Christian (Ekstern)
Project Manager, organisational: Høholdt, Tom (Intern)

Financing sources
Source: Forskningsrådene - SNF
Name of research programme: Forskningsrådene - STVF
Amount: 630,000.00 Danish Kroner

Content Management in a Converging Media World

Department of Informatics and Mathematical Modeling

Period: 01/02/2005 → 25/03/2009
Number of participants: 6
Phd Student: Butkus, Andrius (Intern)
Supervisor: Tadayoni, Reza (Intern)
Main Supervisor: Olesen, Henning (Intern)
Examiner: Havn, Erling C. (Intern)
Ardø, Anders (Intern)
David, Klaus (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Development of Clinical Spectroscopy with High Field MR-scanners
Department of Informatics and Mathematical Modeling
Period: 01/02/2005 → 31/03/2010
Number of participants: 6
Phd Student:
  de Nijs, Robin (Intern)
Supervisor:
  Hanson, Lars G. (Intern)
Main Supervisor:
  Hansen, Lars Kai (Intern)
Examiner:
  Larsen, Jan (Ekstern)
  Björkman-Burtscher, Isabella M. (Ekstern)
  Lonsdale, Markus Nowak (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstipendium
Project: PhD

Geometrisk analyse af transportfænomener via sammenligningsteori for Laplace-operatorer

Department of Mathematics
Period: 01/02/2005 → 31/07/2005
Number of participants: 2
Phd Student:
  Mumm, Andrew Christian (Intern)
Main Supervisor:
  Markvorsen, Steen (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

In silico ADME classification of chemical (NCE) and biological (NBE) drug candidates

Department of Informatics and Mathematical Modeling
Period: 01/02/2005 → 07/09/2006
Number of participants: 6
Phd Student:
  Hagen, Berith Fredsted (Intern)
Supervisor:
  Refsgaard, Hanne (Intern)
Main Supervisor:
  Brockhoff, Per B. (Intern)
Examiner:
  Larsen, Rasmus Werner (Intern)
  Jørgensen, Flemming Steen (Ekstern)
  Næs, Tormod (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Kvantitativ tractografi: Statistisk modellering af hømens neurale forbindelser med diffusion tensor imaging

Department of Informatics and Mathematical Modeling
Period: 01/02/2005 → 28/11/2008
Number of participants: 7
Phd Student:
Dyrby, Tim Bjørn (Intern)
Supervisor:
Baaré, William F. C. (Ekstern)
Waldemar, Gunhild (Ekstern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Examiner:
Winther, Ole (Intern)
Poline, Jean-Baptiste (Ekstern)
Stødkilde-Jørgensen, Hans (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

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**Modellering af biologisk diversitet hos grise**
Department of Informatics and Mathematical Modeling
Period: 01/02/2005 → 02/02/2009
Number of participants: 6
Phd Student:
Erbou, Søren Gylling Hemmingsen (Intern)
Supervisor:
Christensen, Lars Bager (Intern)
Main Supervisor:
Ersbøll, Bjarne Kjær (Intern)
Examiner:
Aanæs, Henrik (Intern)
Darvann, Tron Andre (Intern)
Vangen, Odd (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

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**Signal separation using independent component analysis with explicit source modelling**
Department of Informatics and Mathematical Modeling
Period: 01/02/2005 → 28/01/2009
Number of participants: 4
Phd Student:
Schmidt, Mikkel Nørgaard (Intern)
Main Supervisor:
Larsen, Jan (Intern)
Examiner:
Hansen, Lars Kai (Intern)
Jutten, Christian (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

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**Understanding Multi-Agent Sound Environments**
Department of Informatics and Mathematical Modeling
Period: 01/02/2005 → 28/11/2008
Number of participants: 5
Phd Student:
Feng, Ling (Intern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Examiner:
Larsen, Jan (Ekstern)
Honkela, Timo (Ekstern)
Kyllingsbæk, Søren (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Cryptoanalysis of Secret-Key Cryptosystems
Department of Mathematics
Period: 01/01/2005 → 25/03/2009
Number of participants: 5
PhD Student:
Miolane, Charlotte Vikkelsø (Intern)
Main Supervisor:
Knudsen, Lars Ramkilde (Intern)
Examiner:
Høholdt, Tom (Intern)
Johansson, Thomas (Ekstern)
Preneel, Bart Karel Benedikt (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

Forskningsophold i Brisbane Australien
Department of Mathematics
Period: 01/01/2005 → 30/06/2006
Number of participants: 1
Project Manager, organisational:
Knudsen, Lars Ramkilde (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 167,172.00 Danish Kroner
Project

Statisk analyse af kritiske software systemer
Department of Informatics and Mathematical Modeling
Period: 01/01/2005 → 26/06/2005
Number of participants: 3
PhD Student:
Hansen, Steffen Michael (Ekstern)
Supervisor:
Nielsen, Flemming (Intern)
Main Supervisor:
Nielsen, Hanne Riis (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD
Topological derivatives and generalized shape design
In this project we have developed a fictitious domain method for topology optimization in which the boundary of the optimal design is identified by a level set of the topological derivative field of the objective function that satisfies a given resource constraint. The response analysis employs a smooth and consistent projection of the geometry onto the fictitious analysis domain. We use a simple fixed-point iteration algorithm to solve the optimization problem. The geometry projection delivers smooth and accurate representations of the variable structural boundary. This enhances convergence of the optimization algorithm and supports the reintroduction of solid material in void regions, a critical requirement for robust topology optimization. Several examples for compliance minimization subject to a volume resource constraint have been solved.

Department of Mathematics
University of Illinois
Period: 01/01/2005 → 31/12/2006
Number of participants: 3
Project participant:
Bendse, Martin P. (Intern)
Haber, Robert B. (Ekstern)
Totorelli, Daniel (Ekstern)

Financing sources
Source: [Ordinær drift UK 10]
Name of research programme: [Ordinær drift UK 10]
Amount: 50,000.00 Danish Kroner
Source: Gaver, Private danske Fonde
Name of research programme: Gaver, Private danske Fonde
Amount: 25,000.00 Danish Kroner
Project

Matematisk kodningsteori

Department of Mathematics
Number of participants: 1
Project participant:
Høholdt, Tom (Intern)

Financing sources
Source: Forskningsrådene - SNF
Name of research programme: Forskningsrådene - STVF
Amount: 630,000.00 Danish Kroner
Project

Cryptographic Access Control

Department of Informatics and Mathematical Modeling
Number of participants: 2
PhD Student:
Frank, Kristine (Ekstern)
Main Supervisor:
Jensen, Christian D. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Global Illumination - Anvendelse af dynamiske løsningsrum i spil og animation

Department of Informatics and Mathematical Modeling
Modeling the Effects of Drugs Targeted to Tumor Vasculature using MRI

Department of Informatics and Mathematical Modeling
Period: 01/11/2004 → 05/11/2008
Number of participants: 7
Phd Student:
Holm, David Alberg (Intern)
Supervisor:
Rowland, Ian (Ekstern)
Sidoros, Karam (Intern)
Main Supervisor:
Larsen, Rasmus (Intern)
Examiner:
Ersbøll, Bjarne Kjær (Intern)
Larsson, Elna-Marie (Ekstern)
Maxwell, Ross James (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Models and methods for large-scale structural topology optimization with stress and displacement constraints

One of the major outstanding challenges within the field of topology optimization is the development of optimization models which take local stress constraints into account in a physical consistent way and for which it is also possible to device optimization methods capable of reliably solving large-scale problems. These problem types are of significant importance for applications since the appearance of high local stresses may lead to the failure of a structure (by fatigue or fracture) and many structural designs are driven by weight and strength considerations. The purpose of the project is therefore to develop mathematical models based on an integer format of the design problem such that local stress and other constraints can be modeled in an unambiguous fashion. This will be combined with numerical methods capable of providing provably good feasible solutions to large-scale problems in which local stress and displacement constraints are included. The emphasis of the project will be on topology optimization of discretized continuum structures, where the topology design determines the number, positions, and shape of the holes of the structure and the shape of the outer boundaries. The proposed models and methods should be general enough to be used in other areas, for example in the design of the lay-up of laminates from a discrete set of plies and this problem will also be dealt with.

Department of Mathematics
Period: 01/11/2004 → 31/10/2006
Number of participants: 1
Project Manager, organisational:
Stolpe, Mathias (Intern)

Financing sources
Source: Forskningsrådene - STVF
Detektering af falske ekkoer i data fra vejrradar

Department of Informatics and Mathematical Modeling
Period: 01/10/2004 → 05/11/2008
Number of participants: 8
Phd Student:
Bøvith, Thomas (Ekstern)
Supervisor:
Gill, Rashpal S. (Ekstern)
Hansen, Lars Kai (Intern)
Overgaard, Søren (Ekstern)
Main Supervisor:
Nielsen, Allan Aasbjerg (Intern)
Examiner:
Larsen, Rasmus Werner (Intern)
Michelson, Daniel B. (Ekstern)
Rasmussen, Michael Robdrup (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Power Fluctuations from Large Offshore Wind Farms
The project has developed and verified simulation and prediction models for power fluctuations in large wind farms. The verification is based on extensive measurements in the two large offshore wind farms in Denmark: Horns Rev and Nysted. The models can also be applied to simulation of wind power fluctuations from wind turbines distributed over a larger area than a wind farm. The advantage of the prediction models is that they can be applied in the operation, but these models require a training period before they work in a new system. On the other hand, the simulation model can simulate power fluctuations with possible future wind power developments, based on information about size and location of the individual wind turbines. Thus, the simulation model is a planning tool.

Department of Wind Energy
Wind Energy Systems
Risø National Laboratory for Sustainable Energy
Department of Applied Mathematics and Computer Science
DONG Energy A/S
Vattenfall A/S
Period: 01/10/2004 → 31/03/2007
Number of participants: 4
Project participant:
Cutululis, Nicolaos Antonio (Intern)
Madsen, Henrik (Intern)
Pinson, Pierre (Intern)
Project Manager, academic:
Sørensen, Poul Ejnar (Intern)

Relations
Publications:
Modelling of power fluctuations from large offshore wind farms
Power fluctuations from large offshore wind farms
Analysis of the experimental spectral coherence in the Nysted Wind Farm
Models for assessing power fluctuations from large wind farms
Fluctuations of offshore wind generation: Statistical modelling
Continuing education voucher systems: A flexible and targeted statistics programme based on learning objects and blended learning

Learning should be fun as well as inspiring and innovative. What you learn should be directly applicable to your daily work and should help you see things in a new perspective, and your studies should fit into a busy life. Who of us has not tried to return home from a course, putting the briefcase away and shelving the hand-outs, only to forget the knowledge acquired during the excellent course because it was not really applicable to our daily work, and because there is not time during an ordinary working day to put acquired theories into practice. The world around us changes so fast that life-long learning is a prerequisite for possessing the competencies demanded by the business sector. Today, data analysis is used in practically all areas of society and plays an important role in almost any company. Many employees find it important to be familiar with data analysis and able to apply statistical methods – competencies that will increase the quality of their company and save it considerable expense. So we need a new type of continuing education that will reflect a rethinking of content, form and duration. In the future, continuing education will be in the form of voucher systems. You may attend the specific chunk of a study programme you require whenever it suits you and pay only for what you get. If continuing education is to be attractive to employees as well as companies, study programmes must meet the following requirements: • It should be possible to follow a programme in parallel with an ordinary job • It should be possible to work on study projects at your leisure. • Knowledge gained from a study programme should be directly applicable to your daily work. If the providers are to meet these requirements, the task of developing new study courses and tailor these to new students must be manageable. We have therefore proposed a new type of research-based continuing education courses. These courses are structured around ‘learning objects’, i.e. short complete education sessions, which may be combined in various ways according to the students’ interests and levels. We combine them with ‘blended learning’, i.e. a combination of e-learning, web-based learning and face-to-face learning.

Department of Informatics and Mathematical Modeling

Aarhus University

Coloplast Danmark A/S
Period: 01/09/2004 → 31/12/2007
Number of participants: 3
Project participant:
Jacobson, Lotte (Ekstern)
Project Manager, organisational:
Rootzén, Helle (Intern)
Højsgaard, Søren (Ekstern)

Financing sources
Source: Forskningsprojekter - Andre ministerier og styrelser
Name of research programme: Forskningsprojekter - Andre ministerier og styrelser
Funktionelle hjernebilleder - Modellering og data-analyse

Department of Informatics and Mathematical Modeling
Period: 01/09/2004 → 17/06/2009
Number of participants: 8
Phd Student:
Madsen, Kristoffer Hougaard (Intern)
Supervisor:
Larsen, Axel (Ekstern)
Lund, Torben E. (Ekstern)
Sidaros, Karam (Intern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Examiner:
Larsen, Jan (Ekstern)
Adali, Tulay (Ekstern)
Kjær, Troels Wesenberg (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Secure Communication Protocols

Department of Informatics and Mathematical Modeling
Period: 01/09/2004 → 29/05/2008
Number of participants: 5
Phd Student:
Gao, Han (Intern)
Main Supervisor:
Nielsen, Hanne Riis (Intern)
Examiner:
Baumeister, Hubert (Intern)
Cortesi, Agostino (Ekstern)
Gilmore, Stephen (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Programbevilling
Project: PhD

Simulering og kontrol af ikke-holonom mekaniske systemer

Department of Mathematics
Period: 01/09/2004 → 17/01/2008
Number of participants: 6
Phd Student:
Nordkvist, Nikolaj (Intern)
Supervisor:
Bullo, Francesco (Ekstern)
Main Supervisor:
Hjorth, Poul G. (Intern)
Examiner:
Ravn, Ole (Intern)
Stramigioli, Stefano (Ekstern)
Wisniewski, Rafal (Ekstern)
Ubiquitous Mobility in Personal and Personal Area Networks

Department of Informatics and Mathematical Modeling
Period: 01/09/2004 → 30/04/2008
Number of participants: 6
Phd Student:
Christensen, Dan Saugstrup (Intern)
Supervisor:
Tadayoni, Reza (Intern)
Main Supervisor:
Skouby, Knud Erik (Intern)
Examiner:
Falch, Morten (Intern)
Dalum, Bent (Ekstern)
Hämmäinen, Heikki (Ekstern)

Nonlinear p-Laplacian Comparison Theory
We use drifted Brownian motion in tailor made warped product model spaces as comparison constructions to study $p$-hyperbolicity and $p$-parabolicity of a large class of submanifolds in ambient spaces with restricted curvature behaviour. It is expected that similar techniques will also give generalized isoperimetric inequalities as well as $p$-Laplace heat kernel estimates and mean exit time estimates for the corresponding nonlinear diffusion.

Department of Mathematics
Period: 01/08/2004 → 01/08/2020
Number of participants: 3
p-Laplace comparison theory
Project participant:
Markvorsen, Steen (Intern)
Holopainen, Ilkka (Ekstern)
Palmer, Vicente (Ekstern)

Large-Scale Structural Topology Optimization
Department of Mathematics
Number of participants: 1
Project participant:
Stolpe, Mathias (Intern)

All projects are funded by various sources, including internal funding and external grants. Details of the funding sources and the amounts are provided for each project.
51st European Study Group with Industry

A Study Group is a forum where academic mathematicians work on problems directly related to industry. Workshops of this nature have taken place in Great Britain for a number of years, going back to 1963 when Prof. Alan Tayler started the Oxford Study Group with Industry. The coordination of Study Groups is now in the hands of European Consortium for Mathematics in Industry (ECMI), and the name is currently European Study Group with Industry (ESGI). At a meeting in 1997 of the ECMI Council it was decided that Study Groups should also be held outside Great Britain, and the first one of those was ESGI32 in Lyngby, Denmark. The format of a Study Group is a week long meeting (Monday - Friday) where a number of companies on the first day of the meeting each present a research problem they believe to be of a mathematical nature. Each such problem is taken up by a group of mathematicians who, together with the company representative, work towards the solution of the problem, through Thursday afternoon. Friday is used to present in a plenary session the results from each of the problem groups. The reasons for the continuing success of the Study Groups are simple: The industrial participants get, for a very modest sum, a highly qualified ‘think tank’ of mathematicians to focus on their particular research problem. Besides a full or partial resolution of the problem, the companies establish useful contacts with international researchers. The academics benefit from new ideas and challenges from the real world, providing inspiration for both education and their own research. The success criterion for a Study Group is that participating companies experience the meeting as useful and that it brings them a significant step closer to the resolution of their problem. For the Danish study groups we also have the goal that it will establish closer ties between Danish Industry and Danish mathematicians.

Department of Mathematics
University of Southern Denmark
Period: 01/06/2004 → 31/12/2004
Number of participants: 4
Acronym: ESGI51
Project ID: 10055
Project participant:
Gravesen, Jens (Intern)
Hjorth, Poul G. (Intern)
Petersen, Henrik Gordon (Ekstern)
Willatzen, Morten (Ekstern)

Financing sources
Source: Udenfor rammen
Name of research programme: Ukendt
Amount: 45,000.00 Danish Kroner

Sound Classification and Sound Separation for Hearing Instruments

Department of Informatics and Mathematical Modeling
Period: 01/06/2004 → 30/04/2008
Number of participants: 6
Phd Student:
Beierholm, Thomas (Intern)
Supervisor:
Vries, Bert de (Ekstern)
Main Supervisor:
Winther, Ole (Intern)
Examiner:
Larsen, Jan (Ekstern)
Godsill, Simon J. (Ekstern)
Jensen, Søren Holdt (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

System-Level Design Methodologies for Platform-based Multiprocessor SoC Designs
Department of Informatics and Mathematical Modeling
Period: 01/06/2004 → 05/11/2008
Number of participants: 5
Phd Student:
Virk, Kashif Munir (Intern)
Main Supervisor:
Madsen, Jan (Intern)
Examiner:
Nannarelli, Alberto (Intern)
Jerraya, Ahmed Amine (Ekstern)
Nurmi, Jari Antero (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

Thomas Britz
Department of Mathematics
Period: 05/05/2004 → 31/10/2005
Number of participants: 1
Project participant:
Thomassen, Carsten (Intern)

Financing sources
Source: Gaver, Private danske Fonde
Name of research programme: Gaver, Private danske Fonde
Amount: 440,000.00 Danish Kroner
Project

State Space Models of Sound Environments - Analysis by Synthesis
Department of Informatics and Mathematical Modeling
Period: 01/05/2004 → 05/11/2007
Number of participants: 5
Phd Student:
Olsson, Rasmus Kongsgaard (Ekstern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Examiner:
Larsen, Jan (Ekstern)
Anemüller, Jörn (Ekstern)
Jensen, Søren Holdt (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD
Stochastic Scheduling in Production Planning
Department of Informatics and Mathematical Modeling
Period: 01/04/2004 → 31/01/2008
Number of participants: 5
Phd Student:
Rasmussen, Kourosh Marjani (Intern)
Main Supervisor:
Clausen, Jens (Intern)
Examiner:
Stidsen, Thomas Jacob Riis (Intern)
Sørensen, Peter Norman (Ekstern)
Vladimirou, Hercules (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Adaptive Computing Architectures
Department of Informatics and Mathematical Modeling
Period: 01/03/2004 → 17/01/2008
Number of participants: 4
Phd Student:
Wu, Kehuai (Intern)
Main Supervisor:
Madsen, Jan (Intern)
Examiner:
Kuchcinski, Krzysztof (Ekstern)
Teich, Jürgen (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Dynamical Shape analysis
Department of Informatics and Mathematical Modeling
Period: 01/03/2004 → 30/04/2008
Number of participants: 6
Phd Student:
Ólafsdóttir, Hildur (Intern)
Supervisor:
Larsen, Rasmus (Intern)
Main Supervisor:
Ersboll, Bjarne Kjær (Intern)
Examiner:
Carstensen, Jens Michael (Intern)
Rueckert, Daniel (Ekstern)
Vannier, Michael W. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD
European Network of Excellence for Cryptology
ECRYPT - European Network of Excellence for Cryptology is a 4-year network of excellence funded within the Information Societies Technology (IST) Programme of the European Commission's Sixth Framework Programme (FP6) under contract number IST-2002-507932. It falls under the action line Towards a global dependability and security framework. ECRYPT was launched on February 1st, 2004. Its objective is to intensify the collaboration of European researchers in information security, and more in particular in cryptology and digital watermarking. Overall budget is about DKK 35,000,000

Department of Mathematics
Period: 01/02/2004 → 31/07/2008
Number of participants: 5
Cryptology
Acronym: ECRYPT
Project participant:
Lange, Tanja (Intern)
Miolane, Charlotte Vikkelsø (Intern)
Thomsen, Søren Steffen (Intern)
Birkner, Peter (Intern)
Project Manager, organisational:
Knudsen, Lars Ramkilde (Intern)

Financing sources
Source: Forsk. EU - Andre EU-midler
Name of research programme: Forsk. EU - Andre EU-midler
Amount: 600,000.00 Danish Kroner
Project

Matematisk modellering af multimedie netværk
Department of Informatics and Mathematical Modeling
Period: 01/02/2004 → 03/09/2007
Number of participants: 5
Phd Student:
Jørgensen, Sune Lehmann (Intern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Examiner:
Larsen, Jan (Ekstern)

Cox, Ingemar (Intern)
Johansen, Peter (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Security in Grid Systems
Department of Informatics and Mathematical Modeling
Period: 01/02/2004 → 31/03/2005
Number of participants: 3
Phd Student:
Kampfeldt, Jesper (Intern)
Supervisor:
Jensen, Christian D. (Intern)
Main Supervisor:
Sharp, Robin (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD
Topological design optimization of structures, machines and materials: IUTAM-SYMPOSIUM

It is now more than 15 years ago that the so-called homogenization method was proposed as a basis for computational means to optimize the topology and shape of continuum structures. From initially being capable mainly of treating minimum compliance design we now see the basic material distribution idea of the methodology applied to a wide range of structural and mechanical problems as well as to problems that couple structural response to other physical responses. Also, the method has provided insight for micro-mechanical studies, meaning that the method has given feedback to the area which provided impetus to the field of topological design optimization in its creation. Finally, topological design is now an integral part of most FEM software systems and it has become a standard industrial tool in some fields. The IUTAM Symposium provided a forum for the exchange of ideas for future developments in the area of topological design optimization. This encompassed the application to fluid-solid interaction problems, acoustics problems, and to problems in biomechanics, as well as to other multiphysics problems. New basic modelling paradigms, covering new geometry modelling such as level-set methods and topological derivatives, as well as developments in computational approaches were also focus areas. Without the sponsorship from the International Union of Theoretical and Applied Mechanics (IUTAM) and the International Society for Structural and Multidisciplinary Optimization (ISSMO), and the financial support from the Danish Center for Applied Mathematics and Mechanics (DCAMM), the Villum Kann Rasmussen Foundation, and the Poul Due Jensen Foundation, the symposium and this book would not have been possible. The financial support from the Department of Mechanical Engineering, Aalborg University, and from the Department of Mathematics and the Department of Mechanical Engineering, Technical University of Denmark, is also gratefully acknowledged.

Department of Mathematics

Department of Mechanical Engineering

Aalborg University

Period: 01/01/2004 → 31/12/2005
Number of participants: 3
Project Manager, organisational: Bendsøe, Martin P. (Intern)
Sigmund, Ole (Intern)
Olhoff, Niels (Ekstern)

Financing sources
Diskret matematik

Department of Mathematics
Period: 17/12/2003 → 31/12/2006
Number of participants: 1
Project participant:
Thomassen, Carsten (Intern)

Financing sources
Source: Forskningsrådene - SNF
Name of research programme: Forskningsrådene - STVF
Amount: 735,000.00 Danish Kroner
Project

Geometry and Global Analysis with Applications

Department of Mathematics
Period: 12/12/2003 → 31/12/2006
Number of participants: 1
Project participant:
Hansen, Vagn Lundsgaard (Intern)

Financing sources
Source: Forskningsrådene - SNF
Name of research programme: Forskningsrådene - STVF
Amount: 1,080,000.00 Danish Kroner
Project

Automated Characterization and Recognition of 2D and 3D Brain Structure in MRI for Diagnostic Support

Department of Informatics and Mathematical Modeling
Number of participants: 5
Phd Student:
Sjöstrand, Karl (Intern)
Main Supervisor:
Larsen, Rasmus (Intern)
Examiner:
Hansen, Lars Kai (Intern)
Hastie, Trevor J. (Ekstern)
Äström, Karl (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønned stipendie
Project: PhD

Beslutningsstøttesystem til jagerpiloter

Department of Informatics and Mathematical Modeling
Number of participants: 7
Phd Student:
Randleff, Lars Rosenberg (Intern)
Supervisor:
Jensen, Gert Hvedstrup (Intern)
Søndergaard, Steen (Ekstern)
Main Supervisor:
Clausen, Jens (Intern)
Examiner:
Stidsen, Thomas Jacob Riis (Intern)
Birkemark, Christian M. (Ekstern)
Wright, George A. (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

**Multimedia Services in Residential Broadband Networks**
Department of Informatics and Mathematical Modeling
Period: 01/10/2003 → 03/09/2007
Number of participants: 6
Phd Student:
Sigurdsson, Halldor Matthias (Intern)
Supervisor:
Tadayoni, Reza (Intern)
Main Supervisor:
Olesen, Henning (Intern)
Examiner:
Henten, Anders (Intern)
Ambak, Jens Christian (Ekstern)
Olsen, Borgar T. (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD

**Specification and Programming Languages for Biological Systems**
Department of Informatics and Mathematical Modeling
Period: 01/10/2003 → 13/12/2007
Number of participants: 5
Phd Student:
Pilegaard, Henrik (Intern)
Supervisor:
Nielsen, Hanne Riis (Intern)
Main Supervisor:
Nielsen, Flemming (Intern)
Examiner:
Hillston, Jane (Ekstern)
Ingolfsdottir, Anna (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

**Maciej Krupa**
Department of Mathematics
Period: 18/09/2003 → 31/12/2004
Number of participants: 1
Project participant:
Brøns, Morten (Intern)

Financing sources
Source: Gaver, Private danske Fonde
Name of research programme: Gaver, Private danske Fonde
Amount: 162,000.00 Danish Kroner

Project

Functional Data Analysis in Medical Signal Processing
Department of Informatics and Mathematical Modeling
Period: 15/09/2003 → 31/05/2007
Number of participants: 5
Phd Student:
Jacobsen, Danjal Jakup (Intern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Examiner:
Winther, Ole (Intern)
Nørgård, Peter Magnus (Intern)
Poline, Jean-Baptiste (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Modeller og metoder til analyse af decentral produktion på markedsvilkår
Department of Informatics and Mathematical Modeling
Period: 15/09/2003 → 02/07/2008
Number of participants: 5
Phd Student:
Schaumburg-Müller, Camilla (Intern)
Supervisor:
Ravn, Hans V. (Intern)
Main Supervisor:
Clausen, Jens (Intern)
Examiner:
Stidsen, Thomas Jacob Riis (Intern)
Holttinen, Hannele K. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD

Capacity Improvements in Cellular Systems
Department of Informatics and Mathematical Modeling
Period: 01/09/2003 → 03/09/2007
Number of participants: 6
Phd Student:
Christensen, Lars P.B. (Intern)
Supervisor:
Højen-Sørensen, Pedro (Intern)
Main Supervisor:
Larsen, Jan (Intern)
Examiner:
Winther, Ole (Intern)
Fleury, Bernard H. (Ekstern)
Højen-Sørensen, Pedro (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD

Dynamiske undersøgelser af flerlemesystemer
Department of Informatics and Mathematical Modeling
Period: 01/09/2003 → 15/01/2007
Number of participants: 7
Phd Student:
Hoffmann, Mark (Intern)
Supervisor:
Sørensen, Mads Peter (Intern)
True, Hans (Intern)
Main Supervisor:
Thomsen, Per Grove (Intern)
Examiner:
Houbak, Niels (Intern)
Berg, Mats (Ekstern)
Hansen, John Michael (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Modeling of Animate Object Contours, Surfaces, Regions
Department of Informatics and Mathematical Modeling
Period: 01/09/2003 → 31/12/2005
Number of participants: 3
Phd Student:
Dubienskiy, Alexsandr (Intern)
 Supervisor:
Ersbell, Bjarne Kjær (Intern)
Main Supervisor:
Larsen, Rasmus (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Workshop professor Jørn Justesen
Department of Mathematics
Period: 01/08/2003 → 01/04/2004
Number of participants: 1
Project participant:
Høholdt, Tom (Intern)

Financing sources
Source: Gaver, Private danske Fonde
Name of research programme: Gaver, Private danske Fonde
Amount: 10,000.00 Danish Kroner
Project
Foundations of Cryptography and Security
Department of Mathematics
Period: 03/07/2003 → 31/12/2005
Number of participants: 1
Project participant:
Knudsen, Lars Ramkilde (Intern)

Financing sources
Source: Forskningsprojekter - Andre ministerier og styrelser
Name of research programme: Forskningsprojekter - Andre ministerier og styrelser
Amount: 216,756.00 Danish Kroner

Dynamics In The Complex Plane
Department of Mathematics
Period: 25/06/2003 → 01/10/2003
Number of participants: 1
Project participant:
Hjorth, Poul G. (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Forskningsrådene - Andre
Amount: 20,400.00 Danish Kroner

Global Optimization in Topology Design - Sverige
Department of Mathematics
Period: 20/06/2003 → 29/02/2004
Number of participants: 1
Project participant:
Bendsøe, Martin P. (Intern)

Financing sources
Source: Forskningsrådene - SNF
Name of research programme: Forskningsrådene - STVF
Amount: 397,970.00 Danish Kroner

Computational Auditory Scene analysis for Hearing Aids
Department of Informatics and Mathematical Modeling
Period: 01/06/2003 → 20/11/2006
Number of participants: 6
Phd Student:
Pedersen, Michael Syskind (Intern)
Supervisor:
Kjems, Ulrik (Intern)
Main Supervisor:
Larsen, Jan (Intern)
Examiner:
Winther, Ole (Intern)
Moonen, Marc (Ekstern)
Oja, Erkki (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

Deming Li
Department of Mathematics
Period: 20/05/2003 → 30/06/2004
Number of participants: 1
Project participant:
Thomassen, Carsten (Intern)

Financing sources
Source: Uddannelse. Private. Andre virksomheder
Name of research programme: Uddannelse. Private. Andre virksomheder
Amount: 34,650.00 Danish Kroner

A Functional Analytic Approach to Forward and Inverse Electromagnetic Scattering Theory
Department of Mathematics
Period: 15/05/2003 → 31/01/2008
Number of participants: 5
Phd Student:
Karamehmedovic, Mirza (Intern)
Main Supervisor:
Pedersen, Michael (Intern)
Examiner:
Hansen, Vagn Lundsgaard (Intern)
Cornean, Horia (Ekstern)
Grubb, Gerd (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Probabilistic Networks: Diagnostic Decision Support Systems
Department of Informatics and Mathematical Modeling
Period: 15/05/2003 → 05/11/2007
Number of participants: 6
Phd Student:
Andersen, Morten Nonboe (Intern)
Supervisor:
Hansen, Lars Kai (Intern)
Main Supervisor:
Winther, Ole (Intern)
Examiner:
Nielsen, Bo Friis (Intern)
Gerds, Thomas Alexander (Ekstern)
Heskes, Tom (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

3D-pris
Department of Mathematics
Period: 09/05/2003 → 31/12/2004
Number of participants: 1
Visualisering, opmåling & editering af 3D-medicinske data

Department of Informatics and Mathematical Modeling
Number of participants: 7
Phd Student:
Jakobsen, Bjarke (Ekstern)
Supervisor:
Madsen, Jan (Intern)
Pedersen, Steen (Intern)
Main Supervisor:
Christensen, Niels Jørgen (Intern)
Examiner:
Carstensen, Jens Michael (Intern)
Henriksen, Knud (Ekstern)
Sramek, Milos (Ekstern)

Disruption Management i transportsektoren

Department of Informatics and Mathematical Modeling
Period: 01/04/2003 → 01/07/2009
Number of participants: 6
Phd Student:
Wanscher, Jørgen (Intern)
Supervisor:
Larsen, Jesper (Intern)
Main Supervisor:
Clausen, Jens (Intern)
Examiner:
Stidsen, Thomas Jacob Riis (Intern)
Davidsson, Paul (Ekstern)
Liu, Ronghui (Ekstern)

Stabiliserings-Algoritmer til Storskala-Problemer

Department of Informatics and Mathematical Modeling
Period: 01/04/2003 → 31/05/2006
Number of participants: 5
Phd Student:
Jensen, Toke Koldborg (Intern)
Main Supervisor:
Hansen, Per Christian (Intern)
Financial sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Statisk program analyse af VHDL
Department of Informatics and Mathematical Modeling
Period: 01/04/2003 → 18/04/2007
Number of participants: 6
PhD Student:
Tolstrup, Terkel Kristian (Intern)
Supervisor:
Nielsen, Flemming (Intern)
Main Supervisor:
Nielsen, Hanne Riis (Intern)
Examiner:
Madsen, Jan (Intern)
Banerjee, Anindya (Ekstern)
Sabelfeld, Andrei (Ekstern)

Financial sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Webmining: Finding Meaning in Distributed Signals on the Internet
Department of Informatics and Mathematical Modeling
Period: 01/04/2003 → 30/06/2006
Number of participants: 7
PhD Student:
Meng, Anders (Intern)
Supervisor:
Hansen, Lars Kai (Intern)
Rose, Michael (Intern)
Main Supervisor:
Larsen, Jan (Intern)
Examiner:
Winther, Ole (Intern)
Casey, Michael A. (Ekstern)
Riis, Søren Kamaric (Intern)

Financial sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

Janos Barat
Department of Mathematics
Period: 10/03/2003 → 28/02/2005
Number of participants: 1
Project participant:
Thomassen, Carsten (Intern)
**Financing sources**
Source: Forsk. EU - Rammeprogram  
Name of research programme: Forsk. EU - Rammeprogram  
Amount: 1,023,804.00 Danish Kroner  
Project

**Klassifikation af naturligt forekommende lydmiljøer**
Department of Informatics and Mathematical Modeling  
Period: 01/02/2003 → 30/06/2006  
Number of participants: 4  
Phd Student:  
Ahrendt, Peter (Intern)  
Main Supervisor:  
Larsen, Jan (Intern)  
Examiner:  
Winther, Ole (Intern)  
Jensen, Søren Holdt (Intern)

**Financing sources**
Source: Internal funding (public)  
Name of research programme: DTU-lønnet stipendie  
Project: PhD

**Spatio-Temporal Analysis of Electro-Encephalography Data**
Department of Informatics and Mathematical Modeling  
Period: 01/02/2003 → 07/09/2006  
Number of participants: 5  
Phd Student:  
Dyrholm, Mads (Intern)  
Main Supervisor:  
Hansen, Lars Kai (Intern)  
Examiner:  
Larsen, Jan (Ekstern)  
Anemüller, Jörn (Ekstern)  
Jensen, Søren Holdt (Intern)

**Financing sources**
Source: Internal funding (public)  
Name of research programme: Forskningsrådsfinansiering  
Project: PhD

**Universality and classification in holomorphic dynamics**
Department of Mathematics  
Period: 23/12/2002 → 31/12/2006  
Number of participants: 1  
Project Manager, organisational:  
Henriksen, Christian (Intern)

**Financing sources**
Source: Forskningsrådene - SNF  
Name of research programme: Forskningsrådene - STVF  
Amount: 1,634,020.00 Danish Kroner  
Project

**Computer Supported Drug Development**
Department of Informatics and Mathematical Modeling  
Period: 01/10/2002 → 20/10/2005  
Number of participants: 8
Phd Student:
Tornøe, Christoffer Wenzel (Intern)
Supervisor:
Agersø, Henrik (Ekstern)
Jonsson, E. Niclas (Ekstern)
Nielsen, Henrik Aalborg (Intern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Rootzén, Helle (Intern)
Gabrielsson, Johan (Ekstern)
Valund, Aage (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

Estimationsteori for stokastiske differentialligninger
Department of Informatics and Mathematical Modeling
Period: 01/10/2002 → 15/01/2007
Number of participants: 6
Phd Student:
Nolsøe, Kim (Intern)
Supervisor:
Kessler, Mathieu (Ekstern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Nielsen, Bo Friis (Intern)
Jørgensen, Bent (Intern)
Rydén, Tobias (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Chip Area Interconnection Networks
Department of Informatics and Mathematical Modeling
Period: 01/09/2002 → 18/04/2006
Number of participants: 6
Phd Student:
Mahadevan, Shankar (Intern)
Supervisor:
Madsen, Jan (Intern)
Main Supervisor:
Sparsø, Jens (Intern)
Examiner:
Hansen, Michael Reichhardt (Intern)
Kuchcinski, Krzysztof (Ekstern)
Wolf, Wayne Hendrix (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden EU-finansiering
Project: PhD
Diskrete tilnærmelser til kontinuerte frames
Department of Mathematics
Period: 01/09/2002 → 31/05/2007
Number of participants: 6
Phd Student:
Søndergaard, Peter Lempel (Intern)
Supervisor:
Hansen, Per Christian (Intern)
Main Supervisor:
Christensen, Ole (Intern)
Examiner:
Christiansen, Edmund (Ekstern)
Feichtinger, Hans G. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Intra-Chip Communication
Department of Informatics and Mathematical Modeling
Period: 01/09/2002 → 10/02/2006
Number of participants: 5
Phd Student:
Bjerregaard, Tobias (Intern)
Main Supervisor:
Sparse, Jens (Intern)
Examiner:
Nannarelli, Alberto (Intern)
Ginosar, Ran (Ekstern)
Goossens, seKees (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Near Earth Objects, Detection and Observation
Department of Mathematics
Period: 01/09/2002 → 02/01/2006
Number of participants: 6
Phd Student:
Wolff, Stefan (Intern)
Supervisor:
Jørgensen, Uffe Græ (Ekstern)
Main Supervisor:
Hjorth, Poul G. (Intern)
Examiner:
Jørgensen, John Leif (Intern)
Mignard, Francois (Ekstern)
Rasmussen, Kaare Lund (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD
Rekonfigurérbare optiske bølgelederstrukturer genereret ved solitonvekselvirkning

Department of Mathematics  
Period: 01/09/2002 → 15/05/2006  
Number of participants: 7  
Phd Student:  
Larsen, Peter Ulrik Vingaard (Intern)  
Supervisor:  
Bang, Ole (Intern)  
Christiansen, Peter Leth (Intern)  
Main Supervisor:  
Sørensen, Mads Peter (Intern)  
Examiner:  
Hjorth, Poul G. (Intern)  
Rasmussen, Jens Juul (Intern)  
Wyller, John Andreas (Ekstern)  

Financing sources
Source: Internal funding (public)  
Name of research programme: DTU-lønnet stipendie  
Project: PhD

Web-mining: Finding meaning in distributed signals on the internet

Department of Informatics and Mathematical Modeling  
Period: 01/09/2002 → 13/03/2006  
Number of participants: 6  
Phd Student:  
Madsen, Rasmus Elsborg (Intern)  
Supervisor:  
Larsen, Jan (Intern)  
Main Supervisor:  
Hansen, Lars Kai (Intern)  
Examiner:  
Winther, Ole (Intern)  
Kaski, Samuel (Ekstern)  
Svendsen, Michael Ø. (Ekstern)  

Financing sources
Source: Internal funding (public)  
Name of research programme: DTU-lønnet stipendie  
Project: PhD

Kohærent dynamik af exciterbare koblede beta celler

Department of Mathematics  
Period: 01/07/2002 → 25/10/2006  
Number of participants: 5  
Phd Student:  
Pedersen, Morten Gram (Intern)  
Main Supervisor:  
Sørensen, Mads Peter (Intern)  
Examiner:  
Knudsen, Carsten (Intern)  
Galvanovskis, Juris (Ekstern)  
Sturis, Jeppe (Ekstern)  

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

**Stokastisk dynamik i komplekse systemer**
Department of Informatics and Mathematical Modeling
Period: 01/07/2002 → 25/10/2006
Number of participants: 7
Phd Student:
Overgaard, Rune Viig (Intern)
Supervisor:
Carlsson, Mats (Ekstern)
Knudsen, Carsten (Intern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Nielsen, Henrik Aalborg (Intern)
Gabrielsson, Johan (Ekstern)
Vicini, Paolo (Ekstern)

**Financing sources**
Source: Internal funding (public)

Name of research programme: DTU-lønnet stipendie
Project: PhD

**Condition Monitoring and Management from Acoustic Emissions**
Department of Informatics and Mathematical Modeling
Period: 01/06/2002 → 18/11/2005
Number of participants: 6
Phd Student:
Pontoppidan, Niels Henrik Bohl (Intern)
Supervisor:
Fog, Torben L. (Intern)
Main Supervisor:
Larsen, Jan (Intern)
Examiner:
Hansen, Lars Kai (Intern)
Gustafsson, Fredrik (Ekstern)
Steel, John Alexander (Ekstern)

**Financing sources**
Source: Internal funding (public)

Name of research programme: Anden EU-finansiering
Project: PhD

**Tomographic Reconstruction using Anatomical Regularisation**
Department of Informatics and Mathematical Modeling
Period: 01/06/2002 → 13/03/2006
Number of participants: 7
Phd Student:
Hægh-Rasmussen, Esben (Intern)
Supervisor:
Hansen, Per Christian (Intern)
Svarer, Claus (Ekstern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Examiner:
Larsen, Jan (Ekstern)
Andersen, Jens Damgaard (Ekstern)
Berry, Michael W. (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Ansat ekstert
Project: PhD

**Mobile Location Services for next Generation Wireless Networks**
Department of Informatics and Mathematical Modeling
Period: 01/05/2002 → 02/07/2008
Number of participants: 5
Phd Student:
Schou, Saowanee (Intern)
Supervisor:
Sørensen, Lene Tolstrup (Intern)
Main Supervisor:
Olesen, Henning (Intern)
Examiner:
Schultz, Nette (Intern)
Constantiou, Ioanna D. (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Department of Informatics and Mathematical Modeling
Period: 01/05/2002 → 02/01/2006
Number of participants: 5
Phd Student:
Petersen, Kaare Brandt (Ekstern)
Supervisor:
Hansen, Lars Kai (Intern)
Main Supervisor:
Winther, Ole (Intern)
Examiner:
Söderberg, Bo (Ekstern)
Valpola, Harri (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD

**Tools for Multi-Media Signal Processing the "binding" Problem**
Department of Informatics and Mathematical Modeling
Period: 01/04/2002 → 20/10/2005
Number of participants: 6
Phd Student:
Lehn-Schieler, Tue (Intern)
Supervisor:
Larsen, Jan (Intern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Examiner:
Winther, Ole (Intern)
Müller, Klaus-Robert (Ekstern)
Viberg, Mats (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Design af hierarkiske netværk
Department of Informatics and Mathematical Modeling
Period: 01/03/2002 → 05/08/2005
Number of participants: 5
Phd Student:
Thomadsen, Tommy (Intern)
Main Supervisor:
Clausen, Jens (Intern)
Examiner:
Hansen, Per Christian (Intern)
Boland, Natasha Lesley (Ekstern)
Zachariasen, Martin (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

System design for vision based dermatological measurement
Department of Informatics and Mathematical Modeling
Period: 01/03/2002 → 12/07/2005
Number of participants: 6
Phd Student:
Gomez, David Delgado (Intern)
Supervisor:
Ersbøll, Bjarne Kjær (Intern)
Main Supervisor:
Carstensen, Jens Michael (Intern)
Examiner:
Larsen, Rasmus Werner (Intern)
Johansen, Peter (Ekstern)
Thodberg, Hans Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Programbevilling
Project: PhD

Geodata-Infrastruktur
Department of Informatics and Mathematical Modeling
Period: 01/02/2002 → 01/08/2007
Number of participants: 8
Phd Student:
Christensen, Jesper Vinther (Intern)
Supervisor:
Bjørner, Dines (Intern)
Frederiksen, Poul (Intern)
Jacobi, Ole Illum (Intern)
Main Supervisor:
Nilsson, Jørgen Fischer (Intern)
Examiner:
Villadsen, Jørgen (Intern)
Andreasen, Troels (Ekstern)
Östman, Anders (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

Optimal rydning af landminer og ammunition
Department of Informatics and Mathematical Modeling
Period: 01/02/2002 → 13/03/2006
Number of participants: 6
Phd Student:
Vistisen, Jan Bastholm (Intern)
Supervisor:
Christensen, Torben (Ekstern)
Main Supervisor:
Clausen, Jens (Intern)
Examiner:
Larsen, Jan (Ekstern)
Clausen, Svend (Ekstern)
Haugstad, Bjarne (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden sektorministeriel finans
Project: PhD

Topologisk Fluid Dynamik: Bifurkationer og strukturer i strømninger
Department of Mathematics
Period: 01/02/2002 → 02/01/2006
Number of participants: 6
Phd Student:
Bisgaard, Anders Villefrance (Intern)
Supervisor:
Sørensen, Jens Nørkær (Intern)
Main Supervisor:
Brøns, Morten (Intern)
Examiner:
Sørensen, Mads Peter (Intern)
Krupa, Maciej (Intern)
Ottesen, Johnny Tom (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Algebraisk Kodningsteori og Informationsteori
Department of Mathematics
Period: 03/01/2002 → 31/12/2004
Number of participants: 1
Project participant:
Høholdt, Tom (Intern)
Minimal Metric Skeletons

Metric graphs are considered as geometric background structures in their own right via an extension of the combinatorial Laplacian to the Friedrich extended Laplacian on the graphs which are considered as essentially one-dimensional submanifolds in the ambient space. The vertex minimality of these graphs guarantees not only selfadjointness of the Laplacian but also a direct comparison between functions in the ambient space and their restrictions to the graphs. This 'restriction comparison' is exploited in this project. Metric graphs may serve as good (Haussdorff-close) approximations to surfaces in 3-space. It is conjectured that minimal metric graphs (with straight line edges) in this sense can be used to approximate minimal surfaces modulo any given $\varepsilon > 0$.

Department of Mathematics
Period: 01/01/2002 → 01/01/2020
Number of participants: 1
Locally finite countable graphs, Laplacian comparison geometry, Minimal immersions
Project participant:
Markvorsen, Steen (Intern)

Financing sources
Source: [Ordinær drift UK 10]
Name of research programme: [Ordinær drift UK 10]
Amount: 10,000.00 Danish Kroner
Project

Security Validation through Static Analysis

Department of Informatics and Mathematical Modeling
Period: 01/01/2002 → 06/06/2005
Number of participants: 5
Phd Student:
Hansen, René Rydhof (Intern)
Main Supervisor:
Nielsen, Flemming (Intern)
Examiner:
Fischer, Paul (Intern)
Cortesi, Agostino (Ekstern)
Schmidt, David A. (Ekstern)
**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

**Wavelet in Audio/Visuel Electronic Systems**
Department of Mathematics
Period: 05/11/2001 → 31/03/2006
Number of participants: 1
Project participant:
Christensen, Ole (Intern)

**Financing sources**
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 1,710,746.00 Danish Kroner
Project

**Stokastisk model til beskrivelse af trafik dynamik i tidsperioder med stationær trafik**
Department of Informatics and Mathematical Modeling
Period: 01/10/2001 → 22/08/2003
Number of participants: 3
Phd Student:
Christensen, Thomas Kaare (Intern)
Supervisor:
Iversen, Villy Bæk (Intern)
Main Supervisor:
Nielsen, Bo Friis (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Blandet Finansiering
Project: PhD

**On truncated Taylor series and the position of their spurious zeros**
The title problem arises in the framework of linear and non-linear water waves where the accuracy of various truncated Taylor series solutions to Laplace’s equation is important.

Department of Informatics and Mathematical Modeling
Period: 20/09/2001 → …
Number of participants: 2
Project participant:
Madsen, Per A. (Intern)
Project Manager, organisational:
Christiansen, Søren (Intern)

**Numeriske metoder til strømningsberegninger**
Department of Informatics and Mathematical Modeling
Period: 01/09/2001 → 09/09/2005
Number of participants: 5
Phd Student:
Grooss, Jesper (Intern)
Supervisor:
Sørensen, Jens Nørkæ (Intern)
Main Supervisor:
Thomsen, Per Grove (Intern)
Examiner:
Bingham, Harry B. (Intern)
Warburton, Tim (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

**Antigiotika anvendelse og tidlig og rumlig spredning af antibiotikaresistens**
Department of Informatics and Mathematical Modeling
Period: 15/08/2001 → 27/04/2005
Number of participants: 7
Phd Student:
Christiansen, Lasse Engbo (Intern)
Supervisor:
Andersen, Jens Strodl (Intern)
Wegener, Henrik Caspar (Intern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Thyregod, Poul (Intern)
Agger, Jens (Ekstern)
Guttorp, Peter (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

**System design for vision-based dermatological measurements**
Department of Informatics and Mathematical Modeling
Period: 07/08/2001 → 31/01/2002
Number of participants: 4
Phd Student:
Karras, Panagiotis (Intern)
Supervisor:
Ersbøll, Bjarne Kjær (Intern)
Larsen, Jan (Intern)
Main Supervisor:
Carstensen, Jens Michael (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Forskningsrådsstipendium
Project: PhD

**Geometrisk analyse af resolventer på mangfoldigheder med singulariteter**
Department of Mathematics
Period: 01/08/2001 → 31/05/2005
Number of participants: 3
Phd Student:
Hansen, Lars (Ekstern)
Supervisor:
Grubb, Gerd (Ekstern)
Main Supervisor:
Pedersen, Michael (Intern)

**Financing sources**
Source: Internal funding (public)
Hig-Level Synthesis of Asynchronous

Department of Informatics and Mathematical Modeling
Period: 01/08/2001 → 06/06/2005
Number of participants: 6
PhD Student:
Nielsen, Sune Fallgaard (Intern)
Supervisor:
Madsen, Jan (Intern)
Main Supervisor:
Sparsø, Jens (Intern)
Examiner:
Nannarelli, Alberto (Intern)
Lavagno, Luciano (Ekstern)
Peeters, Ad (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Atsushi Kawamoto

Department of Mathematics
Period: 09/07/2001 → 31/08/2004
Number of participants: 1
Project participant:
Bendsøe, Martin P. (Intern)

Financing sources
Source: Forsk. Andre offentlige og private - Udenlandske
Amount: 245,700.00 Danish Kroner

Mogens Oddershede Larsen

Department of Mathematics
Period: 13/06/2001 → 31/12/2002
Number of participants: 1
Project participant:
Larsen, Mogens Oddershede (Intern)

Financing sources
Source: Uddannelse. Statslige. Andre statslige
Amount: 25,000.00 Danish Kroner

Formanalyse af ørekanaler

Department of Informatics and Mathematical Modeling
Period: 01/06/2001 → 15/09/2004
Number of participants: 8
PhD Student:
Paulsen, Rasmus Reinhold (Intern)
Supervisor:
Conradsen, Knut (Intern)
Bayesian Modelling for Multi-Agent Control

Department of Informatics and Mathematical Modeling
Period: 01/04/2001 → 01/10/2004
Number of participants: 6
PhD Student: Quinonero, Joaquin (Intern)
Supervisor: Rasmussen, Carl Edward (Intern)
Main Supervisor: Hansen, Lars Kai (Intern)
Examiner: Nielsen, Bo Friis (Intern)
Andersen, Jens Damgaard (Ekstern)
Williams, Christopher K. I. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

Development of Statistical Methods and Models for Evaluation and Determination of Environmental Monitoring Programs

Department of Informatics and Mathematical Modeling
Period: 01/04/2001 → 09/02/2005
Number of participants: 6
PhD Student: Lophaven, Søren Nymand (Intern)
Supervisor: Carstensen, Niels Jacob (Intern)
Main Supervisor: Rootzén, Helle (Intern)
Examiner: Nielsen, Allan Aasbjerg (Intern)
Grimvall, Anders (Ekstern)
Guttorp, Peter (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt EU-finansieret
Project: PhD

Preben Alsholm Undervisningspris

Department of Mathematics
Period: 30/03/2001 → 31/12/2001
Number of participants: 1
Project participant:
Alsholm, Preben Kjeld (Intern)

Financing sources
Source: Private funding (private)
Name of research programme: Uddannelse. Private. Fonde
Amount: 25,000.00 Danish Kroner

Optimal foraging theory applied to simple models of patchy environments
Department of Informatics and Mathematical Modeling
Period: 15/03/2001 → 08/02/2007
Number of participants: 6
Phd Student:
Nilsson, Lars Anders Fredrik (Intern)
Supervisor:
Beyer, Jan (Intern)
Thygesen, Uffe Hægsbro (Intern)
Main Supervisor:
Nielsen, Bo Friis (Intern)
Examiner:
Rootzén, Helle (Intern)
Haccou, Patricia (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Quest-projektet
Department of Mathematics
Period: 07/03/2001 → 31/12/2001
Number of participants: 1
Project participant:
Mohr, Gunnar (Intern)

Financing sources
Source: Forsk. Private danske - Andre
Name of research programme: Forsk. Private danske - Andre
Amount: 35,000.00 Danish Kroner

Diskret matematik
Department of Mathematics
Period: 12/02/2001 → 30/09/2004
Number of participants: 1
Project participant:
Thomassen, Carsten (Intern)

Financing sources
Source: Forskningsrådene - SNF
Name of research programme: Forskningsrådene - STVF
Amount: 1,080,000.00 Danish Kroner

Design og Anvendelse af en byggeontologi - Design and Application of a civil engineering Ontology
Department of Informatics and Mathematical Modeling
Period: 01/02/2001 → 05/07/2004
Number of participants: 6
Phd Student:
Eir, Asger (Intern)
Supervisor:
Galle, Per (Intern)
Main Supervisor:
Bjørner, Dines (Intern)
Examiner:
Hansen, Bo Stig (Intern)
Pedersen, Stig Andur (Intern)
Turk, Ziga (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Nonlinear Photonic Crystals
Department of Informatics and Mathematical Modeling
Period: 01/02/2001 → 18/08/2004
Number of participants: 8
Phd Student:
Nikolov, Nikola Ivanov (Intern)
Supervisor:
Bang, Ole (Intern)
Bjarklev, Anders Overgaard (Intern)
Rasmussen, Jens Juul (Intern)
Main Supervisor:
Christiansen, Peter Leth (Intern)
Examiner:
Rottwitt, Karsten (Intern)
Bergé, Luc (Ekstern)
Monro, Tanya (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

PDE-regulering i Scientific Computing
Department of Informatics and Mathematical Modeling
Period: 01/02/2001 → 26/11/2004
Number of participants: 6
Phd Student:
Rasmussen, Jan Marthedal (Intern)
Supervisor:
Pedersen, Michael (Intern)
Main Supervisor:
Hansen, Per Christian (Intern)
Examiner:
Bendsøe, Martin P. (Intern)
Hesthaven, Jan (Intern)
Hugger, Jens (Ekstern)

Financing sources
Source: Internal funding (public)
Minimizing antibiotic resistance development MINIRESIST
The overall objective is to minimize resistance development in the intestinal flora of pigs following antibiotic treatment. The project has the following specific objectives: - To investigate the influence of antibiotic treatment regimes on the efficacy of treatment, the development and spread of resistant bacteria and on the load of resistant bacteria in the intestine at the point of slaughter. - To investigate the underlying kinetics of selection of resistant bacteria and the spread of resistance genes between bacteria in the intestine. - To investigate the association between the load of resistant bacteria in the intestine at the time of slaughter and the load on the carcasses after slaughter. - To develop and validate a comprehensive mathematical model for resistance development associated with the use of antibiotics in pig production. - To formulate improved treatment regimes using the mathematical model.

Division of Veterinary Diagnostics and Research
National Veterinary Institute
Department of Informatics and Mathematical Modeling
University of Copenhagen
Danish Agriculture and Food Council
University of Glasgow
Institute of Farm Animal Genetics
Period: 11/01/2001 → 14/12/2013
Number of participants: 13
Acronym: MINIRESIST
Project ID: 22481
Project participant:
Hansen, Axel Jacob Kornerup (Ekstern)
Guardabassi, Luca (Ekstern)
Nielsen, Jens Peter (Ekstern)
Nielsen, Søren Saxmose (Ekstern)
Toft, Nils (Ekstern)
Angen, Øystein (Intern)
Madsen, Henrik (Intern)
Christiansen, Lasse Engbo (Intern)
Bækbo, Poul (Ekstern)
Andreasen, Margit (Ekstern)
Matthews, Louise (Ekstern)
Schwarz, Stefan (Ekstern)
Project Manager, organisational:
Olsen, John Elmerdahl (Ekstern)

Financing sources
Source: Forskningsprojekter - Andre ministerier og styrelser
Name of research programme: Forskningsprojekter - Andre ministerier og styrelser
Amount: 3,726,720.00 Danish Kroner
Project

MACSI-net
Department of Mathematics
Period: 04/01/2001 → 30/04/2004
Number of participants: 1
Project participant:
Gravesen, Jens (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Forsk. EU - Rammeprogram
Amount: 159,840.00 Danish Kroner
Statistical Image Segmentation in 3D and 4D

Department of Informatics and Mathematical Modeling
Period: 01/01/2001 → 04/06/2004
Number of participants: 6
Phd Student:
Stegmann, Mikkel Bille (Intern)
Supervisor:
Larsen, Rasmus (Intern)
Larsson, Henrik B.W. (Ekstern)
Main Supervisor:
Ersbøll, Bjarne Kjær (Intern)
Examiner:
Hansen, Lars Kai (Intern)
Sonka, Milan (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Scientific Computing in Optimization, Simulation and Inversion

The goal of this research collaboration is to strengthen our research in scientific computing and algorithm development with emphasis on nonlinear and combinatorial optimization, simulation, and inversion. Among the most promising algorithms today are those based on various splitting techniques for subdivision of the problem as well as the algorithm, and there is a significant overlap between the splitting techniques currently in use within the above areas. In this project we will coordinate the algorithm development within our specific research areas and thus be able to draw collectively upon progress in the individual areas. The focus of our research will lie on the following areas: 1) new splitting techniques for branch-and-bound algorithms in optimization, 2) space-mapping techniques for complex optimization problems, 3) application of domain decomposition and approximation theory in simulation algorithms, 4) preconditioning techniques (based on domain decomposition and multilevel algorithms) for inversion algorithms, 5) methods for including prior knowledge/side constraints in linear and nonlinear inversion algorithms.

Department of Informatics and Mathematical Modeling
University of Copenhagen
Period: 01/12/2000 → 31/12/2002
Number of participants: 5
Project participant:
Hansen, Per Christian (Ekstern)
Madsen, Kaj (Ekstern)
Clausen, Jens (Ekstern)
Skelboe, Stig (Ekstern)
Project Manager, organisational:
Hansen, Per Christian (Intern)

Security and Safety of Computer Systems

Static analysis is a proven technology in the implementation of compilers and interpreters. Recent years have begun to see the application of static analysis techniques in novel areas such as software validation (for example, Ariane V) and software re-engineering (for example, the Y2K problem). This project will demonstrate that static analysis facilitates the validation of the security and safety of internet based computer systems.

Department of Informatics and Mathematical Modeling
Imperial College of Science, Technology and Medicine
French National Institute for Computer Science and Applied Mathematics
Trusted Logic
Period: 01/12/2000 → 31/12/2002
Number of participants: 5
Project participant:
Nielsen, Hanne Riis (Intern)
Hankin, Chris (Ekstern)
Jensen, Thomas (Ekstern)
Marlet, Renaud (Ekstern)
Project Manager, organisational:
Nielsen, Flemming (Intern)

*Statistical modelling of Traffic safety development*
ph.d. project financed by the Danish Transport Research Institute (DTF). The purpose of the project is to discuss various statistical models for assessing traffic safety development at an aggregate (national) level, exemplified by a study of the possible influence of various socioeconomic variables on traffic safety in Denmark.

Department of Informatics and Mathematical Modeling
Danish Transport Research Institute
Period: 01/12/2000 → 31/12/2003
Number of participants: 3
Project participant:
Christens, Peter (Intern)
Project Manager, organisational:
Thyregod, Poul (Intern)
Petersen, Kurt (Ekstern)

*Center for Interdisciplinary Studies*
The purpose is to create a virtual center to enhance interdisciplinary studies, workshops, and conferences related to technological issues

Department of Informatics and Mathematical Modeling
Department of Planning
Department of Technology and Social Sciences
Department of Telecommunication
Period: 01/11/2000 → …
Number of participants: 4
Project participant:
Elle, Morten (Intern)
Møller, Niels (Intern)
Sørensen, Lene Tolstrup (Intern)
Project Manager, organisational:
Vidal, Rene Victor Valqui (Intern)

*DESCARTES - Decision Support for Integrated Crew and Aircraft Recovery*
DESCARTES addresses the problem of disruption management for large airlines. This is considered one of the most important and hardest problems to deal with in today's planning procedures in the airline industry. The goal of the project has been to develop a prototype tool enabling the airlines to integrate the management of aircrafts and staff when replanning immediately before a flight due to last minute changes. The project has progressed in an incremental fashion developing a number of individual recovery systems for aircraft, crew, and passengers as well as a system enabling these to collaborate when generation potential solutions for a disruption. Each of the individual systems are useful as a stand-alone system enabling the project to give early business benefit to the industrial partner and to the software vendor participating. A number of different approaches has been tested in the development process: heuristics, constraint programming, and traditional mathematical programming methods. Also, different approaches to solution techniques for the integration of recovery systems has been tested: the Integrated Sequential Recovery method consisting of the individual subsystems collaboration through a well-defined interface to retrieve options, and the Tailored Integration approach, in which the generation of potential solutions is influenced by the current situation for crew and aircraft concurrently. The results of the project now form the basis of a number of commercial products marketed by Carmen System AB.
Location models
Traditional continuous location models attempt to locate point facilities in two-dimensional space so as to minimize transportation costs. In this project we expand the focus and try to locate lines in three-dimensional space or circles on the surface of a sphere. The research results are presented at conferences.

Signal Processing in Humanitarian Demining
The aim is to investigate the possibilities for multisensor based system for detection and classification of buried landmines. The main focus is on signal and image processing techniques for improvement of Ground Penetrating Radar detection system.
Ultra short nonlinear optical pulse propagation
The nonlinear Schrödinger equation (NLS) describes approximately the dynamics of optical pulse envelopes in the limit of many oscillations in the carrier wave. In ultra short optical pulses of order 10 femtoseconds, the number of oscillations is so few that the validity of the NLS equation is highly questionable. In this case it is necessary to study the original vector Maxwell equations including nonlinearity and polarization dynamics. So far investigations have shown that extending the NLS equation using higher order dispersion and nonlinearities and comparing to Maxwells equations describes well even ultra short pulses within the slowly varying envelope approximation. However, in a number of cases also the extended NLS equation cannot be used. As the magnitude of the dispersion and nonlinearity depends on the wave number/frequency, waves with different wave numbers obey different NLS equations. Accordingly, interaction among ultra short pulses of different wave numbers can only be treated using the original Maxwell's equations. Blow up observed in quintic NLS equations may be arrested when investigated in the framework of these original equations. Interference phenomena and propagation in optical crystals of ultra short pulses is better modelled by employing the Maxwell's equations. The purpose of this project is to go beyond the limit of the NLS equation and its extensions in studies of ultra short nonlinear optical pulses by invoking the first principle vector Maxwells equations coupled nonlinearly to the Lorenz equations for the polarization dynamics.

Department of Informatics and Mathematical Modeling
University of Arizona
Number of participants: 4
Project participant:
Moloney, Jerome V. (Ekstern)
Webb, Garry (Ekstern)
Brio, Moysey (Ekstern)
Project Manager, organisational:
Sørensen, Mads Peter (Intern)

Data assimilation in atmospheric dispersion of radioactive material
Department of Informatics and Mathematical Modeling
Period: 01/10/2000 → 18/03/2005
Number of participants: 6
Phd Student:
Drews, Martin (Intern)
Supervisor:
Lauritzen, Bent (Intern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Poulsen, Niels Kjølstad (Intern)
Finck, Robert R. (Ekstern)
Holst, Jan (Ekstern)
Financing sources
Source: Internal funding (public)
Name of research programme: Risø (Løn)

Relations
Publications:
Data assimilation on atmospheric dispersion of radioactive materials
Project: PhD

Modulære regulariserings-algoritmer
Department of Informatics and Mathematical Modeling
Period: 01/10/2000 → 05/10/2004
Number of participants: 5
Phd Student:
Jacobsen, Michael (Intern)
Main Supervisor:
Hansen, Per Christian (Intern)
Mapping Visual Cortical Regions in Awake, Behaving Monkey using Functional MRI (MAPAWAMO)
Most of our understanding of the human visual system comes from comparison with experimental data, especially single-cell data, obtained in monkeys. The problem has been that one has to compare results obtained not only in different species but also with different techniques. A considerable advance could be made if one could compare the functional imaging results in human to those obtained with the same technique in monkeys and then in a second step compare within the same species functional imaging data with single-cell or other experimental data. To that end one needs functional magnetic resonance imaging (fMRI) in the awake, behaving monkey. The overall aim is to perfect the monkey fMRI technique already in place in order to compare different types of fMRI analysis with an existing metabolic mapping standard in the monkey and to compare directly cortical networks in human and non human primates. We will use fMRI to map visual cortical regions responsive to different types of visual stimuli and active in visual discrimination tasks in monkeys and in humans. We will within the same monkey subject compare activation maps measured with fMRI and those obtained by metabolic labeling (double label 2-deoxyglucose - 2DG). This latter data will serve as "ground truth" with which to compare the results of the different analysis techniques for the fMRI signals. We will also use ICA to develop new tools to estimate functional connectivity and compare this to the extensive anatomical knowledge available in the monkey.

Department of Informatics and Mathematical Modeling
Medical School
R.U. Neurophysiology
French National Institute for Computer Science and Applied Mathematics

Anvendelser af harmoniske afbilledinger i geometriske variationsproblemer
Department of Mathematics

Phd Student:
Main Supervisor:
Hansen, Vagn Lundsgaard (Intern)
**Secure and Safe Systems based on Static Analysis**

Static analysis of programs is a proven technology in the implementation of compilers and interpreters. Recent years have begun to see application of static analysis techniques in novel areas such as software validation and software re-engineering. This project will demonstrate that static analysis technology facilitates the validation of systems based on the internet and on smart cards.

**Department of Informatics and Mathematical Modeling**

**Period:** 01/08/2000 → 01/10/2003

**Number of participants:** 2

**Project participant:**

*Nielsion, Hanne Riis (Intern)*

*Project Manager, organisational:*

*Nielsion, Flemming (Intern)*

**Sprog og logikker for ontologier**

**Department of Informatics and Mathematical Modeling**

**Period:** 01/08/2000 → 16/02/2004

**Number of participants:** 6

**Phd Student:**

*Oldager, Steen Nikolaj (Intern)*

**Supervisor:**

*Bruun, Hans (Intern)*

**Main Supervisor:**

*Nilsson, Jørgen Fischer (Intern)*

**Examiner:**

*Hansen, Michael Reichhardt (Intern)*
*Gehrke, Mai (Ekstern)*
*Øhrstrøm, Peter (Ekstern)*

**Financing sources**

*Source: Internal funding (public)*

*Name of research programme: DTU-lønnet stipendie*

*Project: PhD*

**Håndtering af Risiko borbundet med investeringer i et liberaliseret EI-marked**

**Department of Informatics and Mathematical Modeling**

**Period:** 15/07/2000 → 11/02/2005

**Number of participants:** 7

**Phd Student:**

*Lemming, Jacob (Intern)*

**Supervisor:**

*Morthorst, Poul Erik (Intern)*

*Ravn, Hans V. (Intern)*

**Main Supervisor:**

*Clausen, Jens (Intern)*

**Examiner:**

*Larsen, Jesper (Ekstern)*
*Bunn, Derek (Ekstern)*
*Wallace, Stein William (Ekstern)*

**Financing sources**

*Source: Internal funding (public)*
3D/4D image analysis

Department of Informatics and Mathematical Modeling
Period: 01/07/2000 → 11/12/2003
Number of participants: 5
Phd Student: Aanæs, Henrik (Intern)
Main Supervisor: Larsen, Rasmus (Intern)
Examiner: Ersbøll, Bjarne Kjær (Intern) Pollefeys, Marc (Ekstern) Zhu, Song-Chun (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

BIPS - None Touchable Inspections of Industrial Processes and Systems

Traditional ultrasound inspections require physical contact between the piezo-electric sound generator and the product or item to be investigated. Good contact is achieved by smearing oil onto the item which provides a good impedance match. In many potential new applications of ultrasound, physical contact is not desirable between the ultrasound generator/detector and the item to be inspected. This is the case in inspection at assembly lines, where the high speed of production do not allow cumbersome smearing and placement of an ultrasound generator/receiver onto the products on the line. However, in this project non contact ultrasound inspections are suggested to be accomplished using lasers. A powerful laser pulse is directed onto an item which generates a sound wave propagating through the item and is reflected from possible hidden defects. On return to the surface the wave is detected by laser beams who's interference patterns register the movement of the surface. The physical laser system is developed at Risø and FORCE Institute. The contribution to this project from IMM concerns mathematical modelling as an add to design and optimize a non touchable inspection system. This include modelling the generation of ultra sound through rapid laser heating from short pulses and wave propagation. Feedback control and steering of a production line with a non touchable inspection system implemented will be modelled and theoretically investigated.

Department of Informatics and Mathematical Modeling
FORCE Instituttet
Risø National Laboratory
Junckers Industrier A/S
Banestyrelsen A/S
Coloplast Danmark A/S
Hammel Maskinfabrik, SciTech a/s
Period: 01/07/2000 → 31/12/2003
Number of participants: 5
Project participant: Poulsen, Niels Kjølstad (Intern) Halkjær, Søren (Intern) Sevel, Torben (Ekstern) Lynov, Jens-Peter (Intern) Project Manager, organisational: Sørensen, Mads Peter (Intern)

Datamining In distributed medial databases

Department of Informatics and Mathematical Modeling
Period: 01/07/2000 → 16/02/2004
Number of participants: 6
Phd Student:
Have, Anna Szynkowiak (Intern)
Supervisor:
Hansen, Lars Kai (Intern)
Main Supervisor:
Larsen, Jan (Intern)
Examiner:
Winther, Ole (Intern)
Hulle, Marc Van (Ekstern)
Svarer, Claus (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt CAMP
Project: PhD

Limes
Department of Mathematics
Period: 21/06/2000 → 31/03/2004
Number of participants: 1
Project participant:
Branner, Bodil (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Forsk. EU - Rammeprogram
Amount: 586,751.00 Danish Kroner
Project

Image analysis in predictive biotechnology
Department of Informatics and Mathematical Modeling
Period: 01/06/2000 → 26/02/2004
Number of participants: 6
Phd Student:
Hansen, Michael Adsetts Edberg (Intern)
Supervisor:
Frisvad, Jens Christian (Intern)
Main Supervisor:
Carstensen, Jens Michael (Intern)
Examiner:
Nielsen, Jens (Intern)
Esbensen, Kim H. (Ekstern)
Petrou, Maria (Ekstern)

Financing sources
Source: Forskningsrådsfinansiering
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Models for forecasting the number of passengers on OD level
This project is performed in close collaboration with Scandinavian Airlines System (SAS), with the purpose of improving SAS system for passenger forecasting on Origin - Destination (OD) level.

Department of Informatics and Mathematical Modeling
SAS
Period: 01/06/2000 → 30/06/2001
Number of participants: 2
Project participant:
Pedersen, Søren (Ekstern)
Project Manager, organisational:
Nielsen, Henrik Aalborg (Intern)
Project

1-bit audio encoding schemes for digital amplification of audio signals
Department of Informatics and Mathematical Modeling
Period: 01/04/2000 → 01/04/2001
Number of participants: 2
PhD Student:
Hansen, Thomas Karsten (Intern)
Main Supervisor:
Sørensen, John Aasted (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

AMORE
Department of Information Technology
Department of Informatics and Mathematical Modeling
University of Rome
University of Konstanz
University of Patras
Swiss Federal Institute of Technology
University of L'Aquila
Centrum Wiskunde & Informatica
Period: 01/04/2000 → 31/03/2003
Number of participants: 1
Project Manager, organisational:
Bjørner, Dines (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,100,000.00 Danish Kroner

Data assimilering og autokalibrering i 2D/3D hydrodynamisk numerisk modellering af det marine miljø
Department of Informatics and Mathematical Modeling
Period: 01/04/2000 → 17/05/2004
Number of participants: 6
PhD Student:
Sørensen, Jacob Viborg Tornfeldt (Intern)
Supervisor:
Madsen, Henrik (Intern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Poulsen, Niels Kjølstad (Intern)
Cañizares, Rafael (Ekstern)
Heemink, Arnold Willem (Ekstern)

**Financing sources**
- Source: Internal funding (public)
- Name of research programme: Erhvervsforskerordningen
- Project: PhD

**Proof support for raise**

Department of Informatics and Mathematical Modeling
- Period: 01/04/2000 → 25/05/2004
- Number of participants: 6
- Phd Student: Lindegaard, Morten Peter (Intern)
- Supervisor: Hansen, Michael Reichhardt (Intern)
- Main Supervisor: Haxthausen, Anne Elisabeth (Intern)
- Examiner: Sharp, Robin (Intern)
- Janowski, Tomasz (Ekstern)
- Krieg-Brückner, Bernd (Ekstern)

**Financing sources**
- Source: Internal funding (public)
- Name of research programme: DTU-lønnen stipendie
- Project: PhD

**Length of general subdivision curves**

Subdivision curves has recently become popular objects of studies and in this project we search for fast algorithms to evaluate the length of these curves.

Department of Mathematics
- University of Stellenbosch
- Period: 28/03/2000 → ...
- Number of participants: 3
- Project participant: Villiers, Johan de (Ekstern)
- Goosen, Karin (Ekstern)
- Project Manager, organisational: Gravesen, Jens (Intern)

**Naural networks for data editing and imputation**

Department of Informatics and Mathematical Modeling
- Period: 01/03/2000 → 05/12/2001
- Number of participants: 2
- Phd Student: Larsen, Bjørn Steen (Intern)
- Main Supervisor: Hansen, Lars Kai (Intern)

**Financing sources**
- Source: Internal funding (public)
- Name of research programme: Offentlig finansiering
- Project: PhD
Ikke-lineær optimering ved anvendelse af surrogatmodeller

Department of Informatics and Mathematical Modeling
Period: 01/02/2000 → 20/05/2003
Number of participants: 7
Phd Student:
Sendergaard, Jacob (Intern)
Supervisor:
Frandsen, Poul Erik (Ekstern)
Nielsen, Hans Bruun (Intern)
Main Supervisor:
Madsen, Kaj (Intern)
Examiner:
Hansen, Per Christian (Intern)
Ravn, Hans V. (Intern)
Vicente, Luis Nunes (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Nonlinear dynamics of optical polymers

Department of Informatics and Mathematical Modeling
Period: 01/02/2000 → 22/05/2003
Number of participants: 7
Phd Student:
Jespersen, Kim Giessmann (Intern)
Supervisor:
Johansen, Per Michael (Intern)
Pedersen, Thomas Garm (Intern)
Main Supervisor:
Christiansen, Peter Leth (Intern)
Examiner:
Tidemand-Lichtenberg, Peter (Intern)
Bjørnholm, Thomas (Intern)
Kröll, Stefan (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

Novelty detection in video and image signals

Department of Informatics and Mathematical Modeling
Period: 01/02/2000 → 26/09/2003
Number of participants: 6
Phd Student:
Maletti, Gabriela Mariel (Intern)
Supervisor:
Conradsen, Knut (Intern)
Main Supervisor:
Ersbøll, Bjarne Kjaer (Intern)
Examiner:
Larsen, Rasmus Werner (Intern)
Johansen, Peter (Ekstern)
Sonka, Milan (Ekstern)

Financing sources
Wavelet and multiscale finite-element approximations

Department of Mathematics  
Period: 01/02/2000 → 02/12/2003  
Number of participants: 6  
Phd Student:  
Jensen, Torben Klint (Intern)  
Supervisor:  
Pedersen, Michael (Intern)  
Main Supervisor:  
Christensen, Ole (Intern)  
Examiner:  
Sørensen, Mads Peter (Intern)  
Cohen, Albert (Ekstern)  
Villemoes, Lars (Ekstern)

3D Shape Analysis of The Craniofacial Anomaly in Children With Cleft Lip and Palate

This project develops methods for extraction and analysis of the shape and size of the human skull in infancy and adolescence, and is carried out at the joint 3D-Laboratory (3D-Lab) of Copenhagen University Hospital, School of Dentistry, University of Copenhagen and Informatics and Mathematical Modelling, Technical University of Denmark. The methods are applied to three-projection x-ray images, plaster casts of palatal impressions and three-dimensional scans of children with cleft lip and palate. Reliable and detailed (semi-) automatic 3D point-to-point correspondence across a population of shapes is achieved using deformable models. Statistical methods are applied in order to analyze the shape and size variation within groups of children, as well as in order to discern between different types of treatment and study temporal evolution

Department of Informatics and Mathematical Modeling  
School of Dentistry  
Period: 01/01/2000 → 31/12/2003  
Number of participants: 4  
Project participant:  
Ersbøll, Bjarne Kjær (Intern)  
Darvann, Tron (Ekstern)  
Project Manager, organisational:  
Larsen, Rasmus (Intern)  
Kreiborg, Sven (Ekstern)

Bayesiansk signalbehandling og detektion

Department of Informatics and Mathematical Modeling  
Period: 01/01/2000 → 25/09/2003  
Number of participants: 7  
Phd Student:  
Fabricius, Thomas (Intern)  
Supervisor:  
Nørklit, Ole (Ekstern)  
Rasmussen, Carl Edward (Intern)  
Main Supervisor:  
Hansen, Lars Kai (Intern)  
Examiner:
Biomolecular Motor Mechanisms modelled by ratchets and solitons

Department of Informatics and Mathematical Modeling

Period: 01/01/2000 → 31/12/2002
Number of participants: 8

Project participant:
Nordén, Bengt (Ekstern)
Zolotaryuk, Y. (Ekstern)
Zolotaryuk, A. V. (Ekstern)
Ermakov, V. N. (Ekstern)
Kahlac, J. M. (Ekstern)
Savin, A. V. (Ekstern)

Project Manager, organisational:
Christiansen, Peter Leth (Intern)
Karpan, V. M. (Ekstern)


Department of Informatics and Mathematical Modeling

DHI Denmark

Period: 01/01/2000 → 30/06/2003
Number of participants: 2

Project participant:
Lynggaard-Jensen, Anders (Ekstern)

Project Manager, organisational:
Nielsen, Henrik Aalborg (Intern)

CIAMM - Center for Industrialised Application of Mathematical Modelling

CIAMM started its activity in late 1999. The goal has been to develop planning tools based on mathematical modelling, which can be used in everyday planning and replanning in larger companies. The planning problems are usually so complex, that a human planner cannot take into account all possible solutions. During the three project years the main case study has been the steel plate storage at Odense Steel Shipyard. The storage consists of 250 stacks containing more than 3000 types of steel plates. The plates are lifted by two gantry cranes sharing tracks and hence unable to pass each other. When a specific plates is needed in the production, all plates above this in the stack has to be moved to get
access to the plate. Hence each plate is lifted unproductively a number times before it is actually removed from the storage. The problem addressed is how to organize the storage in order to minimize the number of superfluous lifts. The project has developed methods both for planning the daily sequences of lifts and for on-line dispatch strategy for operating the cranes. Saving of 50 - 60 % on the current practice has been achieved. In addition, a packing system has been developed based on a real-life case from Bang & Olufsen, in which boxed are packed into containers taking into account also constraints regarding loads on the items and support of these. Finally, a methodology for IT-system development with a large optimization content has been developed and described - the technique resembles the DSDM method, and much attention is given to rapid prototype developments and to knowledge exchange between end users and developers, since this has turned out to be a major obstacle in the development process.

Department of Informatics and Mathematical Modeling
Department of Management Engineering
Aalborg University
Copenhagen Business School
Odense Steel Shipyard Ltd.
Bang & Olufsen A/S
Teknologisk Institut
Period: 01/01/2000 → 31/12/2002
Number of participants: 8
Project participant:
Hansen, Jesper (Intern)
Project Manager, organisational:
Clausen, Jens (Intern)
Vesterager, Johan (Intern)
Holm, Hans (Ekstern)
Mouritsen, Jan (Ekstern)
Tuxen, Jan (Ekstern)
Kamp, Per (Ekstern)
Risager, Claus (Ekstern)

Coupled excitable cells
Mathematical modelling and theoretical investigations of pancreatic beta-cells, which are responsible for producing and secreting insulin. Pancreatic beta-cells belong to a class of cells that exhibit electrical activity like nerve cells and cells in muscle tissue. The dynamical behaviour results from an action potential across the cell membrane created by ion currents passing into and out of the cell. In the case of beta-cells the current flow is dominated by Ca- and K-ions, and both flows depend on the glucose concentration. Therefore the activity of the beta-cells is correlated to the production of insulin, which is a hormone essential for regulating the level of glucose in the blood. In the pancreas, beta-cells form islets of coupled cells, suggesting a study of cooperative behaviour in a spatially extended system that mimics the islets. Since dynamic pattern formation has been observed in spatially extended excitable media consisting of nervous tissue and heart muscle, we expect similar behaviour in the beta-cell islets.

Department of Informatics and Mathematical Modeling
Period: 01/01/2000 → 31/12/2002
Number of participants: 1
Project Manager, organisational:
Sørensen, Mads Peter (Intern)

Domain-specific Languages for Railway Control Systems
The purpose of this project is to develop a concept for development of railway control systems. The idea is to provide a generic railway control system, a domain-specific language for specifying application specific parameters and a compiler from domain-specific descriptions into configuration data for the generic control system. A validation, verification and test approach is also to be provided.

Department of Information Technology
Department of Informatics and Mathematical Modeling
University of Bremen
Period: 01/01/2000 → 31/12/2010
Number of participants: 2
Project participant:
Peleska, Jan (EKstern)
Project Manager, organisational:
Haxthausen, Anne Elisabeth (Intern)

**Financing sources**
Source: Overhead/overskud
Name of research programme: Overhead/overskud
Amount: 0.00 Danish Kroner

**EDU-IT: 2000-2002**
Brugen af IKT-værktøjer i undervisningen på DTU er gennemgået, best practices identificeret, og et antal forsøg med nye undervisningsformer og -materialer er gennemført. Af særlig interesse er mulighederne for eget VIP-TAP-samarbejde og udnyttelse af DTUs CSCW-system, CampusNet. EDU-IT videreføres i form af IMM’s active deltagelse i SCKK’s "Kompetencerejse"

Department of Informatics and Mathematical Modeling

**Centre for Engineering Educational Development**
Period: 01/01/2000 → 31/12/2002
Number of participants: 1
Project Manager, organisational:
Hansen, Per Skafte (Intern)

**Graduate School in Nonlinear Science**
The Center for Modelling, Nonlinear Dynamics and Irreversible Thermodynamics (MIDIT) at the Technical University of Denmark (DTU), the Department of Optics and Fluid Dynamics (OFD) at Risø National Laboratory (Risø), and the Center of Chaos and Turbulence Studies (CATS) at Copenhagen University (KU) conduct a Graduate School in Nonlinear Science. In collaboration with industry, this school provides a Danish Ph.D. program at the highest international level with the aim of preparing students to apply recent advances in Nonlinear Science to outstanding problems of science and technology and to strengthen international exchange of Ph.D. students. Over the past three decades, science has experienced a revolutionary shift in its fundamental paradigms. Primarily based on linear models through the 1960s, scientific research is now commonly motivated by nonlinear concepts, in which the whole is more than the sum of its parts, and the emergence of qualitatively new phenomena is anticipated and made welcome. The basic theme of modern Nonlinear Science is the interplay between chaos and coherent structures. Formerly deemed unworthy of the attention of a serious scientist, low order systems of nonlinear ordinary differential equations are now known to exhibit explosive behavior, leading to the emergence of strange attractors upon which phase space trajectories wander aimlessly until the end of time. Largely ignored as being far too difficult to solve analytically, nonlinear partial differential equations have been found to generate the emergence of solitary waves, which interact as new dynamic entities at higher levels of description. These new paradigms lead to significant advances in our understanding of a number of observed phenomena in physics, chemistry, and biology. From the theory, methods for constructive applications in the engineering sciences have been developed, using computer technology.

Department of Informatics and Mathematical Modeling

**Department of Physics**
Period: 01/01/2000 → 01/01/2002
Number of participants: 2
Project participant:
Bohr, Tomas (Intern)
Project Manager, organisational:
Christiansen, Peter Leth (Intern)

**Industrialiseret anvendelse af matematisk optimeringsmodel**
Department of Informatics and Mathematical Modeling
Localisation by Nonlinearity and Spatial Discreteness, and Energy Transfer, in Crystals, Biomolecules and Josephson Arrays (LOCNET)

We will apply the concept of "Discrete breather" and recently gained insight into related types of localised excitation, to a wide range of physical and biological contexts. These will include dynamical function of DNA and molecular motors, spectral hole burning, interstellar carbon, high temperature superconductivity, light-emitting polymers, Josephson junction arrays, solid friction, nonlinear conductivity of charge density wave materials, detonation and dynamics of hydrogen bonded systems. This will be achieved via deep two or more way interaction between theorists and experimentalists. It will involve further development of mathematical theory, physical insight, computational techniques, methods of interpretation of experimental data and new experimental tests.

Department of Informatics and Mathematical Modeling

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt CAMP
Project: PhD
**Modellering, ikke-lineær Dynamik og irreversibel termodynamik (MIDIT)**


**Department of Informatics and Mathematical Modeling**

**Department of Mathematics**

**Department of Physics**

**Administration**

**Department of Chemistry**

**Department of Energy Engineering**

**Financing sources**

Source: Unknown

Name of research programme: Ukendt

Amount: 360,000.00 Danish Kroner

**Multivariate Statistics in Predictive Biotechnology**

The aims of the studies are based on the main hypothesis that the combination of multivariate statistics and image analysis of features can be used as a tool in (visual and chemical) database identification processes within isolates from the fungal genera Penicillium and Aspergillus. Databases of functional characteristics are expected to be complementary to the known DNA-sequence based databases. The identification is based on visual as well as secondary metabolite profiles. Secondary metabolites are end products of the bio-chemical processes that take place within cells of all living organisms, and they are therefore indirectly descriptive of the cells metabolic processes. If different cells use different processes, there will also be a difference in the variety of metabolites produced. Furthermore the chemical variation in the metabolites can be directly related to ecology and habitat.

**Department of Informatics and Mathematical Modeling**
Sampling strategy and statistical modelling of exposure

ph.d. project financed by the Danish Research Academy and the Danish National Institute of Occupational Health (AMI). The purpose of the project is to investigate the uncertainty associated with various sampling strategies used for the assessment of individual workers exposure to gases and vapours in the working environment.

Scaling from individuals to populations (SLIP) (38726)

The research school SLIP (Scaling from Individuals to Populations) focuses on how individual behavior and mutual interactions generate the dynamics observed at the population level. This topic forms the link between the basic and applied marine ecological research environments in Denmark and requires input from biology, mathematics and statistics. SLIP is one of the five research networks and research schools under the Danish Network for Aquaculture and Fisheries Research (Fishnet). SLIP has arranged a number of national and international PhD courses and workshops and has served to focus the interest on size and trait-based modeling, as well as on improved understanding of the physiology, genetics and behavior of marine organisms, in particular fish.

The project is coordinated by DTU Aqua.
Gislason, Henrik (Intern)  
Kiørboe, Thomas (Intern)  
Eg Nielsen, Einar (Intern)  

Project

Statistisk modellering af antal trafikuheld i Danmark  
Department of Informatics and Mathematical Modeling  
Period: 01/01/2000 → 16/02/2004  
Number of participants: 5  
Phd Student:  
Christens, Peter (Intern)  
Main Supervisor:  
Thyregod, Poul (Intern)  
Examiner:  
Spliid, Henrik (Intern)  
Elvik, Rune (Ekstern)  
Wegman, Fred (Ekstern)

Financing sources  
Source: Internal funding (public)  
Name of research programme: Offentlig finansiering  
Project: PhD

Storskala parallelberegning af exciterbare cellers dynamik i to dimensioner  
Department of Mathematics  
Period: 01/01/2000 → 01/03/2002  
Number of participants: 2  
Phd Student:  
Petersen, Mette Vesterager (Intern)  
Main Supervisor:  
Sørensen, Mads Peter (Intern)

Financing sources  
Source: Internal funding (public)  
Name of research programme: Institut, samfinansiering  
Project: PhD

Reinholdt W. Jorck og hustru fond  
Department of Mathematics  
Period: 16/12/1999 → 31/10/2010  
Number of participants: 1  
Project participant:  
Markvorsen, Steen (Intern)

Financing sources  
Source: Gaver, Private danske Fonde  
Name of research programme: Gaver, Private danske Fonde  
Amount: 150,000.00 Danish Kroner  
Project:

Fotogrammetrisk opbygning af 3D landskabs- og bymodeller  
Department of Informatics and Mathematical Modeling  
Period: 01/12/1999 → 28/10/2004  
Number of participants: 7  
Phd Student:  
Olsen, Brian Pilemann (Intern)  
Supervisor:
Frederiksen, Poul (Intern)
Knudsen, Per (Intern)
Main Supervisor:
Jacobi, Ole Illum (Intern)
Examiner:
Nielsen, Allan Aasbjerg (Intern)
Colomina, Ismael (Ekstern)
Höhle, Joachim (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Forskerakademiets Samfinansier
Project: PhD

**Signal processing for diagnosis support systems**
Department of Informatics and Mathematical Modeling
Period: 01/12/1999 → 06/10/2003
Number of participants: 6
Phd Student:
Sigurdsson, Sigurdur (Intern)
Supervisor:
Larsen, Jan (Intern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Examiner:
Winther, Ole (Intern)
Andersen, Jens Damgaard (Ekstern)
Benediktsson, Jón Atlí (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

**Intelligent, Interactive Templates and their Application to 3D Medical Modelling**
Department of Informatics and Mathematical Modeling
Number of participants: 7
Phd Student:
Darvann, Tron Andre (Intern)
Supervisor:
Conradsen, Knut (Intern)
Kreiborg, Sven (Ekstern)
Main Supervisor:
Ersbøll, Bjarne Kjær (Intern)
Examiner:
Carstensen, Jens Michael (Intern)
Cootes, Timothy Francis (Ekstern)
Mars, Michael (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Ansat eksternt CAMP
Project: PhD

**THALAMUS**
THALAMUS is a EUREKA-project with Swedish and Danish partners based on an in depth analysis of present in the health care system regarding patient information: The complexity of acquisition and exchange, journal administration, image administration in regards to digitizing of information and various electronic formats. The lack of opportunities for free
flow of information is a significant obstacle for further rationalization of the daily operation at any hospital department and minor health care units. At the same time the opportunity for quality and assurance is disabled. The introduction of the electronic patient journal has only resolved a limited part of the mentioned problem where Thalamus aims towards a complete solution with facilities making digitizing of all types of patient information, text, images, sound, film and at the same time integration these, with the possibility for immediate acquisition and transmission.

Department of Informatics and Mathematical Modeling

Meditel A/S

Aalborg University

MediBase A/S

Sysdemo Mimer AB

National University Hospital

Panum Institutet
Period: 20/10/1999 → …
Number of participants: 1
Project Manager, organisational:
Larsen, Jan (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Mathematical/Numerical Modelling of Irregular Nonlinear water Waves
Project No.: 10-00-1286 Ph.D.project: Henrik Bredmose Funding: DTU

Department of Informatics and Mathematical Modeling
Period: 01/10/1999 → 31/12/2002
Number of participants: 2
Project participant:
Bredmose, Henrik (Intern)
Project Manager, organisational:
Madsen, Per A. (Intern)

Virtual reality - collaborative work

Department of Informatics and Mathematical Modeling
Period: 01/10/1999 → 26/11/2004
Number of participants: 5
Phd Student:
Larsen, Bent Dalgaard (Intern)
Main Supervisor:
Christensen, Niels Jørgen (Intern)
Examiner:
Henriksen, Knud (Ekstern)
Chalmers, Alan (Ekstern)
Myszkowski, Karol (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

IEEE International Workshop on Multimedia Signal Processing, 1999
Project No. 1279. Responsible for the accomplishment of the paper submission, technical program, invited speakers, and conference site. The Workshop is sponsored by Nokia A/S, Teledanmark A/S, Thríges Fond, The Danish National Center for IT Research, and IMM DTU. The workshop was carried out in the period Monday September 13 - 15. The homepage of the workshop is http://eivind.imm.dtu.dk/mmsp99/. At IMM the work was carried out in cooperation with Ellen Marie Borup,
Steffen Duus Hansen, Peter Søren Kirk Hansen, Preben Kidmose, and Ulla Nørhave. The workshop was accomplished in cooperation with IEEE Multimedia Signal Processing Technical Committee.

Department of Informatics and Mathematical Modeling
Period: 13/09/1999 → 15/09/1999
Number of participants: 1
Project Manager, organisational:
Sørensen, John Aasted (Intern)

All-Optical Signal Processing in Quadratic Nonlinear Materials
Danish Technical Scientific Research Council Projekt no. 1280
Department of Informatics and Mathematical Modeling
Period: 01/09/1999 → 31/03/2002
Number of participants: 2
Project participant:
Corney, Joel Frederick (Intern)
Project Manager, organisational:
Bang, Ole (Intern)

Financing sources
Source: Unknown
Name of research programme: Uknown
Amount: 648,000.00 Danish Kroner

Freight Wagon Dynamics and Safety
Department of Informatics and Mathematical Modeling
Period: 01/09/1999 → 25/10/2002
Number of participants: 6
Phd Student:
Xia, Fujie (Intern)
Supervisor:
Van, Bent C. (Ekstern)
Main Supervisor:
True, Hans (Intern)
Examiner:
Thomsen, Per Grove (Intern)
Nielsen, Jakob Birkedal (Intern)
Pascal, Jean-Pierre (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

Geometric knot theory with applications to proteins
This project focuses on relations between the geometry of protein backbones and the geometry of framed space curves. This is done with the purpose of finding continuous models of protein backbones, such that protein structure and dynamics can be studied by methods of (global) differential geometry and infinite dimensional dynamical systems.

Department of Mathematics

Department of Physics
Period: 01/09/1999 → 31/08/2001
Number of participants: 2
Project participant:
Bohr, Henrik (Intern)
Project Manager, organisational:
Ragen, Peter (Intern)
Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 380,367.00 Danish Kroner
Project

Logiske teorier for datamaskinel introspektion og selv-reference med henblik på autonome agenter
Department of Informatics and Mathematical Modeling
Period: 01/09/1999 → 16/02/2004
Number of participants: 6
Phd Student:
Bolander, Thomas (Intern)
Supervisor:
Jensen, Helge Elbønd (Intern)
Main Supervisor:
Nilsson, Jørgen Fischer (Intern)
Examiner:
Pedersen, Stig Andur (Intern)
Fitting, Melvin (Ekstern)
Gehrke, Mai (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Multichannel adaptive analysis of rotating systems
Department of Informatics and Mathematical Modeling
Period: 01/09/1999 → 25/08/2003
Number of participants: 8
Phd Student:
Pedersen, Thorkild Find (Intern)
Supervisor:
Gram-Hansen, Klaus (Ekstern)
Hansen, Per Christian (Intern)
Herlufsen, Henrik (Ekstern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Examiner:
Sørensen, Helge Bjarup Dissing (Intern)
Pedersen, Jacob Mørch (Ekstern)
Randall, R. B. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

Nonlinear dynamics of optical polymers
Department of Informatics and Mathematical Modeling
Period: 01/09/1999 → 01/09/1999
Number of participants: 2
Phd Student:
Broe, Jacob (Intern)
Main Supervisor:
Christiansen, Peter Leth (Intern)

Financing sources
**Ph.D. Project: Multichannel Adaptive Analysis of Rotating Systems (MARS)**

Project No.: 3140. The objectives of the project are to develop methods for the estimation and tracking of the fundamental frequency components in rotating systems, without using tachometers, but only accelerometer measurements from different acquisition points on the system being investigated. Furthermore, the multichannel measurements must be used for the estimation of parameters, which can be used for the diagnosis of unbalance, misalignment, bent shaft and instability in journal bearings and mechanical looseness, and incipient faults in rolling-element bearings. Projects participants: civilingenior Thorkild Find Pedersen, Bruel & Kjaer A/S, ph.d. student. Supervisors: civilingenior Henrik Herlufsen, Bruel & Kjaer A/S, civilingenior Ole Roth, Bruel & Kjaer A/S, civilingenior, ph.d. Klaus Gram-Hansen, Gram & Juhl ApS, Professor Per Chr. Hansen, IMM, DTU, lektor Steffen Duus Hansen, IMM, DTU, lektor John Aa. Sorensen, IMM, DTU.

Department of Informatics and Mathematical Modeling

Period: 01/09/1999 → 31/08/2001

Number of participants: 1

Project Manager, organisational:

Sørensen, John Aasted (Intern)

**Financing sources**

Source: Unknown

Amount: 1,466,950.00 Danish Kroner

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**Purity-analysis of SEED**

Application of herbicides is currently reduced substantially in the conventional seed-production. In organic farms a production of grass and clover are being developed, to meet the needs for ecologically produced seed in the year 2000. These changed methods of cultivation will, no doubt, increase the amount of unwanted seeds in the raw material and therefore increase the need for surveillance and new development of the cleaning process. To meet the increasing demands of the cleaning process the development of a prototype for a vision-based purity-analysis machine have started. The machine aims at a usage in the field of process control of the cleaning process plus the purity control. The project will, in the development phase, focus on one of the most difficult and therefore also one of the most vision-relevant problems, that is to differentiate between seeds of meadow grass and 1 year old meadow grass.

Department of Informatics and Mathematical Modeling

Period: 01/09/1999 → 31/08/2001

Number of participants: 3

Project ID: 3147

Project participant:

Frederiksen, Martin Stig (Intern)

Hartelius, Karsten (Intern)

Project Manager, organisational:

Carstensen, Jens Michael (Intern)

**Financing sources**

Source: Unknown

Amount: 300,600.00 Danish Kroner

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**3D Shape Analysis. Project no.: 1299**

Project no.: 1299. The aim of the present project is to describe three-dimensional (3D) objects in order to model and simulate the shape variation. This allows for: 1. Knowledge driven design/optimal design. 2. Prediction of the full object based on partial knowledge about the object (occlusion) 3. Prediction of a future object based on previous observations (growth prediction). The methods in the study are based on morphometric tools also called shape analysis. The basis for the analysis is landmark data. Landmark are homologous point presumed to correspond over the object of a data set. When having only a few landmarks the registration may be performed manually, but for thousands of points it becomes tedious and practically impossible. In many cases punctual landmarks are hard to establish in images, and the process requires considerable prior anatomical knowledge. We search for automated methods for landmark detection in this study. Such methods have already been developed in the Ph.D study by Per Andresen, but must be extended to provide a tool for industrial and medical 3D shape analysis. Having the landmarks defined for the complete data set, we are able to use well known methods from statistics such as Principal Component Analysis (CPA), different tests on the data (like test for
Geometry of finite metric spaces.
The geometry of finite metric spaces, in particular subspaces of riemannian manifolds, is examined. The central question is how much of topology and geometry that can be decoded from the finite subspace.
Space-Time metrics
Which manifolds can be given Space-Time metrics satisfying certain conditions on causality and curvature?

Department of Mathematics
Period: 01/08/1999 → 01/06/2002
Number of participants: 3
Project participant:
Markvorsen, Steen (Intern)
Hjorth, Poul G. (Intern)
Project Manager, organisational:
Kokkendorff, Simon Lyngby (Intern)

Numerical prediction of green water loads on ships
Ph.d-project, STVF Name: Kristian Bendix Nielsen; (employed at ISH). The objective of the present Ph.D project is to simulate numerically the dynamics of both the ship and the water at instants of high green water load, and hereby gain better understanding of the underlying processes. This is considered to be a step forward in establishing better tools for the design of safe ships and FPSO's.

Department of Informatics and Mathematical Modeling
Department of Naval Architecture and Offshore Engineering
STVF
Period: 01/07/1999 → 01/07/2002
Number of participants: 4
Project participant:
Nielsen, Kristian Bendix (Intern)
Jensen, Jørgen Juncher (Intern)
Andersen, Poul (Intern)
Project Manager, organisational:
Mayer, Stefan (Intern)

Signal and Image Processing for Telemedicine (SITE).
Project No. 3135. The rapid development in sensor technology, signal processing methods and parallel computing technology has enabled the physical realization of complex mathematical models in a diversity of scientific and industrial areas. This beginning interdisciplinary convergence of methodologies in science and technology has already had an impact on several industries and is emerging in medical imaging and more generally in telemedicine. It seems very likely that bringing together specialists from the mentioned areas could further boost the development of medical information processing in Denmark. Such considerations also head to incorporating the disciplines signal processing, scientific computing, and image analysis in the Department of Mathematical Modelling (IMM) together with applied mathematical physics, numerical analysis, operations research, and statistics. Furthermore, there has been established a close co-operation between scientist from DTU and several departments from different hospitals and university clinics.

Department of Informatics and Mathematical Modeling
Period: 01/07/1999 → 30/06/2003
Number of participants: 9
Project participant:
Madsen, Kaj (Intern)
Hansen, Per Christian (Intern)
Hansen, Lars Kai (Intern)
Ersbøll, Bjarne Kjær (Intern)
Carstensen, Jens Michael (Intern)
Larsen, Jan (Intern)
Methods for the detection and evaluation of traffic safety problems in a road network

The project is concerned with 1) to locate such parts of a road network where accident occurrence is unusually high. This involves detailed studies of the random variation of accident occurrence in time and space 2) to give proposals for technical solutions to the accident occurrences and 3) to set up statistical method for the control of the effects of the technical solutions.

Department of Planning

Department of Informatics and Mathematical Modeling

Period: 01/06/1999 → 31/05/2002

Number of participants: 4

Project participant:

Laursen, Jan Grubb (Intern)

Thyregod, Poul (Intern)

Project Manager, organisational:

Jørgensen, N O (Intern)

Aagaard, Pierre Egom (Intern)

Metoder til detektering og vurdering af trafiksikkerhedsproblemer i vejnettet

Department of Informatics and Mathematical Modeling

Period: 01/06/1999 → 20/09/2002

Number of participants: 7

Phd Student:

Vistisen, Dorte (Intern)

Supervisor:

Laursen, Jan Grubb (Intern)

Nielsen, Michael Aakjer (Ekstern)

Main Supervisor:

Thyregod, Poul (Intern)

Examiner:

Rootzén, Helle (Intern)

Kulmala, Risto (Ekstern)

Rørbech, Jens (Intern)

Financing sources

Source: Internal funding (public)

Name of research programme: Erhvervsforskerordningen

Project: PhD

Nonlinear dynamics of optical polymers

Department of Informatics and Mathematical Modeling

Period: 01/06/1999 → 15/11/2002

Number of participants: 7

Phd Student:

Johansen, Steffen Kjær (Intern)

Supervisor:

Sørensen, Mads Peter (Intern)

Main Supervisor:

Bang, Ole (Intern)

Examiner:
The structure of triangle-free graphs
Carsten Thomassen proved in 1999 the conjecture made by Erdos and Simonovits in 1973 that for every c greater than 1/3, the triangle-free graphs of minimum degree at least cn have bounded chromatic number. There is no such result if c is less than 1/3. In collaboration with Adrian Bondy and Stephan Thomasse at Universite Claude Bernard Lyon, Carsten Thomassen studies density conditions implying triangles in graphs.

Department of Mathematics
Period: 01/05/1999 → ...
Number of participants: 1
Project Manager, organisational:
EXPLAIN - Explorative Net Planning
EXPLAIN is concerned with strategic planning of communication networks in the telecommunication sector. The goal has been to construct a planning tool to be used both on an operational and a strategic level by net planners. The tool will have a visual user interface for both in- and output, underlying modules dealing with traffic analysis and network construction under varying assumptions on objectives (such as cost and fail-safeness) and constraints, and the ability to handle also scenarios with uncertainty regarding central parameters. The project resulted in three Ph.D.-theses addressing the issues of traffic, physical net planning, and optimization methods in network design. The project part regarding user interface was left unsolved due to recruitment problems. Regarding the optimization methods, the key result was the ability to take into account not only links and their costs, but also nodes and costs of these when designing a communication network in the greenfield case. Also, optimization of the ring architecture for communication networks with protection was considered, and new results questioning the current practice in design of this type of networks was achieved.

Department of Informatics and Mathematical Modeling
Ericsson Telecom AB
TDC A/S
Period: 01/04/1999 → 01/06/2002
Number of participants: 5
Project participant:
Stidsen, Thomas Jacob Riis (Intern)
Nielsen, Peter Søbye (Ekstern)
Project Manager, organisational:
Clausen, Jens (Intern)
Dittmann, Lars (Intern)
Skjoldstrup, Bjarke (Ekstern)

Modeller og metoder til analyse af elproduktion i internationalt perspektiv
Department of Informatics and Mathematical Modeling
Period: 01/04/1999 → 07/02/2003
Number of participants: 6
Phd Student:
Hindsberger, Magnus (Intern)
Supervisor:
Ravn, Hans V. (Intern)
Main Supervisor:
Vidal, Rene Victor Valqui (Intern)
Examiner:
Thomsen, Per Grove (Intern)
Fosso, Olav Bjarte (Ekstern)
Nissen, Flemming (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

Spatial solitons, vortices, and patterns in non-linear optical media
Department of Informatics and Mathematical Modeling
Period: 01/04/1999 → 08/11/2002
Number of participants: 8
Phd Student:
Bache, Morten (Intern)
Supervisor:
Bang, Ole (Intern)
Rasmussen, Jens Juul (Intern)
Saffman, Mark (Intern)
Main Supervisor:
Christiansen, Peter Leth (Intern)
Examiner:
Tromborg, Bjarne (Intern)
Firth, William J. (Ekstern)
Pedersen, Thomas Garm (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

Types for DSP Assembler Programs
Department of Informatics and Mathematical Modeling
Period: 01/04/1999 → 26/02/2004
Number of participants: 6
Phd Student:
Larsen, Ken (Intern)
Supervisor:
Sestoft, Peter (Intern)
Main Supervisor:
Sparsø, Jens (Intern)
Examiner:
Nielsen, Hanne Riis (Intern)
Hankin, Chris (Ekstern)
Morrisett, Greg (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskerakademiets Samfinansier
Project: PhD

Vindmøllepark-produktionsprediktor
Prediction of the windpower production in Denmark. A prediction model covering wind turbines in question will be installed at 4 major utilities in Denmark. ELSAM, ELKRAF, SEAS, and ELTRA. The prediction model is based on a combination of online observations and meteorological forecasts. The forecasts will be delivered from DMI using their numerical weather forecasting model, HIRLAM.

Department of Informatics and Mathematical Modeling
Risø National Laboratory
Elkraft A.m.b.A.
SEAS-NVE
Elsam A/S
ELTRA I/S
Danish Meteorological Institute
Period: 01/04/1999 → 31/03/2002
Number of participants: 3
Project participant:
Joensen, Alfred K. (Intern)
Nielsen, Torben Skov (Intern)
Project Manager, organisational:
Madsen, Henrik (Intern)

Financing sources
Formelle notationer til specifikation og verification af indlejrede, tidstro systemer

Department of Informatics and Mathematical Modeling
Period: 01/02/1999 → 23/08/2002
Number of participants: 6
Phd Student:
Rasmussen, Thomas Marthedal (Intern)
Supervisor:
Rischel, Hans (Intern)
Main Supervisor:
Hansen, Michael Reichhardt (Intern)
Examiner:
Løvengreen, Hans Henrik (Intern)
Larsen, Kim Guldstrand (Ekstern)
Nipkow, Tobias (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Invariants in differential geometry and elasticity
This project is concerned with finding an explicit fundamental system of invariants, in the case of third order invariants on a surface and in the case of the elasticity tensor in dimension two and three.

Department of Mathematics
Period: 01/02/1999 → …
Number of participants: 1
Project Manager, organisational:
Gravesen, Jens (Intern)

Material Interpolation Schemes in Topology Design
In topology optimization of structures, materials and mechanisms, parametrization of geometry is often performed by a grey-scale density-like interpolation function. In this project we analyze and compare the various approaches to this concept, in the light of variational bounds on effective properties of composite materials. This allows for a derivation of simple necessary conditions for the possible realization of grey-scale via composites, leading to a physical interpretation of all feasible designs as well as the optimal design. Thus it has been shown that the so-called artificial interpolation model in many circumstances actually fall within the framework of microstructurally based models. Single material and multi-material structural design in elasticity as well as in multi-physics problems is studied.

Department of Mathematics
Department of Solid Mechanics
Period: 01/02/1999 → 31/12/2000
Number of participants: 2
Project participant:
Sigmund, Ole (Intern)
Project Manager, organisational:
Bendsøe, Martin P. (Intern)

Modellering og digital signalbehandling for MR-baseret måling af blodgennemstrømning
Department of Informatics and Mathematical Modeling
Period: 01/02/1999 → 27/09/2002
Number of participants: 6
Phd Student:
Sidaros, Karam (Intern)
Supervisor:
Larsson, Henrik B. W. (Ekstern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Examiner:
Larsen, Jan (Ekstern)
Calamante, Fernando (Ekstern)
Schaumburg, Kjeld (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Qos-based Systems Design for Real-Time Multimedia
Department of Informatics and Mathematical Modeling
Period: 01/02/1999 → 20/01/2004
Number of participants: 2
Phd Student:
Todirica, Edward Alexandru (Intern)
Main Supervisor:
Sharp, Robin (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Algebraic Coding Theory and Cryptology
Design and analysis for efficient error-correcting coding and cryptography systems with emphasis on the basic problems.

Department of Mathematics
Department of Telecommunication
Aalborg University
Aarhus University
Period: 01/01/1999 → 31/12/2001
Number of participants: 9
Project participant:
Jensen, Helge Elbrend (Intern)
Jensen, Jørn Møller (Intern)
Heydtmann, Agnes Eileen (Intern)
Nielsen, Rasmus Refslund (Intern)
Justesen, Jørn (Intern)
Thommesen, Cristian (Ekstern)
Damgaard, Ivan (Ekstern)
Hansen, Johan P. (Ekstern)
Project Manager, organisational:
Høholdt, Tom (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 900,000.00 Danish Kroner
Project
Biomedical sensors
At Research Center COM we have entered into a collaboration with other DTU institutions (namely Institute of Physics and IMM) and Forskningscenter Risø, concerning biomedical optics (BIOP). The BIOP initiative covers four focus areas. At COM we are primarily involved in the development of optical coherence tomography (OCT) systems, and over the past year, we have in collaboration with Forskningscenter Risø developed a theoretical/numerical model describing the noise-properties of practical OCT systems. In addition to this model, which has been used in the design of next generation OCT systems, detailed modelling of light propagation in random media (living tissue such as skin or eyes) has been performed. Results of this work have been presented at international conferences such as Conference on Optical Tomography and Spectroscopy of Tissue, San Jose, CA. Another key activity for Research Center COM concerning the BIOP collaboration has been the initial investigations of photonic crystal fibres (PCFs) in sensors. Here we make use of the fact that the PCFs contain micron wide holes and provide the possibility for guiding light in these. Hereby, an attractive alternative to evanescent field waveguides becomes possible, and at COM we have applied our detailed numerical tools in describing the waveguiding properties of such new sensor waveguides presented at the International Conference LIGHT FOR LIFE 99 in Cancun, Mexico.

Fibers & Nonlinear Optics
Department of Photonics Engineering
Rise National Laboratory for Sustainable Energy
Department of Physics
Department of Informatics and Mathematical Modeling
Period: 01/01/1999 → …
Number of participants: 5
Project participant:
Tycho, Andreas (Intern)
Buckhave, Preben (Ekstern)
Ersbøll, Bjarne (Ekstern)
Project Manager, organisational:
Bjarklev, Anders Overgaard (Intern)
Petersen, Paul Michael (Ekstern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Project
Computational Hydrodynamics
The scientific objective of the research program is to develop a number of unique mathematical models and numerical methods for the computation and prediction of the hydrodynamic problems described above. New insight and new prediction methods will be obtained for problems such as surfzone hydrodynamics, scour around large marine structures, ship hydrodynamics and propulsion, vortex-induced vibration of structures and response of moored ships in restricted waters. A new sophisticated experimental facility for multidirectional waves will be used for validation purposes, in conjunction with existing laboratory and field data. Results from the research program will include: - Establishment of a new basic research group at the Technical University of Denmark (DTU) - Education of 5 PhD candidates in collaboration between Danish institutions - Further development of international collaboration e.g. through exchange of PhD students and post docs - Further development of a leading international position within the scientific field - Publication of peer-reviewed journal papers and participation in international conferences - Dissimination of research results and methods to Danish industry and engineering companies
Department of Informatics and Mathematical Modeling
Department of Energy Engineering
Department of Naval Architecture and Offshore Engineering
Department of Hydrodynamics and Water Resources
DHI Denmark
Period: 01/01/1999 → 31/12/2003
Number of participants: 3
Project participant:
Bingham, Harry B. (Intern)
Mayer, Stefan (Intern)
Graduate School in Nonlinear Science

Project no. 7317 Educational project aimed at PhD students. Collaboration with Department of Optics and Fluid Dynamics, Risø National Laboratory, Center for Chaos and Turbulence Studies, Niels Bohr Institute, University of Copenhagen.

Department of Informatics and Mathematical Modeling

Department of Physics

University of Copenhagen

Novo Nordisk A/S

Forskningscenter Risø

Period: 01/01/1999 → 31/12/1999

Number of participants: 8

Project participants:
Scott, Alwyn C. (Intern)
Jensen, M. Høgh (Ekstern)
Colding-Jørgensen, M. (Ekstern)
Johansen, Per Michael (Intern)
Rasmussen, Jens Juul (Intern)
Mosekilde, Erik (Intern)
Sørensen, P. G. (Ekstern)

Project Manager, organisational:
Christiansen, Peter Leth (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,564,400.00 Danish Kroner

Hierarchical optimization of material and structure

In this project we develop a hierarchical computational procedure for optimizing material distribution as well as the local material properties of mechanical elements. The local properties are designed using a topology design approach, leading to single scale microstructures, which may be restricted in various ways, based on design and manufacturing criteria. Implementation issues are a focal point of the investigation and computational experiments are used to illustrate the nature of the procedure.

Department of Mathematics

Instituto Superior Técnico

Period: 01/01/1999 → 31/07/2000

Number of participants: 3

Project participant:
Rodrigues, H. (Ekstern)
Guedes, J.M. (Ekstern)

Project Manager, organisational:
Bendsøe, Martin P. (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 75,000.00 Danish Kroner

Improving the buckling performance of topology designed periodic microstructures

A formulation of linearized buckling for cellular microstructured solids is developed. The goal is to include instability modes in the design of a microstructure. An asymptotic method provides us with the equations for stability analysis at macroscopic and microscopic level and its range of applicability is analyzed. This is then used to address the problem of
the buckling performance of cellular microstructures, leading to a buckling performance index concept that provides the basis for a comparative analysis between different distributions of material in the microstructure, as well as the influence of length scale of the buckling mode (single cell or multiple cell modes). This concept is then used to improve the buckling performance of microstructures designed for, e.g., maximal bulk modulus.

Department of Mathematics
Department of Solid Mechanics
Instituto Superior Técnico
Period: 01/01/1999 → 31/12/2000
Number of participants: 3
Project participant:
Sigmund, Ole (Intern)
Neves, M. (Ekstern)
Project Manager, organisational:
Bendsøe, Martin P. (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 35,000.00 Danish Kroner

Metoder til validering af prøvetagningsmetoder for bulkmaterialer
Department of Informatics and Mathematical Modeling
Period: 01/01/1999 → 01/01/2002
Number of participants: 8
Phd Student:
Thyregod, Camilla (Intern)
Supervisor:
Grønlund, Per (Ekstern)
Iwersen, Jørgen (Ekstern)
Tvermoes, Charlotte (Ekstern)
Main Supervisor:
Thyregod, Poul (Intern)
Examiner:
Rootzén, Helle (Intern)
Kristensen, Henning Gjelstrup (Ekstern)
Windfeld, Kristian (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen

Models and methods for hot spot safety work
ph.d. project financed by the Danish Academy of Technical Sciences (ATV) and Carl Bro A/S. The purpose of the project is to develop statistical methods for targeting intersections and road sections in the road network with an unusual high number of accidents.

Department of Informatics and Mathematical Modeling
Department of Transport
Department of Planning
Carl Bro A/S
Period: 01/01/1999 → 31/12/2002
Number of participants: 5
Project participant:
Laursen, Jan Grubb (Intern)
Vistisen, Dorte (Intern)
**Non- and semiparametric methods with applications in engineering**
The purpose of the project is to collect various research activities within area of non- and semi-parametric methods and application of these. Relevant topics includes applications and developments within the areas of: (i) non- and semi-parametric methods of regression in general, (ii) combination of parametric and non-parametric methods, (iii) adaptive estimation, (iv) structural identification of on-linear time series, (v) non- and semi-parametric methods for dynamic systems.

Department of Informatics and Mathematical Modeling
Period: 01/01/1999 → …
Number of participants: 6
Project participant:
  - Joensen, Alfred K. (Intern)
  - Nielsen, Henrik Aalborg (Intern)
  - Nielsen, Torben Skov (Intern)
  - Sadegh, Payman (Intern)
  - Øjelund, Henrik (Intern)
Project Manager, organisational:
  - Madsen, Henrik (Intern)

**PRESS installation hos Sonderborg Fjernvarme**
Implementering af PRESS prognosesystem hos Sonderborg Fjernvarme. Samarbejdsaftale.

Department of Informatics and Mathematical Modeling
Sønderborg Fjernvarme A.m.b.a.
Period: 01/01/1999 → 31/12/2000
Number of participants: 2
Project participant:
  - Nielsen, Torben Skov (Intern)
Project Manager, organisational:
  - Madsen, Henrik (Intern)

**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 64,000.00 Danish Kroner

**RTMM (Real Time Multimedia Systems)**
The project concentrates on the technical issues involved in systems for Interactive Distributed Multimedia (IDMM). It is part of the larger project DMM, Distributed Multimedia - Technologies and Applications that deals with many aspects of the development and use of distributed multimedia. The project is supported by the Danish Research Councils 1998-2001.

Department of Photonics Engineering
Department of Information Technology
Department of Informatics and Mathematical Modeling
Department of Telecommunication
Period: 01/01/1999 → 01/01/2001
Number of participants: 3
Project participant:
  - Fosgerau, Anders (Intern)
  - Ehlers, Kristian John (Intern)
Project Manager, organisational:
  - Dittmann, Lars (Intern)
Source Localisation from EEG
Patients with severe epilepsy may sometimes be cured by removing tissue containing "epileptogenic" centre from the brain, through a surgical procedure. Multielectrode EEG recordings can help to pinpoint the location of the epileptogenic centre through inverse modelling, using eg dipole models, and spheric or anatomically based head models. The project aims to identify capabilities of existing software and algorithms and their further potential for use in clinical work.

Department of Informatics and Mathematical Modeling
Period: 01/01/1999 → 31/03/1999
Number of participants: 4
Project participant:
Rasmussen, Carl Edward (Intern)
Madsen, Flemming-Find (Ekstern)
Hoegenhaven, Hans (Ekstern)
Project Manager, organisational:
Hansen, Lars Kai (Intern)

Statistical methods for assessment of blend homogeneity
ph.d. project financed by the Danish Academy of Technical Sciences (ATV) and Novonordisk A/S. The purpose of the project is to discuss acceptance criteria for blend and tablet batches in pharmaceutical production.

Department of Informatics and Mathematical Modeling
Novo Nordisk A/S
Period: 01/01/1999 → 31/12/2002
Number of participants: 5
Project participant:
Thyregod, Camilla (Intern)
Iwersen, Jørgen (Ekstern)
Grøvenlund, Per (Ekstern)
Tvermoes Rezai, Charlotte (Ekstern)
Project Manager, organisational:
Thyregod, Poul (Intern)

Stereoskopii 2: C-M-C, 1999-2003
Der er udviklet en ny kategori af metoder til farvekodning af stereoskopiske billeder. Metoden er i principippet anvendelig til de fleste formål, der anvender eller vinder ved stereoskopii, men sigter pri- mært imod sådanne (som f.eks. udstillinger), hvor betragtningsvilkårene er varierende og hvor gengivelse af stereobilledet i fysiske omgivelser skal kunne optimeres. Der er etableret et selvstændigt firma, United Exhibits MultiMedia A/S, hvis mission er at kommercialisere metoden.

Department of Informatics and Mathematical Modeling
United Exhibits A/S
Period: 01/01/1999 → 31/12/2003
Number of participants: 1
Project Manager, organisational:
Hansen, Per Skafte (Intern)
Winterschool on Information and coding theory
A winterschool for ph.d. students from Europe and their supervisors was held at Ebeltoft Strand. The subject was Information Theory and Coding Theory.

Department of Mathematics
Number of participants: 1
Project Manager, organisational: Høholdt, Tom (Intern)

Kvantitativ sammenligning af brystkræftmaterialet i Cancerregistret og DBCG's database
Data fra Cancerregistret (CRG) og Danish Breast Cancer Groups (DBCGs) register anvendes hyppigt ved opgørelser og videnskabelige undersøgelser. Specielt anvendes data fra DBCGs registre ofte i kliniske og epidemiologiske undersøgelser, blandt andet fordi mange af de for prognosen interessante oplysninger kun er tilgængelige i DBCGs register, og fordi kvaliteten af data, alt andet lige, bør være bedre i en klinisk database end i et epidemiologisk minimumsregister. Det er således af interesse at undersøge kompletheden såvel af CRG som af DBCGs register. The aim of the study is to compare the breast cancer patient material in the Danish Cancer Registry and the DBCG clinical database. The purpose of the Danish Cancer Registry and the DBCG clinical database is quite different. Therefore it is not surprising that the main part of the differences can be accounted for by systematical conditions.

Department of Informatics and Mathematical Modeling
Kræftens Bekæmpelse
Period: 02/12/1998 → 31/12/1999
Number of participants: 2
Project participant: Rostgaard, Klaus (Ekstern)
Project Manager, organisational: Rootzén, Helle (Intern)

Storskala inversionsalgoritmer
Department of Informatics and Mathematical Modeling
Period: 01/12/1998 → 20/01/2003
Number of participants: 8
Phd Student: Berglund, Eva Ann-Charlotte (Intern)
Supervisor: Bendtsen, Claus (Intern)
Jacobsen, Bo Holm (Ekstern)
Madsen, Kaj (Intern)
Main Supervisor: Hansen, Per Christian (Intern)
Examiner: Nielsen, Hans Bruun (Intern)
Mosegaard, Klaus (Intern)
Rojas Larrazabal, Marielba de la Caridad (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samarbejdsaftalefinans
Project: PhD

Corrosion Monitoring Device
A device for monitoring corrosion of steel bars in concrete in sea water is constructed, and a mathematical model is developed with the purpose of giving an easy way to predict when the steel bars will start corroding, causing damage to the structure. The project is part of EUREKA. Project leader is Ervin Poulsen, Aps., in cooperation with AEC and the FORCE Institute (the Corrosion Central). First report included in Ervin Poulsen, Jens M. Frederiksen, Leif Mejbro, Chloride Exposed RC-Structures, NIST/ACI/ASTM Workshop, Gaithersburg MD USA, November 9-10, 1998
Period: 06/10/1998 → …
Number of participants: 1
Project Manager, organisational:
Mejlbro, Leif (Intern)

Adaptive tools for shared virtual environments
Department of Informatics and Mathematical Modeling
Period: 01/10/1998 → 26/09/2002
Number of participants: 7
Phd Student:
Kolenda, Thomas (Intern)
Supervisor:
Christensen, Niels Jørgen (Intern)
Larsen, Jan (Intern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Examiner:
Sørensen, Helge Bjarup Dissing (Intern)
Andreasen, Troels (Ekstern)
Jensen, Søren Holdt (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstipendium
Project: PhD

Data Mining in Hydraulics
Department of Informatics and Mathematical Modeling
Period: 01/10/1998 → 14/06/2002
Number of participants: 6
Phd Student:
Keijzer, Maarten (Intern)
Supervisor:
Babovic, Vladan (Ekstern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Examiner:
Larsen, Jan (Ekstern)
Banzhaf, Wolfgang (Ekstern)
Mayoh, Brian (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Blandet Finansiering
Project: PhD

Identification of mental states from EEG
Analysis of multichannel EEG from subjects engaged in meditation is carried out for the purpose of characterising this mental state.

Department of Informatics and Mathematical Modeling
Period: 01/10/1998 → 31/12/1998
Number of participants: 3
Project participant:
Rasmussen, Carl Edward (Intern)
Kjaer, Troels W. (Ekstern)
Project Manager, organisational:
Hansen, Lars Kai (Intern)
Image processing and topology optimization

Structural optimization, posed as finding the optimal distribution of material and void is well known as a mathematically ill-posed problem. This ill-posedness nature expresses itself in the lack of compactness of the set of allowed domains and is commonly considered as being the cause of some numerical problems like mesh dependency, for example. Many solutions have been proposed in order to address this lack of solution and build strong and accurate numerical approximations. In most of these method, the "black-or-white" character of the domain (i.e. material OR void) is replaced with a "gray-level" density function, allowed to take its values between 0 and 1 (0 representing then void while 1, material). Then, one can choose between a penalization of the perimeter of the designed domain (i.e. a penalization of the Total Variation of the density function), a extra bound on the gradient of the density function or the use of a filtering technique. All these methods are strongly related to the problem known in the image processing domain as "image restoration", i.e. trying to reverse the alterations (noise, blur...) made on an image. The main goal of the project is the use of image processing knowledges to help understanding the filtering technique, reinforce its theoretical foundations and improve its implementation.

Department of Mathematics

Chambolle Antonin
Period: 01/10/1998 → 31/12/1999
Number of participants: 1
Project Manager, organisational:
Bourdin, Blaise (Intern)

Modelling of the geoid and the north Atlantic Sea level

Department of Informatics and Mathematical Modeling
Period: 01/10/1998 → 27/03/2002
Number of participants: 6
Phd Student:
Hilger, Klaus Baggesen (Intern)
Supervisor:
Nielsen, Allan Aasbjerg (Intern)
Main Supervisor:
Ersbøll, Bjarne Kjær (Intern)
Examiner:
Madsen, Henrik (Ekstern)
Switzer, Paul (Ekstern)
Windfeld, Kristian (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstipendium
Project: PhD

Statistisk 3-D beregning af sandsynligheden for at finde en jordforurening.


Department of Informatics and Mathematical Modeling
Period: 01/10/1998 → 31/12/1998
Number of participants: 1
Project Manager, organisational:
Rootzén, Helle (Intern)
The GEOid and Sea level Of the North Atlantic Region (GEOSONAR). Project no.: 1217, Ph.D-student Klaus Baggesen Hilger
Project no.: 1217 Financed by: "GEOSONAR"
Department of Informatics and Mathematical Modeling
Period: 01/10/1998 → 01/10/2001
Number of participants: 2
Project participant:
Hilger, Klaus Baggesen (Intern)
Project Manager, organisational:
Ersbøll, Bjarne Kjær (Intern)

Analysis of two-dimensinal electrophoresis images. Project no.: 1276, Ph.D-student Lars Pedersen
Project no.: 1276 Financed by: "CPA", The Center for Proteom Analysis.
Department of Informatics and Mathematical Modeling
Number of participants: 2
Project participant:
Pedersen, Lars (Intern)
Project Manager, organisational:
Ersbøll, Bjarne Kjær (Intern)

Fejlkorrigerede koder baseret på algebraisk geometri
Department of Mathematics
Period: 01/09/1998 → 14/12/2001
Number of participants: 4
Phd Student:
Nielsen, Rasmus Refslund (Intern)
Main Supervisor:
Høholdt, Tom (Intern)
Examiner:
Justesen, Jørn ( Intern)
Sudan, Madhu (Ekstern)
Investigation of the Effectiveness of Co-Array Fortran

Department of Informatics and Mathematical Modeling
Rutherford Appleton Laboratory
Period: 01/09/1998 → 31/12/2000
Number of participants: 3
Project participant:
Rasmussen, Jan M. (Ekstern)
Reid, John (Ekstern)
Hansen, Per Christian (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Low Power Digital Signal Processing

Department of Informatics and Mathematical Modeling
Period: 01/09/1998 → 21/01/2003
Number of participants: 4
PhD Student:
Paker, Ozgun (Intern)
Main Supervisor:
Sparsø, Jens (Intern)
Examiner:
Madsen, Jan (Intern)
Piguet, Christian (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

Multikanal systemer til kombineret adapтив støjreduktion og signalseperation

Department of Informatics and Mathematical Modeling
Period: 01/09/1998 → 14/06/2002
Number of participants: 8
PhD Student:
Kidmose, Preben (Intern)
Supervisor:
Hansen, Steffen Duus (Intern)
Hansen, Per Christian (Intern)
Sørensen, John Aasted (Intern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Examiner:
Larsen, Jan (Ekstern)
Hanssen, Alfred (Ekstern)
Nolan, John (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD
Ph.D. project: Multichannel Systems for Combined Adaptive Noise Reduction and Signal Separation
The research goal is the development of noise reduction/signal separation methods, based on a combination of spatial localization, subspace filtering and application of model information on the signals being noise reduced or separated. In particular there is aimed for noise reduction, spatial localization and separation of speech signals and a selection of impulse noise and broad band noise sources.

Department of Informatics and Mathematical Modeling
Period: 01/09/1998 → 31/08/2001
Number of participants: 5
Project participant:
Hansen, Steffen Duus (Intern)
Hansen, Per Christian (Intern)
Kidmose, Preben (Intern)
Project Manager, organisational:
Serensen, John Aasted (Intern)
Kidmose, Preben (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,200,000.00 Danish Kroner

Stochastic model of the duration of a project.
The purpose of the project is to criticize and improve an existing stochastic model of the duration of a project, proposed by Steen Lichtenberg in his book 'Projektplanlægning - i en foranderlig verden' (Projectplanning - in a changing world). It is an important part of the project to discuss the implications of the model in the light of the difference between the 'degree of belief' and the 'relative frequency' - interpretation of the mathematical concept of probability. The work is done in cooperation with Henrik Kruchow, Kruchow consulting - who uses Lichtenbergs model as a practical tool in projectplanning

Department of Informatics and Mathematical Modeling
Period: 01/09/1998 → 31/12/1999
Number of participants: 1
Project Manager, organisational:
Hansen, Niels Herman (Intern)

VIDIGEO (Visual Interactive Differential Geometry)
A modern tool for the learning of elementary differential geometry is being developed. One key feature will be the inclusion of the computer at several levels in the teaching and learning process.

Department of Mathematics
Aalborg University
Aarhus School of Engineering
Period: 01/09/1998 → …
Number of participants: 6
Project participant:
Gravesen, Jens (Intern)
Sinclair, Robert (Intern)
Fajstrup, Lisbeth (Ekstern)
Karstoft, Henrik (Ekstern)
Raussen, Martin (Ekstern)
Project Manager, organisational:
Markvorsen, Steen (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 60,000.00 Danish Kroner
Optimal topology design of dissipative structures
This project is concerned with the crashworthiness design of structures. The aim of the project is to develop basic optimization concepts for the lay-out design (topology design) of dissipative systems. Presently computational cost prevents the large scale optimization to be coupled with a full crash analysis. Moreover, it is unclear how the basic design modelling of continuum topology design can be applied to such problems. The key idea is thus to simplify the modelling of geometry, analysis and design - using groundstructure type ideas - to an extent where central concepts can be developed emphasizing the design optimization perspective, while capturing the fundamental physics of the problem.

Department of Mathematics
Department of Solid Mechanics
University of Michigan
Period: 01/08/1998 → …
Number of participants: 4
Project participant:
Sigmund, Ole (Intern)
Pedersen, Claus B. Wittendorf (Intern)
Taylor, J.E. (Ekstern)
Project Manager, organisational:
Bendsøe, Martin P. (Intern)

Project-no.: 1223.Center for IT-Research (CIT)
Department of Informatics and Mathematical Modeling
Period: 01/08/1998 → 31/12/1999
Number of participants: 5
Project participant:
Hartelius, Karsten (Intern)
Frederiksen, Martin Stig (Intern)
Dørge, Thorsten Carlheim (Intern)
Folm-Hansen, Jørgen (Intern)
Project Manager, organisational:
Carstensen, Jens Michael (Intern)

Maintenance- and replacement strategies for complex systems.
The aim of the project is to investigate and develop strategies for condition monitoring, i.e., inspection, maintenance and repair of complex systems under consideration to actual condition, repair history and desired reliabity of the system.

Department of Informatics and Mathematical Modeling
Danish Defence Research Establishment
Period: 01/07/1998 → 30/06/2001
Number of participants: 1
Project Manager, organisational:
Thyregod, Poul (Intern)

Teknikker til 3D visualisering, billedbehandling og simulering
Department of Informatics and Mathematical Modeling
Period: 01/07/1998 → 03/05/2002
Number of participants: 6
Phd Student:
Holten-Lund, Hans Erik (Intern)
Supervisor:
Madsen, Jan (Intern)
Main Supervisor:
Pedersen, Steen (Intern)
Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

Vedligeholds- og udskiftningstaktier for komplekse systemer
Department of Informatics and Mathematical Modeling
Period: 01/07/1998 → 28/05/2003
Number of participants: 6
PhD Student:
Pedersen, Thomas Espelund (Intern)
Supervisor:
Løvbjerg, Steen (Ekstern)
Main Supervisor:
Thyregod, Poul (Intern)
Examiner:
Spliid, Henrik (Intern)
Bergman, Bo (Ekstern)
Lindqvist, Bo (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt CAMP
Project: PhD

Workshop in Algebraic Coding Theory
A workshop on codes from Algebraic geometry and trellis decoding of block codes was held at the department of Mathematics
Department of Mathematics
Number of participants: 1
Project Manager, organisational:
Højholdt, Tom (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 30,000.00 Danish Kroner
Project

Forbedring af Videobilledsekvenser
Udvikling af soft- og hardware applikationer til forbedring af videobilleder (sekvenser), med særlig henblik på overførsel til film.
Department of Informatics and Mathematical Modeling
Hokus Bogus Aps.
Context Vision AB
Period: 23/06/1998 → …
Number of participants: 1
Project Manager, organisational:
Erbsdøll, Bjarne Kjær (Intern)
Project
**Bladder tumors**

Dansk Urologisk Selskab har nedsat en arbejdsgruppe, der skal planlægge en landsdækkende registrering af patienter med blæretumor i Danmark med henblik på at forbedre, standardisere og rationalisere behandlingen af denne patientgruppe. Arbejdet tager udgangspunkt i det eksisterende BCR (Blære Cancer Registret), der kontinuerligt har akkumuleret data fra blæretumorpatienter gennem 10 år på Herlev og Skejby hospitaler.

Department of Informatics and Mathematical Modeling

**Blærecancer registreringsgruppen**

**Period:** 01/06/1998 → 31/10/1999  
**Number of participants:** 2  
**Project participant:** Hermann, Gregers (Ekstern)  
**Project Manager, organisational:** Rootzén, Helle (Intern)

**Future IT-infrastructure in the Folketing**

The project group at DTU has made suggestions and recommendations for introducing advanced TV, video and telephone applications in the Danish parliament, The Folketing. These suggestions are based on discussions with the technical staff at The Folketing and a number of presentations by, and discussions with, leading technology vendors. Furthermore some products has been tested and evaluated.

Department of Information Technology  
Department of Telecommunication  
Department of Informatics and Mathematical Modeling  
Department of Photonics Engineering

**Department of Information and Mathematical Modeling**

**Period:** 01/06/1998 → 31/12/1998  
**Number of participants:** 5  
**Project participant:** Sharp, Robin (Intern)  
**Forchhammer, Søren (Intern)  
**Jensen, Ole Riis (Intern)  
**Staalhagen, Lars (Intern)  
**Project Manager, organisational:** Pedersen, Steen (Intern)

**Financing sources**

**Source:** Unknown  
**Name of research programme:** Ukendt  
**Amount:** 250,000.00 Danish Kroner

**Modellering, visualisering og metaanalyse af hjernebilleder**

Department of Informatics and Mathematical Modeling

**Period:** 01/05/1998 → 11/09/2002  
**Number of participants:** 6  
**Phd Student:** Nielsen, Finn Årup (Intern)  
**Supervisor:** Larsen, Jan (Intern)  
**Main Supervisor:** Hansen, Lars Kai (Intern)  
**Examiner:** Thyregod, Poul (Intern)  
**Andersen, Jens Damgaard (Ekstern)  
**Roland, Per Ebbe (Ekstern)  

**Financing sources**

**Source:** Internal funding (public)
Optimizing system level design of mobile phones

Department of Informatics and Mathematical Modeling
Period: 01/05/1998 → 01/10/2003
Number of participants: 2
Phd Student:
Bjørn-Jørgensen, Peter (Intern)
Main Supervisor:
Madsen, Jan (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstipendium
Project: PhD

Ph. D. Project: Finn Årup Nielsen: Analysis, Visualization and Metaanalysis of Neuroimages

Department of Informatics and Mathematical Modeling
Period: 01/04/1998 → 31/03/2001
Number of participants: 3
Project participant:
Larsen, Jan (Intern)
Nielsen, Finn Årup (Intern)
Project Manager, organisational:
Hansen, Lars Kai (Intern)

THOR Center for Neuroinformatics

Neuroinformatics is a research field rooted in classical disciplines like signal processing, biology, physics, computer science and engineering. Neuroinformatics combines learning from the brain and learning about the brain. By studying information processing in the brain neuroinformatics invents new computing paradigms (e.g., artificial neural networks) with the objective of understanding the dynamics of the conscious mind. Neuroinformatics is a key component of a US research program, the Human Brain Project which is supported by all the major American governmental funding agencies and hosted by the National Institute of Health. The geographically and scientifically distributed nature of the collaborating research groups involved in this interdisciplinary neuroscience effort calls for new visual and interactive means of communication. A point strongly emphasized in this program is the need for using the World Wide Web for communication and dissemination of results. With partners in the Copenhagen area we have established the "Copenhagen Brain Research Center".

Department of Informatics and Mathematical Modeling
Period: 01/04/1998 → …
Number of participants: 3
Project participant:
Larsen, Jan (Intern)
Nielsen, Finn Årup (Intern)
Project Manager, organisational:
Hansen, Lars Kai (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,616,400.00 Danish Kroner
Source: Unknown
Name of research programme: Ukendt
Amount: 3,610,000.00 Danish Kroner

Object Oriented Software for Large Scale Air Pollution Models

PhD project no.: 10-00-1261
Student: Anton Antonov Antonov
Finance: Forskerakademiet
Object Oriented (OO) program development offers tools to improve existing Air Pollution models giving more flexibility and improved efficiency. The
project is based on the existing Danish Eulerian Model.

Department of Informatics and Mathematical Modeling

UNI-C

Danmarks Miljøundersøgelser
Period: 01/03/1998 → 28/02/2001
Number of participants: 2
Project participant:
Antonov, Anton Antonov (Intern)
Project Manager, organisational:
Thomsen, Per Grove (Intern)

Virtual reality - Volume sculpting

Department of Informatics and Mathematical Modeling
Period: 01/03/1998 → 06/03/2003
Number of participants: 5
Phd Student:
Bærentzen, Jakob Andreas (Intern)
Main Supervisor:
Christensen, Niels Jørgen (Intern)
Examiner:
Henriksen, Knud (Ekstern)
Chen, Min (Ekstern)
Takala, Tapio (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Breast cancer incidence and mortality
In Denmark, as in all western countries, breast cancer mortality has remained relatively stable. The most obvious explanations for the empirically improved survival would be improved treatment or earlier diagnosis, possibly caused by screening. If earlier diagnosis was the most important explanation one would expect to see a small change in stage specific survival, but a large change in the stage distribution towards less advanced stages of the disease in the time of diagnosis, and vice versa if improved treatment was the most important explanation. Obviously it is important to be able to distinguish between these two explanations. In the project we focus on answering the following questions: How is the breast cancer stage distribution in Denmark 1978 - 94? Why has the stage distribution of breast cancers at time of diagnosis improved in Denmark 1978-94?.

Department of Informatics and Mathematical Modeling

Danish Cancer Society
Aarhus University

Danish Institute of Clinical Epidemiology
University of Copenhagen
Period: 01/02/1998 → 31/12/2005
Number of participants: 7
Project participant:
Rostgaard, Klaus (Ekstern)
Lyne, Elsebeth (Ekstern)
Vaeth, Michael (Ekstern)
Madsen, Mette (Ekstern)
Mouridsen, Henning (Ekstern)
Olesen, Knud P. (Ekstern)
Project Manager, organisational:
Rootzén, Helle (Intern)
Error correcting codes: The basic problems

Department of Mathematics
Period: 01/02/1998 → 29/05/2001
Number of participants: 6
Phd Student: Heydtmann, Agnes Eileen (Intern)
Supervisor: Høholdt, Tom (Intern)
Main Supervisor: Jensen, Jørn Møller (Intern)
Examiner: Jensen, Helge Elbønd (Intern)
Pellikaan, Ruud (Ekstern)
Stichtenoth, Henning (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Ikke-lineære pulser i optiske medier

Department of Informatics and Mathematical Modeling
Period: 01/02/1998 → 29/05/2001
Number of participants: 7
Phd Student: Schjødt-Eriksen, Jens (Intern)
Supervisor: Rasmussen, Jens Juul (Intern)
Main Supervisor: Serensen, Mads Peter (Intern)
Examiner: Christiansen, Peter Leth (Intern)
Mørk, Jesper (Intern)
Bergé, Luc (Ekstern)
Johansen, Per Michael (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

IT based optimization of District Heating Networks

The projects superior objective is to work as a catalyzer for distribution and practical use of a number of optimization methods and tools for the district heating sector. By collecting these functions in one modern IT-tool and by introducing new working methods the project will work as a lever and make these optimizations practically operational and attractive for the district heating companies. It is the aim of the IT-tool to be able to integrate a number of functions, such as: * Network tools for dimensioning and analysis. * Optimization of storage tanks and other supply sources. * Strategies for optimum pump operation and control. * Advanced forecasts and temperature controllers. * On-line measurements and status from SCADA systems. * Geographic map information from pipe registration / GIS systems. * Information from customer databases. * An uncomplicated and clear presentation of deviations from the optimum operation condition. The main contributions from DTU/IMM are: * Installation of the DTU/IMM on-line system PRESS (Prognose- og EnergiStyrings System) at Frederiksberg Varmeværk. * Research regarding heat load forecasting using on-line meteorological forecasts. * Research regarding optimal load scheduling of storage tanks.

Department of Informatics and Mathematical Modeling
ABB Energi & Industri A/S
IT-baseret driftoptimering af fjernvarmedistribution
Projektets formål er at udvikle og afprove modeller og metoder til langtidsforudsigelser (op til 5-7 døgn) af varmebehovet i fjernvarmesystemer. Samtidig skal der udvikles og afproves metoder til optimering af drift af akkumulatorlåg. Disse metoder vil udnytte saavel forudsigtelser af varmebehov som tidligere udviklede metoder til bestemmelse af optimal fremløbstopstemperatur.

Department of Informatics and Mathematical Modeling
VESTKRAFT
VEKS
ABB Energi & Industri A/S
Rambøll Danmark A/S
Frederiksberg Varmeværk
Period: 01/02/1998 → 30/10/2000
Number of participants: 3
Project participant:
Nielsen, Henrik Aalborg (Intern)
Nielsen, Torben Skov (Intern)
Project Manager, organisational:
Madsen, Henrik (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 767,000.00 Danish Kroner

Neural process optimization of pulse plating in the electronic industry
The purpose of the project is to optimize the pulse plating process using mathematical models. The traditional electronic industry uses a chemical bath with additives to make the through-hole plating on printed circuit boards. The pulse plating process can make the through plating without the additives and even improve the quality of the copper. So there is both solution to an environmental problem and a quality problem. Based on the measurements from plated printed circuit boards the mathematical model is used to find the optimal pulse parameters. In this project there is used artificial neural nets to solve the problem. With the final model it should be possible to "feed" the neural net with a CAD-design. Based on the design and the "knowledge" of the neural net it will be possible to compute the optimal pulse parameters.

Computer Science and Engineering
Department of Informatics and Mathematical Modeling
Department of Manufacturing Engineering
Department of Management Engineering
CHEMBO Overfladeteknik A/S
Elcon Pcb Technology A/S
AXA Axel Åkerman A/S
Period: 01/02/1998 → …
Number of participants: 3
Project participant:
Helbo, Carsten (Intern)
Møller, Per (Intern)
Project Manager, organisational:
Larsen, Jan (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 250,000.00 Danish Kroner

Object-Oriented Framework for Large Scale Air Pollution Models
Department of Informatics and Mathematical Modeling
Period: 01/02/1998 → 14/12/2001
Number of participants: 5
Phd Student:
Antonov, Anton Antonov (Intern)
Main Supervisor:
Thomsen, Per Grove (Intern)
Examiner:
Meyer, Stefan (Intern)
Geernaert, Gerald (Ekstern)
Georgiev, Krassimir Todorov (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskerakademiets Samfinansier
Project: PhD

Ph.D. Project: Pedro Hoejen Soerensen: Statistical Analysis of Dynamical Brain Scans
This project concerns basic research in spatio-temporal modelling of functional magnetic resonance images. Methods for identification of significant change in image sequences will be developed and applied to neuroimaging.
Department of Informatics and Mathematical Modeling
Period: 01/02/1998 → 31/01/2001
Number of participants: 3
Project participant:
Højen-Sørensen, Pedro (Intern)
Larsen, Jan (Intern)
Project Manager, organisational:
Hansen, Lars Kai (Intern)

Statistisk analyse af Dynamiske hjerneskan
Department of Informatics and Mathematical Modeling
Period: 01/02/1998 → 07/03/2002
Number of participants: 7
Phd Student:
Højen-Sørensen, Pedro (Intern)
Supervisor:
Larsen, Jan (Intern)
Rasmussen, Carl Edward (Intern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Examiner:
Larsen, Rasmus Werner (Intern)
Kappen, Hilbert Johan (Ekstern)
Nielsen, Mads (Ekstern)

Financing sources
Source: Internal funding (public)
**Utilization of prior information in bio-assays**
The aim of the project is to investigate and develop operational methods for potency assessments by bioassays that take prior knowledge from previous assessments into account.

Department of Informatics and Mathematical Modeling
Statens Serum Institut
Period: 01/02/1998 → 31/07/2000
Number of participants: 1
Project Manager, organisational: Thyregod, Poul (Intern)

**Villum Kann Rasmussen**
Department of Mathematics
Period: 28/01/1998 → 31/10/2010
Number of participants: 1
Project participant: Bendsøe, Martin P. (Intern)

**Financing sources**
Source: Gaver, Private danske Fonde
Name of research programme: Gaver, Private danske Fonde
Amount: 1,000,000.00 Danish Kroner

**ADAPTIVE TOOLS FOR SHARED VIRTUAL ENVIRONMENTS**
Fully immersive virtual environments, while proven useful in many specialized contexts still suffer from relatively high costs and complexity. In this task we will use and expand the already existing VR installations for experiments on immersive multi-user virtual environments. VRML - Virtual Reality Modeling Language - a Web standard which allows interactive access to low-end, but platform independent, hyperlinked virtual environments is a promising candidate for standard workplace VR. We hypothesise that a multi-user interactive virtual environment will be a productive platform for communication of complex data, models, products and organizations. Such environments can be realised on high-end graphics platforms, providing immersion at high speeds in realistic scenery, or alternatively on generic platforms based on Web standards, with emphasis on interaction between geographically remote users in spatial hypertexts. Further we hypothesise that life in complex multiuser environments will meet a number of basic challenges relating to navigation, communication and physical comfort, challenges that are best overcome with the assistance of adaptive software agents.

Cognitive Systems
Department of Informatics and Mathematical Modeling
Aarhus University
Period: 01/01/1998 → 31/12/2001
Number of participants: 6
Project participant: Larsen, Jan (Intern)
Kolenda, Thomas (Intern)
Christiansen, Torben (Intern)
Christensen, Niels Jørgen (Intern)
Project Manager, organisational: Hansen, Lars Kai (Intern)
Høeck, Jens (Ekstern)

**Dynamic modelling of Energy Systems**
Department of Informatics and Mathematical Modeling
Period: 01/01/1998 → 03/12/2001
Number of participants: 5
Phd Student:
  Andersen, Klaus Kaae (Intern)
Main Supervisor:
  Madsen, Henrik (Intern)
Examiner:
  Spliid, Henrik (Intern)
  Bidstrup, Niels (Intern)
  Lebrun, Jean (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

**ESGIs - European Study Groups with Industry**
ESGIs are workshops where mathematicians meet with industry to address problems of a mathematical nature related to production or development

Department of Mathematics
Period: 01/01/1998 → 31/12/2000
Number of participants: 1
Project Manager, organisational:
  Hjorth, Poul G. (Intern)

**FMERail (ESPRIT Project EP26538)**
This dissemination project aims at promoting the adoption of formal methods in the railway domain. The approach of the project is to arrange a series of workshops to show how different formal method technologies can be applied to railway problems.

Department of Information Technology
Department of Informatics and Mathematical Modeling
Instituttet for Anvendt Datateknik
TERMA Elektronik A/S
Formal Systems (Europe) Ltd.
Steria Méditerranée
Period: 01/01/1998 → 30/09/1999
Number of participants: 3
Project participant:
  Bjørner, Dines (Intern)
  Haxthausen, Anne Elisabeth (Intern)
Project Manager, organisational:
  Hansen, Bo Stig (Intern)

**Hierarchical modelling of Bioassays**
ph.d. project financed by the Danish Research Academy and Statens Seruminstitut (SSI). The purpose of the project is to assess statistical models for incorporating additional information from previous assays into the analysis of bioassays used for potency estimation of batches of vaccine.

Department of Informatics and Mathematical Modeling
**Laplacian Processes on Submanifolds**

The Laplacian controls a variety of very natural phenomena ranging from heat diffusion to volume growth. It is the purpose of this project to show precise bounds for specific values of measures such as the mean exit time for Brownian motion and isoperimetric inequalities for well chosen subsets of the submanifolds under consideration. The geometric structures under consideration are minimal (or close to minimal) submanifolds and minimal (or close to minimal) metric graphs. The bounds alluded to are obtained via comparison with corresponding values in constant curvature spaces and in other tailor-made warped product spaces.

**Department of Mathematics**

**Project**

**Modelling and Fairing of Ship Hulls**

If one consider the hull of modern commercial vessel, then 90% of the hull is quite simple. The midship section is more or less a simple cylinder; but the bulbous bow and the stern with the propeller bossing has a very complex geometry and the transition from the simple cylindrical shape to the complex double curved shapes at the bow and stern gives the designer many problems. It also makes the use of ordinary B-spline or NURBS surfaces difficult. In the project we propose to use a generalization of NURBS-surfaces by Frank Weller to model ship hulls. As an other part of the project we want to replace the tedious manual fairing of the ship hull by an automated process which minimizes a suitable chosen fairness measure. The surface fairness measure is derived by demanding that all the planar intersection curves shall have a small curvature variation.

**Department of Mathematics**

**Department of Naval Architecture and Offshore Engineering**

**Ungstrup, Michael (Intern)**

**Baatrup, Jan (Intern)**

**Ecklon, Erling (Ekstern)**

**Gravesen, Jens (Intern)**

**Financing sources**

**Source:** Unknown

**Name of research programme:** Ukendt

**Amount:** 900,000.00 Danish Kroner

**Project**

**Multivariat kalibrering af kemiske sensorer**

**Department of Informatics and Mathematical Modeling**
Optimal Topology Design of Discrete Structures Resisting Degradation Effects

In this project we treat the problem of finding the optimal topology of a truss, so that stiffness after degradation is maximized. It is shown that for the problem setting at hand, the optimal topology has uniform relative degradation in all bars and the topology is unchanged from the topology for a truss not undergoing degradation. As is well known such a design can be realized as a fully stressed, statically determinate truss.

Department of Mathematics
University of Erlangen-Nuremberg
Period: 01/01/1998 → 30/09/1998
Number of participants: 2
Phd Student:
Achtziger, W. (Ekstern)
Main Supervisor:
Larsen, Jesper (Intern)
Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

PARELLELIZATION OF THE VEHICLE ROUTING PROBLEM WITH TIME WINDOWS

Department of Informatics and Mathematical Modeling
Period: 01/01/1998 → 30/09/1999
Number of participants: 2
Phd Student:
Larsen, Jesper (Intern)
Main Supervisor:
Clausen, Jens (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Real-Time Multimedia (RTMM)

This project is part of the Distributed Multimedia project within the framework of the Danish Research Councils' Center for Multimedia. The aim is to investigate technical aspects of multi-user distributed multimedia systems, especially for teaching use.

Department of Information Technology
Department of Informatics and Mathematical Modeling
Department of Telecommunication
Department of Photonics Engineering
Virtual Seminar Room; Audio
Project No. 1255. The aim of the project is the development of a robust speech acquisition system for a Virtual Seminar Room application. The work has been concentrated on the establishment of a multimicrophone, amplifier, signal processor, and loudspeaker system, which allows for research in algorithms for speech localization, noise reduction and signal separation. There has been work on robust adaptive beamforming, where an initial combined beamforming and room simulation model, has been developed in Matlab. Furthermore there has been work on acoustic echo cancellation. This project is a part of a cooperation on the design of a Virtual Seminar Room, and is concentrated on the audio part. The project is carried out in cooperation with the DTU Departments COM, IT and TELE, and in cooperation with the Department of Information and Media Science at Århus University.

Department of Informatics and Mathematical Modeling
Department of Photonics Engineering
Department of Information Technology
Department of Telecommunication

Restructuring of Electronics Studies in Lithuania
TEMPUS Joint European Program (JEP-12398-97) Project web page: http://www.es.oersted.dtu.dk/~el/jep12398.htm

Department of Information Technology
Department of Informatics and Mathematical Modeling
Kaunas University of Technology
Vilnius Gediminas Technical University
City University London
Anvendelse af apriori viden i bioassays

Department of Informatics and Mathematical Modeling
Period: 01/12/1997 → 22/09/2004
Number of participants: 6
Phd Student: Rehm, Dorte (Intern)
Supervisor: Hasløv, Kaare Robert (Ekstern)
Main Supervisor: Thyregod, Poul (Intern)
Examiner: Rootzén, Helle (Intern)
Vølund, Aage (Ekstern)
Windfeld, Kristian (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Kandidatstipendium ansat på DT
Project: PhD

Center for Microinstruments (CfM)
CfM is a collaboration between the Department of Information Technology and the Microelectronics Centre, and is headed by professor Jørgen Staunstrup. CfM is established with a donation from the Thomas B. Thriges fund, while an associated graduate school financially supported by the Research Academy. CfM is supported by a range of Danish companies. The research activities of CfM focus on: - Computer Aided Engineering for micromechanical transducers - Smart transducers: design of sensors and actuators with integrated signal processing - Low power design for digital signal processors The tools and technologies developed within CfM are demonstrated in two main applications: - system level design of transducers, interfaces and digital circuit processors for hearing aids, and - topology optimized microactuators.

Department of Micro- and Nanotechnology
Department of Information Technology
Department of Informatics and Mathematical Modeling
Michigan Microsensor Inc.
Period: 01/12/1997 → 01/01/2003
Number of participants: 9
Project participant: Hansen, Ole (Intern)
Jonsmann, Jacques (Intern)
Vestergaard, Ras Kaas (Intern)
Najafi, Khalil (Intern)
Ginnerup, Morten (Intern)
Crary, Selden (Ekstern)
Staunstrup, Jørgen (Intern)
Sparsø, Jens (Intern)
Project Manager, organisational: Bouwstra, Siebe (Intern)
**Elforbrugsmodeller for ELKRAFT-omraadet**


Department of Informatics and Mathematical Modeling

Elkraft A.m.b.A.

Period: 01/12/1997 → 01/03/1998

Number of participants: 2

Project participant:

Nielsen, Henrik Aalborg (Intern)

Project Manager, organisational:

Madsen, Henrik (Intern)

**High-level program design of telecommunication software**

Department of Informatics and Mathematical Modeling

Period: 01/12/1997 → 01/02/2001

Number of participants: 2

Phd Student:

Hoffmann, Torben (Intern)

Main Supervisor:

Hansen, Michael Reichhardt (Intern)

**EUROPRACTICE (II)**

EUROPRACTICE continued giving service in 5 important microelectronics areas. One important area relevant to analog design is Training and Best Practice Service (TBPS) headed by CIE and responsible for training in all 5 areas. TBPS has made a large investigation of industrial need for analog training. The result was that analog is increasing. 1,200 courses were offered. A change towards industry was made.
Grey-box identification

In the modelling of dynamic systems several approaches exist. For the so-called black box approach the modelling is based solely on measurements obtained for the actual system, and any prior information about the system is not used. The opposite approach is used in the white box or physical approach where the model is formulated solely on prior knowledge. In the project methods for combining the two approaches are developed, and such methods are called grey-box methods. The methods are based on Bayesian statistics. Typically the structure of the models are formulated as stochastic differential equations and the parameters are estimated using available data. The modelling approach has been tested with great success on many physical and technical systems.
Center for IT-tools in the Energy Sector
In this center models for the energy sector is constructed and tested. The purpose is simulation and to be able to develop intelligent components for heating systems. Under this center some other projects are established.

Department of Informatics and Mathematical Modeling

Danfoss A/S
Danish Technological Institute
Grundfos A/S
APV

Period: 01/09/1997 → 31/08/2001
Number of participants: 2

Project participant:
Andersen, Klaus Kaae (Intern)

Project Manager, organisational:
Madsen, Henrik (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 77,880.00 Danish Kroner

Project

Dynamics of Plane Euler Elastica
The configuration space of plane Euler elastica is a two dimensional space with a simple potential function. The associated dynamical system is studied in order to describe the movement of the free end.

Department of Mathematics
Period: 01/09/1997 → …
Number of participants: 5

Project participant:
Brøns, Morten (Intern)
Hjorth, Poul G. (Intern)
Markvorsen, Steen (Intern)
Sinclair, Robert (Intern)

Project Manager, organisational:
Gravesen, Jens (Intern)

Holomorf dynamik og Herman-ringe

Department of Mathematics
Period: 01/09/1997 → 30/03/2001
Number of participants: 6
Phd Student:
Henriksen, Christian (Intern)

Supervisor:
Petersen, Carsten Lunde (Intern)

Main Supervisor:
Branner, Bodil (Intern)
**Holomorphic Dynamics, Herman Rings.**
Geometry of (possibly) degenerated Herman Rings. Geometry of the set of points in parameter space corresponding to maps with a Herman ring exhibiting certain characteristica such as rotation number, modulus and wringing.

Department of Mathematics  
Period: 01/09/1997 → 31/08/2000  
Number of participants: 3  
Project participant:  
Henriksen, Christian (Intern)  
Petersen, Carsten Lunde (Ekstern)  
Project Manager, organisational:  
Branner, Bodil (Intern)  

**Hæmodynamisk modellering af hjertet**

Department of Informatics and Mathematical Modeling  
Period: 01/08/1997 → …  
Number of participants: 7  
Phd Student:  
Adeler, Pernille Thorup (Intern)  
Supervisor:  
Larsen, Jesper Kampmann (Intern)  
Thomsen, Per Grove (Intern)  
Main Supervisor:  
Barker, Vincent A. (Intern)  
Examiner:  
Brøns, Morten (Intern)  
Andreassen, Steen (Ekstern)  
Verdonck, Pascal (Ekstern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Erhvervsforskerordningen  
Project: PhD  

**Modellering og styring af sprøjtestøbeprocess**  

Department of Informatics and Mathematical Modeling  
Novo Nordisk A/S  
Period: 01/08/1997 → 31/07/2000  
Number of participants: 3  
Project participant:  
Spliid, Henrik (Intern)
Thyregod, Peter (Intern)
Project Manager, organisational:
Madsen, Henrik (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 30,645.00 Danish Kroner

Modellering og styring af sprøjtestøbeproces
Department of Informatics and Mathematical Modeling
Period: 01/08/1997 → 19/03/2001
Number of participants: 7
Phd Student:
Thyregod, Peter (Intern)
Supervisor:
Mølgaard, Henrik (Intern)
Spliid, Henrik (Intern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Rootzén, Helle (Intern)
Bisgaard, Søren (Ekstern)
Olsen, Klaus Juel (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

Optimal correction of Scanning Probe Microscopy Images
Department of Mathematics
Period: 01/08/1997 → 09/02/2001
Number of participants: 3
Phd Student:
Dirscherl, Kai (Intern)
Main Supervisor:
Sørensen, Mads Peter (Intern)
Examiner:
March, Knud Aage (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ef-Finansieret, Stipen.-SU
Project: PhD

Optimal Correction of Scanning Probe Microscopy Images.
The project concerns improvement of calibration and correct images from a Scanning Probe Microscope (SPM). The SPM consists of a piezo tube on which the sample is mounted. The tube moves the sample underneath an ultrafine tip. The vertical movement of the tip is registered by a laser beam during scanning across the sample surface in either contact mode or tapping mode. From the vertical movement of the tip an image of the sample surface is recorded. The goal is to provide a better understanding of the movement and control of SPMs through mathematical modelling and to investigate the tip-sample interaction and its influence on the scanned image.

Department of Informatics and Mathematical Modeling
Period: 01/08/1997 → 31/07/2000
Number of participants: 1
Project Manager, organisational:
Sørensen, Mads Peter (Intern)
Simulation of Float-Zone Silicon Single Crystal Growth.

Single crystal silicon is the basic building material for nearly all semiconductor electronics and is therefore an important raw material for the electronics industry. Singlecrystalline silicon rods of very high purity can be manufactured by the Float Zone technique, in which a polycrystalline rod is molten locally using a radio frequency electromagnetic field induced by a narrow coil surrounding the rod. The molten silicon solidifies into a single crystal, which is sliced into thin wafers. Mathematical modelling is employed as a tool for investigating the Float Zone process. Of special interest is the dynamics of the molten zone, crucial for the stability of the process and the quality of the produced crystal. The computational work includes solving the Navier-Stokes equations for the molten silicon with a free surface moving boundary and with boundaries at which melting and solidification occur. The shape of the melt free surface is influenced by the AC electromagnetic field calculated from Maxwell's equations. Heat transfer from the free surface into the silicon melt is included together with buoyancy, gravitational, electromagnetic and surface tension forces.

Three-dimensional topology of the vortex breakdown

The vortex breakdown is the creation of a secondary flow structure around a vortex. Due to its occurrence in many flows in technology and nature, this is a very active research area. The present project is concerned with some recently discovered three-dimensional effects which has important bearing on experimental visualisation of the flow. The project attempts to use bifurcation theory to qualitatively explain and predict the experimental results.
**Department of Informatics and Mathematical Modeling**

*Period: 01/06/1997 → 01/01/9999*
*Number of participants: 1*
*Project Manager, organisational:*
Staunstrup, Jørgen (Intern)

**Financing sources**
*Source: Unknown*
*Name of research programme: Ukendt*
*Amount: 5,000,000.00 Danish Kroner*

**Project**

**Pattern-matching and surveillance of self-reproducing sequences**
The fundamental structure of local population dynamics is investigated and described in terms of biological mathematics. This project is divided into four natural project time slots: - matching of convex-concave patterns - interaction of microstructures creating nanounits of higher information level - self-reproduction codes evolving in a biosphere, these codes are highly nonlinear and self-correcting - control and surveillance of fuzzy logic and neural network steered automotive systems of high degree of freedom

**Department of Mathematics**

*Period: 13/05/1997 → 30/08/1998*
*Number of participants: 2*
*Project participant:*
Moerch, Bente (Ekstern)
*Project Manager, organisational:*
Cromme, Marc (Intern)

**Multiple model approaches to modelling and control**
EU Training and Mobility of Researchers financed research project

**Department of Informatics and Mathematical Modeling**

*Period: 01/05/1997 → 30/04/1999*
*Number of participants: 1*
*Project Manager, organisational:*
Murray-Smith, Roderick (Intern)

**Financing sources**
*Source: Unknown*
*Name of research programme: Ukendt*
*Amount: 400,000.00 Danish Kroner*

**Project**

**TDM prestudy**
A prestudy related to the comparison of signal strength in mobile communications was performed for the Mobile Division of Tele Danmark.

**Department of Informatics and Mathematical Modeling**

*Period: 02/04/1997 → 15/05/1997*
*Number of participants: 3*
*Project participant:*
Thyregod, Poul (Intern)
Larsen, Poul B. (Ekstern)
*Project Manager, organisational:*
Nielsen, Bo Friis (Intern)

**Financing sources**
*Source: Unknown*
*Name of research programme: Ukendt*
*Amount: 20,000.00 Danish Kroner*
Combined physical and statistical on-line prediction of wind power from wind farms.
The purpose is to develop methods for embedding physical and statistical information in prediction models for long term forecasting of wind power in wind mill farms.

Department of Informatics and Mathematical Modeling
Risø National Laboratory for Sustainable Energy
Period: 01/04/1997 → 31/03/2000
Number of participants: 3
Project participant:
Joensen, Alfred K. (Intern)
Nielsen, Torben Skov (Intern)
Project Manager, organisational:
Madsen, Henrik (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 55,162.00 Danish Kroner
Project

Kombineret fysik og statistisk on-line forudsigelse af produktion fra vindmølleparker
Department of Informatics and Mathematical Modeling
Period: 01/04/1997 → 20/05/2003
Number of participants: 6
Phd Student:
Joensen, Alfred K. (Intern)
Supervisor:
Landberg, Lars (Intern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Spliid, Henrik (Intern)
Knudsen, Torben (Ekstern)
Larsen, Søren Ejling (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Risø (Løn)
Project: PhD

Multivariate Calibration in Optical Sensors
The purpose is to develop statistical methods for robust, and efficient calibration of optical sensors used in waste water treatment plants. Several regulatization methods and non-parametric methods will be considered. Also robust techniques are investigated
Department of Informatics and Mathematical Modeling
Danfoss A/S
Period: 01/04/1997 → 31/05/2001
Number of participants: 3
Project participant:
Thyregod, Poul (Intern)
Øjelund, Henrik (Intern)
Project Manager, organisational:
Madsen, Henrik (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 18,017.00 Danish Kroner
**Stochastic Dynamic modelling of Oxigen**

Department of Informatics and Mathematical Modeling  
Period: 01/04/1997 → 08/02/2007  
Number of participants: 7  
Phd Student:  
Jonsdottir, Harpa (Intern)  
Supervisor:  
Eliasson, Jonas (Ekstern)  
Palsson, Olafur Petur (Intern)  
Main Supervisor:  
Madsen, Henrik (Intern)  
Examiner:  
Poulson, Niels Kjølstad (Intern)  
Madsen, Henrik (Ekstern)  
Olsson, Gustaf (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

**Flat surfaces in 3-space and their boundaries.**
A surface in 3-space is called flat if its Gaussian curvature is identically equal to zero. The isotopy classes of flat compact surfaces with non-vanishing boundary have, in this project, been proven to be in one-one correspondence with the isotopy classes of ordinary compact surfaces with non-vanishing boundary in 3-space. The exact statement is: In 3-space, any compact surface with non-vanishing boundary is isotopic to a flat surface and two such flat surfaces are isotopic through ordinary surfaces if and only if they are isotopic through flat surfaces. Some necessary conditions and one sufficient condition for a knot or link in 3-space to bound a flat surface are found. Most of the obtained results are analogous to recent results on positive curvature surfaces and their boundaries obtained by H. Gluck, L.-H. Pan, and M. Ghomi. Long sight goals of this project are to give a necessary and sufficient condition for a knot or link to bound a flat surface and to determine if analogous results holds for negative curvature surfaces in 3-space.

Department of Mathematics  
Period: 01/03/1997 → 31/01/1999  
Number of participants: 3  
Project participant:  
Hansen, Vagn Lundsgaard (Intern)  
Markvorsen, Steen (Intern)  
Project Manager, organisational:  
Røgen, Peter (Intern)

**virtual reality: Visualisation and modelling**

Department of Informatics and Mathematical Modeling  
Period: 01/02/1997 → 06/03/2003  
Number of participants: 5  
Phd Student:  
Bormann, Karsten (Intern)  
Main Supervisor:  
Christensen, Niels Jørgen (Intern)  
Examiner:  
Henriksen, Knud (Ekstern)  
Carlsen, Niels V. (Ekstern)  
Takala, Tapio (Ekstern)

**Financing sources**
Source: Internal funding (public)
Waveletanalyse af systemer med fordelt parametre

Department of Mathematics
Period: 01/02/1997 → 01/08/1997
Number of participants: 2
Phd Student:
Andersen, Kennet (Intern)
Main Supervisor:
Pedersen, Michael (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

1227 Industrial Center for Surface Analysis, Micro Analysis and Image Analysis
Project nr. 1227. The objective is to provide methods for visually analysing surfaces acquired by microscopy. This includes development and implementation of methods to assist and do the actual measurements and characterisation.

Department of Informatics and Mathematical Modeling
Danish Technological Institute
Danaklon A/S
Obtec A/S
Bang & Olufsen A/S
Elsam A/S
Ferroperm A/S
Dandy A/S
Period: 01/01/1997 → 05/02/2001
Number of participants: 3
Project participant:
Jørgensen, Søren Falch (Intern)
Schultz, Nette (Intern)
Project Manager, organisational:
Carstensen, Jens Michael (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 616,541.00 Danish Kroner

Adiabatic Invariants and Equipartition
The collisional relaxation of a 1-D gas of molecules with one internal degree of freedom is studied, in particular with respect to the role of a many-particle adiabatic invariant that exists when the timescale for the internal degrees of freedom is much shorter than the collisional timescale.

Department of Mathematics
Period: 01/01/1997 → …
Number of participants: 1
Project Manager, organisational:
Hjorth, Poul G. (Intern)

Avancerede trackingsensorer
Samarbeide med DELTA LYS & OPTIK, FORCE og en række virksomheder
ConFront
To achieve a higher level of integration, the project proposes a novel approach to the design strategy. Rather than making specifications based on a purely architectural approach, the project will use a concurrent approach, where circuit designers and architecture designers cooperate on the design and specifications. This will allow more circuit issues to be included in the overall architecture, leading to an architecture with circuit blocks suited for full integration. The higher level of integration will be achieved by combining analog and digital signal processing in the front-end.

Elastic Wave Propagation in Anisotropic, Inhomogenous Materials_ Application to Ultrasonic NDT

Phd Student: Halkjær, Søren (Intern)
Supervisor: Langbein, Wolfgang Werner (Intern)
Main Supervisor: Sørensen, Mads Peter (Intern)

Financing sources
Source: Internal funding (public)
**Graduate School in Microelectronics**

The Graduate School in Microelectronics was started in 1997 and its aim was to enhance (quantitatively and qualitatively) the Ph.d.-education in the area of Microelectronics. The Graduate School was funded by the Danish Research Training Council (in Danish: Forskeruddannelsesrådet) with 1 M kr. per year. The graduate school has co-funded summer schools, visiting professors and Ph.d.-scholarships. In total 8 Ph.d.-projects has been funded jointly by the Graduate School, private companies and research projects. The projects are hosted by MIC, Ørsted*DTU and IMM and the companies involved are: B-K Medical, Dicon, GN ReSound, NOKIA, Oticon, Sensor Technology Center and SonionMEMS.

**Department of Information Technology**

**Department of Informatics and Mathematical Modeling**

**Department of Electrical Engineering**

**Department of Micro- and Nanotechnology**

**Period**: 01/01/1997 → 31/12/2001

**Number of participants**: 15

**Project participant:**
- Paker, Ozgun (Intern)
- Larsen, Ken (Intern)
- Holten-Lund, Hans Erik (Intern)
- Pedersen, Steen (Intern)
- Madsen, Jan (Intern)
- Jensen, Jørgen Arendt (Intern)
- Tomov, Borislav Gueorguiev (Intern)
- Andreani, Pietro (Intern)
- Wang, Xiaoyan (Intern)
- Hansen, Ole (Intern)
- Yalcinkaya, Arda Deniz (Intern)
- Menon, Aric Kumaran (Intern)
- Nielsrud, Daniel (Ekstern)
- Larsen, Kristian Pontoppidan (Intern)

**Project Manager, organisational:**
- Sparsø, Jens (Intern)

**Financing sources**

**Source**: Unknown

**Name of research programme**: Ukendt

**Amount**: 1,000,000.00 Danish Kroner

**Project**

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**Guest List at IMM - 1997.**

Mindaugas Radzianas. Dept of dif. equat. and numer. analysis. Vilnius University, Math. faculty (14/1/97 - 1/5/97)

Frank Gohmann. Physikalisches Institut der Universitat Beyreuth. 14/1/97 - 17/1/97

Alexander V. Zolotaryuk. Bogolyubov Inst. for Theoretical Physics of National Academy of Science, Ukraine. (14/1/97 - 14/2/97) (14/10/97 - 14/12/97)

Alexander V. Savin. State Inst. of Physico-Technical Problems. Moscow. (14/1/97 - 14/2/97) (15/10/97 - 14/12/97)


Carlos Goria Corres. Dept. de Matematica Aplica y Estadistica e Investigacion Operativa. Bilbao. (27/1/97)


Bintong Chen. USA (10/7/97 - 22/10/97)

Marcel Neuts. Univ. of Arizona (15/8/97 - 15/11/97)

Salah Mahmoud Hanafy. (19/9/97 - 31/12/97)

Iouri Gladychev. (15/9/97 - 31/1/97)

Antanas Zilinskas Jens Litzenburger. Karlsruhe (23/10/97 - 20/12/97)


Oliver Froment. SNCF, Direction de la Recherche. Paris. France. (3/11/97 - 17/12/97)

Department of Informatics and Mathematical Modeling
**Helicity of Infinite-dimensional Hamiltonian Systems**

For a finite-dimensional Hamiltonian system, the Hamiltonian Helicity is defined as the integral over a 3-volume of the natural 3-form associated with the system. It is of interest to establish the mathematical connection to the helicity invariant associated with infinite dimensional systems (e.g., ideal fluids).

- **Department of Mathematics**
- **CNLS**
- **Period: 01/01/1997 → …**
- **Number of participants: 2**
- **Project participant:** Holm, D.D. (Ekstern)
- **Project Manager, organisational:** Hjorth, Poul G. (Intern)

**Modelling Ultrasound Wave Propagation in Anisotropic and Inhomogeneous Materials.**

In nondestructive testing ultrasound waves are an important tool for inspection of voids and faults in materials. The method is well established for isotropic and homogeneous materials whereas cases with anisotropy and inhomogeneity lead to difficulties in the design of inspection procedures and interpretations of inspection results. The difficulties arise from redirection and/or bending of the sound wave propagation in an unknown manner. In order to investigate the influence of anisotropy and inhomogeneity on the sound wave propagation we have implemented the elastic wave equations using Elasto Dynamics Finite Integration Technique (EFIT).

- **Department of Informatics and Mathematical Modeling**
- **Period: 01/01/1997 → 31/12/1999**
- **Number of participants: 1**
- **Project participant:** Sørensen, Mads Peter (Intern)
- **Project Manager, organisational:**

**Molecular and biomolecular dynamics**


- **Department of Informatics and Mathematical Modeling**
- **Period: 01/01/1997 → …**
- **Number of participants: 32**
- **Project participant:**
  - Trandum, Jens (Intern)
  - Scott, Alwyn C. (Intern)
  - Rasmussen, Kim (Intern)
  - Ellinas, D. (Ekstern)
  - Gaididei, Yu. B. (Ekstern)
  - Enolskii, V. Z. (Ekstern)
  - Savin, A. (Ekstern)
  - Zolotaryuk, A. (Ekstern)
  - Zolotaryuk, Y. (Ekstern)
  - Johansson, Magnus (Ekstern)
  - Lomdahl, P. S. (Ekstern)
  - Muto, V. (Ekstern)
  - Bullough, R. K. (Ekstern)
  - Eilbeck, J. C. (Ekstern)
Cruzeiro-Hansson, L. (Ekstern)
Kuznetsov, V. B. (Ekstern)
Rionero, Salvatore (Ekstern)
Salerno, M. (Ekstern)
Careri, G. (Ekstern)
Zundel, G. (Ekstern)
Hennig, D. (Ekstern)
Gabriel, H. (Ekstern)
Kuprievich, V. A. (Ekstern)
Brizhek, L. (Ekstern)
Gilhoej, Henriette (Ekstern)
Mouritsen, O. (Ekstern)
Olsen, O. H. (Ekstern)
Peyrard, M. (Ekstern)
Collins, M. (Ekstern)
Tsironis, G. P. (Ekstern)
Tuszynski, J. A. (Ekstern)

Project Manager, organisational:
Christiansen, Peter Leth (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 100,000.00 Danish Kroner
Source: Unknown
Name of research programme: Ukendt
Amount: 25,000.00 Danish Kroner

Non-linear stochastic models of molecular crystals
Ph.D. student: Claus Balslev Clausen

Department of Informatics and Mathematical Modeling
Period: 01/01/1997 → …
Number of participants: 24
Project participant:
Scott, Alwyn C. (Intern)
Rasmussen, Kim (Intern)
Serensen, Mads Peter (Intern)
Gaididei, Yuri B. (Ekstern)
Mainen, David Usero (Ekstern)
Eilbeck, J.C. (Ekstern)
Schmidt, Michel Roguelin (Ekstern)
Rasmussen, Jens Juul (Ekstern)
Ramanujam, P.S. (Ekstern)
Tromborg, Bjarne (Ekstern)
Pagano, S. (Ekstern)
Felice, Arco (Ekstern)
Vitiello, G. (Ekstern)
Mezentsev, V.K. (Ekstern)
Principal normal indicatrix of a closed space curves.

Considering the differential geometry of (closed) space curves it is usually assumed that curvature never vanishes. A natural extension of the Frenet Apparatus, that allows curvature to take both signs as long a curvature and torsion do not vanish simultaneously, is eg. used by W. Fenchel in 1950. At that time it was known that the principal normal indicatrix of a closed space curve fulfilling the Fenchel condition has integrated geodesic curvature equal to an integral multiple of $2\pi$.

In 1950 W. Fenchel gave a reformulation of the inverse problem in terms of the convex hulls of a family of closed curves.
on the unit 2-sphere. By a more resent theorem due to J. Weiner (1991), which also is proven curve-theoretically by B. Solomon (1996) it follows that the principal normal indicatrix of a closed space curve with non-vanishing curvature has integrated geodesic curvature zero and contains no sub arc with integrated geodesic curvature $\pi$. In this project it is proven that, when restricted to closed curves on the unit 2-sphere with integrated geodesic curvature zero that contains no sub arc with integrated geodesic curvature $\pi$, then the inverse problem formulated by W. Fenchel always has solutions, if one allows zero and negative curvature of space curves. Furthermore it is explained why this is not true if non-vanishing curvature is required. By giving examples of closed curves on the unit 2-sphere with integrated geodesic curvature $2^*\pi^*z$, for any integer $z$, which are not a principal indicatrix of a closed space curve (even when allowing zero and negative curvature) the general answer to W. Fenchel’s question is found to be to the negative.

Department of Mathematics
Period: 01/01/1997 → 31/01/1999
Number of participants: 3
Project participant:
Hansen, Vagn Lundsgaard (Intern)
Markvorsen, Steen (Intern)
Project Manager, organisational:
Røgen, Peter (Intern)
Project

Project-no.: 1224. Center for Sensor Technologies (CST)

Superconducting elements and nonlinearity

Department of Informatics and Mathematical Modeling
Department of Mathematics

Department of Physics
Period: 01/01/1997 → ...
Number of participants: 27
Project participant:
Sørensen, Mads Peter (Intern)
Scott, Alwyn C. (Intern)
Caputo, Jean Guy (Intern)
Flytzanis, N. (Ekstern)
Kalosakas, G. (Ekstern)
Lazarides, Nikos (Ekstern)
Petraglia, Antonio (Ekstern)
Maksimov, A. G. (Ekstern)
Benabdallah, A. (Ekstern)
Trovile, L. (Ekstern)
Lorenzo, J. Ph. (Ekstern)
Seidel, P. (Ekstern)
Mygind, Jesper (Intern)
Pedersen, Niels Falsig (Intern)
Samuelsen, Mogens Rugholm (Intern)
Pagano, S. (Ekstern)
Salerno, M. (Ekstern)
Costabile, C. (Ekstern)
Filatrella, G. (Ekstern)
Bishop, A. (Ekstern)
Lomdahl, P. (Ekstern)
Groenbech-Jensen, N. (Ekstern)
Bountis, T. (Ekstern)
Ustinov, A. (Ekstern)
Vernik, I.A. (Ekstern)
Oboznov, V.A. (Ekstern)

Project Manager, organisational:
Christiansen, Peter Leth (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 100,000.00 Danish Kroner
Source: Unknown
Name of research programme: Ukendt
Amount: 25,000.00 Danish Kroner

The use of polarimetric SAR for the mapping and characterization of the natural environment

Department of Informatics and Mathematical Modeling
Period: 01/01/1997 → 19/07/2005
Number of participants: 7
Phd Student:
Sørensen, Stefán Meulengracht (Intern)
Supervisor:
Nielsen, Allan Aasbjerg (Intern)
Skriver, Henning (Intern)
Main Supervisor:
Conradsen, Knut (Intern)
Examiner:
Carstensen, Jens Michael (Intern)
Hasager, Charlotte Bay (Intern)
Quegán, Shaun (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden Forskningsrådsfinan.-SU
Project: PhD

Topological Fluid Mechanics
The project is concerned with a qualitative description of flow patterns, mainly in two dimensions. The aim is to classify possible patterns and their bifurcations as external parameters are varied. The results are applied to viscous and Stokes flows and flows with different types of symmetry

Department of Mathematics
Period: 01/01/1997 → …
Number of participants: 2
Project participant:
Hartnack, Johan Nicolai (Intern)
Project Manager, organisational:
Brøns, Morten (Intern)
**Vision-baseret måling**

Anvendelse af en kombination af et kamera og en computer som et avanceret måleinstrument har et enormt potentiale. Der er nu blevet hardwaremæssigt håndterbart at udføre sådanne målinger on-line på generelle platforme som f.eks. PC'ere. Udfordringen i at udnytte dette potentiale ligger på software-siden. Et standard farvekamera leverer ca. 30 MB/s, der måske skal omsættes til de 100B/s, der er relevante i den givne problemstilling. Resultatet skal endvidere være robust ikke kun over for målestøj, men også over for f.eks. ændringer i belysningen samt irrelevante objekter i billedfeltet. Det er projektets formål at udvikle et softwaresystem, der implementerer vision-baseret måling til f.eks. produkt- og procesovervågning i industrien og til sikkerheds-/trygheds-overvågning.

Department of Informatics and Mathematical Modeling

Center for IT-forskning

7-Technologies

Period: 01/01/1997 → …

Number of participants: 1

Project Manager, organisational:

Carstensen, Jens Michael (Intern)

**Financing sources**

Source: Unknown

Name of research programme: Ukendt

Amount: 531,434.00 Danish Kroner

**Adaptive control of a cutting process.**

This activity concerns development of a nonlinear adaptive controller for a cutting process. The objective is to control the feed rate such that it is optimized without exceeding the permitted maximum torque acting on the tool. Most control systems currently available are simple and follow conservative strategies. In the current project we pursue various nonlinear adaptive control strategies for high performance control of the process. The controllers are designed to perform well for arbitrary combinations of material, type of tool, tool wear, depth of cut, and tool speed. The project is carried out in collaboration with Division of Manufacturing Engineering, Luleå University of Technology. This division has at its disposal a machining center with modified control hardware which is used for practical experiments. A nonlinear adaptive controller has been designed and various tests and fine tunings have been carried out. Practical experiments have demonstrated a promising performance for cutting in aluminum. In the forthcoming year we will explore the performance of the controller for other tools and materials.

CICT

Department of Informatics and Mathematical Modeling

Department of Automation

Department of Electrical Engineering

Luleå University of Technology

Period: 05/12/1996 → 05/12/1997

Number of participants: 4

Project participant:

Nørgård, Peter Magnus (Intern)

Ravn, Ole (Intern)

Bäckström, Mikael (Ekstern)

Project Manager, organisational:

Poulsen, Niels Kjølstad (Intern)

**Consistency in Statistical Toxicity Testing**

Ph.D. Project no. 1214 Financier: ATV Ph.D. Student: Helle Andersen Development of models for consistent statistical methods in toxicity testing in pre-clinical experiments in the pharmaceutical industry. The work is aiming at the construction of a knowledge database containing information about selection of mathematical models and for example possible transformations, outlier tests and other statistical procedures for given types of studies.

Department of Informatics and Mathematical Modeling
Spatial models for the benthic communities Mytilus edilus and Posidonia oceanica and spatial estimation herof based on hydroacoustic measurement. Project no.:1250. Ph.D-student Per Settergren Sørensen
Project no.: 1250. Financed by: EU/DTU/VKI

Department of Informatics and Mathematical Modeling
Period: 01/11/1996 → 30/04/1999
Number of participants: 2
Project participant:
Sørensen, Per S. (Intern)
Project Manager, organisational:
Conradsen, Knut (Intern)

Statistical methods and models for standardized toxicological and safety pharmacological studies.
Project no.: 1214 Ph.D. project: ATV - Novo Nordisk A/S Ph.D. student: Helle Andersen During the last couple of years, a group of scientists at Novo Nordisk have developed a decision tree for the statistical analysis of toxicity data from studies with animals. Unfortunately the decision tree has been found to lead to inconsistencies as variables are often analyzed differently from study to study. Furthermore, it does not contain a test battery for the analysis of the dose-response relationship, or recommendations for the analysis of repeated measurements. An other shortcoming of the decision tree is that it does not contain recommendations for the statistical analysis of safety pharmacology data. My project has been initiated to overcome these problems. The purpose of the statistical work in the project is to evaluate existing basic experimental designs and matching statistical models in toxicological studies where statistical methodology has already been applied. The purpose of the statistical work is to establish a "knowledge data base" where experimental designs and empirical knowledge about biological variables determine the statistical model, and hence the statistical analysis. There is some empirical knowledge in the following areas (among others): - Transformation of data - Distribution of variables - Statistical tests for outliers - Statistical tests for homogeneity of variance - Statistical analysis of single and correlated variables - Statistical considerations of repeated measurements on individual animals In this way, variables will be analyzed identically from study to study, i.e. the statistical method will be identical for the same variable independently of study. But at the same time, statistical methods will be established to spot abnormalities (outliers) which could indicate some (important) adverse biological response.

Department of Informatics and Mathematical Modeling
Period: 01/11/1996 → 31/10/1999
Number of participants: 1
Project Manager, organisational:
Andersen, Helle (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 36,175.00 Danish Kroner

Statistiske metoder og modeller til analyse
Department of Informatics and Mathematical Modeling
Period: 01/11/1996 → 14/03/2000
Number of participants: 2
Phd Student:
Andersen, Helle (Intern)
Main Supervisor:
Sliid, Henrik (Intern)

Financing sources
Source: Internal funding (public)
Addition of Consistent Stress Criteria to Homogenized Materials with Optimal Distribution

Control of local stress constraints in topology optimization of continuum structures. The research aims at describing the way stress criteria may be added to the optimal distribution problem based on homogenized materials. Consistent stress criteria for the homogenized materials are enforced in order to limit the stress state in any point of the material. Solution aspects of these large scale problems are investigated.

Department of Mathematics
Period: 01/09/1996 → 31/08/1997
Number of participants: 2
Project participant:
Bendsøe, Martin P. (Intern)
Project Manager, organisational:
Duysinx, Pierre (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 175,000.00 Danish Kroner
Project

Deformable Templates Models. Project no.:1197, Ph.D-student Rune Fisker.
Project no.:1197 Financed by: DTU/Tranes Foundation

Department of Informatics and Mathematical Modeling
Period: 01/09/1996 → 01/09/2000
Number of participants: 2
Project participant:
Fisker, Rune (Intern)
Project Manager, organisational:
Conradsen, Knut (Intern)

Endelig-dimensionale dynamiske systemer i fluid mekanik

Department of Mathematics
Period: 01/09/1996 → 29/09/1999
Number of participants: 2
Phd Student:
Hartnack, Johan Nicolai (Intern)
Main Supervisor:
Brøns, Morten (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Estimation in Stochastic Differential Equations

The purpose is to investigate and eventually develop methods for estimating embedded parameters in stochastic differential equations using discrete time data. We focus on models for describing the dynamics of interest rates.

Department of Informatics and Mathematical Modeling

Unibank
Period: 01/09/1996 → 31/08/1999
Number of participants: 2
Project participant:
Baadsgaard, Mikkel (Intern)
Project Manager, organisational:
Madsen, Henrik (Intern)
Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 81,075.00 Danish Kroner

Estimation Techniques in Stochastic
Department of Informatics and Mathematical Modeling
Period: 01/09/1996 → 01/09/1999
Number of participants: 2
Phd Student:
Baadsgaard, Mikkel (Intern)
Main Supervisor:
Madsen, Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Finite dimensional dynamics in fluid mechanics.
The project is concerned with topological fluid dynamics. That is the description and classification of flow patterns appearing in incompressible fluid flows. The analysis uses methods from the theory of finite dynamical systems and bifurcation theory to describe the qualitatively changes that can take place in fluid flows. The method gives qualitative descriptions of common occurrences in fluid dynamics such as 'flow separaration', 'flow attachment' and the generation of 'separation bubbles'.

Department of Mathematics
Period: 01/09/1996 → 31/08/1999
Number of participants: 1
Project Manager, organisational:
Hartnack, Johan Nicolai (Intern)

Mathematical Programming in Topology and Large Scale Optimization of Structures
Mathematical programming approaches are applied to the solution of topology and large scale optimization problems of structures. This includes tayloring of enhanced convex approximations of structural responses and the solution aspects of convex optimization problems by dual methods.

Department of Mathematics
Period: 01/09/1996 → 31/08/1997
Number of participants: 2
Project participant:
Bendsøe, Martin P. (Intern)
Project Manager, organisational:
Duysinx, Pierre (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 175,000.00 Danish Kroner

Relations
Publications:
Mathematical programming methods for large-scale topology optimization problems

Mathematical Study and Visualization of Complex Dynamical Systems
The aim of this project is to visualize hardly accessable phenomena within complex dynamical systems, such as: the parabolical implosion, holomorific surgery and renormalization, as well as to illustrate the elementary phenomena: iteration, topological models and potential theoretical tools. In order to be able to visualize the phenomena mentioned, thorough mathematical studies are necessary. A number of known proofs need to be modified and new proofs established in order
to achieve the mathematical visualization. The visualization media is the video, but it is accompanied with expilatory material, interactive programs (possibly as CD-ROM) and finally classical mathematical publications. The receiving audience includes mathematical high-school students to fellow researchers within the area. Keywords: Holomorphic dynamics, algorithms, computer animation.

Department of Mathematics
Universite Paris-Sud

Atelier EcoutezVoir
Period: 01/09/1996 → 31/08/1997
Number of participants: 4
Project participant:
Branner, Bodil (Intern)
Douady, Adrien (Ekstern)
Tisseyre, Francois (Ekstern)
Project Manager, organisational:
Sørensen, Dan Erik Knarup (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 397,489.00 Danish Kroner

Non-locally Connected Quadratic Julia Sets
Work is done with non-linear dynamical systems, which appears from iterating with a complex, quadratic polynomial. The main purpose is to increase the understanding of the dynamic, geometry and topology for polynomials with locally connected Julia set. As an example, the behaviour of certain external rays under repeated parabolic pertubations are investigated. As the most important side results we should mentioned the achievement of the first known examples of connected, but not curve-connected Julia sets, as well as non-robust, renormalizeable (infinitely many times) quadratic polynomials. Present work is considering the possibility to relate the polynomial classes found to the so-called Diophantic conditions in the theory of numbers and the possibility to find quadratic Julia sets with positive measure. Keywords: External rays, local connectedness, robustness and Julia sets.

Department of Mathematics
Universite Paris-Sud
Cornell University
Roskilde University
Period: 01/09/1996 → 31/08/1997
Number of participants: 6
Project participant:
Branner, Bodil (Intern)
Willumsen, Pia B.N. (Intern)
Douady, Adrien (Ekstern)
Hubbard, John H. (Ekstern)
Petersen, Carsten Lunde (Ekstern)
Project Manager, organisational:
Sørensen, Dan Erik Knapup (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 397,489.00 Danish Kroner

Projection of computer generated pictures in Tycho Brahe Planetarium, Copenhagen
The aim of the project is to decribe the projectin of slides with a superwideangel projector on to the dome in the Tycho Brahe Planetarium. A matematical model of the projection is derived so that computer generated pictures can be "counter destored" prior to projection. First a slide with a well known geometry is projected on to the dome, and the projected picture is measured by means of thodolites. The result is then used to derive the model. In this way correct pictures can be seen by the spectator in the Planetarium.
Department of Applied Civil and Environmental Engineering
Department of Physics
Department of Planning
Operations Research
Department of Informatics and Mathematical Modeling

Tycho Brahe Planetarium
Period: 01/09/1996 → 01/02/1997
Number of participants: 4
Project participant:
Sørensen, Svend Erik Børre (Intern)
Poulsen, Erik Lund (Intern)
Hansen, Per Skafte (Intern)
Project Manager, organisational:
Mærsk-Møller, Ole (Intern)

Research Monograph: Rank-Deficient and Discrete Ill-Posed Problems
Department of Informatics and Mathematical Modeling
Period: 01/09/1996 → 01/11/1997
Number of participants: 1
Project Manager, organisational:
Hansen, Per Christian (Intern)

Signalbehandling i Delfinens Sonarsystem
Department of Informatics and Mathematical Modeling
Period: 01/09/1996 → 15/05/2000
Number of participants: 5
PhD Student:
Andersen, Lars Nonboe (Intern)
Supervisor:
Larsen, Jan (Intern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Examiner:
Dalsgaard, Paul (Ekstern)
Sørensen, Helge Bjarup Dissing (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Statistical learning theory and neural networks
Study some statistical aspects of learning with linear and non-linear models. Use generalization theory. Study aspects of different learning procedures to analyze their relationship.
Department of Informatics and Mathematical Modeling
Period: 01/09/1996 → 15/09/1997
Number of participants: 2
Project participant:
Hansen, Lars Kai (Intern)
Project Manager, organisational:
Goutte, Cyril (Intern)
Analyse af multimodale 3D & 4D billeder
Department of Informatics and Mathematical Modeling
Period: 01/08/1996 → 28/02/2000
Number of participants: 3
Phd Student:
Andresen, Per Rønsholt (Intern)
Main Supervisor:
Carstensen, Jens Michael (Intern)
Examiner:
Carstensen, Jens Michael (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstip.-SU, Eksp
Project: PhD

High Frequency Wheel/Rail Interaction
The formation and evolution of corrugation on wheel and rail is a big problem in railway traffic. The phenomenon remains yet to be fully understood, especially the physics of the contact between wheel and rail has not been investigated thoroughly. The most frequent used contact models are only valid for stationary cases and are thus not valid for a contact situation with corrugation involved. The aim of the Ph.d.-works is to develop analytical and numerical tools which can be used in the simulations of railway dynamics. In cooperation with DSB is a project on the measuring of noise emission from wheels and rail been established, a project which shall be used for comparrison between the theoretical work and real life dynamics.

Department of Informatics and Mathematical Modeling
Period: 01/08/1996 → ...
Number of participants: 1
Project Manager, organisational:
Nielsen, Jakob Birkedal (Intern)

Statistisk modellering af fiskebestanden i Nordsøen
Department of Informatics and Mathematical Modeling
Period: 01/08/1996 → 28/02/2000
Number of participants: 3
Phd Student:
Kvist, Trine (Intern)
Main Supervisor:
Thyregod, Poul (Intern)
Examiner:
Jørgensen, Bent (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Sektorministerium, Stip-SU
Project: PhD

Stochastic modelling of high-resolution rainfall time series
Two approaches to generate artificial high-resolution rain series for use as input to simulation of urban drainage systems have been tested, both based on waiting times between consecutive tips of tipping bucket gauges calibrated to sample rain in a 0.2 mm depth resolution. ARIMA-models give a reasonable description of data but they have found limited practical use due to difficulties with identification, estimation and simulation of individual extreme rain events. Markov chain models including a state variable representing accumulated rain depth are able to extract the statistical properties of the data series and may be used to generate artificial rain series that resemble the original data structure. The perspective is to couple a stochastic time series model with a regional model for extreme point rainfall in order to make inference about extreme rainfall at ungauged locations.

Department of Environmental Science and Engineering
Surface-bound growth modeling applied to human mandibles. Project no.: 1202, Ph.D-student Per Rønsholt Andresen
Project no.: 1202 Financed By: STVF

Timed RAISE
The goal of this project is to investigate how RAISE can be extended with real-time facilities.

TAST (Tvaer-sektoriel anvendelse af samuleringsteknologi) aim at developing a training simulator for combine harvester drivers, while also building up know-how in simulation at IMM. The partners are: DMI, Hjortekaer, and Dronningborg Industries, Randers. The budget at IMM is D.kr. 2.2 million, 100% financed by Erhvervsfremme Styrelsen.
Analysis of Electromyographic Signals

The object of this project is the analysis of motor unit potentials measured by needle electrodes in muscles. The application area is clinical diagnosis of muscle- and nerve diseases. Emphasis is concentrated on analyzing the sequence of potentials and particular variations in the potentials forms. These variations, also denoted variability, are expected to form diagnostic parameters for the clinical diagnosis of muscle- and nerve diseases. Furthermore they are expected to form a basis for the analysis of the restitution process of nerve- and muscle lesions. A database consisting of measurements on normal persons and patients with a selection of muscle and nerve diseases has been established. Among others the database contains a selection of measurements which is expected to originate in the variability phenomenon. The analysis system is being used for clinical diagnosis at the Department of Neurophysiology, The Royal Hospital. In the period of reporting, the work has concentrated on the elaboration of the ph.d. thesis.

Department of Informatics and Mathematical Modeling
Royal Hospital
Panum Institute
Kristian Dahl
Period: 01/06/1996 → 20/04/1999
Number of participants: 4
Project participant:
Hansen, Steffen Duus (Intern)
Krærup, Chr. (Ekstern)
Nikolic, Mile (Ekstern)
Sørensen, John Aasted (Intern)

Jakob Nielsen and his Contributions to Topology

The Danish mathematician Jakob Nielsen won international recognition as one of the developers of combinatorial group theory and the topology of surfaces. In the period 1925--1951, Nielsen was professor of rational mechanics at the Technical University of Denmark; in this connection he wrote a highly original textbook in rational mechanics. A biography of Jakob Nielsen, to be included in a monograph on the history of topology, has been written; it contains new informations about his relations to other mathematicians and a description of his pioneering work in the topology of surfaces.

Department of Mathematics
Period: 01/06/1996 → …
Number of participants: 1
Project Manager, organisational:
Hansen, Vagn Lundsgaard (Intern)

The Vector Riccati Equation

We extend the theory for the scalar Riccati equation to the multidimensional case

Department of Mathematics
Period: 01/06/1996 → …
Number of participants: 2
Project participant:
Andersen, Kurt Munk (Intern)
Project Manager, organisational:
Sandqvist, Allan (Intern)
Identifikation og regulering af rensningsanlæg


Department of Informatics and Mathematical Modeling

Krüger A/S
Period: 01/05/1996 → 30/04/1999
Number of participants: 4
Project participant:
Poulsen, Niels Kjølstad (Intern)
Bechmann, Henrik (Intern)
Nielsen, Marinus (Ekstern)

Project Manager, organisational:
Madsen, Henrik (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 36,175.00 Danish Kroner

Modellering og Prædiktiv Styring af Spildevandssystemer

Department of Informatics and Mathematical Modeling
Period: 01/05/1996 → 28/04/2000
Number of participants: 3
Phd Student:
Bechmann, Henrik (Intern)
Supervisor:
Poulsen, Niels Kjølstad (Intern)
Main Supervisor:
Madsen, Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

Signalbehandling anvendt til overvågning af distributionsnet

Department of Informatics and Mathematical Modeling
Period: 01/05/1996 → …
Number of participants: 6
Phd Student:
Jensen, Kåre Jean (Intern)
Supervisor:
Munk, Steen M. (Intern)
Main Supervisor:
Serensen, John Aasted (Intern)
Examiner:
Jørgensen, Preben (Ekstern)
Koldby, Erik (Intern)
Wilhjelm, Jens E. (Intern)

Financing sources
Cryptology
We study the construction and cryptoanalysis of some private and public key crypto systems

Department of Mathematics
Period: 01/03/1996 → 01/09/1999
Number of participants: 2
Project participant:
Jakobsen, Thomas (Intern)
Project Manager, organisational:
Høholdt, Tom (Intern)

Financing sources
Source: Unknown
Amount: 900,000.00 Danish Kroner

Stochastic modelling of nonlinear systems
Department of Informatics and Mathematical Modeling
Period: 01/03/1996 → 29/03/2001
Number of participants: 4
Phd Student:
Nielsen, Jan Nygaard (Intern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Poulsen, Niels Kjølstad (Intern)
Ljung, Lennert (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment

Topology Optimization - Methods, Convergence and Adaptive Finite Elements
Mathematical studies are carried out on the convergence of finite element solutions within optimization of structural topology.

Department of Mathematics

Department of Solid Mechanics
Period: 01/03/1996 → 28/02/1997
Number of participants: 3
Project participant:
Bendsøe, Martin P. (Intern)
Sigmund, Ole (Intern)
Project Manager, organisational:
Petersson, Joakim (Intern)

Financing sources
Source: Unknown
Amount: 350,000.00 Danish Kroner

BioSonar (EU project MA53-CT95-0026)
Monitoring of typical benthic communities and quantification of their living conditions is an important tool for establishing and maintaining knowledge about marine environments. The health of benthic communities is closely influenced by
environmental impacts due to human activities in coastal areas, and many benthic communities have central roles in their ecosystems. In Northern Europe this applies to e.g. common mussels (Mytilus edulis) and in the Mediterranean to e.g. neptune grass (Posidonia oceanica). The neptune grass meadows and the common mussel beds play vital roles in favouring biological diversity in the marine ecosystems. Benthic communities are good environmental impact indicators as they respond in well-understood ways, and are important for the sustainability of their ecosystems. The priorities for protection of the environment are strengthened in these years, and the demands for information at higher resolution scales are continually rising. Thus, it is vital to develop methods and technology dedicated to deliver high resolution information on the health of the environment, in particular the difficult observable conditions at sea. The overall aim of the BIOSONAR project is to contribute to the development of technologies and methodologies for use of acoustic equipment in monitoring of biological communities at the sea floor. The project is considered a step towards a larger goal comprising development of equipment and data processing algorithms dedicated to produce sonar pictures of larger sea bottom areas on a level equivalent to current earth observation technology. The expected results of the project will be a validated methodology for estimation of distribution of benthic communities based on sonar monitoring.

Department of Informatics and Mathematical Modeling
Period: 01/02/1996 → 31/01/1999
Number of participants: 7
Project participant:
Sørensen, Per S. (Intern)
Ersbøll, Bjarne Kjær (Intern)
Ersbøll, Annette Kjær (Intern)
Nielsen, Allan Aasbjerg (Intern)
Hilger, Klaus Baggesen (Intern)
Schultz, Nette (Intern)
Project Manager, organisational:
Conradsen, Knut (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukenr
Amount: 402,425.00 Danish Kroner

Block Ciphers
Block ciphers are a class of symmetric cryptosystems used for secure communications. The project examines the strength of various types of block ciphers using generalizations of linear cryptanalysis and a new approach called the interpolation attack. Moreover, relations between coding theory and cryptography are investigated, e.g., the connection between the theory of S-boxes used in block ciphers and the theory of linear codes. The project also examines some complexity theory related issues concerning cryptography.

Department of Mathematics
Period: 01/02/1996 → 01/08/1999
Number of participants: 1
Project Manager, organisational:
Jakobsen, Thomas (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

ikke-lineær dynamisk modellering af optiske komponenter med stokastiske egenskaber

Department of Informatics and Mathematical Modeling
Period: 01/02/1996 → 28/06/1999
Number of participants: 2
Phd Student:
Clausen, Carl A. Balslev (Intern)
Main Supervisor:
Christiansen, Peter Leth (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD
**Kryptologi**

Department of Mathematics  
Period: 01/02/1996 → 23/09/1999  
Number of participants: 3  
Phd Student: Jakobsen, Thomas (Intern)  
Main Supervisor: Høholdt, Tom (Intern)  
Examiner: Jensen, Helge Elbrønd (Intern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: DTU-Su Stipendium, Eksperiment  
Project: PhD

**Modelling of Nonlinear Dynamical System**  
This project was carried out under a cooperation with the Institute of Mathematical Modeling (IMM), DTU. Simulation and practice experiments were performed using a hydraulic robot. The obtained model was intended to provide a basis for model-based control of the robot. The physical model was formulated in continuous time and was derived by application of the laws of physics on the system. The unknown (or uncertain) parameters were estimated with Maximum Likelihood (ML) parameter estimation. The identified model was evaluated by comparing the measurements with simulation of the identified model.

Department of Control and Engineering Design  
Department of Informatics and Mathematical Modeling  
Department of Mechanical Engineering

**Phantom models**  
The project goal has been to establish techniques making it possible to control the perspective effects and stereoscopic parameters in a stereogram independently. Of particular interest is the application of these techniques to obliquely projected stereograms, giving rise to the so-called "Phantom models". The project has led to the submission of a patent application, nr. 00849, priority date 26.06.98. In the interest of prospective license takers, the technical contents of the project are withheld until the expiry of the so-called priority year, i.e. until 26.06.99. The project was supported by Danish Agency for Trade and Industry, total support amounting to D.Kr. 180,000. The mediator was Frank Knudsen, Danish technological Institute. Project leader: Svend B. Sørensen, FYS-DTU Project members: Per Skafte Hansen, IMM-DTU Nils Lykke Sørensen, AAA

Department of Physics  
Department of Informatics and Mathematical Modeling

**Prædiktorer i komplekse stokastiske systemer**  
Department of Informatics and Mathematical Modeling  
Period: 01/02/1996 → 25/09/2000  
Number of participants: 3
Phd Student:
Nielsen, Henrik Aalborg (Intern)
Supervisor:
Holst, Jens Juul (Ekstern)
Main Supervisor:
Madsen, Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Kandidatstipendium ansat på DT
Project: PhD

Examination of statistical methods for analysis of gamma-ray spectra
Existing methods for examination of airborne gamma-ray spectra with the aim of detecting minor amounts of manmade radioactivity in the environment are evaluated and compared to promising new methods.

Department of Automation
Department of Informatics and Mathematical Modeling

Examination of statistical methods for analysis of gamma-ray spectra
Existing methods for examination of airborne gamma-ray spectra with the aim of detecting minor amounts of manmade radioactivity in the environment are evaluated and compared to promising new methods.

Department of Automation
Department of Informatics and Mathematical Modeling

2-convex Differential Systems
We generalize the notion of 2-convexity to vector functions and try to derive results on the number of and the stability properties for closed solutions of differential systems with a 2-convex right hand side.

Department of Mathematics

Stokastisk Prædiktiv Kontrol i Komplekse Systemer
Department of Informatics and Mathematical Modeling
Period: 01/02/1996 → 14/11/2002
Number of participants: 6
Phd Student:
Nielsen, Torben Skov (Intern)
Supervisor:
Holst, Jan (Intern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Poulsen, Niels Kjølstad (Intern)
Bisdstrup, Niels (Intern)
Egardt, Bo (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Kandidatstipendium ansat på DT
Project: PhD

2-convex Differential Systems
We generalize the notion of 2-convexity to vector functions and try to derive results on the number of and the stability properties for closed solutions of differential systems with a 2-convex right hand side.

Department of Mathematics

2-convex Differential Systems
We generalize the notion of 2-convexity to vector functions and try to derive results on the number of and the stability properties for closed solutions of differential systems with a 2-convex right hand side.
Andersen, Kurt Munk (Intern)
Project Manager, organisational:
Sandqvist, Allan (Intern)
Project

3D-Med
The project is carried out together with Assoc. Prof. Jan Madsen at IT, DTU, in collaboration with 3D-Lab, which is situated at the Panum Institute, at the University of Copenhagen. In 1998 the project has been enlarged to include a collaboration with Århus University Hospital, where Prof. Niels Egund has joined the project. In 1999 the project included a collaboration with Prof. Børresen, the Rigshospitalet and Carl Bro A/S, which will produce a report describing the technical and commercial possibilities to continue the project. This activity is supported by Erhversfremmestyrelsen. The project started as a case study in the Codesign project. The main topic in this project, is to design and implement a cost efficient workstation, based on an ordinary PC running MicroSoft Windows, which can be used for 3-dimensional modelling and manipulation of medical objects. The main idea is to bring this functionality form the specialists laboratory to the desk of the physicians in the clinic. In 1998 Hans Holten-Lund has started a Ph.D. study and Mogens Hvidtfeldt was employed as a research assistant within the project. Both activities has been supported financially by the Thomas B. Thriges Center for Microinstruments

Department of Information Technology
Department of Informatics and Mathematical Modeling

Panum Instituttet
Aarhus University
Carl Bro A/S
University of Copenhagen
Period: 01/01/1996 → …
Number of participants: 3
Project participant:
Holten-Lund, Hans Erik (Intern)
Madsen, Jan (Intern)

Pedersen, Steen (Intern)
Project Manager, organisational:

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 600,000.00 Danish Kroner

Adaptive Extremum control.
Ph.D. project. Ma Xin. The main idea in this project is to maximize some performance criteria by using adaptive control methods. The purpose of the controller design is to increase the efficiency of some processes. The extremum control is related to optimization techniques. A wind turbine is taken as an example for applying adaptive extremum control. In order to design a high performance control system, a detailed model of dynamic behaviour of the wind turbine is needed. Such a model can be achieved from two approaches: theoretical method and identification techniques. In this year the nonlinear theoretical model is established by using simulink, the system is modelled from known physical interpretations. Some control methods require the knowledge of wind speed, but it is impossible to measure the effective wind speed on the rotor plane. Therefore estimation of wind speed on the rotor plane is considered by using the wind turbine as wind measuring device. Several estimation methods are investigated.

Computer Science and Engineering
Department of Informatics and Mathematical Modeling

Rise National Laboratory for Sustainable Energy
Period: 01/01/1996 → …
Number of participants: 3
Project participant:
Ma, Xin (Intern)
Bindner, Henrik (Ekstern)

Poulsen, Niels Kjølstad (Intern)

Project Manager, organisational:
Algebraic groups and algebraic geometry over finite fields
We study algebraic geometry over finite fields and construct error correcting codes and cryptographic systems.

Department of Mathematics
Period: 01/01/1996 → 31/12/1998
Number of participants: 8
Project participant:
Jakobsen, Thomas (Intern)
Jensen, Helge Elbønd (Intern)
Jensen, Jørn Møller (Intern)
Nielsen, Rasmus Refslund (Intern)
Heydtmann, Agnes Eileen (Intern)
Beyer, Joan (Ekstern)
Project Manager, organisational:
Høholdt, Tom (Intern)

Andersen, Henning Haahr (Ekstern)

Analysis of Regularity for Partial Differential Equations
Boundary value problems are considered for elliptical differential operators, where the boundary conditions are given in a distributional sense. This allows for the modelling of systems with distributed parameters and pointwise feedback coupling on the boundary. A simple method has been developed to determine well-posedness features for classical non well-posed problems.

Department of Mathematics
Period: 01/01/1996 → ...
Number of participants: 1
Project Manager, organisational:
Pedersen, Michael (Intern)

Application of fuzzy systems within trafficplanning.
The application of fuzzy logic and neural nets has been analyzed and the potential applications within traffic planning has been considered. The project is made in cooperation with the company TetraPlan and it is financed by The Danish Transport Council.

Department of Informatics and Mathematical Modeling
Tetraplan A/S
Period: 01/01/1996 → 31/12/1997
Number of participants: 1
Project Manager, organisational:
Madsen, Oli B.G. (Intern)

Automated Visual Inspection of Textile
A system for in-line inspection of textile using a line-scan camera is designed. Algorithms based on stochastic modelling of weave pattern are developed and tested.

Department of Informatics and Mathematical Modeling
Mitex
Period: 01/01/1996 → 31/08/1997
Number of participants: 2
Project participant:
Bedømmelse af den atmosfæriske turbulens over områder af varierende overfladetype

Department of Mathematics
Period: 01/01/1996 → 11/03/1999
Number of participants: 4
Phd Student:
Falk, Anne Katrine Vinther (Intern)
Main Supervisor:
Brøns, Morten (Intern)
Examiner:
Ditlevsen, Ove Dalager (Intern)
Heimburg, Thomas (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskerakademiets Samfinansier
Project: PhD

Bifurcational Control
Geometric and dissipative methods of non-linear control are applied on a bifurcational problem arising in fluid mechanics, more precisely in the control of turbocompressors.

Department of Mathematics
Period: 01/01/1996 → 31/05/1998
Number of participants: 1
Project Manager, organisational:
Cromme, Marc (Intern)
Project

Bifurcation in Chemical Systems
Bifurcations in systems of chemical reactions are investigated with a combination of analytical and numerical methods.

Tel Aviv University
Period: 01/01/1996 → …
Number of participants: 2
Project participant:
Bar-Eli, Kedma (Ekstern)
Project Manager, organisational:
Brøns, Morten (Intern)
Project

Bifurcations and chaos in Nonlinear Dynamics
In relation to specific high-dimensional parameter dependent nonlinear dynamic systems - mainly models of moving railway vehicles - the dynamics of the systems is examined, and the qualitative behaviour investigated. Since the models are rather complicated, the analysis is carried out numerically, and some results verified through analytic investigations of simple model examples. The results are applied to actual railway vehicles, and have demonstrated their ability to predict accurately the critical speed, at which a railway vehicle may change its stable equilibrium state from steady motion along the track center line, to a motion along the track combined with a lateral oscillation. Chaotic motion has been predicted, and recently confirmed by Japanese scientists.

Department of Informatics and Mathematical Modeling
Period: 01/01/1996 → …
Number of participants: 1
Project Manager, organisational:
True, Hans (Intern)
Bounds on the Effect of Progressive Structural Degradation
In classical, phenomenological models for damage in elastic materials it is assumed that damage results in reduced stiffness of the material. Normally a linear interpolation is applied and the damage propagation is found as the distribution of damage maximizing the global stiffness reduction. The linear interpolation induces technical difficulties in continuum models, since one will typically not have existence of the solution in an ordinary sense. The project has considered alternative interpolations and it has been found that linear interpolation of the inverse stiffness provides a physically realistic and well posed model. Moreover, it is possible to establish highly efficient numerical algorithms, which in complexity are comparable to algorithms for solving classical problems in elasto plasticity. Keywords: Damage models, convex analysis.

Department of Mathematics
University of Michigan
Friedrich-Alexander University Erlangen-Nuremberg
Period: 01/01/1996 → 01/06/1998
Number of participants: 3
Project participant:
Achtziger, W. (Ekstern)
Taylor, John E. (Ekstern)
Project Manager, organisational:
Bendsøe, Martin P. (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 20,000.00 Danish Kroner
Source: Unknown
Name of research programme: Ukendt
Amount: 40,000.00 Danish Kroner
Source: Unknown
Name of research programme: Ukendt
Amount: 25,000.00 Danish Kroner
Source: Unknown
Name of research programme: Ukendt
Amount: 25,000.00 Danish Kroner

Chloride Ingress into Concrete
New models for estimation of chloride ingress into concrete and prediction of service lifetime with reference to marine RC structures and solutions of these models. The project is carried out in cooperation with Professor emer. Ervin Poulsen, Ervin Poulsen Aps., Skovbrynet 8, Noedebo, DK-3480 Fredensborg.

Department of Mathematics
Period: 01/01/1996 → …
Number of participants: 1
Project Manager, organisational:
Mejlbro, Leif (Intern)

Classical Differential Geometry Revisited
The purpose of this project is to advance the use of the computer as a natural vehicle for the teaching of - and research in - advanced differential geometry as well as for the revitalization of interesting classical insight into low dimensional geometrical invariants.

Department of Mathematics
Period: 01/01/1996 → …
Number of participants: 1
Project Manager, organisational:
Markvorsen, Steen (Intern)
Classification of Closed Strips in the Three Dimensional Euclidean Space

Take a strip of paper and 'twist' it, tie a knot on it, and glue its ends together. This is the model for a class of geometric objects which we call the class of closed strips. We define the twisting number of a closed strip which is an invariant of ambient isotopy measuring its topological twist. We classify closed strips in euclidean 3-space by their knots and their twisting number. We have proven that this classification exactly divides closed strips into isotopy classes. Using this classification we point out how some polynomial invariants for links lead to polynomial invariants for strip links. We give a method for knotting a strip with control on its twist, and our method includes a closed braid description of a closed strip. Finally, we generalize the notion of closed braids, allowing braids to be closed by any oriented knot and not only by the unknot. The inverse braid closing operator problem is still open, but it contains Markov's Theorem for classical closed braids as a special case.

Department of Mathematics
Period: 01/01/1996 → 01/06/1997
Number of participants: 4
Project participant:
Markvorsen, Steen (Intern)
Gravesen, Jens (Intern)
Randrup, Thomas (Intern)
Project Manager, organisational:
Røgen, Peter (Intern)

Coding Theory
Error-correcting codes, chryptography and data compression are essential tools for reliable, secure, and fast transmission of information in a modern communication system. Many of the mathematical problems that arises can be treated with algebraic, geometric and combinatorial methods. The main research effort is concentrated on the fundamental problems in error-correcting codes, that is analysis and construction of good codes along with the design of low complexity encoding and decoding algorithms.

Department of Mathematics
Period: 01/01/1996 → …
Number of participants: 6
Project participant:
Jensen, Jørn Møller (Intern)
Jakobsen, Thomas (Intern)
Heholt, Tom (Intern)
Heydtmann, Agnes Eileen (Intern)
Nielsen, Rasmus Refslund (Intern)
Project Manager, organisational:
Jensen, Helge Elbrønd (Intern)

Colour and texture inspection equipment ESPRIT Project 21023 - CATIE
The objective is to provide cost effective colour and texture based automatic inspection and sorting solutions for industry. Three application areas are considered: Hot steel strip, wood slabs, and food. Novel solutions for low delay image analysis, a few tens of milliseconds from imaging to decision, will be developed and used in real-time on-line inspection demonstrators in each application. The inspection system platform will be the same and exploit an off-the-shelf component based parallel architecture designed to support hypothesis-and-verification oriented inspection strategies. The platform will cope with the high volumes of data associated with colour and texture inspection. The basic technology of high-performance personal computers will be used. Because of the vibrations of hot strip and the nature of motion of food particles to be sorted high speed prism based colour line-scan cameras will be developed to capture the RGB values of each pixel at the same time. Due to the required high line scan rates, stable illuminators with feature enhancing radiation patterns will be designed, and an online colour camera calibration technique will be developed to make the colour measurements independent of longer term changes in illumination.

Department of Informatics and Mathematical Modeling
Spectra-Physics VisionTech, Oy
ELEXSO Sortiertechnik GmbH
Junckers Industrier A/S
Combinatorial Differential Geometry
The purpose of this project is to use finite distance geometry in conjunction with theoretical work on Alexandrov spaces to find good candidates for metric invariants that can efficiently be used to recognize and characterize Riemannian manifolds and metric spaces in general. Computer experiments play a natural and very crucial role for the advancement of this project.

Department of Mathematics
Period: 01/01/1996 → …
Number of participants: 3
Project participant:
Hjorth, Poul G. (Intern)
Thomassen, Carsten (Intern)
Project Manager, organisational:
Markvorsen, Steen (Intern)
Project

Concatenated Codes
A concatenated code consist of two codes: A short "inner" code and a long "outer" code. The outer code is often a Reed-Solomon code. Concatenation is the only known construction which allows for the correction of a large number of errors, with a fairly low complexity. Concatenated codes are therefore widely used. In this project we study the algebraic structure of concatenated codes. This analysis has led to the construction of large classes of cyclic codes, which performs better than the well-known and widely used BCH codes. It has also led to the design of a low-complexity Reed-Solomon encoder. Some problems concerning decoding are currently under investigation.

Department of Mathematics
Period: 01/01/1996 → …
Number of participants: 1
Project Manager, organisational:
Jensen, Jørn Møller (Intern)
Project

Consciousness.
A global dynamic state of the brain is widely recongnized as "consciousness" but this state is poorly understood from the point of view of descriptive science. It is proposed that the key to understanding such phenomena as consciousness and life will be the study of dynamics systems that are nested into hierarchies of integro-differential equations. Life and consciousness are then expected to emerge as multi-level global states of hierarchical system. A major international conference on this subject has been organized in Copenhagen and Elsinore, August 1997. Publications (ACS refers to A.C.Scott's publication list): ACS2, ACS3, ACS4, ACS6

Department of Informatics and Mathematical Modeling
**Convex and Concave Differential Systems**

We consider a system \( x' = f(t, x) \) of \( n \) first order differential equations, where all coordinate functions are weakly convex (or weakly concave) in \( x \). We have investigated how the closed solutions behave in subsets (of suitable form), in which the off-diagonal entries in the Jacobi matrix have fixed sign. The investigations have shown that it is possible to generalize an earlier (published) result in the case \( n=1 \) on the number of closed solutions. Furthermore, we have found some geometrical and topological properties of the set of initial points for closed solutions in a subset of the mentioned type. These results are in particular interesting in the cooperative (or the competitive) case.

**Correlating phospholipid fatty acids (PLFA) in a landfill leachate polluted aquifer with biochemical factors by multivariate statistical methods.**

Different multivariate statistical analyses were applied to phospholipid fatty acids representing the biomass composition and to different biogeochemical parameters measured in 37 samples from a landfill contaminated aquifer at Grindsted Landfill (Denmark). Principal component analysis and correspondence analysis were used to identify groups of samples showing similar patterns with respect to biogeochemical variables and phospholipid fatty acid composition.

**Crew and vehicle scheduling.**

The objective of the project is to develop methods for finding the optimal or near optimal scheduling of crews and vehicles. Rules concerning e.g. working periods and union regulations have to be taken into consideration. In 1996 a system ACROS has been developed for computer based crew rostering, in particular applicable for medium term planning for allocation of bus drivers. ACROS was developed in cooperation with the company TR-Partners. Furthermore a system concerning the scheduling of duties for nurses has been developed. The system is based on set partitioning and constrained branch and bound, and it was developed in cooperation with Hovedstadens Sygehusselskab and Andersen Consulting.
Cycles in Graphs

In 1996 we have developed a general method for finding a second hamiltonian cycle in a hamiltonian graph. The method has been used to attack the conjecture made by Thomassen in 1976 that every longest cycle in a 3-connected graph has a chord. The conjecture has now been verified for cubic graphs. Furthermore, it has been proved in a joint work with R.E.L. Aldred, New Zealand, that the number of cycles in a cubic, 3-connected graph grows superpolynomial, a conjecture made in 1986 by Barefoot, Clark and Entringer. In 1997 we have combined the sufficient condition for a second hamiltonian cycle in terms of independent dominating sets with Lovasz' Local Lemma to prove that every hamiltonian r-regular graph has a second hamiltonian cycle if r is at least 300. This is a step towards the 1975 conjecture of John Sheehan that every such graph has a second hamiltonian graph provided r is at least 4. In 1997 we also proved the conjecture made by Bermond, Fouquet, Habib and Peroche in 1984 that every cubic graph has a 2-edge-coloring such that each monochromatic component is a path of length at most 5. The number 5 cannot be replaced by 4.
Deformation of Surfaces in Threespace
Given an embedded two-dimensional surface in three space, and a smooth deformation of the metric (the first fundamental form), is it then possible for this intrinsic deformation of the metric to be induced by an extrinsic deformation of the embedding. If the intrinsic deformation is trivial (the metric is constant), then the question is the so called bending problem.

Delta-domain predictive control and identification for control.
Traditionally, discrete-time sampled-data systems are represented using shift-operator parametrizations. Such parametrizations are not suitable at fast sampling rates. An alternative parametrization using the so-called delta-operator is examined. It is shown how to maintain a close correspondence to continuous-time when sampling a system described in continuous-time by stochastic differential equations. A new prediction method is developed. It is based on ideas from continuous-time but derived from discrete-time delta-operator models. It is shown to include the optimal minimum-variance predictor as a special case and to have a well-defined continuous-time limit. By means of this new prediction method a unified framework for discrete-time and continuous-time predictive control algorithms is developed. This contains a continuous-time like discrete-time predictive controller which is insensitive to the choice of sampling period and has a well-defined limit in the continuous-time case. Also more conventional discrete-time predictive control methods may be described within the unified approach. The predictive control algorithms are extended to frequency weighted criterion functions. Also a state-space approach is described which extends straightforwardly to the multi-variable case. Finally, aspects on the connection between system identification and control design are discussed. Several approaches to improve this interconnection have been proposed. The frequency-distribution of the estimation error with low-complexity models is treated and proves to be important for the development of control-relevant prefilters in estimation. Iterative approaches are presented, both using standard estimation methods with prefiltering and non-standard control-relevant estimation methods. New combined adaptive/iterative techniques are proposed.

Design of Material and Structure for Optimal Damage
The work is based on a micro mechanical model, allowing for a combination of topology design using a material distribution method with micro mechanical models for damage to structures. An important element is to achieve a well posed formulation, which is also reasonable to handle numerically. Furthermore, dual formulations of damage models are considered, with the aim to achieve formulations suitable for optimization. Keywords: Optimal topology, optimal material, damage models.

Financing sources
Source: Unknown
Name of research programme: U켄트
Amount: 15,000.00 Danish Kroner
Development of the Image in a Photocopying Machine
The mathematical problem to compute the development of the toner image from an electrostatic one during photocopying has been studied from the point of view of existence and uniqueness by Friedman and coworkers. Here we formulate the problem as an integral equation. We use the Green's function involved to solve the problem exactly at the initial instant and approximately by numerical solution of the equation at later times.

Department of Mathematics
Period: 01/01/1996 → 01/05/1997
Number of participants: 1
Project Manager, organisational:
Hansen, Erik Bent (Intern)

Dissipative methods
Project nr. 1219 Ph.D project. Uffe Høgsbro Thygesen Control systems are often based on a mathematical model for the control object in terms of ordinary differential equations. There is always some uncertainty in such a model which may be modelled in terms of unknown system components (perturbations), uncertain parameters, and stochastic disturbances. A powerful framework for addressing the unknown system components builds on Jan C. Willem's theory of dissipation. Here one starts out with establishing quantities that the single component cannot produce, for instance energy. Then one investigates how these properties constraint the dynamical behaviour of the component. In a final step one is then able to give qualitative statements about the overall system. In this project we investigate the application of dissipation theory to robust (or worst-case) control. To this end we investigate system components which possess several properties of dissipation. Furthermore we consider adaptive control problems in which we seek controllers which are able to make the control object dissipative even when parameter uncertainty is present. Finally we develop a framework of dissipation applicable to systems in which stochastic disturbances also are present.

Department of Informatics and Mathematical Modeling
Period: 01/01/1996 → …
Number of participants: 2
Project participant:
Thygesen, Uffe Høgsbro (Intern)
Project Manager, organisational:
Poulsen, Niels Kjølstad (Intern)

Financing sources
Source: Unknown
Amount: 108,100.00 Danish Kroner

Dissipativity and Control of Invariant Sets
Combining the theory of dissipative control, in special H-infinity control, with Lyapunov-like stability arguments such as La Salles invariance principle, the dynamics of nonlinear systems are controlled with multiple control objectives as stability of invariant sets with L^2 gain attenuation, or with Input-to-State stability. The region of validity for such multiple task nonlinear controllers is estimated and the robustness of these controllers is investigated.

Department of Mathematics
Period: 01/01/1996 → 31/05/1998
Number of participants: 1
Project Manager, organisational:
Cromme, Marc (Intern)
Does pigmentation protect against ultraviolet B induced immunosuppression?

Department of Informatics and Mathematical Modeling

Amtsygehuset i Gentofte
Period: 01/01/1996 → …
Number of participants: 2
Project participant:
Skov, Lone (Ekstern)
Project Manager, organisational:
Ersbøll, Bjarne Kjær (Intern)

Dynamisk kvalitetskontrol

Department of Informatics and Mathematical Modeling
Period: 01/01/1996 → …
Number of participants: 3
Project participant:
Thyregod, Poul (Intern)
Iwersen, Jørgen (Ekstern)
Project Manager, organisational:
Madsen, Henrik (Intern)

Error Diagnosis in Dynamical Control Systems
A control system generates control signals to a dynamical system, based on a number of measurements. The set of measurements are established by one or more sensors. The control signals change the behaviour of the dynamical system via a number of actuators. In several applications it is important to be able to determine whether the actuators and/or sensors fail. The present project studies analytical methods for determining whether the function of actuators and sensors are satisfactory, by investigating whether correlated values (in functional spaces) of control signal and measurements are consistent with the differential equations modelling the system. A number of results has been achieved, that reveals advantages and disadvantages in integrating the dimensioning process for control and diagnosis system. Moreover, explicit algorithms for the integrated design are given.

Department of Mathematics
Department of Automation
Period: 01/01/1996 → 31/12/1997
Number of participants: 2
Project participant:
Niemann, Hans Henrik (Intern)
Project Manager, organisational:
Stoustrup, Jakob (Intern)

Estimation and quantification of digitised craniofacial X-rays
Department of Informatics and Mathematical Modeling

University of Copenhagen
Period: 01/01/1996 → …
Number of participants: 2
Extremal Overall Elastic Response of Polycrystalline Materials

A simple polycrystal is a composite material consisting of a mixture of a number of rotated crystals of the same anisotropic material. Based on a variational characterization of the effective material parameters, bounds on the energy in such polycrystals are calculated analytically in the form of what is referred to as optimal bounds, that is bounds which always hold and which cannot be sharpened. In the calculation no assumptions have been made concerning the symmetry of the polycrystal. The achieved energy bounds have also been compared to other bounds, achieved for crystals with certain material symmetries (e.g. isotropy). Keywords: Polycrystals, bounds, effective parameters.

Fault detection in dynamic systems

In the control of industrial systems, it is rare that a control system functions continuously without shutdown throughout the scheduled life cycle of the plant and controller hardware. Owing to ware of mechanical and electrical components, both actuators, sensor and internal components can fail in more or less critical ways. For safety critical processes, it is of paramount importance to detect when faults are likely to happen and then to identify these faults as fast as possible once they have occurred. To meet such industrial needs, a number of schemes for fault detection and isolation (FDI) have been set up. Much of the research has dealt with the design of filters which monitor a process and generate alarms when faults have occurred. In most cases, the filters are model based devices which act independently of the computer implemented digital controller. In this project, the focus is on both analysis and design of fault detectors as well as the task of combining control algorithm and FDI filters in a single module. In the area of analysis and design of fault detectors, both observer based detectors as well as more general filters are applied. The work done in this area has primarily been focus on the possibility to apply systematic standard methods from robust and optimal control for the analysis and design of fault detectors. The work done until now in the area of combining fault detector and controller has just been started. A general setup for the design of a combined fault detector and controllers has been formulated using standard methods from robust control. It has been shown by examples, that it is possible to obtain a very large reduction the dynamic order of the control module compared to the case when separate fault detector and controller are applied.
Footprint analysis/ Source weight functions
When measuring a scalar flux, it is interesting to know how representative it is for the area in which the sensor is placed. The "footprint" or "source weight function" is a measure of the relative contribution from an upwind source to the measured flux. It is the aim of the project to determine the footprint for an inhomogeneous fetch by simulating the scenario with a random walk model.

Department of Mathematics
Period: 01/01/1996 → 31/12/1998
Number of participants: 1
Project Manager, organisational:
Falk, Anne Katrine Vinther (Intern)

Fourier Analysis of Pseudo Differential Boundary Value Problems
The regularity of various boundary element methods are analysed using pseudo differential methods. Results achieved may be used to improve the convergence for a number of numerical methods.

Department of Mathematics
Texas A&M University
Period: 01/01/1996 → …
Number of participants: 1
Project Manager, organisational:
Pedersen, Michael (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 164,000.00 Danish Kroner

Fundamental Operations in Linear Algebra
The investigation of the parallel equation solver continues. Problems in connection with small systems have been solved.

Department of Informatics and Mathematical Modeling
Period: 01/01/1996 → 01/10/1998
Number of participants: 1
Project Manager, organisational:
Tingleff, Ole (Intern)

Gauss-Bonnet's Formula and Closed Frenet Frames
Closed space curves with non-vanishing curvature defines via the Frenet formulas some closed curves on the unit 2-sphere, called the spherical indicatrices. By using Gauss-Bonnet's Formula after cutting a spherical curve into simple closed sub-curves an index on the unit 2-sphere is found. This spherical index may be seen as a spherical analogy to the winding number of closed plane curves. The spherical index has the property that the integral over the unit 2-sphere of this index, equals the integrated geodesic curvature of the spherical curve. Using this result on the spherical indicatrices of a space curve, we obtain almost similar proofs of some (generalizations of) classical theorems. The spherical index gives both upper and lower bounds on the total curvature and total torsion of space curves.

Department of Mathematics
Period: 01/01/1996 → 31/01/1999
Number of participants: 3
Project participant:
Hansen, Vagn Lundsgaard (Intern)
Markvorsen, Steen (Intern)
Project Manager, organisational:
Røgen, Peter (Intern)
**Geometric Measure Theory**

Determination of measures in infinite dimensional spaces by means of their values on systems of balls; density and differentiation theorems for such systems. The project is carried out in cooperation with Professor David Preiss, University College London, England, and Professor Jaroslav Tiser, Technical University of Prague, Czech Republic.

Department of Mathematics  
Period: 01/01/1996 →…  
Number of participants: 1  
Project Manager, organisational:  
Mejlbro, Leif (Intern)  
Project

**GEOSONAR, GEOid and Sealevel Of the North Atlantic Region.**

The goal of the GEOSONAR project is to develop methods for integrating multi sensor and multi channel satellite data for improved recovery of the sea level height. This will be carried out at regional scales (10-20 km) in the North Atlantic region as well as at local scales (3-5 km) in the Danish seas. Hereby, the understanding of the ocean, its state, and its dynamics will be improved. In turn, this will lead to enhanced ocean tides modelling, sea level forecasting and storm surge warning. Furthermore, Denmark will contribute to the success of EU COST action 40 that is currently being signed. An important goal is also to prepare for the dedicated gravity mission and develop methods for enhanced analysis of the gravity field, so that Denmark can play a central role in the future determination of the geoid, the sea level, and possible effects of Global Change.

Department of Informatics and Mathematical Modeling  
Period: 01/01/1996 → 31/12/2001  
Number of participants: 1  
Project Manager, organisational:  
Nielsen, Allan Aasbjerg (Intern)  
Project

**Graphs on Surfaces**

In 1996 Thomassen proved the conjecture made by R.B. Richter in 1991, that the graph genus problem for cubic graphs is NP-complete. Furthermore, we have obtained a relatively short proof of the deep result in the Robertson-Seymour theory that, for any fixed surface, there are only finitely many obstructions for the graph embedding problem in that surface. Since 1997, the work in this project has concentrated on the monograph on graphs on surfaces written in collaboration with Bojan Mohar, University of Ljubljana. This work is planned to be completed in 2000.

Department of Mathematics  
Period: 01/01/1996 →…  
Number of participants: 2  
Project Manager, organisational:  
Thomassen, Carsten (Intern)  
Mohar, B. (Ekstern)  
Project

**Guest list of IMM - 1996.**


Department of Informatics and Mathematical Modeling  
Period: 01/01/1996 → 31/12/1996  
Number of participants: 1  
Project Manager, organisational:  
Madsen, Kaj (Intern)  
Project
Gyrosopic Stabilization of Indefinitely Damped Systems
Modelling of mechanical systems with sliding bearings or with dry friction, can lead to linear systems with an indefinite damping matrix. We ask under what conditions such a system is unstable (the indefinite property of the damping matrix alone is insufficient) and under what conditions we can stabilize the system by adding a gyroscopic term.

Department of Mathematics
Period: 01/01/1996 → …
Number of participants: 3
Project participant:
Müller, Peter C. (Ekstern)
Freitas, Pedro (Ekstern)
Kliem, Wolfhard (Intern)

High Resolution Medical Image Analysis in Acoustical Microscopy
A non-destructive method, scanning acoustic microscopy (SAM), is being developed for the purpose of tissue analysis and characterisation of materials. The aim is resolution improvements and investigation of the passive elastic properties from specimens of the abdominal aorta to study early stages of arteriosclerosis

Department of Mathematics
Aarhus University
Period: 01/01/1996 → …
Number of participants: 2
Project participant:
Poulsen, Jens Kristian (Ekstern)
Skovgaard, Ove (Intern)

Holomorphic Dynamical Systems
In holomorphic dynamics one studies iteration of holomorphic maps, in particular polynomials. The dynamical space (typically the complex plane or the Riemann sphere) is divided into the Fatou set, where the dynamics is stable, and the Julia set where the dynamics is chaotic. The goal is not only to understand the topology and geometry of Julia sets of individual holomorphic maps, but also to understand how the Julia set and the dynamics vary with the map, in particular to understand bifurcation sets of maps where the dynamics change qualitatively. The scope of the project is broad. It concentrates on describing special types of results and techniques, namely those for which a transfer of results is possible from dynamical spaces to parameter spaces, parametrizing families of holomorphic maps. For instance, results obtained using puzzles in dynamical spaces and para-puzzles in parameter spaces as a tool.

Department of Mathematics
University of Paris-Sud - University of Paris XI
Cornell University
University of Warwick
Universidad Autonoma de Barcelona
Period: 01/01/1996 → …
Number of participants: 5
Project participant:
Douady, Adrien (Ekstern)
Hubbard, John H. (Ekstern)
Lei, Tan (Ekstern)
Fagella, Nuria (Ekstern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 20,000.00 Danish Kroner
**Homoclinic Bifurcation to Infinity**

This project is concerned with investigations of the homoclinic bifurcation to infinity for spatially distributed systems. The resulting mathematical models are partial differential equations. Specific models of importance for biochemistry are investigated.

Department of Mathematics
Novo Nordisk A/S
Period: 01/01/1996 → …
Number of participants: 2
Project participant: Sturis, Jeppe (Ekstern)
Project Manager, organisational: Brøns, Morten (Intern)

**Hypergeometric Series and Functions in One and Several Variables**

Hypergeometric series and functions in one and several variables are studied in order to establish reducible cases, transformations, integral representations, regions of convergence and q-basic generalizations. Also, connections with certain applications are considered. Funding: MAT.

Department of Mathematics
Period: 01/01/1996 → …
Number of participants: 1
Project Manager, organisational: Karlsson, Per W. (Intern)

**Instability of Gyroscopic Systems**

Mathematical models of mechanical systems exhibit instability if the stiffness matrices are indefinite. Under certain circumstances such systems may be stabilized by adding gyroscopic terms. The investigation includes specific systems (e.g. a simple model of a spaceship) as well as the mathematical behaviour of general systems in the vicinity of multiple eigenvalues.

Department of Mathematics
Department of Applied Engineering Design and Production
Period: 01/01/1996 → …
Number of participants: 4
Project participant: Seyranian, Alexander P. (Ekstern)
Lancaster, Peter (Ekstern)
Pommer, Christian (Intern)
Project Manager, organisational: Kliem, Wolfhard (Intern)

**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 5,000.00 Danish Kroner
Source: Unknown
Name of research programme: Ukendt
Amount: 5,000.00 Danish Kroner

**Linear and Quadratic Programming**

A new type of method has been developed for positive definite problems. It is based on solving a dual problem which is an unconstrained minimization of a piecewise quadratic function. Finite convergence has been proved and an efficient implementation has been made.

Department of Informatics and Mathematical Modeling
**Loop Transfer Recovery**

Loop Transfer Recovery (LTR) is a general method for designing linear control systems. The idea is, that the demands to the dimensioning are formulated as frequency domain properties, by prescribing desired behaviours for a number of transfer functions in the control system. Traditionally, linear and quadratic optimization has been applied in connection with LTR design methods. However, it is by far more natural to define the final demands in H-infinity norm, since the final target almost always contains a specification of robustness, which is easily handled with H-infinity Theory. Through several publications it has been described how H-infinity Theory may be applied for this purpose in theory as well as in practice.

Department of Mathematics

Department of Automation

**Mathematical Modelling and Stability of Rotor Systems**

The dynamics of a large class of rotor systems can be modelled by linearized matrix differential equations in a complex setting. Such systems can exhibit instability due to internal damping, unsymmetrical steam flow or imperfect lubrication in the bearings. Stability limits are investigated by means of the Lyapunov matrix equation, in order to express stability by properties of the system matrices.

Department of Mathematics

Department of Applied Engineering Design and Production

**Measurement of short-circuit capacity**

The short-circuit capacity in the electric transmission and distribution system is important when connecting equipment to the network. In the transmission system, this could for example be connection of HVDC lines or very big consumers, and at lower voltage levels it could be minor power stations or other consumers. The short-circuit impedance is dependent on the actual configuration of the network, and of the consumption. This investigation concerns establishing methods for measuring the short-circuit impedance from naturally occurring variations in voltage and current. In particular two cases, where the measurements are presently requested are investigated. The first case is about the 400 kV bus in Bjæverskov, where the short-circuit capacity should be known before start of the HVDC line to Germany. The second case is a measurement on the 132 kV bus in Hove, where a pronounced consumer is connected, and the problem is voltage fluctuations, for which reason the impedance measurement is combined with a flicker measurement. In the project, two pc-based measurement systems are developed. The first one with the sampling rate locked to the power frequency, and the
second one with constant sampling rate. In the frequency locked system, the naturally occurring variations in voltage and current are collected and used as basis for a statistical analysis and an estimation of the short-circuit impedance. In the system with constant frequency data acquisition, the method includes an algorithm for detection of significant events in the variation of voltage and current.

Department of Electric Power Engineering
Department of Informatics and Mathematical Modeling

Period: 01/01/1996 → ...
Number of participants: 3
Project participant:
Pedersen, Knud Ole Helgesen (Intern)
Poulsen, Niels Kjølstad (Intern)

Project Manager, organisational:
Nielsen, Arne Hejde (Intern)

Microlocal Analysis of Control Problems
Considering a wave equation, it is interesting to study how the limit behaviour of the solutions (time approaching infinity), depends on various types of posed boundary conditions. This includes feedback boundary operators, which can provide exponentially damped solutions.

Department of Mathematics

Period: 01/01/1996 → ...
Number of participants: 1
Project Manager, organisational:
Pedersen, Michael (Intern)

Project

Modelling of dispersion in the planetary boundary layer
In this project a Lagrangian Stochastic Model (Random Walk Model) for dispersion of passive scalars in the planetary boundary layer (PBL) is developed.

Department of Mathematics

Period: 01/01/1996 → 31/12/1998
Number of participants: 1
Project Manager, organisational:
Falk, Anne Katrine Vinther (Intern)

Project

Models for Vibration Levels Caused by Railway Traffic
The project is concerned with developing models for estimating vibration levels caused by railway traffic. Estimates of vibration levels from passenger trains are found by two fundamentally different methods: 1) A neural network model. 2) A statistical model. The work is carried out in close cooperation with the industry.

Department of Mathematics

Department of Geology and Geotechnical Engineering
DSB Consult

Rambøll Danmark A/S

Geotechnical Institute

Period: 01/01/1996 → 01/04/1997
Number of participants: 2
Project participant:
Hansen, Bent (Intern)
Projects Manager, organisational:
Skovgaard, Ove (Intern)

Project

Multi Criterion Regulation
The literature on modern Theory of Regulation contains numerous publications concerned with the optimization based design of regulators based on specific criteria. However, a realistic design problem would rather contain a range of
specifications. Hence, optimization based methods are to a large extent inapplicable, until it has been made possible to impose multiple specifications on the same control problem. Many control problems may be formulated with constraints on sensitivity functions and a number of results have been achieved for this kind of problems. The results within this area has in particular been applied in connection with active damping of rolling of ships by steering the rudder.

Department of Mathematics

Department of Automation
Period: 01/01/1996 → 31/12/1997
Number of participants: 2
Project participant:
Niemann, Hans Henrik (Intern)

Project Manager, organisational:
Stoustrup, Jakob (Intern)

Nonlinear optics
Soliton propagation and quasi phase matching in stochastic nonlinear media (of chi(3) and chi(2) type) is investigated. Publications (PLC, CBC, and MPS) refer to publication lists of P.L. Christiansen, C.B. Clausen, and M. P. Soerensen):


Department of Informatics and Mathematical Modeling

Department of Electromagnetic Systems

Numerical solutions of stochastic differential equations
A commonly used model for dispersion of a passive scalar in the atmospheric boundary layer is the Langevin Equation, which is a stochastic differential equation. In atmospheric sciences it is integrated by the stochastic Euler scheme, which has a very low order of convergence and thus is very time-consuming. In this project a higher-order scheme for numerical integration of the non-linear height-inhomogeneous Langevin Equation is developed.

Department of Mathematics
Period: 01/01/1996 → 31/12/1996
Number of participants: 1
On Accumulation of Stretching Rays - Cubic Polynomials with a Multiple Fixed Point
The project studies the parameter space for polynomials of degree $k$, where $k$ is at least 3. More precisely, we study the boundary of the connectedness locus (the area in the parameter space, where the corresponding polynomials have a connected Julia set). A stretching ray is a real analytical curve in the complement of the connectedness locus. We are interested in the limiting behaviour of stretching rays when approaching the connectedness locus from the outside.

Already a degree three polynomial with a multiple fixpoint exhibits interesting behaviour: An area in the boundary of the cubic connectedness locus has been found, where no stretching ray lands. The corresponding cubic polynomials are parabolic-attracting with both critical points in the immediate basin of the multiple fixpoint. We have established necessary conditions for the stretching ray through a polynomial to land in this area. The work is continued attempting to prove that stretching rays can land only on a specific graph in this area and that only a very special type of stretching rays can land on this graph. Keywords: Complex dynamical systems, parabolic cycles, stretching rays.

Optimal Solutions of Concave Differential Systems
We consider a system $x' = f(t, x)$ of $n$ first order differential equations, where all coordinate functions are weakly concave in $x$ and all off-diagonal entries in the Jacobi matrix are nonnegative, i.e., a cooperative system. We give a characterization of those initial points, for which the corresponding Poincare-mapping and some related mappings assume extreme values.

Optimization and power planning.
The project has concentrated on developing a new tool for power planning in Denmark. The goal has been to solve models with many time periods considering both power and energy aspects. The model developed has a quadratic objective function and linear constraints. The elements in the model include both power plants and the power network as well as natural gas contracts and constraints on the discharge of CO2. The solution method implemented is based on interior point methods and the results obtained so far seem very promising.
Parallel Methods for Unconstrained Optimization
The implementation of parallel versions of the quasi-Newton and the Gauss-Newton methods continues. A parallel equation solver has been incorporated.

Department of Informatics and Mathematical Modeling
Period: 01/01/1996 → 01/10/1998
Number of participants: 1
Project Manager, organisational:
Tingleff, Ole (Intern)

Percolative Flow in a Melting Medium
A mathematical model of the flow of water in a melting layer of snow is being worked out. During melting an instability, the nature of which is unknown, appears to develop. The ultimate purpose is to explain why a wavy surface shape, which can be observed, develops.

Department of Mathematics
University of Western Ontario
Period: 01/01/1996 → …
Number of participants: 2
Project participant:
Rasmussen, Henning (Ekstern)
Project Manager, organisational:
Hansen, Erik Bent (Intern)

Prediction models for wind energy production
During the recent years the number of wind mills in Denmark has increased dramatically. The amount of electricity produced by wind mills is now considerable compared to what is produced by other sources, and it is necessary to take this amount into consideration in the production planning. This is in particular the case for the areas Funen and Jutland where ELSAM is responsible for the production and delivery of electricity. Due to rather large startup periods for some production units it is advantageous to estimate the amount of wind energy up to about 36 hours ahead. In this project statistical methods for predicting the wind energy for the ELSAM area 36 hours ahead are developed. The methods are based on actual measurements from 7 wind mill parks distributed across the area. Methods for taking meteorological forecasts into the model are developed. Also models for on-line detection and correction of errors in the data are formulated. All the models are implemented with a graphical user interface, and the results will be used in the daily production planning at ELSAM. An off-line version of the program is developed for a distribution company called SEP in Holland.

Department of Informatics and Mathematical Modeling
Elsam A/S
SEP
Period: 01/01/1996 → 31/12/1998
Number of participants: 4
Project participant:
Nielsen, Torben Skov (Intern)
Segaard, Henning (Ekstern)
Sejling, Ken (Ekstern)
Project Manager, organisational:
Madsen, Henrik (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 301,500.00 Danish Kroner

Propagation and scattering of electromagnetic waves
Within the area of propagation and scattering of linear waves the Institute's research is focused on classical applications of electromagnetic theory (antennas, waveguide, diffractive theory etc.) These problems are inated with both analytical and
numerical methods. Analytical methods include eg. Wiener-Hopf technique, while the numerical methods typically are integral equations and the Geometrical theory of Diffraction (GTD) combined with complex ray optics

Department of Informatics and Mathematical Modeling
Period: 01/01/1996 → …
Number of participants: 1
Project Manager, organisational:
Albertsen, Niels Christian (Intern)
Project

Quality Improvement of Drug Therapy for Asthma Patients - Evaluation of a Co-operative Danish Programme
Drug therapy is an essential in managing asthma. In spite of increased possibilities in asthma management (eg. peak-flow meters and patient diaries) and the existence of improved anti-asthmatic drugs, the morbidity and mortality of asthma have not improved in Denmark. The purpose of this Therapeutic Outcomes Monitoring project is to establish therapeutic outcomes monitoring as a continuous quality improvement activity for the medication use process among asthma patients in primary health care. To evaluate the experiment in pharmacy practice we use a combined evaluation strategy which is composed of (i) a controlled effect study, (ii) a process- and participant evaluation, (iii) a health economical analysis, and (iv) a qualitative interview study.

Department of Informatics and Mathematical Modeling
Danish College of Pharmacy Practice
Period: 01/01/1996 → 31/12/1999
Number of participants: 3
Project participant:
Rootzén, Helle (Intern)
Herborg, Hanne (Ekstern)
Project Manager, organisational:
Ersbøll, Bjarne Kjær (Intern)
Project

Quantification of enzymatic effect
Department of Informatics and Mathematical Modeling
Novo Nordisk A/S
Period: 01/01/1996 → …
Number of participants: 2
Project participant:
Folm-Hansen, Jørgen (Intern)
Project Manager, organisational:
Carstensen, Jens Michael (Intern)
Project

Reconstruction of Surfaces for Reverse Engineering
Whereas conventional engineering uses CAD/CAM systems to create real parts, reverse engineering transforms a real part into a computer model, in particular it develops a CAD model of the part. In this project, we deal with problems that arise in the context of reverse engineering of geometric models. The surface of a part may consist of different surface types. There might be simple surfaces like planes, spheres, cones and cylinders of revolution and tori. It might also contain more general surfaces of revolution, general cylinders, helical and spiral surfaces, and it might exhibit general freeform surfaces. Both for the CAD representation and for the manufacturing of the part, it is essential to recognize the simpler surface types and fit the given data, usually clouds of points with measurement errors, by surfaces of the determined type.

Department of Mathematics
Period: 01/01/1996 → …
Number of participants: 2
Project participant:
Gravesen, Jens (Intern)
Project Manager, organisational:
Randrup, Thomas (Intern)
Project
Reduction methods for Partial Differential Equations
Rotating flows connected with vortex breakdown are investigated with proper orthogonal decomposition (POD), based on a numerical solution of the Navier-Stokes equations.

Department of Mathematics
Department of Energy Engineering
City College of New York
Period: 01/01/1996 → …
Number of participants: 3
Project participant:
Sørensen, Jens Nørkær (Intern)
Christensen, Erik Adler (Ekstern)
Project Manager, organisational:
Brøns, Morten (Intern)

Reliability of Repairable Systems.
The traditional theories for reliability of electronic components has turned out to be insufficient in describing the lifetime conditions for repairable systems, that is reinstalled in production after repair. The project seek to develop statistical models, that can be used to describe the reliability of repairable systems.

Department of Informatics and Mathematical Modeling
Period: 01/01/1996 → …
Number of participants: 2
Project participant:
Nyborg, Mads (Ekstern)
Project Manager, organisational:
Thyregod, Poul (Intern)

Robust adaptive control
The goal in this project is to investigate and develop robust identification methods and adaptive controllers. The practical application is related to steering of ships (autopilots). Adaptive control is interesting in connection to ships, because these strategies are able to handle timevarying systems operating under unpredictable situations. In the period there has been focussed on model reduction in order to obtain resonable models suitable for control design. In the project there has been developed and investigated methods for designing predictive controllers, which in the design procedure take the restriction into account. classical systemidentification is based on the models ability to predict one step a head. This ability is not necessarily connected to the control objective and methods for connecting control and systemidentification has been investigated.

Department of Informatics and Mathematical Modeling
Period: 01/01/1996 → …
Number of participants: 2
Project participant:
Hansen, Anca Daniela (Intern)
Project Manager, organisational:
Poulsen, Niels Kjølstad (Intern)

Robust Regulation of Systems with Infinite Dimensions
Infinite dimensional systems usually arise from models involving partial differential equations or time delays. Robust control is concerned with controller design based on mathematical models, where the inevitable modeling errors are taken into account during the design phase. In robust control one specifies a model which in a certain sense approximates the physical plant to be controlled. Based on the approximating model a feedback control law is developed, which is satisfactory for a set of models, that in a certain sense are close to this model. This project considers the so-called H-infinity method, which is generally considered as an important method for robust control of finite dimensional systems. However, in the infinite dimensional case the method is not yet fully developed. As a case study the robust control of a pasteurization plant is considered.

Department of Mathematics
**Shoulder Muscle Forces during Work**

Work with human hands and arms imply a live load of the muscles in the shoulder. In the project several methods to determine the live load on shoulder muscles have been developed for different situations with the aim of minimizing the static load when designing a work place. The work is carried out in cooperation with Bjarne Laursen and Gisela Sjoegaard, both at the National Institute of Occupational Health, Denmark.

Department of Mathematics

**Stability Problems for Frames**

A frame can be considered as an overcomplete basis, in the sense that the constituent elements may be linear dependent. The aim of this project is to pose criteria, ensuring that the frame properties are conserved under small perturbations. This is not of theoretical interest only, but do also have considerable practical importance, since the formation of an actual frame is often based on measurements, where uncertainties may be significant.

Department of Mathematics

**Stagnation Points in Point Vortex Flows**

This project is concerned with a description of the stagnation points and the streamline topology in a flow generated by few point vortices. Some classical results from algebraic geometry find a surprising application here.

Department of Mathematics

University of Illinois at Urbana-Champaign
**Statistical methods in standardization.**
The purpose of the project is to develop procedures and guidelines for utilizing statistical ideas and statistical methods in standardization work. The project covers as well statistical procedures for assessment of the uncertainty of test methods, procedures for conformity assessment, as statistical methods for improving quality and productivity.

Department of Informatics and Mathematical Modeling  
Period: 01/01/1996 → …  
Number of participants: 1  
Project Manager, organisational:  
Thyregod, Poul (Intern)

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**Strategy and Climate Change**  
Application of Soft and Multicriteria methods to develop strategies to cope with the problems of climate change in Peru

Department of Informatics and Mathematical Modeling  
Risø National Laboratory  
CONAM, President Office  
Period: 01/01/1996 → 30/12/1998  
Number of participants: 2  
Project participant:  
Borges, Pedro Manuel F. C. (Intern)  
Project Manager, organisational:  
Vidal, Rene Victor Valqui (Intern)

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**Subgroup Subcodes**  
The advantage of a subgroup subcode is that one can adjust the symbols in a codeword to match the byte-size of the computer. Or it is a way to construct long codes. In this project we study the fundamental properties of subgroup subcodes. It has been demonstrated that high rate subgroup subcodes are among the best known codes.

Department of Mathematics  
Period: 01/01/1996 → …  
Number of participants: 1  
Project Manager, organisational:  
Jensen, Jørn Møller (Intern)

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**Teknikker til Co-syntese**

Department of Informatics and Mathematical Modeling  
Period: 01/01/1996 → 13/10/1999  
Number of participants: 4  
Phd Student:  
Knudsen, Peter Voigt (Intern)  
Supervisor:  
Madsen, Jan (Intern)  
Main Supervisor:  
Sharp, Robin (Intern)  
Examiner:  
Ernst, Rolf (Ekstern)

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**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Forskningsrådsstip.-SU, Eksp  
Project: PhD
**TEMPUS**
Exchange of staff and know-how. A full day workshop was given at Kaunas University for 60 participants from the local industry and universities. The content was future technology and CAD tools. Results from exchange researchers from Kaunas working at the universities of Darmstadt and Lynby respectively proved successful.

Department of Information Technology
Department of Informatics and Mathematical Modeling
Technische Universität Darmstadt
Kaunas University of Technology
Period: 01/01/1996 → 31/12/1998
Number of participants: 1
Project Manager, organisational:
Olesen, Ole (Intern)

**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 359,213.00 Danish Kroner

**The Mobius Strip Embedding Problem**
We present necessary and sufficient conditions for a curve to be the center curve of an analytic and flat embedding of the Mobius strip (or an orientable cylinder) into euclidean 3-space. Using these conditions we extend an example by G. Schwarz into a continuous family of analytic and flat Mobius strips. This family is split into two connected components. We give a topological argument that explains this behaviour. A connection to the work of C. Chicone and N.J. Kalton on the Mobius strip embedding problem, suggests a close relation between a linking number and the total torsion of the orthogonal axes of a Mobius strip or an orientable cylinder.

Department of Mathematics
Period: 01/01/1996 → 01/10/1996
Number of participants: 4
Project participant:
Markvorsen, Steen (Intern)
Randrup, Thomas (Intern)
Gravesen, Jens (Intern)
Project Manager, organisational:
Røgen, Peter (Intern)

**The Riemannian Recognition Programme**
Typical examples of metric invariants which are instrumental for the global description of Riemannian manifolds and Alexandrov spaces are diameter, volume, curvature bounds etc. In this project we investigate several interesting invariants of this type and decide their importance for the inverse problem of recognizing a space metrically or topologically from a given list of such invariants.

Department of Mathematics
University of Maryland
Period: 01/01/1996 → …
Number of participants: 2
Project participant:
Grove, K. (Ekstern)
Project Manager, organisational:
Markvorsen, Steen (Intern)

**The Shape of a Fluid Interface in a Moving Tube**
The shape of the interface between two fluids in a tube, which is easily found in the static case, is changed (and unknown) if the tube moves through the interface. The free boundary problem to find the shape is formulated as an integral equation, to be solved numerically, in the Stokes approximation.

Department of Mathematics
**Vehicle routing with time windows.**
The purpose of the project is to develop and test optimal solution methods to vehicle routing problems with customer time windows. A method based on Dantzig-Wolfe decomposition, generation of valid inequalities, and branch and bound is developed. The results are very promising and the algorithm turns out to be faster than other algorithms considered in the literature, and several previously unsolved problems has been solved to optimality. For the time being we are improving the branch and bound procedure and implementing a parallel branch and bound.

Department of Informatics and Mathematical Modeling
Period: 01/01/1996 → …
Number of participants: 3
Project participant:
Larsen, Jesper (Intern)
Clausen, Jens (Intern)
Project Manager, organisational:
Madsen, Oli B.G. (Intern)

**Wavelets and Frames**
Wavelets is currently gaining a lot of attention within signal processing. The transformation of wavelets provides simultaneous time/frequency analysis, where the problem with the well known Fourier transform is, that time information is lost. An important ingredient in wavelets are the so-called frames. Lately a number of articles considering theoretical aspects of frames has emerged. The purpose of this project is to contribute to this development. Previous results of the project includes time/frequency analysis seen from a group theoretical point of view as well as the connection between frames and a classical moment problem.

Department of Mathematics
Period: 01/01/1996 → …
Number of participants: 1
Project Manager, organisational:
Christensen, Ole (Intern)

**Weierstrass Polynomials for Links**
There is a natural way of identifying knots and links in 3-space with covering spaces defined as zero sets for parametrized families of complex polynomials over the circle (polynomial covering spaces over the circle). The geometrical objects mentioned can all be constructed by closing a braid around an axis in 3-space. Polynomial invariants are very important in the study of knots and links. However, polynomials of Weierstrass type, as above, have not been considered in the earlier studies. In the present project these connections are examined.

Department of Mathematics
Period: 01/01/1996 → …
Number of participants: 1
Project Manager, organisational:
Hansen, Vagn Lundsgaard (Intern)

**Yielding Capacities for Control Systems with Uncertain Parameters**
Modelling physical and dynamical systems there will inevitably be a discrepancy between the model and the real system. Sometimes even minor discrepancies may have serious consequences for certain desired properties. The present project considers input/output characteristics for these type of systems, allowing nonlinear uncertainties on the parameters.
Results have been established, which for certain classes of systems provide explicit expressions for the largest allowable deviations, considering quadratic norm conditions on the input/output properties.

Department of Mathematics
Department of Automation
**Diffraction of an electromagnetic field by a quarterplane**

It has remained a challenge in electromagnetic diffraction theory to solve the problem of scattering around a perfectly conducting quarterplane. In this project the solutions to the scalar problems (for a hard and soft quarterplane) are used to obtain the electromagnetic solution to the scattering of the field from a halfwave dipole around a quarterplane.

Department of Informatics and Mathematical Modeling

**Signalbehandling anvendt til overvågning af distributionsnet**

Department of Informatics and Mathematical Modeling

**Calling in vehicles for inspection.**

In 1998 and the following years all cars which are more than three years old must be inspected by the Danish Car Inspection (Statens Bilinspektion) every second year. Therefore the Danish Car Inspection needed to know how, when and where should the cars be called in for inspection and which capacity was necessary. To answer these questions we developed a large aggregated optimization model. The results from the model was used by the management of the Danish Car Inspection to make decisions concerning the overall structure of the future process for car inspection.

Department of Informatics and Mathematical Modeling

**Financing sources**

Source: Internal funding (public)

Name of research programme: Erhvervsforskerordningen

Project: PhD
CoFI
CoFI (Common Framework Initiative) is an international project with participants from most major groups working on algebraic specification. The goal of the initiative is to design a common framework for algebraic specification. The rationale behind this is that the lack of such a framework hinders the dissemination and application of research results in algebraic specification. CoFI will provide a family of specification languages, a development method and tool support. The project was partly supported by STVF under the "Codesign" program 1996-1997, and by the ESPRIT CoFI WG 1998-2001.

Department of Information Technology
Department of Informatics and Mathematical Modeling
Aarhus University
University of Bremen
Period: 01/11/1995 → 31/12/2003
Number of participants: 38
Project participant:
Mosses, Peter (Ekstern)
Lescanne, Pierre (Ekstern)
Astesiano, Egidio (Ekstern)
Bergstra, Jan (Ekstern)
Bert, Didier (Ekstern)
Bidoit, Michel (Ekstern)
Bettaz, Mohammed (Ekstern)
Broy, Manfred (Ekstern)
Choppy, Christine (Ekstern)
Dahl, Ole-Johan (Ekstern)
Ehrich, Hans-Dieter (Ekstern)
Ehrig, Hartmut (Ekstern)
Fiadeiro, Jose (Ekstern)
Gaudel, Marie-Claude (Ekstern)
Goguen, Joseph A. (Ekstern)
Grosu, Radu (Ekstern)
Heering, Jan (Ekstern)
Kirchner, Helene (Ekstern)
Kreowski, Hans-Joerg (Ekstern)
Krieg-Bruckner, Bernd (Ekstern)
Maibaum, Tom (Ekstern)
Malcolm, Grant (Ekstern)
Meinke, Karl (Ekstern)
Orejas, Fernando (Ekstern)
Owe, Olaf (Ekstern)
Padawitz, Peter (Ekstern)
Reggio, Gianna (Ekstern)
Reichel, Horst (Ekstern)
Sannella, Don (Ekstern)
Sernadas, Amilcar (Ekstern)
Tarlecki, Andrzej (Ekstern)
Wagner, Eric (Ekstern)
Walicki, Michal (Ekstern)
Wirsing, Martin (Ekstern)
Wolter, Uwe (Ekstern)
Cerioli, Maura (Ekstern)
Mossakowski, Till (Ekstern)
Project Manager, organisational:
Haxthausen, Anne Elisabeth (Intern)
EUROPRACTICE (I)
EUROPRACTICE replaced EUROCHIP October 1st, 1995, giving service in 5 important Microelectronics areas. One important area relevant to analog design is Training and Best Practice Service (TBPS) responsible for training in all 5 areas. TBPS has made a large investigation of industrial need for analog training. The result was that analog is increasing. Means have been taken to fulfil this.

Department of Information Technology
Department of Informatics and Mathematical Modeling
TWI
CNMF
COREP
CNM
Period: 01/10/1995 → 30/09/1997
Number of participants: 4
Project participant:
Andersen, Anders C. (Intern)
Høvring, Hanne Nielsen (Intern)
Berthelsen, Vibeke (Intern)
Project Manager, organisational:
Olesen, Ole (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 5,587,000.00 Danish Kroner

A network model of oil/water flow
One of the techniques of oil recovery involves the displacement of oil from the reservoir by the injection of water. The flow of oil and water in this process can be simulated by a network model consisting of a regular lattice of pores connected by throats. The model is nonlinear due to capillary forces that block the flow between neighboring pores of different phases under certain conditions. This project is concerned with the mathematical properties of the model and its numerical solution.

Department of Informatics and Mathematical Modeling
Period: 15/09/1995 → 31/12/1996
Number of participants: 1
Project Manager, organisational:
Barker, Vincent A. (Intern)

Design and Engineering of Double Curved Ship Surfaces
The objective of the project is to invent new mathematical methods for the design of ship surfaces. These methods should take into account the actual processes at a shipyard; rolling and heating. In the production the developed (plane) surface is by rolling turned into a single-curved plate, mostly, cylinder shaped. Henceforth, heating is applied to deform it to its final shape. The first part of the project is to find the developed shape, such that after the rolling process the obtained developable surface is closest to the desired final shape hereby minimizing the heat input. The second part consists of modelling the heating process in geometrical terms.

Department of Mathematics
Number of participants: 2
Project participant:
Gravesen, Jens (Intern)
**Project Manager, organisational:**
Randrup, Thomas (Intern)

**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 596,700.00 Danish Kroner

**Konstruktion af flader i computer assisteret geometrisk skibsdesignsk design (GAGD) via Gauss-afbildningen**

Department of Mathematics
Number of participants: 5
Phd Student: Randrup, Thomas (Intern)
Main Supervisor: Gravesen, Jens (Intern)
Examiner: Dæhlen, Morten (Ekstern)
Jensen, Jørgen Juncher (Intern)
Perram-John, William (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

**Microlocal Analysis of Control Problems**
Microlocal analysis and the propagation of singularities provides necessary and sufficient conditions for exact controllability for a linear system - even for very complicated geometries. This project treats approximative control exploiting the good geometric description provided by microlocal analysis. That is, to find a measure for the quality of an approximate control as well as geometrical conditions for the existence of a sufficiently 'good' control.

Department of Mathematics
Number of participants: 1
Project Manager, organisational: Binzer, Knud Andreas (Intern)

**Mikrolokal analyse i scattering teori og anvendelser, specielt med henblik på kontrol f partielle differentiaal ligninger**

Department of Mathematics
Period: 01/09/1995 → 08/02/1999
Number of participants: 3
Phd Student: Binzer, Knud Andreas (Intern)
Main Supervisor: Pedersen, Michael (Intern)
Examiner: Sørensen, Mads Peter (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Forskningsrådsstip.-SU, Eksp
Project: PhD

**Nonlinear Geometrical Optics**
Linear geometrical optics describe the propagation of waves with high frequency as the propagations of rays and supplies an approximate solution. The approximate solution is considerably easier to evaluate numerically, than the actual solution to the partial differential equation. For nonlinear phenomena there exists a number of studies and heuristics, while the development of a stringent theory is still only commencing. For instance, the exponential functions in the linear
approximation need to be replaced by more general 'profiles' in order to take the creation of harmonics into account.

**Department of Mathematics**

Number of participants: 1  
Project Manager, organisational:  
Binzer, Knud Andreas (Intern)

**Optimality and Robustness of Stochastic Adaptive Controllers**

Department of Informatics and Mathematical Modeling  
Period: 01/09/1995 → 11/01/1999  
Number of participants: 4  
Phd Student:  
Thygesen, Uffe Høgsbro (Intern)  
Main Supervisor:  
Poulsen, Niels Kjølstad (Intern)  
Examiner:  
Madsen, Henrik (Ekstern)  
Perram-John, William (Ekstern)

**Financing sources**

Source: Internal funding (public)  
Name of research programme: DTU-Su Stipendium, Eksperiment  
Project: PhD

**Parallel beregning af roterende strømninger**

Department of Informatics and Mathematical Modeling  
Period: 01/09/1995 → 23/02/1999  
Number of participants: 4  
Phd Student:  
Lundin, Lars Kristian (Intern)  
Supervisor:  
Sørensen, Jens Nørkær (Intern)  
Main Supervisor:  
Barker, Vincent A. (Intern)  
Examiner:  
Meyer, Stefan (Intern)

**Financing sources**

Source: Internal funding (public)  
Name of research programme: Program Stipendium-SU, Eksp  
Project: PhD

**Research visit at Bell Communications Research**

Department of Informatics and Mathematical Modeling  
Bell Communications Research Inc.  
Period: 01/09/1995 → 31/08/1996  
Number of participants: 2  
Project participant:  
Ramaswami, V. (Ekstern)  
Project Manager, organisational:  
Nielsen, Bo Friis (Intern)

**Financing sources**

Source: Unknown  
Name of research programme: Ukendt  
Amount: 133,390.00 Danish Kroner  
Project
Statistiske metoder til vurdering af kontrol af kemiske referencematerialer

Department of Informatics and Mathematical Modeling
Period: 01/09/1995 → 04/05/1999
Number of participants: 4
Phd Student:
Schramm-Nielsen, Karina Edith (Intern)
Supervisor:
Hansen, Elo Harald (Intern)
Main Supervisor:
Sliid, Henrik (Intern)
Examiner:
Velund, Aage (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Fluid dynamics: Ventilation of livestock buildings
Project no. 1153 Ph.D. project: Danish Research Academy Ph.D. Student: Jens Chr. Bennetsen A theoretical model of airflow in livestock buildings is being developed. The model is 3-dimensional. Computer simulations will also be carried out in 2 D's and compared to experimental results for a 2D-model. Publication (PLC refers to P.L.Christiansens's publication list): PLC16

Department of Informatics and Mathematical Modeling
Department of Energy Engineering
Research Center Bygholm
Number of participants: 7
Project participant:
Bennetsen, Jens Christian (Intern)
Thomsen, Per Grove (Intern)
Sørensen, Mads Peter (Intern)
Sørensen, Jens Nørkær (Intern)
Segaard, Henning T. (Ekstern)
Morsing, Svend (Ekstern)
Project Manager, organisational:
Christiansen, Peter Leth (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 500,000.00 Danish Kroner
Project

Statistisk Behnadling af Økotoksikologiske DATA

Department of Informatics and Mathematical Modeling
Period: 01/07/1995 → 30/10/1998
Number of participants: 3
Phd Student:
Andersen, Jens Strodl (Intern)
Main Supervisor:
Rootzén, Helle (Intern)
Examiner:
Løkke, Hans (Ekstern)

Financing sources
Caspar Wessel and the Complex Numbers

In 1797 a paper by the Norwegian surveyor Caspar Wessel was presented to the Royal Danish Academy of Sciences and Letters. In this paper he introduced the geometrical representation of complex numbers. From his surveying reports we know that he had the idea at least as early as 1787. A biography relating his mathematical paper to his work as surveyor under the auspices of the Academy will appear in a book, edited by Jesper Lutzen, and published by the Academy in 1998.

Department of Mathematics

University of Oslo
Period: 01/06/1995 → ...
Number of participants: 2
Project participant:
Johansen, Nils Voje (Ekstern)
Project Manager, organisational:
Branner, Bodil (Intern)

Center for informationsteknologi i miljøsektoren
CINTEM: I projektet udvikles såvel målemetoder som modelleringsteknologier i forbindelse med spildevandssystemer. Der udvikles eksempelvis nye optiske målesystemer i samarbejde med Danfoss, og i samarbejde med Kruger Systems udvikles modeller til forbedret styring af rensenanlæg.

Department of Informatics and Mathematical Modeling

Department of Environmental Science and Engineering

Danfoss A/S
VKI Water Quality Institute
Krüger A/S
KTH - Royal Institute of Technology

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 250,273.00 Danish Kroner

Adaptiv signalbehandling og detektion af modernærkekæft

Department of Informatics and Mathematical Modeling
Period: 01/03/1995 → 16/04/1999
Number of participants: 5
Phd Student:
Hintz-Madsen, Mads (Intern)
Supervisor:
Larsen, Jan (Intern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Examiner:
Lautrup, Benny (Ekstern)
Wulf, Hans Christian (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Control of Partial Differential Equations
The aim of this project is to study the control of systems described by bilinear and semilinear partial differential equations (PDEs). These PDEs could for example describe the propagation waves or the temperature profile of a body. Controllability is the property of being able to drive a system to a desired state in finite time. The essential ingredient in the analysis of controllability problems is obtaining estimates for the energy of these systems. These energy estimates are then combined with the Hilbert Uniqueness Method, Fixed Point Theorems and the Generalized Inverse Function Theorem in order to obtain controllability results.

Department of Mathematics
Period: 01/03/1995 → 31/05/1998
Number of participants: 1
Project Manager, organisational:
Krishnaswamy, Vijayaraghavan (Intern)

Development of methods for evaluation of electricity saving and load levelling measures
The purpose of the project is to (i) develop and test methods for analysis of the dependence of the electricity power consumption on factors (possibly) affecting the consumption, (ii) develop and test methods for the planning and execution of relatively small trials concerning power conservation campaigns, and (iii) develop methods for estimation of the effect of power conservation campaigns, based on trial data. The results of the project have been published as two reports, both listed under the title of this project.

Department of Informatics and Mathematical Modeling
NESA A/S
Elkraft A.m.b.A.
Period: 01/03/1995 → 31/12/1997
Number of participants: 3
Project participant:
Nielsen, Henrik Aalborg (Intern)
Bergstrøm, Willy (Ekstern)
Project Manager, organisational:
Madsen, Henrik (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 300,000.00 Danish Kroner
Project

Rekonstruktion og segmentering af PET-scan data
Department of Informatics and Mathematical Modeling
Period: 01/03/1995 → 16/06/1999
Number of participants: 5
Phd Student:
Philipsen, Peter Alshede (Intern)
Supervisor:
Svarer, Claus (Ekstern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Examiner:
Holm, Søren (Intern)
Sørensen, Helge Bjarup Dissing (Intern)
Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Styring af systemer beskrevet ved ikke-lineære partielle differentialligninger
Department of Mathematics
Period: 01/03/1995 → 14/10/1998
Number of participants: 3
PhD Student:
Krishnaswamy, Vijayaraghavan (Intern)
Main Supervisor:
Pedersen, Michael (Intern)
Examiner:
Madsen, Henrik (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

EPOS: Efficient Parallel algorithms for Optimization and Simulation
The goal is to develop efficient and reliable parallel algorithms that can utilize supercomputers for solving large-scale optimization and simulation problems.

Department of Informatics and Mathematical Modeling
Fluid Mechanics
Department of Mechanical Engineering
UNI-C
Period: 03/02/1995 → …
Number of participants: 10
Project participant:
Clausen, Jens (Intern)
Barker, Vincent A. (Intern)
Hansen, Per Christian (Intern)
Madsen, Oli B.G. (Intern)
Nielsen, Hans Bruun (Intern)
Thomsen, Per Grove (Intern)
Sørensen, Jens Nørkær (Intern)
Wasniewski, Jerzy (Ekstern)
Other:
Caprani, Ole (Ekstern)
Project Manager, organisational:
Madsen, Kaj (Intern)

Financing sources
Source: Unknown
Name of research programme: Undefind
Amount: 5,758,000.00 Danish Kroner
Project

Bayesiansk signalbehandling og fortolkning af pet-scan
Department of Informatics and Mathematical Modeling
Period: 01/02/1995 → 06/05/1998
Number of participants: 4
PhD Student:
Kjems, Ulrik (Intern)
Financing sources
Source: Internal funding (public)
Name of research programme: DTU Su Stipendium, Eksperiment
Project: PhD

Lænker og knuder i differential-geometrisk perspektiv
Department of Mathematics
Period: 01/02/1995 → 14/04/1999
Number of participants: 3
Phd Student:
Røgen, Peter (Intern)
Main Supervisor:
Hansen, Vagn Lundsgaard (Intern)
Examiner:
Gravesen, Jens (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU Su Stipendium, Eksperiment
Project: PhD

Metaheuristics and Planning
Application of simulated annealing and tabu search to solve real-life combinatorial optimization problems. The fields of interest are: - planning of examinations - design of tele-networks, and - target radar allocation.
Department of Informatics and Mathematical Modeling
Department of Telecommunication
Ministry of Education
Period: 01/02/1995 → 30/12/1999
Number of participants: 3
Project participant:
Hansen, Michael Pilegaard (Intern)
Borges, Pedro Manuel F. C. (Intern)
Project Manager, organisational:
Vidal, Rene Victor Valqui (Intern)

Project no.: 1219 Financed By: DTU
Department of Informatics and Mathematical Modeling
Period: 01/02/1995 → 31/01/1999
Number of participants: 2
Project participant:
Folm-Hansen, Jørgen (Intern)
Project Manager, organisational:
Conradsen, Knut (Intern)

Ph.D. Project: Bayesian Signal Processing and Interpretation of Brain Scans
This Ph.D.-project is about digital image processing of three-dimensional functional and anatomical image volumes of the human brain. Several approaches are investigating for improvement of the functional analysis. A problem in activation studies involving multiple subjects is the individual anatomical variation. This variation can be minimized by performing normalizing "warp"s of the anatomy. Another approach investigated is noise reduction in PET activation images using
Prior models for random fields. Parameter estimation in these random fields is of particular interest.

Department of Informatics and Mathematical Modeling

Period: 01/02/1995 → 01/03/1998
Number of participants: 3
Project participant:
Larsen, Jan (Intern)
Kjems, Ulrik (Intern)

Project Manager, organisational:
Hansen, Lars Kai (Intern)

Visualisering af funktionel konnektivitet i den menneskeligejerne. Statistisk analysyse af PET-billeder

Department of Informatics and Mathematical Modeling

Period: 01/02/1995 → …
Number of participants: 3
Phd Student:
Mørch, Niels J.S. (Intern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Examiner:
Larsen, Jan (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskerakademiets Samfinansier
Project: PhD

Algorithms and Software for Rank-Revealing Decompositions
Research co-operation, sponsored by a NATO Collaborative Research Grant.

Department of Informatics and Mathematical Modeling

California State University
Period: 01/01/1995 → 31/12/2000
Number of participants: 2
Project participant:
Fierro, Ricardo D. (Ekstern)
Project Manager, organisational:
Hansen, Per Christian (Intern)

Anvendelse af stokastiske differentialligninger i biometri.
De klassiske modeller for biologisk nedbrydning af stoffer antager at forløb, der følger en eller flere sammenhoerende differentialligninger med faste og tidsuafhængige koefficienter. I praksis ses imidlertid et forløb, der nok er kontinuerligt, men mere tilfældigt og desuden er overlært for maalstoen. Projektets formael er saaledes at beskrive de tilfældige variationer i nedbrydningsforløbet ved hjælp af stokastiske differentialligninger samt at identificere maalstoen.

Department of Informatics and Mathematical Modeling

Period: 01/01/1995 → 31/12/1999
Number of participants: 3
Project participant:
Spliid, Henrik (Intern)
Wang, Chunyan (Ekstern)
Project Manager, organisational:
Rootzén, Helle (Intern)

Biologisk vækst i multikomponentsystemer.
Der betragtes multikomponentsystemer af organiske stoffer, hvor de enkelte stoffer kan nedbrydes af en eller flere grupper af mikroorganism. Der skal saaledes opstilles en model der beskriver omsætningen af stoffer. Ligningssystemets strukturelle karakter antages at være kendt og problemet bestaar saaledes i at estimere de ukendte parametre, der
indgaar i differentialligningerne. Desuden behandles problemer vedr. observerbarhed. Konkret er formaalet at bedre
forståelsen af de grundlæggende biologiske og reaktionskinetiske forhold, der bestemmer omsætningen af mono
aromatiske hydrocarboner (MAH) i grundvand, saaledes at der skabes basis for en biologisk baseret oprensningsteknik for
MAH-forurennet grundvand.

Department of Informatics and Mathematical Modeling
Department of Environmental Science and Engineering
Period: 01/01/1995 → 31/12/1999
Number of participants: 4
Project participant:
Spliid, Henrik (Intern)
Sommer, Helle Mølgaard (Intern)
Arvin, Erik (Intern)

Project Manager, organisational:
Rootzén, Helle (Intern)

Coding in Data Transmission
Coding problems related to concatenated codes are studied in cooperation between the Department of Telecommunication and the Department of Mathematics, DTU, and Institute of Electronic Systems, AAU. This work has been supported by the Danish Research Council, STVF, since 1991. Various activities are listed as separate projects.

Department of Telecommunication
Department of Mathematics

Aalborg University
Period: 01/01/1995 → 31/12/1997
Number of participants: 1
Project Manager, organisational:
Justesen, Jørn (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 2,300,000.00 Danish Kroner

Concentration-Dependent changes of PCB Patterns in Fish-Eating Mammals
Data on chlorobiphenyls (CB’s) in fish-eating mammals from five laboratories are combined to test and refine a pharamacokinetic model for the capacity of marine mammals to metabolize CB’s. The study covers data on otter, harbour porpoise, common dolphin, harbour and grey seal. The marine mammal samples originated from the coasts of the British Isles, the Netherlands and Denmark. Otter samples originated from The Netherlands, Denmark, Austria and the Czech Republic. The main purpose of the project has been to relate observed differences in CB patterns between species to differences in biotransformation capacity. Publ.: Arch. Environ. Contam. Toxicol. 33, 298-311 (1997).

Department of Informatics and Mathematical Modeling
Royal Netherlands Institute for Sea Research - NIOZ

National Environmental Research Institute
Period: 01/01/1995 → 31/12/1997
Number of participants: 4
Project participant:
Boon, Jan (Ekstern)
vander Meer, Jaap (Ekstern)
Storr-Hansen, Eva (Ekstern)

Project Manager, organisational:
Spliid, Henrik (Intern)
Distributed Systems in ATM Networks
The purpose of this research is to investigate the use of high-speed data networks as a basis for distributed applications.

Department of Information Technology
Department of Informatics and Mathematical Modeling
University of Copenhagen

Aalborg University
Period: 01/01/1995 → …
Number of participants: 4
Project participant:
Skou, Arne (Ekstern)
Sharp, Robin (Intern)
Project Manager, organisational:
Sharp, Robin (Intern)
Jul, Erik (Ekstern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 126,000.00 Danish Kroner

Faktorforsoeg med funktionelt respons.

Department of Informatics and Mathematical Modeling
Period: 01/01/1995 → 31/12/1999
Number of participants: 3
Project participant:
Spliid, Henrik (Intern)
Sommer, Helle Mølgaard (Intern)
Project Manager, organisational:
Rootzén, Helle (Intern)

High Temperature Superconductivity
The Bardeen, Cooper and Schrieffer (BCS) approach is used to investigate the influence of anisotropy on the superconducting state in heavy fermionic systems or in the high-Tc oxide superconductors. We investigate the influence of anisotropy and nonlinearity on physical properties as the electron specific heat, the spin susceptibility, and Josephson tunelling. The moment approach has been used to calculate the single particle spectral functions for the tJ-model of a high-Tc superconductor. Within the framework of a mean field theory the energy gap is calculated together with spin-susceptibility and electron heat capacity. The results comply with cluster calculations.

Department of Informatics and Mathematical Modeling

Univerisdade Federal Fluminense

University of Crete
Period: 01/01/1995 → …
Number of participants: 3
Project participant:
Rodriguez-Nunez, J.J. (Ekstern)
Lazarides, N. (Ekstern)
Project Manager, organisational:
Sørensen, Mads Peter (Intern)
Implementing Short Term Predictions at Utilities
The purpose of the project is to investigate possible prediction models for wind power in a larger area using on-line measurements from selected wind farms and meteorological forecasts of weather variables. The resulting models are implemented in a software tool for on-line wind power predictions - WPPT - and tested at utilities (ELSAM and ELTRA).

Department of Informatics and Mathematical Modeling

Risø National Laboratory
Danish Meteorological Institute
Elsam A/S
OEM Development Corp.
National Observatory of Athens
University of Athens
Eikraft A.m.b.A.
Rutherford Appleton Laboratory
Period: 01/01/1995 → 31/12/1998
Number of participants: 3
Project participant:
Nielsen, Torben Skov (Intern)
Nielsen, Henrik Aalborg (Intern)
Project Manager, organisational:
Madsen, Henrik (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,500,000.00 Danish Kroner

Incidence of clubfoot in Frederiksborg County, Denmark.
The incidence of congenital clubfoot in Frederiksborg County, Denmark, was studied over a period of 16 years (1979-1994). Altogether 60,166 living infants were born, and of these 72 had a congenital clubfoot. Twenty-five children (35%) had bilateral clubfoot and 54 (75%) were boys. The overall incidence was 1.20 per thousand children. The incidence increased significantly during the observation period and was 2.41 per thousand in 1994. We cannot explain the rising incidence. The statistical analysis is made on the base of the theory for generalized linear models.

Department of Informatics and Mathematical Modeling

Hillerød Sygehus
Period: 01/01/1995 → 31/12/1997
Number of participants: 2
Project participant:
Andersen, Mikkel O. (Ekstern)
Project Manager, organisational:
Rootzén, Helle (Intern)

Matematiske metoder til validering af jernbanesikringsanlæg
Department of Informatics and Mathematical Modeling
Period: 01/01/1995 → 25/01/1999
Number of participants: 3
Phd Student:
Petersen, Jakob Lyng (Intern)
Main Supervisor:
Rischel, Hans (Intern)
Examiner:
Statistical Treatment of Ecotoxicological Data based on Hazard Modelling

When characterising complex chemical pollution i.e. pesticide polluted groundwater or testing the effects of chemical compounds on the environment, ecotoxicological tests are of great value. This is due to their sensitivity and their expression of the overall toxicity. Since environmental pollution is increasing it is judged that ecotoxicological assays will have increasing impact on the toxicity- and risk assessment of environmental pollution. Evaluating results from ecotoxicological tests inevitably include estimation of dose-response relations. Conclusions about toxicity of the pollution or tested chemicals are summarised in characteristics extracted from the dose-response relationship. A revision of the statistical methods for extracting these measures has been internationally recommended by the scientific community. The dose/time-response models used are based on biological considerations, the key assumption is that the hazard rate is proportional to the concentration of the chemical compound in the animal as far as it exceeds the no-effect level. The uptake dynamics are described by a one compartment model involving the uptake rate and elimination rate. The dynamic models are compared with the traditional models, regarding the number of parameters, description of experimental data etc.

Department of Informatics and Mathematical Modeling
Department of Environmental Science and Engineering

Vrije Universiteit Amsterdam
Period: 01/01/1995 → 31/12/1998
Number of participants: 6
Project participant:
Andersen, Jens Strodl (Intern)
Baun, Anders (Intern)
Nyholm, Niels (Intern)
Bedaux, Jacques (Ekstern)
Kooijam, S.A.L.M. (Ekstern)

Project Manager, organisational:
Rootzén, Helle (Intern)

Statistical Treatment of Ecotoxicological Data with Continuous Response using biologically based models

When characterising complex chemical pollution i.e. pesticide polluted groundwater or testing the effects of chemical compounds on the environment, ecotoxicological tests are of great value. This is due to their sensitivity and their expression of the overall toxicity. Since environmental pollution is increasing it is judged that ecotoxicological assays will have increasing impact on the toxicity- and risk assessment of environmental pollution. Evaluating results from ecotoxicological tests inevitably include estimation of dose-response relations. Conclusions about toxicity of the pollution or tested chemicals are summarised in characteristics extracted from the dose-response relationship. A revision of the statistical methods for extracting these measures has been internationally recommended by the scientific community. Generalized Nonlinear regression methods using classical dose-response models, are used to estimate the variance heterogeneous dosis-response relations and estimate endpoints and their confidence limits.

Department of Informatics and Mathematical Modeling
Department of Environmental Science and Engineering

Period: 01/01/1995 → 31/12/1998
Number of participants: 4
Project participant:
Andersen, Jens Strodl (Intern)
Baun, Anders (Intern)
Nyholm, Niels (Intern)

Project Manager, organisational:
Rootzén, Helle (Intern)
Statistics in ecotoxicological guidelines
Project no. 1161. Grundvandscentret. Ph.D. project: Jens Strodl Andersen A revision of the guidelines for ecotoxicological tests has shown severe lack of statistical recommendations. It has been internationally recommended by the scientific community to enhance the use of statistics in the design and data treatment in most ecotoxicological tests. Helle Holst has participated in International workshops which have resulted in reports and articles describing the state of the art and the perspectives for the future. Research regarding design and modelling is ongoing

Department of Informatics and Mathematical Modeling
Period: 01/01/1995 → 31/12/1998
Number of participants: 1
Project Manager, organisational:
Rootzén, Helle (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 391,200.00 Danish Kroner

Statistisk analyse af jordkomponenters betydning for cadmium sorption i jord.
Formålet med projektet er at undersøge om distributionskoefficienten, der udtrykker forholdet mellem komponenten bundet i hhv. jord- og vandfasen kan beskrives ved hjælp af en række jordparametre samt hvilke jordparametre der i denne forbindelse er vigtige. Sekundaert er formålet at optimere bestemmelsen af distributionskoefficienten ud fra sammenhørende værdier af S og C. Projektet udføres i samarbejde med IMT og KVL.

Department of Informatics and Mathematical Modeling
Department of Environmental Science and Engineering
Period: 01/01/1995 → 31/12/1997
Number of participants: 2
Project participant:
Christensen, Thomas Højlund (Intern)
Project Manager, organisational:
Rootzén, Helle (Intern)

Stereoskopi 1 : ColorCode 1995 - 2003

Department of Informatics and Mathematical Modeling
Department of Physics
Technical University of Denmark
Period: 01/01/1995 → 31/12/2003
Number of participants: 1
Project Manager, organisational:
Hansen, Per Skafte (Intern)

Subtyping and Higher-order Functions
The goal of this project is to give a proposal for the semantic foundations of algebraic specification languages having subtypes and higher-order functions.

Department of Information Technology
Department of Informatics and Mathematical Modeling
Period: 01/01/1995 → 31/12/1999
Number of participants: 1
Project Manager, organisational:
Haxthausen, Anne Elisabeth (Intern)

Financing sources
**Surrogate Modelling for Engineering Optimization**

Design optimization of computationally expensive engineering devices and systems through fast, inexpensive surrogate models. Based on corresponding response evaluations a mapping between the expensive system and the inexpensive model is approximated and used in the optimization of the expensive system.

Department of Informatics and Mathematical Modeling

Period: 01/01/1995 → …

Number of participants: 3

Project participant:

Bandler, John W. (Ekstern)

Zhang, Q.J. (Ekstern)

Madsen, Kaj (Intern)

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**Acquisition and analysis of complex dynamic intra- and intercellular signaling events. Project no.: 1144, Ph.D-student Ole Skyggebjerg.**

Project no.: 1144

Financed by: ATV/Novo

Department of Informatics and Mathematical Modeling

Period: 01/12/1994 → 30/11/1997

Number of participants: 2

Project participant:

Skyggebjerg, Ole (Intern)

Project Manager, organisational:

Conradsen, Knut (Intern)

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**Aircraft, Bifurcation and Control**

Department of Mathematics

Period: 01/12/1994 → 13/10/1998

Number of participants: 5

Phd Student:

Cromme, Marc (Intern)

Supervisor:

Stoustrup, Jakob (Intern)

Main Supervisor:

Brøns, Morten (Intern)

Examiner:

Jørgensen, Sten Bay (Intern)

Perram-John, William (Ekstern)

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**Financing sources**

Source: Internal funding (public)

Name of research programme: DTU-Su Stipendium, Eksperiment

Project: PhD

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**Condition Monitoring And Fault Diagnosis In Marine Diesel Engines**

Department of Informatics and Mathematical Modeling

Period: 01/12/1994 → …

Number of participants: 5

Phd Student:

Fog, Torben L. (Intern)

Supervisor:
Ph.D. Project: Prediction of the Cylinder Condition in Marine Engines Using Neural Networks

Marine engine monitoring is an active research area with a long history. Successful monitoring is vital for marine traffic safety and significant economic factors can be involved, e.g., in the form of transport delay costs and additional use of spare parts. At present, only quite simple electronic methods exist for monitoring the cylinder condition in marine engines. Certain mechanical systems have been constructed, although robust, they do not provide adequate information about the specific fault conditions. Development of new and better methods for signal analysis in fault diagnosis is therefore of great interest. The goal of the project is to develop a detailed and reliable system for monitoring the cylinder condition in marine engines. The cylinder condition will be monitored by use of sensors which either directly or indirectly can measure important parameters of the cylinder condition (temperature, cylinder pressure and sound/vibrations). This demands integration of information from sources with different signal characteristics and signal-to-noise ratios in a comprehensive evaluation of the cylinder condition (signal/sensor fusion). Also, design of performance criteria by use of for instance Bayesian analysis and integration of specific expert knowledge (prior information) will be considered. One specific form of prior information is the so-called wavelet representation for sound/vibration signals. In this case the network input could be represented as sound/vibration "images" describing time dependent development of the signal's frequency spectrum. Such representation can be useful for detection of anomalies and non-stationarity. The diagnosing tool will be a neural network and therefore a detailed study of neural network architectures and performance optimization methods will be necessary. Especially methods for analyzing multivariate time series (simultaneous prediction of several parameters) will be in focus.

Department of Informatics and Mathematical Modeling
MAN B&W Diesel A/S
University of Copenhagen
Period: 01/12/1994 → 31/05/1998
Number of participants: 5
Project participant:
Hansen, Lars Kai (Intern)
Fog, Torben L. (Intern)
Pedersen, Peter Sunn (Ekstern)
Lautrup, Benny (Ekstern)
Project Manager, organisational:
Sørensen, John Aasted (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 600,000.00 Danish Kroner

Ph.D. Project: Hidden Markov Models and Neural Networks

Hidden Markov Models (HMM) are statistical models that are widely used in Automatic Speech Recognition and molecular biology. The parameters (emission and transition probabilities) of a HMM can be estimated from a set of examples by using a Maximum Likelihood (ML) training algorithm. In small vocabulary speech recognition a HMM is trained for each word in the vocabulary, whereas in large vocabulary speech recognition subword HMM's are used (e.g. phoneme HMM's). During recognition the likelihood of each HMM is calculated, and the observed sequence is classified according to the highest likelihood. Since each model is trained using only the sequences assigned to it, it is obvious that training by ML gives non-discriminative models, i.e., the models are not trained to discriminate between words. A discriminative training method called Maximum Mutual Information (MMI) has therefore been developed and successfully applied to a range of applications. There has recently been a widespread interest in combining neural networks and HMM's for speech recognition. If neural networks are used to estimate probabilities in HMM's, it is possible to estimate the weights in the neural network and the parameters in the HMM at the same time by using a gradient descent algorithm. The intention of this project is to analyze and develop algorithms for training combined neural network and HMM models. Investigations
have been carried out using the hybrid for recognition of five broad phoneme classes in continuous speech (the TIMIT database). The obtained are promising. Furthermore work has been carried on a more real-world task (the recognition of 39 phonemes in the TIMIT database) also with promising results. Publication.

Department of Informatics and Mathematical Modeling

University of Sheffield
Number of participants: 4
Project participant:
Riis, Søren Kamaric (Intern)
Krogh, Anders Stærmose (Intern)
Renals, Steve (Ekstern)

Project Manager, organisational:
Hansen, Steffen Duus (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 100,000.00 Danish Kroner
Source: Unknown
Name of research programme: Ukendt
Amount: 1,000,000.00 Danish Kroner

Skjulte Markovmodeller og Neutrale Netværk

Department of Informatics and Mathematical Modeling
Number of participants: 3
Phd Student:
Riis, Søren Kamaric (Intern)
Main Supervisor:
Hansen, Steffen Duus (Intern)
Examiner:
Sørensen, Helge Bjarup Dissing (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Selv-organiserede processer og kohærente strukturer i kontinuumsystemer

Department of Informatics and Mathematical Modeling
Period: 01/10/1994 → 15/04/1999
Number of participants: 6
Phd Student:
Schmidt, Michel R. (Intern)
Supervisor:
Bohr, Tomas (Intern)
Rasmussen, Jens Juul (Intern)
Main Supervisor:
Christiansen, Peter Leth (Intern)
Examiner:
Alstrøm, Preben (Ekstern)
Brøns, Morten (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskerakademiets Samfinansier
**Sustain**
Sustain is a 3 year network project with 23 leading semiconductor institutes. The topic is submicron technology. The project has included exchange of staff members and workshops every year. The project was ended with 5 reports in 1997.

Department of Information Technology
Department of Informatics and Mathematical Modeling
University of Catania
Universitat Politècnica de Catalunya
NMRC
IMEC
University of Southampton
University of Parma
RESSI
Instituto de Engenharia de Sistemas e Computadores do Porto
Consiglio Nazionale delle Ricerche
Max Planck Institute
University of Hannover
National Centre for Scientific Research "Demokritos"
University of Surrey
Delft University of Technology
FhG-IIS-B
University of Twente
Università di Bologna
Vienna University of Technology
University of Salford
Period: 01/10/1994 → 30/09/1997
Number of participants: 24
Project participant:
Campisano, S. (Ekstern)
Castañer, L. (Ekstern)
Crean, G. (Ekstern)
Keersmaecker, R. De (Ekstern)
Meyer, K. De (Ekstern)
Van Overstraeten, R. (Ekstern)
Evans, A. (Ekstern)
Fantini, F. (Ekstern)
Klein, J. P. (Ekstern)
Bornhil, G. (Ekstern)
Freitas, P. (Ekstern)
Gentili, M. (Ekstern)
Habermeier, H. U. (Ekstern)
Hasse, W. (Ekstern)
Hatzakis, M. (Ekstern)
Hemment, P. (Ekstern)
Janssen, G. (Ekstern)
Lorenz, J. (Ekstern)
Mouthaan, T. (Ekstern)
Ricò, B. (Ekstern)
Langer, E. (Ekstern)
van den Berg, J. A. (Ekstern)
Zwicker, G. (Ekstern)
Project Manager, organisational:
Olesen, Ole (Intern)

**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 28,398.00 Danish Kroner

**Talekodning ved digital signalbehandling og lydkvalitet i sammensatte digitale transmissionssystemer**

Department of Informatics and Mathematical Modeling
Period: 01/10/1994 → …
Number of participants: 4
PhD Student:
Petersen, Kim T (Intern)
Supervisor:
Sørensen, John Aasted (Intern)
Main Supervisor:
Hansen, Steffen Duus (Intern)
Examiner:
Elberling, Claus (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

**Ventilation af staldanlæg**

Department of Informatics and Mathematical Modeling
Period: 01/10/1994 → 04/05/2000
Number of participants: 3
PhD Student:
Bennetsen, Jens Christian (Intern)
Main Supervisor:
Christiansen, Peter Leth (Intern)
Examiner:
Barker, Vincent A. (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Forskerakademiets Samfinansier
Project: PhD

**Analysis and Optimization of the progressive damage in fiber-reinforced materials**

A Ph.D. Study. The cumulative damage and failure of composite materials is modelled by a continuum damage mechanics approach. The sensitivities of the nonlinear and transient system are determined analytically and used in the subsequent optimization problem of finding the optimal fiber-orientation, ply-thicknesses and stacking sequence yielding the strongest lay-up design of the laminate for a given load-situation.

Department of Solid Mechanics
Department of Mathematics
Department of Mechanical Engineering
**Dynamic vehicle routing.**
Dynamic vehicle routing is dealing with vehicle routing problems in which not all information is available at the start of the planning period. Vehicles are dispatched to satisfy service requests, that evolve in real time. In 1996 a simulator was developed. The simulator generated problem instances which were solved by a static algorithm. The purpose was to analyze how the degree of dynamism influenced the quality of the static solution procedure. Furthermore an algorithm has been developed for dispatching medical doctors serving patients in their homes at night. The algorithm was combined with a very fast shortest route algorithm and a road network database.

Department of Informatics and Mathematical Modeling

COWI A/S

**Elektrisk stimulation af lammede muskler**
Department of Informatics and Mathematical Modeling
Period: 01/09/1994 → 03/02/1998
Number of participants: 2
Phd Student:
Thorsen, Rune A (Intern)
Main Supervisor:
Hansen, Steffen Duus (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen

**Parametrization in Laminate Design for Optimal Compliance**
The design problem is analyzed by performing a reformulation to an equivalent problem which is local in character and it is shown how this, together with an enlargement of the design space to allow for out of plane chattering designs, leads to a significant simplification of the problem. Thus the number of variables is reduced to only four for the stiffness problem at hand, even in the general case with coupling stiffnesses and multiple loads. Moreover, in the special case of in-plane loads, the optimal solution for each design element of the plate can be realized as a single rotated ply of material or in special strain situations by two plies. A computational solution procedure for the simplified problem is described and several numerical examples illustrate basic features of the design approach.

Department of Solid Mechanics
Department of Mathematics
Ph.D. Project: Signal Processing with Feedback Networks
The aim of this project is the analysis of feed-back neural networks, including the learning process, optimization of model structure and statistical validation. A essential property of an adaptive system is adequate training performance. However, it is generally accepted that training feedback networks is a difficult task. The project concerns the analysis of mechanisms complicating training and suggests second order training methods. The use of feedback networks calls for an analysis of stability and robustness. By considering the network as a dynamical system, the project objective is clarify stability issues. Finally, the project is devoted to the study of model structure optimization. In particular, the study focuses on whether existing methods for feed-forward networks can be applied to feed-back networks as well. Further, methods for validation of model structures is under development. The feed-back networks are primarily analyzed in connection with time-series modeling/prediction problems.

Selv-validerende computerbaserede beregningsmetoder for funktionalanalysen (med særlig henblik på anvendelsesmulighederne)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Signalbehandling med feedback netværk
Department of Informatics and Mathematical Modeling
Period: 01/09/1994 → 31/10/1997
Number of participants: 5
Phd Student:
Pedersen, Morten With (Intern)
Supervisor:
Larsen, Jan (Intern)
Main Supervisor:
Hansen, Lars Kai (Intern)
Examiner:
Lautrup, Benny (Ekstern)
Sørensen, Helge Bjarup Dissing (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Program Stipendium-SU, Eksp
Project: PhD

Tele-Information and Operations Research
Department of Informatics and Mathematical Modeling
Period: 01/09/1994 → …
Number of participants: 3
Phd Student:
Borges, Pedro Manuel F. C. (Intern)
Main Supervisor:
Vidal, Rene Victor Valqui (Intern)
Examiner:
Leleur, Steen (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Friplads_SU
Project: PhD

Testing Techniques for Self-Timed Circuits
Department of Informatics and Mathematical Modeling
Number of participants: 2
Phd Student:
Jianwei, Liu (Intern)
Main Supervisor:
Sparsø, Jens (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Friplads_SU
Project: PhD

Error Bounds for Differential Equations
Methods for the solution of integral equations and ordinary differential equations, with automatic determination of error bounds which are guaranteed to enclose the exact solution. Interval analysis is used. The methods are applied to prove the existence of periodic solutions to certain differential equations occurring in dynamic systems theory.

Department of Informatics and Mathematical Modeling
Period: 01/08/1994 → 31/12/1997
Number of participants: 2
Project participant:
Stauning, Ole (Intern)
Project Manager, organisational:
Madsen, Kaj (Intern)
Optimering af ligningsløsere
Department of Informatics and Mathematical Modeling
Period: 01/08/1994 → 21/07/2000
Number of participants: 6
Phd Student: Jeppesen, Michael (Intern)
Supervisor: Michelsen, Jess (Intern)
Sørensen, Jens Nørkær (Intern)
Main Supervisor: Thomsen, Per Grove (Intern)
Examiner: Barker, Vincent A. (Intern)
Michelsen, Jess (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstip.-SU, Eksp
Project: PhD

Proof visualization
A new branch of mathematical visualization was proposed by Niels Bonde Jensen, viz.: the visualization (as opposed to mere illustration) of mathematical proofs. This subject can be regarded as a branch of mathematics or, independently, as a branch of scientific graphical communication. Both points of view are pursued.

Department of Informatics and Mathematical Modeling
Period: 01/08/1994 → …
Number of participants: 2
Project participant: Jensen, Niels Bonde (Ekstern)
Project Manager, organisational: Hansen, Per Skafte (Intern)

Integrations- og konsistensproblemer i produktmodeller for byggeri
Department of Informatics and Mathematical Modeling
Period: 01/07/1994 → 21/01/1998
Number of participants: 2
Phd Student: Jacobsen, Kim (Intern)
Main Supervisor: Galle, Per (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstip.-SU, Eksp
Project: PhD

Boundary Element Analysis and Computation of Shell Equations
The aim of the project is to provide precise boundary element formulations for plate and shell equations, using pseudodifferential methods.

Department of Mathematics
Texas A&M University
Period: 21/06/1994 → 31/12/1998
Number of participants: 2
Project participant:
Chen, Goong (Ekstern)
Project Manager, organisational:
Pedersen, Michael (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 50,000.00 Danish Kroner
Project

Prognosemodeller for gasforbrug
Der udvikles statistiske modeller til prognoser af gasforbrug. Modellerne implementeres i samarbejde med LICconsult i en større tysk by.

Department of Informatics and Mathematical Modeling
LICconsult
Period: 17/06/1994 → 30/06/1996
Number of participants: 2
Project participant:
Nielsen, Torben Skov (Intern)
Project Manager, organisational:
Madsen, Henrik (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 200,000.00 Danish Kroner
Project

Identification af modeller for kedel og varmeanlæg

Department of Informatics and Mathematical Modeling
Grundfos A/S
Period: 01/06/1994 → 31/05/1997
Number of participants: 5
Project participant:
Hansen, Lars Henrik (Intern)
Holst, Jan (Ekstern)
Bidstrup, Niels (Ekstern)
Vadstrup, Pierre (Ekstern)
Project Manager, organisational:
Madsen, Henrik (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 30,645.00 Danish Kroner
Project

Identification af modeller for kedel- og varmeanlæg
Department of Informatics and Mathematical Modeling
Period: 01/06/1994 → 11/02/1998
Number of participants: 4
Phd Student:
Design of observer based controllers
This project deal with design of observers in connection with feedback control. The concept of loop transfer recovery (LTR) has been invesitgated for the design of observers as well as design of fixed order LTR controllers. In the usual LTR setting, design rules are developed based on sufficient conditions for recovery only. A consequence of this is that the design rules might not necessary point out the 'best' controller from an LTR point of view. Another drawback lies in the assumed controller architecture in previous approaches. Thust, it has not been investigaged if different choices of controller types would yield better general performance, or, conversely. which special performance properties are associated with different classes of compensators. The LTR concept has, in this project, been applied on continuous-time, discrete-time and sampled date systems. Further, there has been focus on both design methods as well as on new observer/controller architectures for increasing the controller performance, In the area of design methods, new methods has been derived out from standard induced norm based methods. Two new architectures has been derived for increasing the specific performance conditions of the controller. The first architecture is the so-called PI observer which make it possible to increase the performance at low frequencies. This is quite relevant in connection with non minimum phase systems, where it is not possible to obtain good performance at low frequencies by using a standard observer architecture. The other new architecture is related with fixed order LTR controller design. A linear matrix inequality (LMI) design approach for fixed order controllers has been derived.
hitherto most used methodology. Here, known physical differential equations, as well as the data, are used to estimate parameters and possibly unknown processes. This means that non-linear processes can easily be included in the model, as opposed to traditional black-box models. Furthermore, stochastic effects, that any natural system will contain, can be accommodated.

Department of Informatics and Mathematical Modeling

PH-Consult Aps.
Period: 01/04/1994 → 31/05/1997
Number of participants: 4
Project participant:
Jacobsen, Judith L. (Intern)
Harremoes, Poul (Ekstern)
Linde Jensen, Jens Jørgen (Ekstern)
Project Manager, organisational:
Madsen, Henrik (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 13,500.00 Danish Kroner
Project

Usikkerhedsbeskrivelse i kvantitative risikoanalyser.
Det er projektets direkte formål at forøge anvendeligheden af kvantitative risikoanalyser gennem udvikling af metoder, som gør det muligt at leve op til kvalitetskravene i Dansk Standards DS-Information om risikoanalyse (DS/INF85) for så vidt angår kvantitative usikkerhedsvurderinger. Dvs. udvikling af metoder og principper for beskrivelse og analyse af usikkerheder med en sådan troværdighed, at kvantificerede risici meningsfyldt kan sammenlignes indbyrdes eller relateres til kvantitative acceptkriterier.

Department of Informatics and Mathematical Modeling
Period: 01/04/1994 → 01/06/1996
Number of participants: 1
Project Manager, organisational:
Hansen, Niels Herman (Intern)
Project

Adaptive Neural Signal Processing Systems
Starting from nonlinear adaptive systems based on neural networks, the objective is to study methods for: * model evaluation and interpretation * adaptive learning in non-stationary environments * optimization of model structures * design of experimental conditions including database design. Model evaluation (including generalization ability) and interpretation are fundamental issues when designing signal processing systems for practical applications, and several problems regarding definition and reliable estimation are still to be solved. The fact that most practical problems involves adaptation to changing environmental conditions calls for investigation of methods for model design, including optimization of model structure. In particular, recurrent neural networks and heterogeneous network ensembles will be studied. Finally, the project covers methods for experimental design, especially active learning and combined supervised/unsupervised learning schemes. The theoretical research is carried out in close synergy with application projects covering: * Analysis and interpretation of brain scan data * Medical decision support systems * Humanitarian mine detection * Monitoring and inspection systems.

Department of Informatics and Mathematical Modeling
Period: 01/03/1994 → …
Number of participants: 2
Project participant:
Hansen, Lars Kai (Intern)
Project Manager, organisational:
Larsen, Jan (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 500,000.00 Danish Kroner
Project
Lesning af Komplekse Kombinatoriske Problemer

Department of Informatics and Mathematical Modeling
Period: 01/03/1994 → 03/08/1998
Number of participants: 2
Phd Student:
Hansen, Michael Pilegaard (Intern)
Main Supervisor:
Vidal, Rene Victor Valqui (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Stipendium, Eksperiment
Project: PhD

Parallelle Algoritmer til løsning af partielle differentialligninger

Department of Informatics and Mathematical Modeling
Period: 01/03/1994 → 17/08/1998
Number of participants: 4
Phd Student:
Nielsen, Ole Møller (Intern)
Supervisor:
Sørensen, Mads Peter (Intern)
Main Supervisor:
Barker, Vincent A. (Intern)
Examiner:
Skelboe, Stig (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden Offentlig Finansier-SU
Project: PhD

Ph.D. Project: Wavelets in Scientific Computing
This project is concerned with the use of wavelets to solve certain partial differential equations, the nonlinear Schrödinger equation in particular, and the parallel computation of wavelet transforms. The emphasis is on the wavelets with compact support discovered by I. Daubechies.

Department of Informatics and Mathematical Modeling
Period: 01/03/1994 → 28/02/1998
Number of participants: 4
Project participant:
Nielsen, Ole Møller (Intern)
Hansen, Per Christian (Intern)
Sørensen, Mads Peter (Intern)
Project Manager, organisational:
Barker, Vincent A. (Intern)

Wavelets in Scientific Computing
Wavelet analysis is a relatively new mathematical concept that has already been widely accepted in signal processing, e.g. for purposes such as image compression. The crucial feature of wavelets is the ability to represent different parts of a function on different scales which makes for very sparse representations of functions that contain local oscillations or even singularities. We study the potential for using these desirable properties of wavelets for solving partial differential equations.

Department of Informatics and Mathematical Modeling
Period: 01/03/1994 → 28/02/1998
Number of participants: 1
Project Manager, organisational:
Geometric Heat Kernel Comparison Theory
Using comparison theory for the Laplacian of geometrically restricted distance functions we obtain relations between essential features of diffusion processes, isoperimetric inequalities and curvature.

Department of Mathematics
Universitat Jaume I
Period: 01/02/1994 → …
Number of participants: 4
Project participant:
Gravesen, Jens (Intern)
Sinclair, Robert (Intern)
Palmer, Vicente (Ekstern)
Project Manager, organisational:
Markvorsen, Steen (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 60,000.00 Danish Kroner

Kredsløbsteknikker for Asynkrone Systemer
Department of Informatics and Mathematical Modeling
Period: 01/02/1994 → 09/09/1997
Number of participants: 4
Phd Student:
Nielsen, Lars Skovby (Intern)
Main Supervisor:
Sparsø, Jens (Intern)
Examiner:
Skelboe, Stig (Ekstern)
Staunstrup, Jørgen (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstip.-SU, Eksp
Project: PhD
Vegetation and soil

Vegetation and soil parameters are important for studies using global circulation models. The parameters are essential in estimating and modelling e.g. surface energy balance, evapotranspiration, desertification, deforestation, and carbon dioxide circulation, and on a local scale on yield prediction and agricultural subsidiary enforcement. Vegetation and soil parameters such as soil moisture, vegetation type, structural characteristics for the vegetation (height, foliage, density), and vegetation biomass may be estimated from microwave remote sensing. The research aims at: 1) improving the techniques to determine vegetation type from SAR images, especially agricultural crops, but also with a view to natural vegetation, such as trees and heath; and 2) studying and evaluating algorithms for retrieval of vegetation and soil parameters, such as soil moisture, and vegetation height and biomass. The application of SAR to monitor agricultural crops, biomass and soil moisture is being studied in collaboration with Research Center Foulum (RCF). The farmland at RCF has been mapped each year from 1994 to 1998 from March to July with both L- and C-band polarimetric SAR. During the growing season and particularly at the time of data acquisition, a series of in-situ measurements was performed of soil and vegetation parameters. This information is used to interpret and model the backscatter characteristics of the soil and vegetation and forms the basis for studying methods for parameters retrieval. The main results of this project are new results in the understanding of scattering mechanisms for backscattering from agricultural crops, new methods for the classification of crops, and thorough evaluation of the classification potential of polarimetric SAR. Results have been or will be published at conferences and in papers.
Compound slot waveguide antennas
Large, slotted waveguide arrays, used e.g. in satellite borne remote sensing payloads have a very narrow band width, since the slots must be detuned to compensate for mutual coupling. It is investigated whether the band width can be increased through the use of compound radiating slots, since they can compensate for mutual coupling through change of off-set and inclination, while remaining resonant

Department of Informatics and Mathematical Modeling
Period: 01/01/1994 → …
Number of participants: 1
Project Manager, organisational: Albertsen, Niels Christian (Intern)

European Centre for mathematics and technology of urban water pollution.

Department of Environmental Engineering
Department of Environmental Science and Engineering
Department of Informatics and Mathematical Modeling
Period: 01/01/1994 → 31/12/1998
Number of participants: 18
Project participant:
Warnaars, Eric (Intern)
Spliid, Henrik (Intern)
Hvidtved-Jacobsen, Thorkild (Ekstern)
Aalderink, Hans (Ekstern)
Matos, Maria R. (Ekstern)
Andreadakis, Andreas (Ekstern)
Butler, David (Ekstern)
Dupont, Rene (Ekstern)
Dørge, Jesper (Ekstern)
Heras, Jaime G. (Ekstern)
Gujer, Willi (Ekstern)
Nelen, Fons (Ekstern)
Pinto, Appio di (Ekstern)
Revitt, Mike (Ekstern)
Svensson, Gilbert (Ekstern)
Tyson, John (Ekstern)
Verworn, Hans R. (Ekstern)
Project Manager, organisational: Harremoës, Poul (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 3,045,000.00 Danish Kroner
Project

Forsøgsplanlægning for identifikation af delvis kendte systemer (grey-box modeller)
Forsøgsplanlægning er et fundamentalt område inden for system-identifikation. Optimalt planlagte eksperimenter fører til en mere effektiv model som f.eks. kan bruges til estimation af ukendte parametre, regulering, fejl-detektering, mv. Apriori viden (delvis viden) kan i denne sammenhæng formuleres og benyttes i design.

Department of Informatics and Mathematical Modeling
Human Brain Project

Neuroscience is expanding nationally and internationally. The 90's were proclaimed "Decade of the Brain" by the US Congress, and a large funding program the so-called "Human Brain Project" was established. Nationally the Danish Research Councils created a substantial funding program for Interdisciplinary Neuroscience. New technology is key to the growth of neuroscience and engineering and informatics competences are of vital importance for large neuroscience projects. The DTU Human Brain Project group collaborates with an international consortium of researchers from leading neuroscience labs in the USA and Japan on new data analytic strategies for functional neuroimaging. In the 1996 the group was funded by the US Human Brain Project and by the Danish Research Councils. Functional neuroimaging by Positron Emission Tomography (PET) and functional Magnetic Resonance Imaging (fMRI) is opening a new window to the working human brain. These brain scan techniques provide highly complex data sets. The scans are indirect measures of brain activity while subjects perform well defined mental tasks. The work of the DTU group concerns basic signal processing, pattern recognition and visualization. A fast volume "warp" algorithm was developed for co-registration of PET brain scans using anatomical MRI applied to co-registration of PET group studies at Rigshospitalet, University of Copenhagen. Markov Field methods were developed for edge preserving smoothing of PET scans. Artificial neural network models were designed, evaluated, and visualized for detection of brain activation in PET scans under saccadic eye movements. Noise levels in PET scans were analyzed. A number of data analytic strategies for fMRI were compared on data sets from Massachusetts General Hospital. Artificial neural networks were used to estimate Glucose Metabolism from dynamic PET scans.

Department of Informatics and Mathematical Modeling
University of Copenhagen
Minneapolis VA Medical Center
University of Minnesota
Research Institute of Brain & Blood Vessels
University of Chicago
Massachusetts General Hospital
Harvard Medical School

Period: 01/01/1994 → …
Number of participants: 21
Project participant:
Ohlsson, Børje Ola Mattias (Intern)
Toft, Peter Aundal (Intern)
Nielsen, Finn Årup (Intern)
Merchant, Niels J.S. (Intern)
Kjems, Ulrik (Intern)
Philipsen, Peter Alshede (Intern)
Rasmussen, Carl Edward (Intern)
Larsen, Jan (Intern)
Paulson, Olaf B. (Ekstern)
Svarer, Claus (Ekstern)
Law, Ian (Ekstern)
Gade, Anders (Ekstern)
Microbial studies of an anaerobic leachate plume
Microbial studies were performed in 37 locations in the leachate plume at Grindsted Landfill in terms of MPN-counting of methanogens, sulfate-reducers, iron-reducers, manganese-reducers and denitrifiers, ATP levels, PLFA levels and composition and redox activities in unamended bioassays. Volatile fatty acids, H2 concentrations and (no) protozoa were measured as well. Several redox processes were identified in the same samples but usually one process dominated when compared on a carbon conversion basis. The leachate significantly affected the microbial populations, but the distribution of the actual redox activities were not limited by the microbial populations but the availability of electron donors and acceptors.

Department of Environmental Science and Engineering
Department of Informatics and Mathematical Modeling
Department of Environmental Engineering
Waterways Experimental Station, Vikcsburg (PLFA)

University of Copenhagen
Period: 01/01/1994 → 30/03/1997
Number of participants: 8
Project participant:
Ludvigsen, Liselotte (Intern)
Albrechtsen, Hans-Jørgen (Intern)
Refstrup, Mona (Intern)
Hansen, Karin (Intern)
Ringelberg, D.B. (Ekstern)
Holst, Helle (Ekstern)
Ekelund, F. (Ekstern)

Project Manager, organisational:
Christensen, Thomas Højlund (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 845,377.00 Danish Kroner

Robust og optimal regulering af uendelig-dimensionale systemer

Department of Mathematics
Period: 01/01/1994 → …
Number of participants: 4
Phd Student:
Larsen, Mikael (Intern)

Main Supervisor:
Statistisk finansieringsteori

Liberaliseringen af de internationale finansmarkeder har gjort det nødvendigt for banker og investeringsselskaber mm. at anvende avancerede matematiske og statistiske metoder til risikostyring og -elimination (hedging). Der benyttes ikke-lineære filtreringsmetoder til parameter- og tilstandsestimation i diskret observerede stokastiske differentialligninger. Der anvendes ikke-parametriske metoder til identifikation af stokastiske differentialligninger og heteroskedastiske modeller i diskret tid. Metoderne anvendes til modellering af multivariate rentestrukturmodeller og stokastiske volatilitetsmodeller.

Department of Informatics and Mathematical Modeling

Unibank

Basispoint
Period: 01/01/1994 → …
Number of participants: 3
Project participant:
Nielsen, Jan Nygaard (Intern)
Baadsgaard, Mikkel (Intern)
Project Manager, organisational:
Madsen, Henrik (Intern)

Tracking Problems for Distributed Parameter System

This project is primarily about control of a beer pasteurization process, treated as a robust tracking problem for a distributed parameter system. The treatment includes modelling of the system, aspects of controller design and computational issues. The framework is a combination of recently developed advanced techniques for robust control of finite and infinite dimensional systems. The tunnel pasteurizer is modelled as a Cauchy problem and standard semigroup theory is applied in order to write the solution in closed form (a semigroup solution). After calculating the respective transfer functions, the appearing linear systems are formulated within the framework of the Pritchard-Solomon class, a class of systems that allow more general input and output operators than standard distributed systems. This ensures that the entire system is well-posed. Due to this, one can refer to rather general robustness results, which obviously is convenient, although some generalization is required. Also, a novel approach to robust tracking problems has been introduced, which directly distinguishes between control actions which must be taken due to the presence of uncertainties, and control actions which must be taken due to tracking criteria, which are of an altogether different nature. The approach addresses the class of almost periodic functions and the main results provide necessary and sufficient conditions for the existence of (possibly infinite-dimensional) controllers which solve the robust tracking problems. Moreover, explicit controller formulae can be given in semigroup formulations.

Department of Mathematics
Period: 01/01/1994 → 01/01/1997
Number of participants: 3
Project participant:
Bendsøe, Martin P. (Intern)
Larsen, Mikael (Intern)
Project Manager, organisational:
Pedersen, Michael (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,000,000.00 Danish Kroner
Project
Visualization of Cut-loci
The purpose of this project is to visualize the cut-locus for a point on a two-dimensional surface.

Department of Mathematics
Period: 01/01/1994 → ...
Number of participants: 3
Project participant:
Markvorsen, Steen (Intern)
Sinclair, Robert (Intern)
Project Manager, organisational:
Gravesen, Jens (Intern)

Distributed Parameter Systems: Analysis, Synthesis and Control
EU-HCM-programme concerning various aspects of the control of systems governed by pde's.

Department of Mathematics
Number of participants: 4
Project participant:
Bendsøe, Martin P. (Intern)
Cromme, Marc (Intern)
Larsen, Mikael (Intern)
Project Manager, organisational:
Pedersen, Michael (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 30,000.00 Danish Kroner

CADUS, Center for Arteriosclerosis Detection with Ultrasound
Atherosclerosis of the carotid arteries is a common cause of stroke, the leading cause of disabling disease and the third most common cause of death. Atherosclerosis arises from the formation of material deposits (plaque) on the inside of the artery wall. The plaque slowly builds up in the artery wall over a number of years. The pathogenetic mechanism is believed to be embolic in the large majority of cases, with either fragments of the atherosclerotic lesion or thrombotic elements of the surface of the plaque braking off and moving with the blood into the brain. Once a major brain artery is occluded by an embolus and brain damage has resulted, no specific therapy exists today. Therefore, preventive measures are of great importance and today patients with symptomatic severe lesions are offered surgical therapy. Until now, treatment has mainly been given based on the degree of narrowing of the carotid arteries. Recent research has indicated that other factors may be important as well. Especially, the appearance of the carotid atherosclerotic lesions on ultrasound B-mode images has been shown to be related to the risk of development of neurological symptoms. The aim of CADUS is to develop new improved methods for detection and classification of atherosclerotic plaque. A number of projects are conducted within CADUS: Influence of Formalin Fixation Prior to in vitro Ultrasound Examination of Porcine Arteries, Digital Image Analysis of Ultrasound B-Mode Images of Carotid Plaque, Estimation of Carotid Plaque Contents With Multi-Angle 3D Compound Imaging, Experimental Ultrasound System for investigation of multi-angle compound imaging, The Diffraction Response Interpolation Method, Measurement of Echo Signals from Rough Surfaces of Infinite Extent.

Department of Information Technology
Department of Informatics and Mathematical Modeling
BK Medical Aps
Worcester Polytechnic Institute
University of Copenhagen
Period: 01/11/1993 → ...
Number of participants: 7
Project participant:
Jespersen, Søren Kragh (Intern)
Martinsen, Kjeld (Intern)
 Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 250,000.00 Danish Kroner
Source: Unknown
Name of research programme: Ukendt
Amount: 100,000.00 Danish Kroner

**Elektrisk stimulation af delvist lammede muskler**

Department of Informatics and Mathematical Modeling
Number of participants: 4
PhD Student:
Sennels, Søren (Intern)
Supervisor:
Andersen, Ole Trier (Intern)
Main Supervisor:
Hansen, Steffen Duus (Intern)
Examiner:
25_NN_Studenter/Øvrige medarb. (Ekstern)

 Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstip.-SU, Eksp
Project: PhD

**Generation of Ultra Short Optical Pulses**

A mathematical model has been derived, describing Colliding-Pulse Mode-Locked (CPM) quantum well lasers. Simulations have been conducted on an InGaAsP laser. Spectral hole burning influences strongly the optical pulse formation. The final pulse width results from a balance between spreading in the gain sections and compression in the absorber section of the CPM laser. Both effects are influenced by ultra fast gain dynamics. An alternative approach to generation of ultra short optical pulses is the use of a mode-locked fibre ring laser. Both passive and active mode-locking have been studied by numerical simulations of the Nonlinear Schrodinger equation. Active mode-locking is achieved by the use of a Mach-Zehnder amplitude modulator.

Department of Informatics and Mathematical Modeling
Tele Danmark Research
University of Rouen
Chalmers University of Technology
Period: 01/09/1993 → …
Number of participants: 10
Project participant:
Prip, L. (Ekstern)
Nielsen, J.M. (Ekstern)
Møller-Larsen, A. (Ekstern)
Broson, S.D. (Ekstern)
Mork, J. (Ekstern)
Franck, T. (Ekstern)
Hofmann, M. (Ekstern)
Caputo, J.G. (Ekstern)
Ikke-lineær dynamik af CPM kvantebrøndslaser og andre optiske komponenter

Department of Mathematics
Period: 01/09/1993 → 24/07/1997
Number of participants: 3
Phd Student:
Bischoff, Svend (Intern)
Main Supervisor:
Sørensen, Mads Peter (Intern)
Examiner:
Hvam, Jørn Marcher (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Specifikation og verifikation af modulære parallelprogrammer

Department of Informatics and Mathematical Modeling
Period: 01/09/1993 → 09/09/1997
Number of participants: 4
Phd Student:
Sørensen, Morten U. (Intern)
Main Supervisor:
Løvengreen, Hans Henrik (Intern)
Examiner:
Hansen, Bo Stig (Intern)
Liu, Zhiming (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Visualisering af geometriske modeller-rendering

Department of Informatics and Mathematical Modeling
Period: 01/09/1993 → 09/09/1997
Number of participants: 5
Phd Student:
Jensen, Henrik Wann (Intern)
Main Supervisor:
Christensen, Niels Jørgen (Intern)
Examiner:
Henriksen, Knud (Ekstern)
Jansen, Frederik W. (Ekstern)
Takala, Tapio (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD
Identifikation af Grey-Modeller

Department of Informatics and Mathematical Modeling
Period: 01/08/1993 → 21/03/1997
Number of participants: 3
Phd Student:
Sadegh, Payman (Intern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Ljung, Lennert (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Optimering af fjernvarmestystemer


Department of Informatics and Mathematical Modeling
Rambøll Danmark A/S
HTF
Period: 01/07/1993 → 30/06/1996
Number of participants: 3
Project participant:
Nielsen, Torben Skov (Intern)
Nielsen, Henrik Aalborg (Intern)
Project Manager, organisational:
Madsen, Henrik (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 200,000.00 Danish Kroner

Parallele numeriske algoritmer til løsning af systemer af sædvanlige differentialligninger

Department of Informatics and Mathematical Modeling
Period: 01/07/1993 → 04/12/1996
Number of participants: 5
Phd Student:
Bendtsen, Claus (Intern)
Supervisor:
Skelboe, Stig (Ekstern)
Main Supervisor:
Thomsen, Per Grove (Intern)
Examiner:
Houbak, Niels (Intern)
Söderlind, Gustaf (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskerakademiets Samfinansier
Quasi-conformal Surgery
The technique of quasi-conformal surgery in holomorphic dynamics was initiated by Sullivan, Douady, Hubbard and Shishikura in the early eighties. The method is to create new dynamical systems out of some given ones, by changing not only the dynamical plane (through cutting and sewing) and the map defining the dynamical system, but also the complex structure of the new dynamical plane. The theory of quasi-conformal mappings is the basic tool. Surgery techniques appear to be particularly successful, when two families of maps can be related in such a way that dynamical similarities are transferred to similarities between structures in the corresponding parameter spaces. Homeomorphisms between p/q-lims of the Mandelbrot set, with fixed denominator q, have been obtained. Generalizations are currently being investigated.

Department of Mathematics
Universidad Autonoma de Barcelona
Period: 01/07/1993 → ...
Number of participants: 2
Project participant:
Fagella, Nuria (Ekstern)
Project Manager, organisational:
Branner, Bodil (Intern)

Udvikling, afprøvning og implementering af GPC-regulatorer i fjernvarmesystemer
Formålet med projektet er at udvikle praktisk anvendelige GPC (General Predictive Control) reguleringsalgoritmer til driftsoptimering af kraftvarme- og fjernvarmesystemer. Arbejdet er en videreførelse af et tidligere EFP projekt - "Optimeret drift af fjernvarmesystemer". GPC-regulatoren er baseret på tidligere fundne modeller for tidsforsinkel og temperatur forløb i distributionssystemet samt på prognosemodeller for forventet varmeforbrug. Den styrede variabel er fremløbstemperaturen der optimeres mht. brændselsoforbrug, forsyningssikkerhed, slitage på distributionssystemet mm.. De udviklede algoritmer afprøves online hos Høje Taastrup Fjernvarme. Arbejdet er delvist finansieret af Energiministeriets Forskningsprogram gennem EFP93 - "Regulering af fremløbstemperatur".

Department of Informatics and Mathematical Modeling
Høje Tåstrup Fjernvarme
Rambøll, Hannemann og Højlund
Period: 01/07/1993 → 30/06/1996
Number of participants: 2
Project participant:
Nielsen, Torben Skov (Intern)
Project Manager, organisational:
Madsen, Henrik (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 300,000.00 Danish Kroner

Modelling and control of flexible robot
The project deals with the modelling and control of flexible robot arms with special reference to be able to increase the payload/own weight ratio of manipulators. It is of vital importance to improve this ratio in the endeavour to improve the skills and the efficiency of future robots. The mechatronic approach in robotics is tested in a design case study of a pick and place 2 DOF SCARA robot as the restrictive constraint in the mechanical design that the links have to be rigid is relaxed. To maintain a good link tip position accuracy the relaxing of the constraint necessitate improved knowledge in the remaining involved disciplines in the integrated design in order to avoid that vibrations induced in the robot link have destructive effect on the tip positioning. A brief introduction to the modelling of distributed parameter systems is subsequently given before the theory is applied in modelling a flexible robot arm. A number of link models are derived. The first two models presented describes in-plane transverse vibrations in a free rotating flexible robot link. (modal representation and finite element modelling). In some applications of manipulators they interact with the environment which affect the dynamics of a flexible link. This fact resulted in the derivation of three models of a flexible link used in tip force control. The extended knowledge of the behaviour of a working flexible robot link gained is used on the case study manipulator in a passive non-ad-hoc rigid robot design application and in an active flexible robot design application. Out-of-plane link vibrations are treated as well in the thesis as they in most applications will be excitated too. In order to be
able to damp the out-of-plane transverse vibrations a lightweight distributed piezoelectric actuator is introduced which acts as an active artificial stiffening in the particular direction.

Department of Informatics and Mathematical Modeling
Period: 01/06/1993 → …
Number of participants: 1
Project Manager, organisational:
Poulsen, Niels Kjølstad (Intern)

Analyse af tids-frekvens-fordelinger v.h.a. den diskrete Radontransformation
Department of Informatics and Mathematical Modeling
Period: 01/03/1993 → 27/11/1996
Number of participants: 5
Phd Student:
Toft, Peter Aundal (Intern)
Supervisor:
Møller, Peter Koefoed (Ekstern)
Main Supervisor:
Sørensen, John Aasted (Intern)
Examiner:
Forchhammer, Søren (Intern)
Granum, Erik (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU Stipendium, Eksperiment
Project: PhD

Kleinske grupper og Holomorfe dynamiske systemer
Department of Mathematics
Period: 01/02/1993 → 24/07/1997
Number of participants: 2
Phd Student:
Willumsen, Pia B.N. (Intern)
Main Supervisor:
Branner, Bodil (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstip.-SU, Eksp
Project: PhD

Multiplikatorfrie, digitale filterstrukturer
Department of Informatics and Mathematical Modeling
Period: 01/02/1993 → 03/09/1996
Number of participants: 4
Phd Student:
Shajaan, Mohammad (Intern)
Supervisor:
Møller, Peter Koefoed (Ekstern)
Main Supervisor:
Sørensen, John Aasted (Intern)
Examiner:
Sørensen, Helge Bjarup Dissing (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
**NEAR**

Department of Information Technology
Department of Informatics and Mathematical Modeling

Katholieke Universiteit
Period: 01/02/1993 → 01/09/1997
Number of participants: 2
Project participant:
Sansen, Willy (Ekstern)

Olesen, Ole (Intern)
Project Manager, organisational:

**Stokastisk analyse**

Department of Mathematics
Period: 01/02/1993 → 29/05/1996
Number of participants: 3
Phd Student:
Knudsen, Thomas Skov (Intern)
Supervisor:
Jørsboe, Ole Groth (Intern)
Main Supervisor:
Hansen, Vagn Lundsgaard (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU Stipendium, Eksperiment

**Transformationsorienterede metoder i VLSI-design**

Department of Informatics and Mathematical Modeling
Period: 01/02/1993 → 09/09/1997
Number of participants: 2
Phd Student:
Rasmussen, Ole Steen (Intern)
Main Supervisor:
Sharp, Robin (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU Stipendium, Eksperiment
Project: PhD

**Adaptively controlled surfaces**

Future communication satellite antennas will need to be able to change their radiation characteristics in space to adapt to changes in the volume of traffic carried. For reflector antennas, this can be achieved with a reflector surface which can change shape under control of a limited number of remotely controlled actuators. A mathematical description of such a surface in the form of a 4th order partial differential equation with appropriate boundary values is developed. The project is carried out as part of the work prepared by the scientific staff at IMM. No specified budget. Publication: Niels C. Albertsen, Soeren Christiansen, Knud Pontoppidan and Stig Busk Soerensen: Mathematical Treatment of an Adjustable Surface Formed by a Fabric of Interwoven Flexible Wires. Mathematical Engineering in Industry 6 (1997)115-132. IMM-REP-1996-2.

Department of Informatics and Mathematical Modeling
IONS  
Computational and Experimental Fluid Mechanics. Cooperation with dept. of Fluid Mechanics Frame programme from STVF Grant nr. 5.26.16.31

Department of Informatics and Mathematical Modeling  
Period: 01/01/1993 → 01/03/1998  
Number of participants: 1  
Project Manager, organisational:  
Thomsen, Per Grove (Intern)

Project  

Numerical problems in topology optimization  
This project investigates different problems appearing in numerical applications of topology optimization methods. Examples are appearance of checkerboard patterns in "optimal" designs, mesh-dependencies and convergence to local minima. Another problem is to implement stress constraints in topology optimization in a numerically efficient way. (Financed by STVF).

Department of Solid Mechanics  
Department of Mathematics  
Period: 01/01/1993 → ...  
Number of participants: 3  
Project participant:  
Petersson, Joakim (Intern)  
Bourdin, Blaise (Intern)  
Project Manager, organisational:  
Sigmund, Ole (Intern)

Project  

Robustness of Stochastic Differential Equations  
The robustness in the mean square and in the pathwise sense of stochastic differential equations in $\mathbb{R}^d$, driven by $r$-dimensional Wiener process was shown. Implications for robustness of the nonlinear filtering problem were investigated.

Department of Mathematics  
Period: 01/01/1993 → 01/02/1996  
Number of participants: 1  
Project Manager, organisational:  
Knudsen, Thomas Skov (Intern)

Project  

Space mapping for engineering optimization  
The space mapping technique is intended for optimization of engineering models which involve very expensive function evaluations. It is assumed that two different models of the same physical system are available: Besides the expensive model of primary interest (denoted the fine model), access to a cheaper (coarse) model is assumed which may be less accurate. The main idea of the space mapping technique is to use the coarse model to gain information about the fine model, and to apply this in the search for an optimal solution of the latter. Thus the technique iteratively establishes a mapping between the parameters of the two models which relate similar model responses. Having this mapping, most of the model evaluations can be directed to the fast coarse model. In many cases this technique quickly provides an approximate optimal solution to the fine model that is sufficiently accurate for engineering purposes. Thus the space mapping technique may be considered a preprocessing technique that perhaps must be succeeded by use of classical optimization techniques.
Subdivision and geometric properties of Bézier Curves and Surfaces

Subdivision is a well-known algorithm which often is used to evaluate Bézier curves and surfaces. In this project we investigate the possibility to use subdivision to determine important geometric properties of the curve or surface, such as length, area, and curvature.

Department of Mathematics
Period: 01/01/1993 → ...
Number of participants: 1
Project Manager, organisational:
Gravesen, Jens (Intern)

Biomekanisk Skuldermodel

Department of Mathematics
Period: 01/12/1992 → 07/10/1996
Number of participants: 2
Phd Student:
Laursen, Bjarne (Intern)
Main Supervisor:
Skovgaard, Ove (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskerakademiets Samfinansier
Project: PhD

Development of a Decision Support System for Predicting Wear in Bulk and Sheet Forming Operation - PREDWEAR

The main objective of this project was to enhance available decision support systems used in the industrial design and optimisation practice in sheet and bulk metal forming to take into account the phenomena of wear. To meet this objective the research and development work has been performed in five main technical tasks dedicated to micromechanical modeling, laboratory testing, inverse analyses, finite element analyses and industrial applications.

Department of Manufacturing Engineering
Institute for Product Development
Department of Informatics and Mathematical Modeling
Rockfield Software Ltd
Universitat Politècnica de Catalunya
Matrix Sa
University of Padua
Techint Compagnia Tecnica Internazionale S.p.A.
Mr. Gomez de Dios, Candemat Sa
British Steel
Period: 01/12/1992 → 30/11/1996
Number of participants: 10
Project participant:
Eriksen, Morten (Intern)
Lovato, Andrea (Intern)
Lassen, Søren (Intern)
Wanheim, Tarras (Ekstern)
Crook, Tony (Ekstern)
Onate, E. (Ekstern)
Heege, A. (Ekstern)
Bariani, P. (Ekstern)
Dvorkin, E. (Ekstern)
Project Manager, organisational: Wanheim, Tarras (Intern)

Nonlinearity in superconductivity and Josephson Junctions
Department of Mathematics
Period: 01/12/1992 → 17/03/1995
Number of participants: 2
Phd Student:
Lazarides, Nickos (Intern)
Main Supervisor:
Sørensen, Mads Peter (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel Ordning - Blandet Finan
Project: PhD

signalbehandling anvendt til overvågning af distributionsnet
Department of Informatics and Mathematical Modeling
Period: 01/12/1992 → …
Number of participants: 4
Phd Student:
Munk, Steen M. (Intern)
Supervisor:
Pedersen, Knud Ole Helgesen (Intern)
Main Supervisor:
Sørensen, John Aasted (Intern)
Examiner:
Laubst, Torben (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ATV- Gammel ordning
Project: PhD

Evaluering og dimensionering af signalingssystemer for digitale kommunikationssystemer
Department of Informatics and Mathematical Modeling
**Computer-aided Design and Engineering in Electronic Engineering Education**
TEMPUS Joint European Program (JEP-2031)

- **Department of Information Technology**
- **Department of Informatics and Mathematical Modeling**
- **Warsaw University of Technology**
- **Technical University of Lodz**
- **Institut National des Sciences Appliquees de Toulouse**
- **University of York**

**Period**: 01/09/1992 → 01/10/1996
**Number of participants**: 1
**Project Manager, organisational**: Lindberg, Erik (Intern)

**Financing sources**
- **Source**: Unknown
- **Name of research programme**: Ukendt
- **Amount**: 1,000,000.00 Danish Kroner

**Digital kodning af talesignaler ved 600 bit/sek**

- **Department of Informatics and Mathematical Modeling**

**Period**: 01/08/1992 → 08/02/1996
**Number of participants**: 3
**Phd Student**: Thyssen, Jes (Intern)
**Main Supervisor**: Hansen, Steffen Duus (Intern)
**Examiner**: Sørensen, Helge Bjarup Dissing (Intern)

**Financing sources**
- **Source**: Internal funding (public)
- **Name of research programme**: Forskerakademiets Samfinansier

**GODESS**

Generic ODE Solving System Platform for solving systems of DAE's Object Oriented software development Cooperation with LTH (Lund) and NTNU (Trondheim) The primary goal is to provide a tool for solving ODE's and DAE's that are appearing in applications as efficiently as possible. The platform that is developed allows for accurate comparisons between methods and algorithms involved in the solution process.

- **Department of Informatics and Mathematical Modeling**
- **Norwegian University of Science and Technology**
- **Lund University**
Period: 01/08/1992 → 31/12/1999  
Number of participants: 2

Project participant:  
Poulsen, Mikael Zebbelin (Intern)  
Project Manager, organisational:  
Thomsen, Per Grove (Intern)

Klassisk og kvante-mekanisk behandling af lokalisering, blow-up og kaos i ikke-lineære systemer

Department of Informatics and Mathematical Modeling  
Period: 01/08/1992 → 18/09/1995
Number of participants: 4
Phd Student:  
Jørgensen, Michael Finn (Intern)  
Supervisor:  
Scott, Alwyn C. (Intern)  
Sørensen, Mads Peter (Intern)  
Main Supervisor:  
Christiansen, Peter Leth (Intern)

Financing sources  
Source: Internal funding (public)  
Name of research programme: Gammel ordning u/skema-SU  
Project: PhD

Numerisk lineær algebra på massivt parallele datamater

Department of Informatics and Mathematical Modeling  
Period: 01/06/1992 → 02/08/1995
Number of participants: 2
Phd Student:  
Balle, Susanne Mølleskov (Intern)  
Main Supervisor:  
Nielsen, Hans Bruun (Intern)

Financing sources  
Source: Internal funding (public)  
Name of research programme: Gammel ordning u/skema-SU  
Project: PhD

Stochastic Differential Equations and Biological System

Department of Informatics and Mathematical Modeling  
Period: 01/06/1992 → 17/03/1995
Number of participants: 3
Phd Student:  
Wang, Chunyan (Intern)  
Main Supervisor:  
Spliid, Henrik (Intern)  
Examiner:  
Vølund, Aage (Ekstern)

Financing sources  
Source: Internal funding (public)  
Name of research programme: Centerfinansieret  
Project: PhD

Variability in Microbiological Degradation Experiment - Analysis and Case Study

Department of Informatics and Mathematical Modeling
Generation of Ground Structures

Within topology optimization of trusses the ground structure approach has established itself as the prevailing method. The basic idea is to limit the optimization algorithm to a certain set of bars, as opposed to allowing it to choose freely between all available bars. Previously, ground structures has been generated more or less by hand. This project has attempted to
explore the possibilities for automation of this process. Three reasonable geometrical selection criteria are considered: inclusion of the shortest (or longest) bars, omission of overlapping bars and finally the implementation of prescribing a design domain. Inspired by ideas from computer aided geometric design and traditional shape optimization the latter makes it possible to consider non-convex design areas - in 2D as well as in 3D.

Department of Mathematics
Department of Solid Mechanics
Aalborg University
Period: 01/02/1992 → 01/02/1996
Number of participants: 4
Project participant:
Bendse, Martin P. (Intern)
Pedersen, Pauli (Intern)
Rasmussen, J. (Ekstern)
Project Manager, organisational:
Smith, Ole P Pereira da Silva (Intern)

Kohærente struktures dynamik
Department of Informatics and Mathematical Modeling
Period: 01/02/1992 → 18/12/1995
Number of participants: 3
Phd Student:
Hesthaven, Jan (Intern)
Main Supervisor:
Thomsen, Per Grove (Intern)
Examiner:
Sørensen, Jens Nørkær (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskerakademiets Samfinansier
Project: PhD

Methods for analysis and dimensioning of heterogenous telecommunication networks
Department of Informatics and Mathematical Modeling
Period: 01/02/1992 → 24/04/1995
Number of participants: 2
Phd Student:
Møller, Dorte Marianne (Intern)
Main Supervisor:
Nielsen, Bo Friis (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: samarbejdsaftale-finans.
Project: PhD

Optimering af gitterkonstruktioners topologi.
Department of Mathematics
Period: 01/02/1992 → 29/05/1996
Number of participants: 3
Phd Student:
Smith, Ole P Pereira da Silva (Intern)
Main Supervisor:
Bendse, Martin P. (Intern)
Examiner:
Olhoff, Niels (Intern)
Robust adaptive control system design for aerospace applications.

Department of Informatics and Mathematical Modeling
Period: 01/02/1992 → 21/03/1997
Number of participants: 7
Phd Student:
Hansen, Anca Daniela (Intern)
Supervisor:
Colding-Jørgensen, Morten (Ekstern)
Mosekilde, Erik (Intern)
Main Supervisor:
Poulsen, Niels Kjølstad (Intern)
Examiner:
Knudsen, Carsten (Intern)
Bakker, Barbara Marleen (Ekstern)
Sørensen, Preben Graae (Ekstern)

Truss Topology Optimization against Local Buckling Conditions
This project has reconsidered a truss topology optimization algorithm originated by Pedersen. The algorithm considers local buckling effects within each bar due to static equilibrium of the overall design. This results in a non-convex cost function. In this project this framework is extended to allow for ground structures and the effect of the restriction of the possible bars to non-convex design domains are investigated. In another branch of the project an important deficiency in previously developed methods to the local buckling problem is considered and a possible solution procedure is developed. Consider a bar in a generated design and add a node to the internal part of this bar. Due to the non-linearity and concavity of the objective function, the cost of the two small bars is lower than the cost of the long bar. In this case, the bar should be considered as one long bar. However, if a third bar is added connecting to the internal node, the long bar should be modelled as two short bars. An objective evaluation has been implemented evaluating the correct design cost in these situations. The concept of chains as a generalization of bars, to line segments with two or more spanning nodes, is introduced. Moreover, indexing of designs as a simple count of the number of bars in the design connecting to each node is considered. Despite its simplicity design indices allows for efficient localization of critical nodes. From the point of view of static equilibrium the critical nodes are the nodes where the constraining force equilibrium matrix displays linear dependencies.

Department of Mathematics
Department of Solid Mechanics
Period: 01/02/1992 → 01/02/1996
Number of participants: 3
Project participant:
Bendsøe, Martin P. (Intern)
Pedersen, Pauli (Intern)
Project Manager, organisational:
Smith, Ole P Pereira da Silva (Intern)

Verifikation af parallelle systemer
Department of Informatics and Mathematical Modeling
Period: 01/02/1992 → 22/12/1998
Number of participants: 2
Phd Student:
Nyblad, Kasten (Intern)
Asynchronous Circuit Design
Asynchronous circuits operate without a global clock signal - the flow of data is controlled by local handshaking between modules and registers. This gives asynchronous circuits some unique characteristics that can be exploited to advantages (higher speed, lower power consumption, modularity and robustness). The research addresses methods and techniques for designing efficient circuits, and in particular circuits with low power consumption. The experimental part of this work is based on industrial applications and involves design and fabrication of various prototype IC's. From 2001 the activities have focused on high-level synthesis of asynchronous circuits and on network-on-chip. The activity represents a long term effort and it is funded through a number of sources including the ACiD working group (IST-1999-29119), the Thomas B. Thirge Foundation and a donation from Nokia.

Robust control system design for a wind energy commersion system

Implementering af parallekomposition
Blood Velocity Estimation with Frequency Modulated Ultrasound

This project investigates the applicability of coherent, linearly frequency modulated (FM) excitation signals for blood velocity measurements. Systems based on such excitation signals are called FM Doppler systems. By utilizing FM signals, it is possible to avoid the high peak energy emitted with conventional pulsed wave Doppler systems. In an echo-ranging system, everything else equal, the range resolution size is inversely proportional to the bandwidth of the emitted signal. Thus, if the range resolution is to be improved in a PW Doppler system, the time duration of the emitted burst must be reduced. On the other hand, if the signal to noise ratio is to remain unchanged, the mean emitted power must also be kept constant, which requires increased peak emitted power. However, from a design point of view, a high peak to average power is undesirable, as the duty cycle diminish and non-linear propagation may occur. In addition, especially for medical applications, the peak power level might in certain situations exceed the regulatory limits for diagnostic ultrasound equipment. We have shown that the signal processing principles, utilized with Pulsed Wave - time shift measurement Doppler (PW-tsm), can be used with FM excitation signals as well. The FM counterpart to the PW-tsm technique is spectral cross-correlation, and such a system is called Frequency Modulation - frequency shift measurement, FM-fsm. Experimental data, recorded at Worcester Polytechnic Institute, has been processed with an improved version of the fsm signal processing technique. The promising results show that the FM technique has a precision comparable to that of the PW technique.

Department of Information Technology
Department of Informatics and Mathematical Modeling
Worcester Polytechnic Institute
Period: 01/05/1991 → 01/01/9999
Number of participants: 2
Project participant:
Pedersen, Peder C. (Ekstern)
Project Manager, organisational:
Wilhjelm, Jens E. (Intern)
Project

Algebraic Decoding Methods

For several classes of error-correcting block codes, decoding may be performed by solving equations in suitable number systems and doing similar calculations. Reed-Solomon codes are of particular interest in applications, but recently codes contructed using algebraic geometry have been studied extensively. New versions of the decoding algorithms are being investigated in order to correct more errors or improve implementations.

Department of Telecommunication
Department of Mathematics
Period: 01/04/1991 → ...
Number of participants: 2
Project participant:
Haholdt, Tom (Intern)
Project Manager, organisational:
Justesen, Jørn (Intern)
Project

CONNECT, Computational Neural Network Center

The Computational Neural Network Center was established March 1, 1991. The center's main research objective is actively to promote and support the collaboration between Danish researchers in theory, implementation and application of neural computation. An additional objective is to establish a graduate level training in the subject of artificial neural networks. In 1993 a plan funded by the Danish Research councils extended CONNECT for the period 1994-1996. The research plan is now centered around two projects: a theory project at the Niels Bohr Institute and the neural signal processing project at the Technical University of Denmark. Neural networks form an attractive framework for development of non-linear signal processing systems. They allow for system specification by "example" and thereby avoid explicit modeling. Arbitrary transfer functions may be modeled and neural net programs are "born" parallel facilitating implementation on massively parallel hardware. Theoretical tools for studying learning dynamics and generalization have matured considerably. Generalization, i.e., the ability to perform well on data not seen during adaptation, is the key concept for network design and evaluation. The research in 1996 concerned design, evaluation and visualization of non-linear adaptive models. A novel criterion for network pruning based on the generalization theory was formulated. A method for fast approximate crossvalidation of adaptive models was developed, and applied to system identification. The first scheme for generalization based evaluation of unsupervised learning algorithms was published and applied to optimization of Principal Component Analysis and k-Means Clustering. The Boltzmann Machine Learning Rule was generalized and applied to parameter estimation in inhomogeneous Markov Fields. The generalized form of the Boltzmann
Machine network becomes susceptible to the generic tools for design and evaluation previously developed.

Department of Informatics and Mathematical Modeling

University of Copenhagen
Period: 01/03/1991 → …
Number of participants: 14
Project participant:
Larsen, Jan (Intern)
Goutte, Cyril (Intern)
Ohlsson, Børje Ola Mattias (Intern)
Toft, Peter Aundal (Intern)
Fog, Torben L. (Intern)
Mørch, Niels J.S. (Intern)
Pedersen, Morten With (Intern)
Hintz-Madsen, Mads (Intern)
Kjems, Ulrik (Intern)
Nielsen, Johannes Kristoffer (Intern)
Lautrup, Benny (Ekstern)
Solla, Sara (Ekstern)
Winter, Ole (Ekstern)
Project Manager, organisational:
Hansen, Lars Kai (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 5,000,000.00 Danish Kroner
Project

Invers spektral Geometri

Department of Mathematics
Period: 01/02/1991 → 21/03/1994
Number of participants: 2
Phd Student:
Simonsen, Annette (Intern)
Main Supervisor:
Markvorsen, Steen (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstipendium
Project: PhD

Type systems for specifications languages

Department of Informatics and Mathematical Modeling
Period: 01/02/1991 → 03/11/1994
Number of participants: 3
Phd Student:
Damm, Flemming M. (Intern)
Supervisor:
Hansen, Bo Stig (Intern)
Main Supervisor:
Bruun, Hans (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-stipendium
Project: PhD
**Varifolds-geometrisk målteori**

Department of Mathematics  
Period: 01/02/1991 → 17/03/1995  
Number of participants: 2  
Phd Student:  
Kristensen, Jan (Intern)  
Main Supervisor:  
Hansen, Vagn Lundsgaard (Intern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: DTU-stipendium  
Project: PhD

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**European Consortium for Mathematics in Industry (ECMI)**  
The goal of ECMI is to promote the interaction between universities and research groups in industry. The aims of ECMI are to promote the use of mathematical models in industry, to educate industrial mathematicians to meet the growing demand for such experts and finally to operate on a European scale. Activities comprises: Attracting EU funding for post docs and research in industrial mathematics, student exchange through ERASMUS, organizing ECMI modelling weeks, biannual conferences, European Study Groups for Industry (ESGI), and others.

Department of Informatics and Mathematical Modeling

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**Identifikation og styring af spildevandsprocesser**

Department of Informatics and Mathematical Modeling  
Period: 01/01/1991 → 01/06/1994  
Number of participants: 3  
Phd Student:  
Carstensen, Niels Jacob (Intern)  
Main Supervisor:  
Madsen, Henrik (Intern)  
Examiner:  
Harremoës, Poul (Intern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: ATV- Gammel ordning  
Project: PhD

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**Modelleringsmetoder for udstyr og programmel med henblik på automatisk generering af tekstbeskrivelser af dets funktion**

Department of Informatics and Mathematical Modeling  
Period: 01/12/1990 → 13/10/1993  
Number of participants: 2  
Phd Student:  
Andersen, Asbjørn (Intern)
Main Supervisor: Østerby, Tom (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: ATV- Gammel ordning
Project: PhD

Adaptive filter til undertrykkelse af akustisk ekko i mobiltelefoner
Department of Informatics and Mathematical Modeling
Period: 01/09/1990 → 06/09/1995
Number of participants: 2
PhD Student: Jensen, Søren Holdt (Intern)
Main Supervisor: Sørensen, John Aasted (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
Project: PhD

Deltamodellering
Department of Informatics and Mathematical Modeling
Period: 01/09/1990 → 30/05/1994
Number of participants: 2
PhD Student: Thygesen, Bent Georg (Intern)
Main Supervisor: Poulsen, Niels Kjølstad (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
Project: PhD

Formelle metoder til test af parallele systemer
Department of Informatics and Mathematical Modeling
Period: 01/09/1990 → 05/07/1994
Number of participants: 2
PhD Student: Binau, Ulla (Intern)
Main Supervisor: Sharp, Robin (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-stipendium
Project: PhD

Korrektthed af protokoller i ditribuerede systemer
Department of Informatics and Mathematical Modeling
Period: 01/09/1990 → 22/04/1994
Number of participants: 2
PhD Student: Segaard-Andersen, Jørgen F. (Intern)
Main Supervisor: Løvengreen, Hans Henrik (Intern)
Global optimization
A new method for global optimization is being developed. It is based on the same principles as the well established interval branch-and-bound method but without so severe limitations on the objective function. It only needs to be a smooth function (i.e. twice differentiable), calculated by a "black box" procedure. Stochastic methods, like simulated annealing and genetic algorithms also are used as sources of inspiration. Parallel processing is applied.

Department of Informatics and Mathematical Modeling
Period: 01/08/1990 → …
Number of participants: 5
Project participant:
Stauning, Ole (Intern)
Zerchaninov, Serguei (Ekstern)
Zilinskas, Antanas (Ekstern)
Zilinskas, Julius (Ekstern)
Project Manager, organisational:
Madsen, Kaj (Intern)

Global semi-riemannsk geometri
Department of Mathematics
Period: 01/08/1990 → 01/02/1993
Number of participants: 2
Phd Student:
Mikkelsen, Michael Anker (Intern)
Main Supervisor:
Markvorsen, Steen (Intern)

Programudviklingsmodeller i et hypertekstbaseret informationssystem
Department of Informatics and Mathematical Modeling
Period: 01/07/1990 → 16/09/1993
Number of participants: 2
Phd Student:
Lange, Danny B (Intern)
Main Supervisor:
Bjørner, Dines (Intern)

Undersøgelser af kontrolstrategier for regulering af fjernvarmesystemer
Department of Informatics and Mathematical Modeling
Period: 01/07/1990 → 16/06/1994
Number of participants: 3
Phd Student:
Palsson, Olafur Petur (Intern)
Supervisor:
Ravn, Hans V. (Intern)
Main Supervisor:
Madsen, Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Nordisk finansiering
Project: PhD

Datalogisk retsvidenskab. Vidensrepræsentation og inferens i forb. med menneskeskabte overenskomster og forskrifter
Department of Informatics and Mathematical Modeling
Period: 01/03/1990 → 15/08/1995
Number of participants: 3
Phd Student:
Karpf, Jørgen (Intern)
Supervisor:
Østerby, Tom (Intern)
Main Supervisor:
Nilsson, Jørgen Fischer (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
Project: PhD

Idenfifikation af dynamiske systemer i kontinuer tid
Department of Informatics and Mathematical Modeling
Period: 01/03/1990 → 17/03/1995
Number of participants: 4
Phd Student:
Melgaard, Henrik (Intern)
Supervisor:
Hendricks, Elbert (Intern)
Holst, Jan (Intern)
Main Supervisor:
Madsen, Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
Project: PhD

Design of neural network filters
Department of Informatics and Mathematical Modeling
Period: 01/02/1990 → …
Number of participants: 2
Phd Student:
Larsen, Jan (Intern)
Main Supervisor:
Sørensen, John Aasted (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
**Formelle metoder til udvikling af parallele systemer**

Department of Informatics and Mathematical Modeling  
Period: 01/02/1990 → 30/01/1997  
Number of participants: 2  
Phd Student: Grønning, Peter (Intern)  
Main Supervisor: Løvengreen, Hans Henrik (Intern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Gammel ordning u/skema-SU  
Project: PhD

**Identifikation af varmedynamikken for bygningskomponenter**

EF-projektet PASSYS har til formål at styrke grundlaget for udnyttelse af passiv solvarme i bygninger. Vha. en udendørs testcelle med udskiftelig endevæg ønskes de varmedynamiske egenskaber for en sådan væg bestemt. Det er meningen, at projektet skal munde ud i en fælles europæisk testmetode. Den danske metode til estimering i kontinuert tid (stokastiske differentialligninger) er blevet valgt som den ene af de to metoder, der arbejdes med. En del statistiske problemstillinger indgår i projektet, fx. bestemmelse af et optimalt testsignal, som giver den bedst mulige bestemmelse af testcellens dynamik. Gruppen har deltaget i CEN standardisering omkring måling på bygningselementer.

Department of Informatics and Mathematical Modeling

JRC

Lund Institute of Technology  
Period: 01/01/1990 → …  
Number of participants: 2  
Project participant: Melgaard, Henrik (Ekstern)  
Project Manager, organisational: Madsen, Henrik (Intern)

**Financing sources**  
Source: Unknown  
Name of research programme: Ukendt  
Amount: 400,000.00 Danish Kroner  
Project

**Meta-logiske teorier i datalogien**

Department of Informatics and Mathematical Modeling  
Period: 01/09/1989 → 06/09/1995  
Number of participants: 3  
Phd Student: Villadsen, Jørgen (Intern)  
Main Supervisor: Nilsson, Jørgen Fischer (Intern)  
Examiner: Jensen, Hans Siggård (Intern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: DTU-stipendium  
Project: PhD

**Identifikation og estimation af underliggende parametervariationer i stokastiske modeller**

Department of Informatics and Mathematical Modeling
Period: 15/02/1989 → 30/05/1994
Number of participants: 3
Phd Student:
Søgaard, Henning Tangen (Intern)
Supervisor:
Holst, Jan (Intern)
Main Supervisor:
Madsen, Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
Project: PhD

Modelling and prediction of load in district heating systems
Department of Informatics and Mathematical Modeling
Period: 01/02/1989 → 01/02/1994
Number of participants: 2
Phd Student:
Sejling, Ken (Intern)
Main Supervisor:
Madsen, Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
Project: PhD

The Didactical Challenges of Mathematics
Internationally, mathematicians have become more and more aware of the importance of qualified dissemination of mathematical ideas and popularization of mathematics to a wider audience; not least of the importance of the generation of teaching material showing a perspective and adapted to the various levels in the educational system. In particular with roots in a number of geometrical subjects work is continuously done within this general scope and towards these goals. Also research in the history and philosophy of mathematics is part of the project.

Department of Mathematics
Period: 01/01/1989 → …
Number of participants: 1
Project Manager, organisational:
Hansen, Vagn Lundsgaard (Intern)
Project

Geometrisk modellering
Department of Informatics and Mathematical Modeling
Period: 01/02/1988 → 19/05/1995
Number of participants: 2
Phd Student:
Brown, Jan (Intern)
Main Supervisor:
Christensen, Niels Jørgen (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
Project: PhD

Computer Aided Control System Design (CACSD)
CACSD and CACE (Computer Aided Control Engineering) is a active field in international research. The new developments in computer hardware and software enables the development of new and enhanced tools and methodologies. Several subjects are treated in the departmental research: - User friendly interface construction in CACSD systems. - Implementation of device and system independant controller software. - Symbolic manipulation and
representation in controller design - Development of standard methodologies and procedures for modelling of
electromechanical systems. The department has both a HP 9000 UNIX server and PC platforms available for the research
in this area. The software include MATLAB/Simulink including several toolboxes, Maple and Mathematica. More
information may be found at http://www.iau.dtu.dk/research/control/CACE.html

Department of Automation

Department of Informatics and Mathematical Modeling
Period: 01/01/1988 → 01/01/1998
Number of participants: 3
Project participant:
Jannerup, Ole Erik (Intern)
Nørgård, Peter Magnus (Intern)
Project Manager, organisational:
Ravn, Ole (Intern)

System til optimal regulering af fjernvarmeoproduktion
Resultat af projektet er et PC-baseret system, kaldet 'Prognose- og energistyringssystem' PRESS, til løbende udpegning
af kritiske fremløbstemperaturer i fjernvarmenettet i Esbjerg/Varde, samt løbende beregning af varmebehovsprognoser op
til 12 timer frem. Systemet beregner løbende den nødvendige fremløbstemperatur fra kraftvarmeværket (Vestkraft) dels til
tilfredsstillelse af udetemperaturafhængige minimumstemperaturer i udvalgte/kritiske punkter i nettet, og dels til
tilfredsstillelse af fjernvarmesystemets predikterede varmebehov. Som et delresultat estimeres for hvert enkelt kritisk punkt, tiden for fjernvarmevandets transport fra Vestkraft til det pågældende punkt i fjernvarmenettet. Aftastning af
relevante målinger i fjernvarmesystemet foretages automatisk af programsystemet. Systemet er en væsentligt udbygget
version af et prognoseprogram, som tidligere er udviklet på IMM. Programsystemet er installeret på en computer i et
kontrolrum på Vestkraft. Operatørene regulerer fremløbstemperaturen fra Vestkraft ifølge programmets anvisninger.
Projektet er finansieret af og gennemført i henhold til en samarbejdsaftale med I/S Vestkraft og
Forsyningsvirksomhederne i Esbjerg. Erfaringerne med anvendelse af systemet følges og udnyttes i projektet: "Optimeret
drift af fjernvarmesystemer".

Department of Informatics and Mathematical Modeling
Rambøll Danmark A/S

HTF
Period: 01/01/1988 → …
Number of participants: 3
Project participant:
Nielsen, Torben Skov (Intern)
Nielsen, Henrik Aalborg (Intern)
Project Manager, organisational:
Madsen, Henrik (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,780,000.00 Danish Kroner
Project

Udvikling og optimering af kemiske processer under anvendelse af statistiske korrelationsmetoder
Department of Informatics and Mathematical Modeling
Period: 01/09/1987 → 25/04/1995
Number of participants: 2
Phd Student:
Erbsøl, Annette Kjær (Intern)
Main Supervisor:
Spliid, Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
Project: PhD
Derivation and analysis of fifth order quadrature formulas for biharmonic boundary integral operators

Department of Informatics and Mathematical Modeling
Period: 01/01/1986 → 19/04/2001
Number of participants: 1
Project Manager, organisational: Christiansen, Søren (Intern)

Detecting non-uniqueness of solutions to biharmonic integral equations through SVD

Department of Informatics and Mathematical Modeling
Period: 01/01/1986 → 26/09/2001
Number of participants: 1
Project Manager, organisational: Christiansen, Søren (Intern)

Movement of surface gravity water wawes in a canal expressed and computed by two systems of ordinary differential equations
The one system of ordinary differential equations is derived, the other system is known. The inherent properties of the two systems are compared and analysed in detail using the computer algebra system MAPLE. Subsequently the systems are solved numerically using appropriate methods.

Department of Informatics and Mathematical Modeling
Period: 01/01/1986 → …
Number of participants: 3
Project participant: Thomsen, Per Grove (Intern)
Madsen, Per A. (Intern)
Project Manager, organisational: Christiansen, Søren (Intern)

Using Maple V to derive and analyse a quadrature formula for a harmonic boundary integral operator

Department of Informatics and Mathematical Modeling
Period: 01/01/1986 → 29/08/2000
Number of participants: 1
Project Manager, organisational: Christiansen, Søren (Intern)

Hypercalcaemia Discriminant Functions
Discriminant functions are developed as a diagnostic tool. The aim of the project is to provide a decision support which can alert the clinician in cases of hypercalcaemia. Secondary the system can indicate a possible diagnosis.

Department of Informatics and Mathematical Modeling
Period: 01/10/1985 → …
Number of participants: 6
Project participant: Conradsen, Knut (Intern)
Froelich, Anne (Ekstern)
McNair, Peter (Ekstern)
Transboel, Ib (Ekstern)
Nielsen, Jan (Ekstern)
Project Manager, organisational: Nielsen, Bo Friis (Intern)
Adaptive Control
In practice this implies that an adaptive controller is a controller with adjustable parameters, which is tuned on-line according to some mechanism in order to cope with time-variations in process dynamics and changes in the environment. This can be approached in different ways, but at IAU we focus primarily on the so-called indirect self-tuning regulators. A "pragmatic" approach to adaptive control is taken. We do not spend much time on stability proofs, but our research is primarily governed by implementation issues. We are continuously working on developing a set of software tools to facilitate practical implementation of adaptive controllers. Furthermore we are always interested in trying out adaptive methods on "real world" systems. This is also reflected in the DTU course "50360 Adaptive Control", taught by the department. The IRCST tool was originally implemented in an adaptive control context, but it has since then developed way beyond that. Today the tool contains an adaptive controller "template" and a "library" of building blocks for use in adaptive control. The library contains a number of utilities for control design, filtering, recursive estimation, and utilization of physical insight. A feature is the close connection to MATLAB. Matlab is an integrated part of the tool: filters, matrices, vectors, parameters, etc. are initialized in MATLAB and then send to the Real-time program. The results are then returned to MATLAB either during or after a run.

Department of Automation

CICT

Department of Informatics and Mathematical Modeling

Department of Electrical Engineering
Period: 01/01/1983 → 01/01/1993
Number of participants: 2
Project participant:
Nørgård, Peter Magnus (Intern)
Project Manager, organisational:
Ravn, Ole (Intern)

Solution of boundary value problems using the point collocation method
An analysis of the numerical properties of the method is carried out using, e.g., interval methods, stochastic methods and many-decimal methods. Collaborators: Armand Wirgin, Laboratoire de Mecanique et d'Acoustique, Marseille, France, Jean-Marie Chesneaux, Laboratoire MASI, Universite Paris VI, Paris, France, Poul Wulff Pedersen, UNI-C, DTU, Lyngby, Denmark. The project is carried out as part of the work prepared by the scientific staff at IMM. No specified budget. Albertsen, Niels Christian; Jean-Marie Chesneaux; Søren Christiansen and Armand Wirgin: Mathematics and Computers in Simulation 48 #3 (1 Feb. 1999) 307-317. Published 23-04-1999

Department of Informatics and Mathematical Modeling

Wirgin, Armand
Period: 01/10/1982 → …
Number of participants: 5
Project participant:
Albertsen, Niels Christian (Intern)
Kleinman, Ralph E. (Ekstern)
Chesneaux, Jean-Marie (Ekstern)
Pedersen, Poul Wulff (Ekstern)
Project Manager, organisational:
Christiansen, Søren (Intern)

Applications of parameter estimation
Software for robust modelling of electromagnetic circuits is developed in collaboration with "Optimization Systems Associates", Canada.

Department of Informatics and Mathematical Modeling

TICRA
Period: 01/08/1979 → …
Number of participants: 4
Project participant:
Frandsen, Poul Erik (Ekstern)
On the elastostatic significance of four boundary integrals involving biharmonic functions
Using the computer algebra system Maple V it has been possible to ascribe an elastostatic significance to some boundary integrals. Publication: Christiansen, Soeren: On the elastostatic significance of four boundary integrals involving biharmonic functions. Acta Mechanica 126 (1998) 37-43 Published 1998-01-12 The project is carried out as part of the work prepared by the scientific staff at IMM. No specified budget.

Department of Informatics and Mathematical Modeling
Period: 01/06/1975 → 01/02/1998
Number of participants: 1
Project Manager, organisational:
Christiansen, Søren (Intern)

Integral equations for the fundamental biharmonic boundary value problem
Three pairs of equations have been derived and are analysed with respect to uniqueness.

Department of Informatics and Mathematical Modeling
Period: 01/10/1974 → …
Number of participants: 1
Project Manager, organisational:
Christiansen, Søren (Intern)

Solution of integral equations
Quadrature methods for integral operators, derived from harmonic and biharmonic boundary integral equations are investigated with respect to their order of convergence. The project is carried out as part of the work prepared by the scientific staff at IMM. No specified budget. Christiansen, Søren: Detecting non-uniqueness of solutions to biharmonic integral equations through SVD. Department of Mathematical Modelling, Technical University of Denmark, DK-2800 Lyngby, Denmark ISSN 0909 6264 Technical Report IMM-REP-1999-10 1999-06-28, 17 pp. Christiansen, Søren: Derivation and analysis of fifth order quadrature formulas for biharmonic boundary integral operators. Department of Mathematical Modelling, Technical University of Denmark, DK-2800 Lyngby, Denmark ISSN 0909 6264 Technical Report IMM-REP-1999-14 1999-09-22, 16 pp.

Department of Informatics and Mathematical Modeling
Period: 01/06/1966 → …
Number of participants: 2
Project participant:
Saranen, Jukka (Ekstern)
Project Manager, organisational:
Christiansen, Søren (Intern)

Activities:

International Workshop on Business Process Intelligence
Period: 9 Sep 2018 → 10 Sep 2018
Andrea Burattin (Organizer)
Department of Applied Mathematics and Computer Science
Software and Process Engineering
Degree of recognition: International

Related event
International Workshop on Business Process Intelligence
09/09/2018 → 10/09/2018
Sydney, Australia
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Exam in statistics, University of Århus
Period: 25 Jun 2018 → 26 Jun 2018
Anders Stockmarr (External examiner)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Activity: Examinations and supervision › External examination

Synchronization in stochastic oscillatory networks
Period: 18 Jun 2018
Erik Andreas Martens (External examiner)
Department of Applied Mathematics and Computer Science
Dynamical Systems
Activity: Examinations and supervision › Internal examination

24th Annual Meeting of the Organization of Human Brain Mapping
Period: 17 Jun 2018 → 21 Jun 2018
Lærke Karen Krohne (Participant)
Department of Applied Mathematics and Computer Science
Cognitive Systems
Degree of recognition: International
Related event

Does corticospinal excitability depend on oscillatory phase of the mu-rhythm?
Period: 17 Jun 2018 → 21 Jun 2018
Lærke Karen Krohne (Speaker)
Department of Applied Mathematics and Computer Science
Cognitive Systems
Description
Poster
Related event

24th Annual Meeting of the Organization of Human Brain Mapping
17/06/2018 → 21/06/2018
Singapore, Singapore
Activity: Attending an event › Participating in or organising a conference

Eksamination in Bachelor project Social inequality in multimorbidity: The association between socioeconomic status and multimorbidity'
Period: 12 Jun 2018
Anders Stockmarr (External examiner)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Activity: Examinations and supervision › External examination

2018 Summer Short Course on Causal Discovery
Period: 11 Jun 2018 → 15 Jun 2018
Lærke Karen Krohne (Participant)
Department of Applied Mathematics and Computer Science
Cognitive Systems

Description
Short course and Datathon

Related event

2018 Summer Short Course on Causal Discovery
11/06/2018 → 15/06/2018
Pittsburgh, United States
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Transmission of information in Thermoacoustic Tomography (TAT)
Period: 5 Jun 2018
Mirza Karamehmedovic (Guest lecturer)
Department of Applied Mathematics and Computer Science
Scientific Computing
Neutrons and X-rays for Materials Physics
Degree of recognition: International

Related event

SIAM Conference of Imaging Science
05/06/2018 → 08/06/2018
Bologna, Italy
Activity: Talks and presentations › Conference presentations

Active-subspace Analysis of Up-crossing Probability for Shallow-water Model
Period: 17 Apr 2018
Kenan Sehic (Guest lecturer)
Mirza Karamehmedovic (Guest lecturer)
Department of Applied Mathematics and Computer Science
Scientific Computing
Neutrons and X-rays for Materials Physics
Degree of recognition: International

Related event

SIAM Conference on Uncertainty Quantification
16/04/2018 → 19/04/2018
Garden Grove, United States
Activity: Talks and presentations › Conference presentations

Archives of Dairy Research and Technology (Journal)
Period: 3 Apr 2018 → 5 Apr 2018
Anders Stockmarr (Reviewer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Description
Paper review

Related journal

Archives of Dairy Research and Technology
Local database
Activity: Research › Peer review of manuscripts

Innotalk - En verden Uden hemmeligheder
Period: 22 Mar 2018
Anders Stockmarr (Participant)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Related event

Innotalk - En verden Uden hemmeligheder
22/03/2018 → 22/03/2018
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

3D printed system for testing intestinal drug transport
Period: 21 Mar 2018
Morten Leth Jepsen (Other)
Line Hagner Nielsen (Other)
Kristoffer Almdal (Other)
Anja Boisen (Other)
Martin Dufva (Other)
Department of Micro- and Nanotechnology
Fluidic Array Systems and Technology
Nanoprobes
Center for Intelligent Drug Delivery and Sensing Using Microcontainers and Nanomechanics
Department of Applied Mathematics and Computer Science

Related event

11th World Meeting on Pharmaceutics, Biopharmaceutics and Pharmaceutical Technology
21/03/2018 → …
Granada, Spain
Activity: Talks and presentations › Conference presentations

Loading of poorly soluble drugs by supercritical CO2 impregnation into microcontainers for oral drug delivery
Period: 19 Mar 2018 – 22 Mar 2018
Chiara Mazzoni (Other)
Anastasia Antalaki (Other)
Rasmus Due Jacobsen (Other)
Jacob Mortensen (Other)
Fabio Tentor (Other)
Roman Slipets (Other)
Oleksii Ilchenko (Other)
Stephan Sylvest Keller (Other)
Line Hagner Nielsen (Other)
Anja Boisen (Other)
Department of Micro- and Nanotechnology
Center for Intelligent Drug Delivery and Sensing Using Microcontainers and Nanomechanics Nanoprobes
Department of Applied Mathematics and Computer Science

Related event
11th World Meeting on Pharmaceutics, Biopharmaceutics and Pharmaceutical Technology
21/03/2018 → …
Granada, Spain
Activity: Talks and presentations › Conference presentations

Udvidet Introducerende Statistik (02508)
Period: 13 Mar 2018 → 18 Jun 2018
Anders Stockmarr (Course lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Activity: Other

Active-subspace analysis of speckle patterns
Period: 6 Mar 2018
Mirza Karamemodovic (Guest lecturer)
Department of Applied Mathematics and Computer Science
Scientific Computing
Neutrons and X-rays for Materials Physics
Degree of recognition: International
Documents:
Schedule_Full

Related event
17th Electromagnetic and Light Scattering Conference, Texas A&M University, College Station, TX, USA
04/03/2018 → 09/03/2018
College Station, United States
Activity: Talks and presentations › Conference presentations

NordSecMob Network meeting 2018 (Event)
Period: 5 Mar 2018
Flemming Stassen (Reviewer)
Department of Applied Mathematics and Computer Science
Embedded Systems Engineering

Related event
NordSecMob Network meeting 2018
05/03/2018 → 05/03/2018
Espoo, Finland
Activity: Communication › Peer review of manuscripts

SecClo Network meeting 2018 (Event)
Period: 5 Mar 2018 → 6 Mar 2018
Flemming Stassen (Reviewer)
Department of Applied Mathematics and Computer Science
Embedded Systems Engineering

Description
SecClo Network meeting 2
1st selection meeting

Related event
SecClo Network meeting 2018
05/03/2018 → 06/03/2018
Finland
Activity: Communication › Peer review of manuscripts

Talk in the Computational Logic Group at the University of Innsbruck
Period: 1 Mar 2018
Anders Schlichtkrull (Organizer)
Department of Applied Mathematics and Computer Science
Algorithms and Logic

Description
IsaFoL - Isabelle Formalization of Logic - An Overview
Speaker: Anders Schlichtkrull

Abstract: IsaFoL is the Isabelle Formalization of Logic — a project that aims to develop libraries of lemmas and methods for formalizing research on logic. The project contains formalizations of several logics and tools. Examples are: first-order resolution, a first-order proof assistant, SAT solving and a paraconsistent logic. I give an overview of IsaFoL and go into details on the formalization of first-order resolution.

Talk "IsaFoL - Isabelle Formalization of Logic - An Overview" in the Computational Logic Group of the Department of Computer Science at the University of Innsbruck.

Related event
Talk in the Computational Logic Group at the University of Innsbruck
01/03/2018 → …
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Probabilistic Gossip
Period: 27 Feb 2018
Anders Stockmarr (Invited speaker)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Degree of recognition: National
Documents:
DSTS 27022018 ANST

Related event
Dansk Selskab for Teoretisk Statistik Generalforsamling 2018
27/02/2018 → 27/03/2018
Copenhagen, Denmark
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Fjerde workshop for forsker- og udviklernetværk om multisygdom i Region Hovedstaden
Period: 22 Feb 2018
Anders Stockmarr (Participant)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Related event

**Fjerde workshop for forsker- og udviklernetværk om multisygdom i Region Hovedstaden**
22/02/2018 → 22/02/2018
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Fagprojekt ’Det går ufatteligt godt - eller gør det?’**
Period: 5 Feb 2018 → 20 Jun 2018
Anders Stockmarr (Main supervisor)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Department of Management Engineering

**Description**
supervision og eksamen - for Emil Rendbæk Nygaard s164524, Mikkel Johannsen Feddersen s164507, Theis Schäfer Gregersen s160691, Andri Geir Arnarson s164518, Jonatan Larsen Edry s165499.
Activity: Examinations and supervision › Supervisor activities

**Bryghuset - Svendborg Demensby**
Period: 2 Feb 2018
Anders Stockmarr (Guest lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Documents:
Bryghuset - Svendborg Demensby

**Related event**

**Robotter på Tvaers: Workshop om robotter, Innovationsfonden**
02/02/2018 → 02/02/2018
Odense, Denmark
Activity: Talks and presentations › Conference presentations

**PACE – Proactive Care for Elderly People with Dementia**
Period: 2 Feb 2018
Anders Stockmarr (Guest lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Documents:
Præsentation PACE 02022018

**Related event**

**Robotter på Tvaers: Workshop om robotter, Innovationsfonden**
02/02/2018 → 02/02/2018
Odense, Denmark
Activity: Talks and presentations › Conference presentations

**Assessment of Infection risk in a Drug Development Program**
Period: 1 Feb 2018 → 12 Jun 2018
Anders Stockmarr (Main supervisor)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Description
supervision and exam for Masters project for Faiza Ahmed, s152160
Activity: Examinations and supervision › Internal examination

Bachelor project 'Strategies for acting simultaneously on northern european gas markets'
Period: 1 Feb 2018 → 15 Jun 2018
Anders Stockmarr (Main supervisor)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Department of Management Engineering

Description
Supervision and exam for Aleksander Pratt-Dam s153642 og Clara Frederikke Foss
Activity: Examinations and supervision › Supervisor activities

Stock market analysis and investment modelling
Period: 1 Feb 2018 → 29 Jun 2018
Anders Stockmarr (Main supervisor)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Description
Supervision and exam on Masters project for Federico Romano s161184
Activity: Examinations and supervision › Supervisor activities

Time Series Analysis of Stock Prices
Period: 1 Feb 2018 → 29 Jun 2018
Anders Stockmarr (External examiner)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Description
Supervision and exam for bachelor project of Helena Hansen s153178.
Activity: Examinations and supervision › Supervisor activities

3D printed system for based on hydrogels for drug transport
Period: 29 Jan 2018
Morten Leth Jepsen (Other)
Line Hagner Nielsen (Other)
Kristoffer Almdal (Other)
Anja Boisen (Other)
Martin Dufva (Other)
Department of Micro- and Nanotechnology
Fluidic Array Systems and Technology
Nanoprobes
Center for Intelligent Drug Delivery and Sensing Using Microcontainers and Nanomechanics
Department of Applied Mathematics and Computer Science

Description
3D printed system for based on hydrogels for drug transport
Related external organisation

University of Southern Denmark
Odense, Denmark
Activity: Talks and presentations › Conference presentations

Microcontainers for oral vaccine delivery
Period: 29 Jan 2018 → 31 Jan 2018
Line Hagner Nielsen (Guest lecturer)
Department of Applied Mathematics and Computer Science
Department of Micro- and Nanotechnology
Nanoprobes
Center for Intelligent Drug Delivery and Sensing Using Microcontainers and Nanomechanics

Description
Oral presentation
Documents:
Odense meeting_Microcontainers for oral vaccine delivery

Related event

Northern Pharma Network Meeting
29/01/2018 → 31/01/2018
Odense, Denmark
Activity: Talks and presentations › Conference presentations

Polarization noise study in all-normal dispersion fiber supercontinuum generation
Period: 29 Jan 2018
Ivan Bravo Gonzalo (Speaker)
Rasmus Dybbro Engelsholm (Other)
Andreas Falkenstrøm Mieritz (Other)
Mads Peter Sørensen (Other)
Ole Bang (Other)
Department of Photonics Engineering
Fiber Sensors and Supercontinuum Generation
Department of Applied Mathematics and Computer Science
Dynamical Systems
Center for Intelligent Drug Delivery and Sensing Using Microcontainers and Nanomechanics

Related event

29/01/2018 → …
Activity: Talks and presentations › Conference presentations

IEEE Transactions on Image Processing (Journal)
Period: 26 Jan 2018
Tommi Olavi Brander (Reviewer)
Department of Applied Mathematics and Computer Science
Scientific Computing

Related journal

IEEE Transactions on Image Processing
1057-7149
Innovationsfondens Prisuddeling 2018
Period: 26 Jan 2018
Anders Stockmarr (Participant)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Description
invited participation
Links:
https://innovationsfonden.dk/da/priser

Related event
Innovationsfondens Prisuddeling 2018
26/01/2018 → 26/01/2018
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Artifact removal for Unmanned Aerial System multispectral imagery based on tensor decomposition methods
Period: 22 Jan 2018 → 29 Jun 2018
Anders Stockmarr (Main supervisor)
Andreas Baum (Supervisor)
Monica Garcia (Supervisor)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Department of Environmental Engineering
Air, Land & Water Resources

Description
Supervision and exam for the Master project of Andri Freyr Þórðarson s160967
Activity: Examinations and supervision › Supervisor activities

Hybrid data tomography
Period: 22 Jan 2018 → 26 Jan 2018
Tommi Olavi Brander (Organizer)
Kim Knudsen (Organizer)
Bjørn Christian Skov Jensen (Organizer)
Ekaterina Sherina (Organizer)
Department of Applied Mathematics and Computer Science
Scientific Computing

Related event
Hybrid data tomography
22/01/2018 → 26/01/2018
Kongens Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Eksamination in statistics, Public health science 5th term, University of Copenhagen
Period: 11 Jan 2018
Boundary determination with interior data
Period: 4 Jan 2018
Tommi Olavi Brander (Speaker)
Department of Applied Mathematics and Computer Science
Scientific Computing
Degree of recognition: International

Related event
Finnish mathematical days 2018: Joint EMS-FMS-ESMTB Mathematical Weekend
04/01/2018 → 05/01/2018
Joensuu, Finland
Activity: Talks and presentations › Conference presentations

Statistical Genetics (02938)
Period: 2 Jan 2018 → 29 Jan 2018
Anders Stockmarr (Other)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Description
phd course
Degree of recognition: Local
Activity: Other

Statistical Genetics (02950)
Period: 2 Jan 2018 → 15 Jan 2018
Anders Stockmarr (Other)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Description
phd course
Degree of recognition: Local
Activity: Other

Chaotic Mean Field Dynamics in Two Populations of Phase Oscillators with Heterogeneous Phase-Lag
Period: 2017
Erik Andreas Martens (Speaker)
Department of Applied Mathematics and Computer Science
Dynamical Systems
Description
Talk
Degree of recognition: International
Related event
SIAM Conference on Applications of Dynamical Systems 2017
21/05/2017 → 26/05/2017
Chimera states - mythological monsters from math arise in the real world

Period: 2017
Erik Andreas Martens (Speaker)
Department of Applied Mathematics and Computer Science
Dynamical Systems
Department of Electrical Engineering

Description
Invited topical lecture
Degree of recognition: International

Related event
ICMS Complexity Science Winter School 2017
13/02/2017 → 17/02/2017
Eindhoven, Netherlands
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Inverse Problems and Imaging (Journal)
Period: 2017
Tommi Olavi Brander (Reviewer)
Department of Applied Mathematics and Computer Science
Scientific Computing

Related journal
Inverse Problems and Imaging
1930-8337
BFI (2018): BFI-level 1, Scopus rating (2017): CiteScore 1.38 SJR 0.59 SNIP 0.958, ISI indexed (2013): ISI indexed yes,
Web of Science (2018): Indexed yes
Central database
Activity: Research › Peer review of manuscripts

Robotics and Computer-Integrated Manufacturing (Journal)
Period: 2017
Alessandro Stolfi (Reviewer)
Department of Applied Mathematics and Computer Science
Department of Mechanical Engineering
Manufacturing Engineering

Related journal
Robotics and Computer-Integrated Manufacturing
0736-5845
BFI (2018): BFI-level 1, Scopus rating (2017): CiteScore 4.11 SJR 1.041 SNIP 2.681, ISI indexed (2013): ISI indexed yes,
Web of Science (2018): Indexed yes
Central database
Activity: Research › Peer review of manuscripts

Mathematical modeling of neurons: Perspectives for the treatment of epilepsy
Period: 13 Dec 2017
Dimitri Boiroux (Guest lecturer)
Department of Applied Mathematics and Computer Science
Implementation of enclosure method for p-Laplacian
Period: 12 Dec 2017
Tommi Olavi Brander (Speaker)
Department of Applied Mathematics and Computer Science
Scientific Computing
Degree of recognition: International

Related event
Inverse days
12/12/2017 → 14/12/2017
Oulu, Finland
Activity: Talks and presentations › Conference presentations

Controlling Chimeras
Period: 1 Dec 2017
Erik Andreas Martens (Guest lecturer)
Department of Applied Mathematics and Computer Science
Dynamical Systems

Description
Invited Talk
Degree of recognition: International

Related external organisation
Technische Universität Berlin
Germany
Activity: Talks and presentations › Conference presentations

Speed of evolution in spatially extended habitats
Period: Nov 2017
Erik Andreas Martens (Guest lecturer)
Department of Applied Mathematics and Computer Science
Dynamical Systems
Degree of recognition: International

Related event
Workshop: Future Trends in Mathematical Biology: In vitro, in vivo, and in silico,
22/11/2017 → 23/11/2017
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

 Hvad spærrer for god opklaring, læring og forebyggelse af ulykker
Period: 28 Nov 2017
Frank Huess Hedlund (Guest lecturer)
Department of Applied Mathematics and Computer Science
Dynamical Systems
Statistics and Data Analysis

Description
What is blocking good accident investigation, learning and prevention of occupational accidents
Degree of recognition: National
Documents:
Workshop 411 - Frank Hedlund, Hvad spærrer opklaring

Related event
Arbejdsmiljøkonferencen AM:2017
27/11/2017 → 28/11/2017
Nyborg, Denmark
Activity: Talks and presentations › Conference presentations

SecClo Network meeting 1Programme negotiations (Event)
Period: 22 Nov 2017 → 23 Nov 2017
Flemming Stassen (Reviewer)
Department of Applied Mathematics and Computer Science
Embedded Systems Engineering

Related event
SecClo Network meeting 1
Programme negotiations
22/11/2017 → 23/11/2017
Espoo, Finland
Activity: Communication › Peer review of manuscripts

learnT DTU Conference 2017 - The 2nd Conference on Digital Learning Technology
Period: 17 Nov 2017
Charlotte Lærke Weitze (Organizer)
Helle Rootzén (Organizer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Degree of recognition: National

Related event
learnT DTU Conference 2017 - The 2nd Conference on Digital Learning Technology
17/11/2017 → …
2800 Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising a conference

‘The student as a game designer – What professional learning can students achieve when designing digital learning games?’
Period: 17 Nov 2017
Charlotte Lærke Weitze (Guest lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Degree of recognition: Local

Related event
learnT DTU Conference 2017 - The 2nd Conference on Digital Learning Technology
17/11/2017 → …
2800 Kgs. Lyngby, Denmark
Workshop: Create a concept for a learning game in one hour  
Period: 17 Nov 2017  
Charlotte Lærke Weitze (Guest lecturer)  
Department of Applied Mathematics and Computer Science  
Statistics and Data Analysis  
Degree of recognition: National  
Related event  
learnT DTU Conference 2017 - The 2nd Conference on Digital Learning Technology  
17/11/2017 → …  
2800 Kgs. Lyngby, Denmark  
Activity: Talks and presentations › Conference presentations  

Pilot Demonstration of Alarm Management in Oil & Gas Operations. - Decision Support from Functional Modelling.  
Period: 14 Nov 2017 → 15 Nov 2017  
Thomas Martini Jørgensen (Guest lecturer)  
Department of Applied Mathematics and Computer Science  
Statistics and Data Analysis  
Centre for oil and gas – DTU  
Degree of recognition: International  
Documents:  
DHRTC-Presentation-abstracts  
Links:  
http://www.oilgas.dtu.dk/english/-/media/Andre_Universitetsenheder/Oilgas_ny/Tech-conf-17/DHRTC-Presentation-abstracts.ashx?la=da  
Related organisation  
Pilot Demonstration of Alarm Management in Oil & Gas Operations. - Decision Support from Functional Modelling.  
Jørgensen, T. M. (Guest lecturer)  
14 Nov 2017 → 15 Nov 2017  
Activity: Talks and presentations › Conference presentations  

Proof Assistants and Related Tools - The PART & PART 2 Projects 2017  
Period: 9 Nov 2017  
Anders Schlichtkrull (Participant)  
Department of Applied Mathematics and Computer Science  
Algorithms and Logic  
Description  
IsaFoL - Isabelle Formalization of Logic - A Brief Overview  
Talk "IsaFoL - Isabelle Formalization of Logic - A Brief Overview"  
Related event  
Proof Assistants and Related Tools - The PART & PART 2 Projects 2017  
07/09/2017 → 07/09/2017  
Kgs. Lyngby, Denmark  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.  

DeepLoc: Prediction of protein subcellular localization using deep learning  
Period: 3 Nov 2017  
Henrik Nielsen (Guest lecturer)
Jose Juan Almagro Armenteros (Guest lecturer)
Department of Bio and Health Informatics
Disease Intelligence and Molecular Evolution
Department of Applied Mathematics and Computer Science

Related external organisation

Intomics A/S
Denmark
Activity: Talks and presentations › Conference presentations

TCS and PAM seminar
Period: 3 Nov 2017
Anders Schlichtkrull (Participant)
Department of Applied Mathematics and Computer Science
Algorithms and Logic

Description
Formalization of an Ordered Resolution Prover in Isabelle/HOL

Abstract:
This is joint work with Jasmin Christian Blanchette, Dmitriy Traytel and Uwe Waldmann. We present a formalization of the first half of Bachmair and Ganzinger's chapter on resolution theorem proving in Isabelle/HOL, culminating with a refutationally complete first-order prover based on ordered resolution with literal selection. We develop general infrastructure and methodology that can form the basis of completeness proofs for related calculi (e.g., superposition). Our work clarifies several fine points in the chapter's text, emphasizing the value of formal proofs in the field of automated reasoning.

Talk at the TCS and PAM seminar of the Theoretical Computer Science group at the Vrije Universiteit Amsterdam.

Related event

Security at chemical facilities – overview of different regulatory approaches taken in EU Member States
Period: 2 Nov 2017
Frank Huess Hedlund (Speaker)
Department of Applied Mathematics and Computer Science
Dynamical Systems
Statistics and Data Analysis

Description
It is a European Union policy goal to enhance high-risk chemical facility security. This presentation presents some results of a study carried out for the European Commission, DG Home Affairs. The study aimed to provide an overview of existing provisions and measures that help to enhance security at chemical facilities. These provisions and measures may for instance have their background in safety legislation or non-regulatory initiatives implemented by industry or in specific legislative provisions targeting security aspects implemented by individual Member States.

This presentation briefly reviews: 1) the concept of a high-risk chemical facility; 2) the analytical framework developed to identify security elements relevant for a chemical facility; and 3) possible synergies, the extent to which safety measures can be expected also to improve security. The study found that Member States have taken three distinct regulatory approaches: 1) folding security into Seveso safety legislation; 2) enlarging the scope of existing national security provisions; and 3) encouraging partnerships with industry associations to promote voluntary initiatives such as the security addendum to the Responsible Care programme.

Denmark has recently taken the first approach, adding security to Seveso (III) safety reporting. The presentation briefly reviews some of the resulting challenges.
GEOMETRICAL CHARACTERISATION OF INDIVIDUAL FIBRES FROM X-RAY TOMOGRAMS
Period: 27 Oct 2017
Monica Jane Emerson (Speaker)
Department of Applied Mathematics and Computer Science
Image Analysis & Computer Graphics

Description
Numerous modelling possibilities are opened up by an advanced image analysis pipeline that can accurately extract individual fibres from X-ray tomograms
Degree of recognition: International

30th Nordic Seminar on Computational Mechanics (NSCM-30)
25/10/2017 → 27/10/2017
Copenhagen
Activity: Talks and presentations › Conference presentations

Reflective, Creative and Computational Thinking Strategies Used When Students Learn Through Making Games
Period: 5 Oct 2017
Charlotte Lærke Weitze (Guest lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Degree of recognition: International

ECGBL 2017: 11th European Conference on Games Based Learning, ACPI. FH JOANNEUM University of Applied Science, Graz, Austria, 5-6 October 2017
05/10/2017 → 06/10/2017
Graz, Austria
Activity: Talks and presentations › Conference presentations

Aalto University
Period: 25 Sep 2017
Tommi Olavi Brander (Visiting researcher)
Department of Applied Mathematics and Computer Science
Scientific Computing

Description
Research collaboration with Antti Hannukainen and Nuutti Hyvönen.
Degree of recognition: International
Activity: Visiting an external institution › Visiting another research institution

Inferring feeding in Southern bluefin tuna from visceral temperature data using a mechanistic model of digestion
Period: 22 Sep 2017 → 27 Sep 2017
Uffe Høgsbro Thygesen (Guest lecturer)
Related event

Biologging Symposium 2017
25/09/2017 → 29/09/2017
Konstanz, Germany
Activity: Talks and presentations › Conference presentations

Active-subspace analysis of speckle-based characterisation of particle suspensions
Period: 20 Sep 2017
Mirza Karamehmedovic (Guest lecturer)
Department of Applied Mathematics and Computer Science
Scientific Computing
Neutrons and X-rays for Materials Physics
Degree of recognition: International

Related event

Inverse Problems from Theory to Application
19/09/2017 → 21/09/2017
Cambridge, United Kingdom
Activity: Talks and presentations › Conference presentations

Active-subspace analysis of speckle-based particle measurements
Period: 20 Sep 2017
Mirza Karamehmedovic (Guest lecturer)
Department of Applied Mathematics and Computer Science
Scientific Computing
Degree of recognition: International

Related event

Inverse Problems from Theory to Application
19/09/2017 → 21/09/2017
Cambridge, United Kingdom
Activity: Talks and presentations › Conference presentations

ECSO 2017
Period: 20 Sep 2017 → 22 Sep 2017
Ignacio Blanco (Guest lecturer)
Daniela Guericke (Other)
Department of Applied Mathematics and Computer Science
Dynamical Systems

Description
European Conference on Stochastic Optimization
Links:
http://ecso2017.inf.uniroma3.it/

Related external organisation

Università Roma Tre
Italy
Activity: Talks and presentations › Conference presentations
Microcontainers for oral vaccine delivery
Period: 18 Sep 2017 → 22 Sep 2017
Line Hagner Nielsen (Guest lecturer)
Department of Applied Mathematics and Computer Science
Department of Micro- and Nanotechnology
Nanoprobes
Center for Intelligent Drug Delivery and Sensing Using Microcontainers and Nanomechanics

Description
Oral presentation

Documents:
MNE2017 Microcontainers for oral vaccine delivery

Related event
43rd International conference on Micro and Nano Engineering
18/09/2017 → 22/09/2017
Braga, Portugal
Activity: Talks and presentations › Conference presentations

Kroniske Sygdomme i Hovedstadsregionen – Borgerklynger, Storforbrugere og Socioøkonomiske Effekter
Period: 14 Sep 2017
Anders Stockmarr (Invited speaker)
Anne Frølich (Other)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Degree of recognition: Local

Related event
Tredie workshop for forsker-og udviklernetværk om multisygdom i Region Hovedstaden
14/09/2017 → 14/09/2017
København, Denmark
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Formal Methods for Software Development
Period: 11 Sep 2017 → 14 Sep 2017
Anne Elisabeth Haxthausen (Guest lecturer)
Department of Applied Mathematics and Computer Science
Software and Process Engineering

Description
A PhD course.

Related external organisation
University of Florence
Italy
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

International Workshop on Business Process Intelligence
Period: 10 Sep 2017 → 11 Sep 2017
Andrea Burattin (Organizer)
Department of Applied Mathematics and Computer Science
Software and Process Engineering
Degree of recognition: International

Related event

International Workshop on Business Process Intelligence
10/09/2017 → 11/09/2017
Barcelona, Spain
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

PACE – Proactive Care for Elderly People with Dementia
Period: 7 Sep 2017
Anders Stockmarr (Guest lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Related event

Hillerød city council: committee meeting
07/09/2017 → 07/09/2017
Hillerød, Denmark
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Proof Assistants and Related Tools - The PART & PART 2 Projects 2017
Period: 7 Sep 2017
Anders Schlichtkrull (Participant)
Department of Applied Mathematics and Computer Science
Algorithms and Logic
Description
Anders Schlichtkrull (joint work with Jasmin Christian Blanchette, Dmitriy Traytel and Uwe Waldmann): Formalization of an Ordered Resolution Prover in Isabelle/HOL
Talk "Formalization of an Ordered Resolution Prover in Isabelle/HOL" at PART

Related event

Proof Assistants and Related Tools - The PART & PART 2 Projects 2017
07/09/2017 → 07/09/2017
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Statistical Genetics (02586)
Period: 4 Sep 2017 → 9 Dec 2017
Anders Stockmarr (Other)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Description
course at master level
Degree of recognition: Local
Activity: Other

Sync patterns in phase oscillator in community network structure
Period: Aug 2017
Erik Andreas Martens (Guest lecturer)
Department of Applied Mathematics and Computer Science
Dynamical Systems

Description
Invited Lecture, Advanced Study Group "From Microscopic to Collective Dynamics in Neural Circuits"
Degree of recognition: International

Related external organisation
Max-Planck-Institute for the Physics of Complex Systems
Germany
Activity: Talks and presentations › Conference presentations

University of Florence
Period: 15 Aug 2017 → 14 Sep 2017
Anne Elisabeth Haxthausen (Visiting researcher)
Department of Applied Mathematics and Computer Science
Software and Process Engineering

Description
Guest professor
Activity: Visiting an external institution › Visiting another research institution

IFORS 2017
Period: 17 Jul 2017 → 21 Jul 2017
Ignacio Blanco (Speaker)
Daniela Guericke (Other)
Department of Applied Mathematics and Computer Science
Dynamical Systems
Degree of recognition: International

Related event
IFORS 2017: 21st Conference of the International Federation of Operations and Research
17/07/2017 → 21/07/2017
Québec City, Canada
Activity: Talks and presentations › Conference presentations

Electrospraying Chitosan Particles for Oral Vaccine Delivery
Period: 16 Jul 2017 → 19 Jul 2017
Line Hagner Nielsen (Guest lecturer)
Department of Applied Mathematics and Computer Science
Department of Micro- and Nanotechnology
Nanoprobes
Center for Intelligent Drug Delivery and Sensing Using Microcontainers and Nanomechanics

Description
Poster presentation
Documents:
Abstract CRS 2017_electrospray

Related event
44th Annual Meeting & Exposition of the Controlled Release Society
16/07/2017 → 19/07/2017
Boston, United States
Activity: Talks and presentations › Conference presentations
Microcontainers as an Oral Drug Delivery System  
Period: 16 Jul 2017 → 19 Jul 2017  
Line Hagner Nielsen (Guest lecturer)  
Department of Applied Mathematics and Computer Science  
Department of Micro- and Nanotechnology  
Nanoprobes  
Center for Intelligent Drug Delivery and Sensing Using Microcontainers and Nanomechanics  
Description  
Poster presentation  
Documents:  
Abstract CRS 2017_microcontainers  
Related event  
44th Annual Meeting & Exposition of the Controlled Release Society  
16/07/2017 → 19/07/2017  
Boston, United States  
Activity: Talks and presentations › Conference presentations  
On multivariate Wilson bases  
Period: 6 Jul 2017  
Jakob Lemvig (Invited speaker)  
Department of Applied Mathematics and Computer Science  
Mathematics  
Description  
Invited talk at the 12th International conference on Sampling Theory and Applications in Tallinn, Estonia.  
Degree of recognition: International  
Related event  
2017 International Conference on Sampling Theory and Applications  
03/07/2017 → 07/07/2017  
Tallinn, Estonia  
Activity: Talks and presentations › Conference presentations  
Decision-making for integrated energy systems  
Period: 1 Jul 2017  
Daniela Guericke (Invited speaker)  
Department of Applied Mathematics and Computer Science  
Dynamical Systems  
Centre for IT-Intelligent Energy Systems in Cities  
Description  
Presentation at 10th DS&OR Forum  
Related external organisation  
University of Paderborn  
Germany  
Activity: Talks and presentations › Conference presentations  
Symposium on Geometry Processing 2017  
Period: 1 Jul 2017 → 5 Jul 2017
Jakob Andreas Bærentzen (Organizer)
Department of Applied Mathematics and Computer Science
Image Analysis & Computer Graphics

Description
Papers co-chair
Degree of recognition: International

Related event
Symposium on Geometry Processing 2017
01/07/2017 → 05/07/2017
London, United Kingdom
Activity: Attending an event › Participating in or organising a conference

Konstantin Klemm
Start date: Jun 2017 → Aug 2017
Erik Andreas Martens (Host)
Department of Applied Mathematics and Computer Science
Dynamical Systems
Department of Electrical Engineering
Degree of recognition: International
Activity: Hosting a guest lecturer

NeuroImage (Journal)
Period: Jun 2017 → …
Lærke Karen Krohne (Reviewer)
Department of Applied Mathematics and Computer Science
Cognitive Systems

Description
Reviewer
Degree of recognition: International

Related journal
NeuroImage
1053-8119
Central database
Activity: Research › Peer review of manuscripts

New approach for validating the segmentation of 3D data applied to individual fibre extraction
Period: 30 Jun 2017
Monica Jane Emerson (Speaker)
Department of Applied Mathematics and Computer Science
Image Analysis & Computer Graphics
Documents:
ICTMS2017_300617_monj presentation
Links:
https://www.dropbox.com/s/eq5528lplxomjqi/20170630_105434.mp4?dl=0 (Recorded talk)

Related event
3rd International Conference on Tomography of 3D Materials and Structures
26/06/2017 → 30/06/2017
Making use of Big Data in Industries- and the Challenge for the Design of Organizations
Period: 23 Jun 2017
Thomas Martini Jørgensen (Guest lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Description
Presentation given at Digitalization Workshop at FL Smidth
Degree of recognition: Regional

Related external organisation
F.L. Smidth A/S
Denmark
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Modeling of dynamic functional networks for prediction of schizotypy
Period: 20 Jun 2017
Lærke Karen Krohne (Lecturer)
Department of Applied Mathematics and Computer Science
Cognitive Systems

Description
30 min symposium talk
Degree of recognition: International

Related event
2017 International Consortium for Research on Schizotypy
19/06/2017 → 20/06/2017
Beijing, China
Activity: Talks and presentations › Conference presentations

Statistical modelling of space-time processes with application to wind power
Period: 16 Jun 2017
Anders Stockmarr (Internal examiner)
Thordis Thorarinsdottir (External examiner)
Robin Girard (External examiner)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
A Stochastic Method to Manage Delay and Missing Values for In-Situ Sensors in an Alternating Activated Sludge Process

Period: 13 Jun 2017

Peter Alexander Stentoft (Speaker)
Jan Kloppenborg Møller (Other)
Henrik Madsen (Other)
Peter Steen Mikkelsen (Other)
Thomas Munk-Nielsen (Other)

Department of Applied Mathematics and Computer Science
Dynamical Systems
Department of Environmental Engineering
Urban Water Systems

Integration of Nanopillar SERS Substrates in a Microfluidic Platform for Analyte Separation and Quantitative Sensing

Period: 11 Jun 2017 → 17 Jun 2017

Onur Durucan (Guest lecturer)
Lidia Morelli (Guest lecturer)
Kaiyu Wu (Guest lecturer)
Marlitt Viehrig (Guest lecturer)
Oleksii Ilichenko (Guest lecturer)
Kinga Zor (Guest lecturer)
Marco Matteucci (Guest lecturer)
Tommy Sonne Alstrøm (Guest lecturer)
Tomas Rindzevicius (Guest lecturer)
Michael Stenbæk Schmidt (Guest lecturer)
Anja Boisen (Guest lecturer)

Department of Micro- and Nanotechnology
Nanoprobes
Center for Intelligent Drug Delivery and Sensing Using Microcontainers and Nanomechanics
Department of Applied Mathematics and Computer Science
Cognitive Systems

Related event

9th International Conference on Advanced Vibrational Spectroscopy
11/06/2017 → 17/06/2017
Victoria, Canada
Introduction to Applied Statistics with R for PhD Students
Period: 9 Jun 2017 → 30 Jun 2017
Anders Stockmarr (Lecturer)
Bjarne Kjær Erbsøll (Lecturer)
Elisabeth Wreford Andersen (Guest lecturer)
Murat Kulahci (Lecturer)
Andreas Baum (Lecturer)
Camilla Thyregod (Other)
Jesper Fink Andersen (Other)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Related organisation

Introduction to Applied Statistics with R for PhD Students
Stockmarr, A. (Lecturer), Erbsøll, B. K. (Lecturer), Andersen, E. W. (Guest lecturer), Kulahci, M. (Lecturer), Baum, A. (Lecturer), Thyregod, C. (Other), Andersen, J. F. (Other)
9 Jun 2017 → 30 Jun 2017
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Dynamics Days Europe 2017
Period: 5 Jun 2017
Erik Andreas Martens (Speaker)
Department of Applied Mathematics and Computer Science
Dynamical Systems
Department of Electrical Engineering

Description
Organization of minisymposium "Complex patterns on networks"
Degree of recognition: International

Related event

Dynamics Days Europe 2017
05/06/2017 → ...
Szeged, Hungary
Activity: Talks and presentations › Conference presentations

Bounds on the stably recoverable information for the Helmholtz equation in R^2
Period: 2 Jun 2017
Mirza Karamahmedovic (Guest lecturer)
Department of Applied Mathematics and Computer Science
Scientific Computing
Degree of recognition: International
Documents:
AIP_Abstract

Related event

Applied Inverse Problems
29/05/2017 → 02/06/2017
Hangzhou, China
Activity: Talks and presentations › Conference presentations
DSWeb Magazine - The Dynamical Systems Web (Journal)
Period: May 2017
Erik Andreas Martens (Reviewer)
Department of Applied Mathematics and Computer Science
Dynamical Systems

Description
https://dsweb.siam.org/
Degree of recognition: International

Related journal
DSWeb Magazine - The Dynamical Systems Web
Local database
Activity: Communication › Journal editor

Green Light for Smarter Methods in Railway Safety Verification
Period: 31 May 2017
Anne Elisabeth Haxthausen (Guest lecturer)
Department of Applied Mathematics and Computer Science
Software and Process Engineering

Description
Invited pitch talk

Related event
Transport Summer Summit DTU 2017: Challenges, research and new developments within transportation, mobility and sustainability
31/05/2017 → 31/05/2017
Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Decision-making under uncertainty for energy companies in smart cities
Period: 30 May 2017
Daniela Guericke (Speaker)
Ignacio Blanco (Other)
Department of Applied Mathematics and Computer Science
Dynamical Systems
Centre for IT-Intelligent Energy Systems in Cities
Links:

Related event
CITIES consortium meeting 2017: Centre for IT–Intelligent Energy System in Cities
30/05/2017 → 31/05/2017
Aarhus, Denmark
Activity: Talks and presentations › Conference presentations

Canards in Stiction: On Solutions of a Friction Oscillator by Regularization
Period: 22 May 2017
Elena Bossolini (Speaker)
Department of Applied Mathematics and Computer Science
Mathematics

Description
We consider the problem of the friction oscillator using the stiction model of friction. This friction law has a discontinuity between the dynamic and the static regime. The discontinuity set has a sticking region in which the forward solution is non-unique. In particular, there are special points along these segments where the solution is tangent to the boundary of the discontinuity set. In order to resolve this uncertainty, we introduce a regularization of the vector field and we obtain a multiple-time scale problem. Here the special points of the piecewise-smooth problem become folded saddles and a canard solution appears. We study the interaction of periodic orbits with the canard and we find that the regularized problem has solutions that do not appear in the original problem.

Degree of recognition: International

Links:
http://meetings.siam.org/sess/dsp_programsess.cfm?SESSIONCODE=61861 (Minisymposium description)

Related event

SIAM Conference on Applications of Dynamical Systems 2017
21/05/2017 → 26/05/2017
Snowbird, United States
Activity: Talks and presentations › Conference presentations

Introduction to R
Period: 22 May 2017
Anders Stockmarr (Speaker)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Department of Management Engineering

Description
Invited seminar talk
Degree of recognition: Local
Documents:
Intro R DTU Management Engineering
Intro R DTU Management Engineering

Related organisation

Introduction to R
Stockmarr, A. (Speaker)
22 May 2017
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

SIAM Conference on Applications of Dynamical Systems 2017
Period: 22 May 2017
Morten Brends (Participant)
Kristian Uldall Kristiansen (Participant)
Alan R. Champneys (Chairman)
John Hogan (Chairman)
Department of Applied Mathematics and Computer Science
Mathematics

Description
Canards in Stiction: On Solutions of a Friction Oscillator by Regularization

We consider the problem of the friction oscillator using the stiction model of friction. This friction law has a discontinuity between the dynamic and the static regime. The discontinuity set has a sticking region in which the forward solution is non-unique. In particular, there are special points along these segments where the solution is tangent to the boundary of the discontinuity set. In order to resolve this uncertainty, we introduce a regularization of the vector field and we obtain a multiple-time scale problem. Here the special points of the piecewise-smooth problem become folded saddles and a canard solution appears. We study the interaction of periodic orbits with the canard and we find that the regularized problem has solutions that do not appear in the original problem.

Degree of recognition: International
Links:
http://meetings.siam.org/sess/dsp_programsess.cfm?SESSIONCODE=61861 (Minisymposium description)

**Related event**

**SIAM Conference on Applications of Dynamical Systems 2017**
21/05/2017 → 26/05/2017
Snowbird, United States
Activity: Attending an event › Participating in or organising a conference

**Applying LCA in decision making- the need and the future perspective**
Period: 10 May 2017
Yan Dong (Speaker)
Simona Miraglia (Other)
Stefano Manzo (Other)
Stylianos Georgiadis (Other)
Hjalte Jomo Danielsen Sarup (Other)
Elena Boriani (Other)
Tine Hald (Other)
Sebastian Thøns (Other)
Michael Zwicky Hauschild (Other)

Department of Management Engineering
Quantitative Sustainability Assessment
Centre for oil and gas – DTU
Transport DTU
Transport Modelling
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Department of Environmental Engineering
Urban Water Systems
National Food Institute
Research Group for Genomic Epidemiology
Department of Civil Engineering
Section for Structural Engineering

Documents:
AbstraApplying LCA in policy decision making_Final

Links:
https://brussels.setac.org/welcome/

**Related event**

**SETAC Europe: 27th Annual Meeting – Environmental Quality Through Transdisciplinary Collaboration**
07/05/2017 → 13/07/2017
Brussels, Belgium
Activity: Talks and presentations › Conference presentations

**SMATAD 2017**
Period: 8 May 2017 → 11 May 2100
Ignacio Blanco (Participant)
Juan Miguel Morales González (Organizer)

Department of Applied Mathematics and Computer Science
Dynamical Systems
There is nowadays a need for including sustainable considerations in the policy and decision making. Sound decision making requires evidence-based support, i.e. decision analysis to help decision makers in identifying the best alternative based on the associated impacts. Decision analysis includes four steps: 1) structure decision problem; 2) assess possible impacts associated with alternatives; 3) determine stakeholder preferences and 4) evaluate alternatives. Decision analysis can be performed applying different tools, such as cost-benefit analysis (CBA), risk assessment, and life cycle assessment (LCA).

LCA is a decision analysis tool that focuses on environmental impacts. One limit is that LCA is based on defined impact categories and therefore does not provide information for those impacts and consequences out of the LCA scope. However, the LCA framework closely follows the decision analysis scheme and has the potential to be integrated with other decision analysis tools to enhance their assessment of environmental impacts.

To understand why LCA is needed in the policy decision context, we looked into the decision support for policy in several disciplines. Taking sustainable transport policy as an example, the traditional decision analysis tool for choosing the best alternative is CBA. CBA mainly analyses socio-economic impacts, such as travel time savings and costs, while only some environmental impacts are considered; i.e. the damage costs of greenhouse gas emissions, particulate matters, SOx, NOx and noise. Therefore, current transport policy making rarely reflect a full environmental profile of the suggested alternatives. Making decisions based on incomplete information may lead to sub-optimal solutions, especially where the environment is a major concern. There is a growing attention of conducting LCA in transport. Some identified environmental hotspots, such as consumer and household behavior, which may be the focus for future policies. Others assess the environmental impacts associated with building infrastructures and vehicle use. These studies verify that LCA can successfully quantify the environmental profile of alternatives in transport policy, if the relevant physical changes, e.g. vehicle travel distance and new infrastructures, are well-defined. However, before integrating LCA with other decision analysis methods for decision support, the study system, objectives, scopes, evaluation metrics and uncertainty handling need to be aligned.
Degree of recognition: International
Links:
https://brussels.setac.org/

Related event

SETAC Europe: 27th Annual Meeting – Environmental Quality Through Transdisciplinary Collaboration
07/05/2017 → 13/07/2017
Brussels, Belgium
Activity: Talks and presentations › Conference presentations

Quantitative Measure of Optic Disc Drusen Location in Enhanced Depth Imaging Optical Coherence Tomography Scans
Period: 5 May 2017
Anne-Sofie Wessel Lindberg (Guest lecturer)
Department of Applied Mathematics and Computer Science
Image Analysis & Computer Graphics
Statistics and Data Analysis
Degree of recognition: International
Documents:
Final_poster_Arvo

Related event

Association for research in vision and ophthalmology
05/05/2017 → 11/05/2017
Baltimore, United States
Activity: Talks and presentations › Conference presentations

Computer Graphics Forum (Journal)
Period: 1 May 2017 → 1 May 2020
Jakob Andreas Bærentzen (Reviewer)
Department of Applied Mathematics and Computer Science
Image Analysis & Computer Graphics

Description
Associate Editor
Degree of recognition: International

Related journal

Computer Graphics Forum
0167-7055
Local database
Activity: Research › Journal editor

Chimera states-mythological monsters from mathsarise in the real world
Period: Apr 2017
Erik Andreas Martens (Guest lecturer)
Department of Applied Mathematics and Computer Science
Dynamical Systems

Description
Invited Lecture
Degree of recognition: International

Related external organisation
Making sense of Big Data
Period: 24 Apr 2017
Thomas Martini Jørgensen (Guest lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Centre for oil and gas – DTU

Description
Talk given at internal Digitalization workshop within Maersk Oil
Degree of recognition: Local

Related organisation
Making sense of Big Data
Jørgensen, T. M. (Guest lecturer)
24 Apr 2017
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Theriogenology (Journal)
Period: 6 Apr 2017
Anders Stockmarr (Reviewer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Degree of recognition: International

Related journal
Theriogenology
0093-691X
Central database
Activity: Research › Peer review of manuscripts

Burden of disease of barbecued meat - who's at risk?
Period: 31 Mar 2017
Lea Sletting Jakobsen (Guest lecturer)
Stylianos Georgiadis (Guest lecturer)
Bo Friis Nielsen (Guest lecturer)
Anders Stockmarr (Guest lecturer)
Elena Boriani (Guest lecturer)
Lene Duedahl-Olesen (Guest lecturer)
Tine Hald (Guest lecturer)
Sara Monteiro Pires (Guest lecturer)
National Food Institute
Research Group for Risk-Benefit
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Research Group for Genomic Epidemiology
Research Group for Analytical Food Chemistry
IC3 and IC4 Trains Under Risk of Blocking their Wheels - A Big Data Case Story

**Period:** 21 Mar 2017

Anders Stockmarr (Speaker)

Department of Applied Mathematics and Computer Science

Statistics and Data Analysis

DTU Executive School of Business

**Degree of recognition:** Local

**Documents:**

DTU Management 2103017

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**Visit from Antwerp Management School to DTU Business**

20/03/2017 → 22/03/2017

**Activity:** Talks and presentations › Conference presentations

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**Cities research for District Heating Innovation**

**Period:** 6 Mar 2017

Alfred Heller (Speaker)

Henrik Madsen (Speaker)

Centre for IT-Intelligent Energy Systems in Cities

Department of Civil Engineering

Department of Applied Mathematics and Computer Science

**Description**

Workshop on further development of district heatings after 4DH.

Henrik presented mathematical tools for district heating, and Alfred presented the Science Cloud for District Heating Innovation.

**Documents:**

Data Infrastruktur - Niras møde Århus marts 2017 - Alfred Heller

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**NIIRAS A/S**

Denmark

**Activity:** Talks and presentations › Conference presentations

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**Time Series Analysis (02417)**

**Period:** 17 Feb 2017

Anders Stockmarr (Speaker)

Department of Applied Mathematics and Computer Science

Statistics and Data Analysis

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**Related organisation**

**Time Series Analysis (02417)**

Stockmarr, A. (Speaker)

17 Feb 2017

Activity: Talks and presentations › Conference presentations
10th International Conference on Advanced Technologies and Treatments for Diabetes
Period: 15 Feb 2017 → 18 Feb 2017
Dimitri Boiroux (Participant)
Department of Applied Mathematics and Computer Science
Scientific Computing
Degree of recognition: International

Related event

10th International Conference on Advanced Technologies and Treatments for Diabetes
15/02/2017 → 18/02/2017
Paris, France
Activity: Attending an event › Participating in or organising a conference

Statistics
Period: 25 Jan 2017 → 26 Jan 2100
Anders Stockmarr (External examiner)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Description
Exam in statistics at the public health education programme, KU
Activity: Examinations and supervision › External examination

Statistical Genetics (02938)
Period: 6 Jan 2017 → 27 Jan 2017
Anders Stockmarr (Lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Description
Lectured by Anders Stockmarr
Related event

Statistical Genetics
06/01/2017 → 14/01/2017
Kgs. Lyngby, Denmark
Activity: Other

Statistical Genetics (02950)
Period: 6 Jan 2017 → 14 Jan 2017
Anders Stockmarr (Lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Related event

Statistical Genetics
06/01/2017 → 14/01/2017
Kgs. Lyngby, Denmark
Activity: Other

Precision Engineering (Journal)
Period: 2016 → …
Alessandro Stolfi (Reviewer)
Department of Applied Mathematics and Computer Science
Department of Mechanical Engineering
Manufacturing Engineering
Degree of recognition: International

Related journal

Precision Engineering
0141-6359
BFI (2018): BFI-level 1, Scopus rating (2017): CiteScore 2.79 SJR 0.98 SNIP 1.874, ISI indexed (2013): ISI indexed yes,
Web of Science (2018): Indexed yes
Central database
Activity: Research › Peer review of manuscripts

Sensors (Journal)
Period: 2016 → …
Alessandro Stolfi (Reviewer)
Department of Applied Mathematics and Computer Science
Department of Mechanical Engineering
Manufacturing Engineering

Related journal

Sensors
1424-8220
BFI (2018): BFI-level 2, Scopus rating (2017): CiteScore 3.23 SJR 0.584 SNIP 1.55, ISI indexed (2013): ISI indexed yes,
Web of Science (2018): Indexed yes
Indexed in DOAJ
Central database
Activity: Research › Peer review of manuscripts

Online Educa Berlin 2016
Period: 1 Dec 2016
Helle Rootzén (Speaker)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Related event

Online Educa Berlin 2016
30/11/2016 → 02/12/2016
Berlin, Germany
Activity: Talks and presentations › Conference presentations

Tidligere uheld på biogas- og renseanlæg, herunder danske
Period: 18 Nov 2016
Frank Huess Hedlund (Speaker)
Department of Applied Mathematics and Computer Science
Dynamical Systems
Statistics and Data Analysis

Related event

SEVESO-direktivet og sikkerhedsdokumenter til biogasanlæg
18/11/2016 → …
Making sense of big data for Produced Water Treatment
Period: 17 Nov 2016
Thomas Martini Jørgensen (Invited speaker)
Centre for oil and gas – DTU
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Documents: DHRTC-Technology-Conference.

Related event
DHRTC Technology Conference 2016
16/11/2016 → 17/12/2016
Helsingør, Denmark
Activity: Talks and presentations › Conference presentations

INFORMS Annual Meeting
Period: 13 Nov 2016 → 17 Nov 2016
Ignacio Blanco (Speaker)
Juan Miguel Morales González (Other)
Department of Applied Mathematics and Computer Science
Dynamical Systems
Description

Related event
INFORMS Nashville 2016 Annual Meeting: Fine Tuning Decisions in Music City
13/11/2016 → 17/11/2016
Nashville, United States
Activity: Talks and presentations › Conference presentations

Introduction to applied statistics and R for PhD students (02935)
Anders Stockmarr (Speaker)
Guillermina Eslava (Speaker)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Related organisation

Optimization challenges in the evolution of energy networks to smart cities.
Ignacio Blanco (Speaker)
Juan Miguel Morales González (Other)
Department of Applied Mathematics and Computer Science
Dynamical Systems

**Description**
Optimization challenges in the evolution of energy networks to smart cities.

**Related event**
**Optimization challenges in the evolution of energy networks to smart cities.**
27/10/2016 → 28/10/2016
Coimbra, Portugal
Activity: Talks and presentations › Conference presentations

**Optimization challenges in the evolution of energy networks to smart grids**
**Period:** 27 Oct 2016 → 28 Oct 2016
Giulia De Zotti (Speaker)
Department of Applied Mathematics and Computer Science

**Description**
Presentation about "Short-term Forecasting of Price-responsive Loads Using Inverse Optimization"

Workshop about optimization models and methods to address the challenges arising in the evolution of energy networks to smart grids.

**Related event**
**Optimization challenges in the evolution of energy networks to smart grids**
27/10/2016 → 28/10/2016
Coimbra, Portugal
Activity: Talks and presentations › Conference presentations

**Big data og glatte skinner**
**Period:** 11 Oct 2016
Anders Stockmarr (Invited speaker)
Statistics and Data Analysis
Department of Applied Mathematics and Computer Science

**Description**
*(in Danish)*

Documents:
Kollektiv Trafik Konferencen 11102016 ANST

**Related event**
**Kollektiv Trafik Konferencen 2016**
10/10/2016 → 11/10/2016
Korsør, Denmark
Activity: Talks and presentations › Conference presentations

**IC3 and IC4 Trains Under Risk of Blocking their Wheels - A Big Data Case story**
**Period:** 3 Oct 2016
Anders Stockmarr (Lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Documents:
Big Data Business Academy 03102016 ANST

**Related event**
Big Data Business Academy
03/10/2016 → 05/10/2016
Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

University of Virginia
Period: 1 Oct 2016 → 10 Dec 2016
Dimitri Boiroux (Visiting researcher)
Department of Applied Mathematics and Computer Science
Scientific Computing
Activity: Visiting an external institution › Visiting another research institution

MAS & HOL
Period: 28 Sep 2016
Anders Schlichtkrull (Participant)
Department of Applied Mathematics and Computer Science
Algorithms and Logic
Description
Formalization of Algorithms and Logical inference Systems in Proof Assistants
Talk "Formalization of Algorithms and Logical inference Systems in Proof Assistants"
Related event
MAS & HOL
28/09/2016 → …
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

International Workshop on Business Process Intelligence
Period: 19 Sep 2016
Andrea Burattin (Organizer)
Department of Applied Mathematics and Computer Science
Software and Process Engineering
Degree of recognition: International
Related event
International Workshop on Business Process Intelligence
19/09/2016 → 19/09/2016
Rio de Janeiro, Brazil
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Heidelberg Laureate Forum
Period: 18 Sep 2016 → 23 Sep 2016
Hugo Daniel dos Santos Macedo (Participant)
Department of Applied Mathematics and Computer Science
Software and Process Engineering
Description
Attended the 4th Heidelberg Laureate Forum
Related event
Heidelberg Laureate Forum
18/09/2016 → 23/09/2016
Activity: Attending an event › Participating in or organising a conference
Veterinary Journal (Journal)  
Period: 3 Sep 2016 → 17 Sep 2016  
Anders Stockmarr (Reviewer)  
Department of Applied Mathematics and Computer Science  
Statistics and Data Analysis  

Description  
The Veterinary Journal  
peer review of manuscript  

Related journal  
Veterinary Journal  
1090-0233  
BFI (2018): BFI-level 2, Scopus rating (2017): CiteScore 1.87 SJR 0.979 SNIP 1.22, ISI indexed (2013): ISI indexed yes,  
Web of Science (2018): Indexed yes  
Central database  
Activity: Research › Peer review of manuscripts  

Statistical Genetics (02586)  
Anders Stockmarr (Other)  
Department of Applied Mathematics and Computer Science  
Statistics and Data Analysis  

Description  
master level course  
Degree of recognition: Local  
Activity: Other  

Water permeability  
Anders Stockmarr (Consultant)  
Department of Applied Mathematics and Computer Science  
Statistics and Data Analysis  

Description  
External consultancy  

Related external organisation  
MBH-international A/S  
Allerød, Denmark  
Activity: Public and private sector consultancy › Consultancy  

Mathematics Working Group of the European Society for Engineering Education (External organisation)  
Mirza Karamehrmedovic (Participant)  
Department of Applied Mathematics and Computer Science  
Scientific Computing  
Neutrons and X-rays for Materials Physics  

Description  
National contact point for Denmark
Related external organisation

Mathematics Working Group of the European Society for Engineering Education
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Nordic Number Theory Network Days IV: On the limits of towers over finite fields
Period: 3 Jun 2016 → 4 Jun 2016
Nurdagül Anbar Meidl (Invited speaker)
Department of Applied Mathematics and Computer Science
Mathematics

Related event
Nordic Number Theory Network Days IV
03/06/2016 → 04/06/2016
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

Smart Energy and Stochastic Optimization
Period: 30 May 2016 → 2 Jun 2016
Giulia De Zotti (Participant)
Department of Applied Mathematics and Computer Science
Dynamical Systems

Description
International thematic week about stochastic optimization, decentralized optimization and their applications to the management of new energy systems.

Related event
Smart Energy and Stochastic Optimization
30/05/2016 → 02/06/2016
Paris, France
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

On curves over finite fields and their number of rational points
Period: 26 May 2016
Nurdagül Anbar Meidl (Lecturer)
Department of Applied Mathematics and Computer Science
Mathematics

Description
Sabancı University, İstanbul, Turkey

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

WikiCite 2016
Period: 25 May 2016 → 26 May 2016
Finn Årup Nielsen (Participant)
Department of Applied Mathematics and Computer Science
Cognitive Systems
**Description**
Participation in Wikicite 2016

**Related event**

**WikiCite 2016**
25/05/2016 → 26/05/2016
Berlin, Germany
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**BAOJ Pediatrics (Journal)**
Period: 20 May 2016
Anders Stockmarr (Reviewer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

**Related journal**

**BAOJ Pediatrics**
Local database
Activity: Research › Peer review of manuscripts

**Biology Letters (Journal)**
Period: 20 May 2016
Anders Stockmarr (Reviewer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

**Description**
Biology Letters

**Related journal**

**Biology Letters**
1744-9561
Central database
Activity: Research › Peer review of manuscripts

**Curves with many rational points**
Period: 18 May 2016 → 22 May 2016
Nurdagül Anbar Meidl (Invited speaker)
Department of Applied Mathematics and Computer Science
Mathematics

**Related event**

**Antalya Algebra Days XVIII**
19/05/2016 → 23/05/2016
İzmir, Turkey
Activity: Talks and presentations › Conference presentations

**Veterinary Journal (Journal)**
Period: 13 May 2016 → 20 May 2016
Anders Stockmarr (Reviewer)
Department of Applied Mathematics and Computer Science
Formalization of the Resolution Calculus for First-Order Logic

Speaker: Anders Schlichtkrull

Abstract: A formalization in Isabelle/HOL of the resolution calculus for first-order logic is presented. Its soundness and completeness are formally proven using the substitution lemma, semantic trees, Herbrand's theorem, and the lifting lemma. In contrast to previous formalizations of resolution, it considers first-order logic with full first-order terms, instead of the propositional case.

Talk "Formalization of the Resolution Calculus for First-Order Logic" at Club2 of the Chair for Logic and Verification at the Technical University of Munich
Statistics and Data Analysis

Related journal

Nutrition & Metabolism
Scopus rating (2017): CiteScore 3.61 SJR 1.528 SNIP 1.138, Web of Science (2018): Indexed yes
Indexed in DOAJ
Local database
Activity: Research › Peer review of manuscripts

Proof Assistants and Related Tools - The PART & PART 2 Projects 2016
Period: 20 Apr 2016
Anders Schlichtkrull (Participant)
Department of Applied Mathematics and Computer Science
Algorithms and Logic

Description
Jørgen Villadsen & Anders Schlichtkrull: Computer-Checked Logical Inference Systems
Talk "Computer-Checked Logical Inference Systems" at PART

Related event

Proof Assistants and Related Tools - The PART & PART 2 Projects 2016
20/04/2016 → 20/04/2016
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

HD-Tomo Days
Period: 6 Apr 2016 → 8 Apr 2016
Mirza Karamehmedovic (Participant)
Department of Applied Mathematics and Computer Science
Scientific Computing
Neutrons and X-rays for Materials Physics

Description
HD-Tomo Days

Related event

HD-Tomo Days
06/04/2016 → 08/04/2016
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising a conference

SIAM Conference on Uncertainty Quantification
Period: 5 Apr 2016 → 8 Apr 2016
Magnus Dam (Participant)
Department of Applied Mathematics and Computer Science
Mathematics
Plasma Physics and Fusion Energy

Description
Participation in conference

Related event

SIAM Conference on Uncertainty Quantification
Lausanne, Switzerland
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Notes on the computation of periodic orbits using Newton and Melnikov's method: Stroboscopic vs Poincaré map
Albert Granados (Lecturer)
Department of Applied Mathematics and Computer Science
Mathematics

Description
Lecture notes for the subject "Dynamical Systems " held at DTU.
Documents:
week9_notes
Links:
https://arxiv.org/abs/1610.03363 (Arxiv's link)

Related external organisation

Ecole Polytechnique Federale de Lausanne (EPFL)
Magnus Dam (Visiting researcher)
Department of Applied Mathematics and Computer Science
Mathematics
Plasma Physics and Fusion Energy

Description
Research Stay at EPFL
An external stay at the Mathematics Institute of Computational Science and Engineering (MATHICSE) at École Polytechnique Fédérale de Lausanne. Performed work on PhD project supervised by Professor Jan Hesthaven.

Introduction to applied statistics and R for PhD students (02935)
Anders Stockmarr (Lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Related external organisation

NordSecMob Network meeting (Event)
Period: 19 Feb 2016
Flemming Stassen (Reviewer)
Department of Applied Mathematics and Computer Science
Embedded Systems Engineering

Description
NordSecMob Network meeting
29 selection meeting
Related event

NordSecMob Network meeting 2016
19/02/2016 → …
Finland
Activity: Communication › Peer review of manuscripts

Inverse scattering problems in characterisation of nanomaterials
Period: 11 Feb 2016
Mirza Karamehmedovic (Invited speaker)
Department of Applied Mathematics and Computer Science
Scientific Computing
Neutrons and X-rays for Materials Physics

Description
Inverse scattering problems in characterisation of nanomaterials
Degree of recognition: International

Related event

Inverse scattering problems in characterisation of nanomaterials
11/02/2016 → …
Sarajevo, Bosnia and Herzegovina
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Formel Modellering og Verifikation af Jernbanekontrolsystemer: Et eksempel fra RobustRailS WP 4.1
Period: 3 Feb 2016
Anne Elisabeth Haxthausen (Invited speaker)
Department of Applied Mathematics and Computer Science
Software and Process Engineering

Description
Invited talk at the Inauguration of RailTech DTU, the Centre for Rail Technology

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Workshop on Finite Fields: Arcs, Curves and Bent Functions
Period: 1 Feb 2016 → 3 Feb 2016
Nurdagül Anbar Meidl (Speaker)
Department of Applied Mathematics and Computer Science
Mathematics

Description
A new tower meeting Zink's bound with good p-rank

Workshop on Finite Fields: Arcs, Curves and Bent Functions

Related event

Workshop on Finite Fields: Arcs, Curves and Bent Functions
01/02/2016 → 03/02/2016
İstanbul, Turkey
Activity: Talks and presentations › Conference presentations
Multivariate Time Series Estimation using marima
Period: 26 Jan 2016
Henrik Spliid (Speaker)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Related event
38. Symposium i Anvendt Statistik 2016
25/01/2016 → 27/01/2016
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

A new tower meeting Zink’s bound with good p-rank, Ankara, Turkey
Period: 23 Dec 2015
Nurdagül Anbar Meidl (Lecturer)
Mathematics
Department of Applied Mathematics and Computer Science

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Sikkerhed, sikring og sikkerhedskultur
Period: 14 Dec 2015
Frank Huess Hedlund (Speaker)
Department of Applied Mathematics and Computer Science
Dynamical Systems
Statistics and Data Analysis

Description
Fællesarrangement mellem IDA – SAM (selskab for arbejdsmiljø) og IDA – RISK (selskab for risikovurdering)
Ingeniørhuset, København

Sikkerhed, sikring og sikkerhedskultur,
Indlæg om sikkerhed og sikring, herunder præsentation af resultater fra opgave for EU kommissionen om sikring af
Seveso anlæg.
Documents:
Frank Hedlund IDA sikkerhed, sikring

Related event
Sikkerhed, sikring og sikkerhedskultur
14/12/2015 → 14/12/2015
Denmark
Activity: Talks and presentations › Conference presentations

Arithmetic Geometry: Explicit Methods and Applications
Period: 7 Dec 2015 → 11 Dec 2015
Nurdagül Anbar Meidl (Speaker)
Mathematics
Department of Applied Mathematics and Computer Science

Description
On the limits of a cubic tower

Arithmetic Geometry: Explicit Methods and Applications
1st Nordic Chapter Risk Conference
Period: 16 Nov 2015
Frank Huess Hedlund (Speaker)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Description
Failure to learn after accidents – the lamentable situation in Denmark

1st Nordic Chapter Risk Conference

Related event

1st Nordic Chapter Risk Conference: The Future of Risk Analysis in the Nordic Countries
16/11/2015 → 17/11/2015
Lund, Sweden
Activity: Talks and presentations › Conference presentations

Failure to learn after accidents – the lamentable situation in Denmark
Period: 16 Nov 2015
Frank Huess Hedlund (Speaker)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Description
Learning from own – and better, other people’s – past accidents and misfortune is an ancient accident prevention strategy. The benefits of such learning are obvious. What is not so obvious, however, is how to make this seemingly simple and straightforward idea work in practice. This presentation presents evidence in support of the view that such learning processes appear to be impeded, dysfunctional or entirely absent in Denmark. Two Danish accident cases in which major learning opportunities were foregone will be presented. The first case relates to a wood pellet facility, a sustainable renewable energy project, which experienced a devastating dust explosion. The accident was insufficiently investigated and root cause issues relating to principles of inherent safety were not identified. As a result, a repeat explosion took place eight years later. The case offers a textbook example of the truism that if accidents are not investigated, and root causes not identified, accidents recur. The second case (not presented). In both cases, significant sector-relevant learning opportunities were foregone. Indeed, the cases have slipped into oblivion. There is no useful information in open sources that could potentially prevent repeat occurrences elsewhere. Learning is absent.

Documents:
Hedlund - Lamentable situation DK

Related event

International Journal of Agricultural Sciences (Journal)
Period: 13 Nov 2015 → 19 Nov 2015
Anders Stockmarr (Reviewer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Related journal

**International Journal of Agricultural Sciences**

Local database
Activity: Research › Peer review of manuscripts

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**Somatic Cell Count in Milk from Dairy Cattle: The Dilution Effect Matters**

*Period: 7 Nov 2015*

Kaare Græsbøll (Speaker)
Department of Applied Mathematics and Computer Science
National Veterinary Institute
Section for Epidemiology
Documents:
Abstract

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**Related event**

**14th Conference of the International Society for Veterinary Epidemiology and Economics**

*03/11/2015 → 07/11/2015*

Mérida, Yucatan, Mexico
Activity: Talks and presentations › Conference presentations

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**Predicting the Future Average Production of a Dairy Cow**

*Period: 6 Nov 2015*

Kaare Græsbøll (Speaker)
Department of Applied Mathematics and Computer Science
National Veterinary Institute
Section for Epidemiology
Documents:
ISVEE FAP

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**Related event**

**14th Conference of the International Society for Veterinary Epidemiology and Economics**

*03/11/2015 → 07/11/2015*

Mérida, Yucatan, Mexico
Activity: Talks and presentations › Conference presentations

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**Veterinary Journal (Journal)**

*Period: 3 Nov 2015 → 5 Nov 2015*

Anders Stockmarr (Reviewer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

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**Related journal**

**Veterinary Journal**

1090-0233
Central database
Activity: Research › Peer review of manuscripts

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**Columbia University**

*Period: 1 Nov 2015 → 31 Jan 2016*

Helle Rootzén (Visiting researcher)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

**Description**
Visiting Professor
Activity: Visiting an external institution › Visiting another research institution

**World Customs Organization Technology and Innovation Forum**
*Period: 28 Oct 2015 → 29 Oct 2015*

Jens Kristian Munk (Participant)
Department of Micro- and Nanotechnology
Surface Engineering
Department of Applied Mathematics and Computer Science

**Description**
World Customs Organization Technology and Innovation Forum 2015

**Related event**

**World Customs Organization Technology and Innovation Forum**
*26/10/2015 → 29/10/2015*
Rotterdam, Netherlands
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Which priorities for a European policy on multimorbidity?**
*Period: 27 Oct 2015*

Anders Stockmarr (Participant)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

**Description**
participation in conference

Links:
http://ec.europa.eu/health/ageing/events/ev_20151027_en.htm (Conference home page)

**Related event**

**Which priorities for a European policy on multimorbidity?**
*27/10/2015 → 27/10/2015*
Brussels, Belgium
Activity: Attending an event › Participating in or organising a conference

**10 years of NordSecMob: The NordSecMob journey**
*Period: 17 Oct 2015*

Flemming Stassen (Invited speaker)
Department of Applied Mathematics and Computer Science
Embedded Systems Engineering

**Related event**

**NordSecMob Alumni Conference**
*17/10/2015 → 18/10/2015*
Stockholm, Sweden
Activity: Talks and presentations › Conference presentations
BSc program Strategic Analysis and Systems Design (Event)
Period: 6 Oct 2015 → …
Anders Stockmarr (Participant)
Department of Applied Mathematics and Computer Science
Department of Management Engineering

Description
Member of monitoring group

Member of DTU Internal monitoring group for the BSc program Strategic Analysis and Systems Design

Links:
http://www.dtu.dk/english/education/bachelor-beng-and-bsc/-bsc/strategic_analysis_and_systems_design (Strategic Analysis and Systems Design)

Related event

BSc program Strategic Analysis and Systems Design
06/10/2015 → …
Denmark
Activity: Membership › Membership of research networks or expert groups

University of Southern Denmark (External organisation)
Period: 29 Sep 2015 → 21 Dec 2015
Jens Gravesen (Participant)
Department of Applied Mathematics and Computer Science
Mathematics

Description
The Ph.D. committee of Konstantin Filonenko, University of Southern Denmark
Thesis: Mathematical modelling of the Purcell effect in plasmonic nanostructures

The Ph.D. committee of Konstantin Filonenko, University of Southern Denmark Thesis: Mathematical modelling of the Purcell effect in plasmonic nanostructures

Body type: Ph.D committee
Degree of recognition: International

Related external organisation

University of Southern Denmark
Odense, Denmark
Activity: Membership › Membership in review committee

Proof Assistants and Related Tools - The PART & PART 2 Projects 2015
Period: 23 Sep 2015
Anders Schlichtkrull (Participant)
Department of Applied Mathematics and Computer Science
Algorithms and Logic

Description
Formalization of Resolution Calculus in Isabelle

Talk "Formalization of Resolution Calculus in Isabelle" at PART

Related event

Proof Assistants and Related Tools - The PART & PART 2 Projects 2015
23/09/2015 → 24/09/2015
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.
On the p-rank of the tower of Bassa, Beelen, Garcia and Stichtenoth, Linz, Austria
Period: 22 Sep 2015
Nurdagül Anbar Meidl (Lecturer)
Department of Applied Mathematics and Computer Science

Description
Talk at Johann Radon Institute (RICAM), Linz, Austria

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

PLoS One (Journal)
Period: 21 Sep 2015 → 31 Dec 2015
Anders Stockmarr (Reviewer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Related journal
PLoS One
1932-6203
BFI (2018): BFI-level 1, Scopus rating (2017): CiteScore 3.01 SJR 1.164 SNIP 1.111, ISI indexed (2013): ISI indexed yes,
Web of Science (2018): Indexed yes
Indexed in DOAJ
Central database
Activity: Research › Peer review of manuscripts

CRIM-TRACK: Sensor system for detection of criminal chemical substances
Period: 20 Sep 2015
Jens Kristian Munk (Speaker)
Department of Micro- and Nanotechnology
Surface Engineering
Department of Applied Mathematics and Computer Science

Related event
SPIE Security + Defence 2015
21/09/2015 → 24/09/2015
Toulouse, France
Activity: Talks and presentations › Conference presentations

National Academy Science Letters (Journal)
Period: 16 Sep 2015 → 1 Oct 2015
Anders Stockmarr (Reviewer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Related journal
National Academy Science Letters
Local database
Activity: Research › Peer review of manuscripts
Segmentation and characterization of fibers
Period: 15 Sep 2015
Vedrana Andersen Dahl (Invited speaker)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Documents:
20150915_fibersegmentering

Related event

CT Scanning Erfa-gruppe
15/09/2015 → …
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

An Introduction to Multisensory Perception
Period: 8 Sep 2015
Tobias Andersen (Lecturer)
Department of Applied Mathematics and Computer Science
Cognitive Systems

Related external organisation

University of Copenhagen
Thorvaldensvej 40, DK-1871 Frederiksberg C, Copenhagen, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Dynamics Days Europe 2015
Period: 6 Sep 2015 → 10 Sep 2015
Magnus Dam (Participant)
Department of Applied Mathematics and Computer Science
Mathematics
Department of Physics
Plasma Physics and Fusion Energy
Description
Attended conference and presented a poster.
Documents:
TopologicalBifurcation poster - Magnus

Related event

Dynamics Days Europe 2015
06/09/2015 → 10/09/2015
Exeter, United Kingdom
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Statistical Quality Control (02413)
Period: 3 Sep 2015 → 9 Dec 2015
Anders Stockmarr (Lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Related event

Statistical Quality Control
02411 Statistical Design and Analysis of Experiments  
Period: 1 Sep 2015 → 31 Aug 2016  
Camilla Thyregod (Lecturer)  
Department of Applied Mathematics and Computer Science  
Statistics and Data Analysis  

Description  
Course lecturer  

Related organisation  

02411 Statistical Design and Analysis of Experiments  
Thyregod, C. (Lecturer)  
1 Sep 2015 → 31 Aug 2016  
Activity: Other  

International Workshop on Business Process Intelligence  
Period: 31 Aug 2015  
Andrea Burattin (Organizer)  
Department of Applied Mathematics and Computer Science  
Software and Process Engineering  
Degree of recognition: International  

Related event  

International Workshop on Business Process Intelligence  
31/08/2015 → 31/08/2015  
Innsbruck, Austria  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.  

Statistical Genetics (02586)  
Period: 31 Aug 2015 → 17 Dec 2015  
Anders Stockmarr (Lecturer)  
Department of Applied Mathematics and Computer Science  
Statistics and Data Analysis  

Description  
lectured by Anders Stockmarr  

Related event  

Statistical Genetics  
31/08/2015 → 17/12/2015  
Kgs. Lyngby, Denmark  
Activity: Other  

A Smart Mobile Lab-on-Chip-Based Medical Diagnostics System Architecture Designed For Evolvability  
Period: 27 Aug 2015  
François Patou (Speaker)  
Department of Micro- and Nanotechnology  
Nano Bio Integrated Systems  
Department of Applied Mathematics and Computer Science
**Description**
Oral presentation

**Related event**

**Digital Systems Design 2015: Special Session on Advanced Systems for Healthcare, Sports and Wellness**
26/08/2015 → 28/08/2015
Funchal, Portugal
Activity: Talks and presentations › Conference presentations

**Training School on Big Data and Data Warehousing**
Period: 27 Aug 2015
Ana Carolina Lopes Antunes (Participant)
Department of Applied Mathematics and Computer Science
National Veterinary Institute

**IC3 and IC4 Trains Under Risk of Blocking their Wheels: A case study on challenges when working with data from multiple databases**
Period: 26 Aug 2015
Anders Stockmarr (Invited speaker)
Statistics and Data Analysis
Department of Applied Mathematics and Computer Science
Documents:
Big Data Data Warehousing and Data Analytics ANST 2608_2015

**Big Data, Data Warehousing, and Data Analytics: EU-COST FAIM Training School**
26/08/2015 → 29/08/2015
Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

**Battling Bluetongue and Schmallenberg virus: Local scale behavior of transmitting vectors**
Period: 10 Aug 2015
Anders Stockmarr (Invited speaker)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
National Veterinary Institute
Section for Epidemiology
Documents:
Infectious Diseases 1008 2015 Anders Stockmarr
Abstract_Anders_Stockmarr_et_al_Infectious_Diseases_2015

**Related event**

**World Congress on Infectious Diseases 2015**
10/08/2015 → 12/08/2015
London, United Kingdom
Activity: Talks and presentations › Conference presentations
**Ph.D. School-Conference on “Mathematical Modeling of Complex Systems”**  
Magnus Dam (Participant)  
Department of Applied Mathematics and Computer Science  
Mathematics  
Department of Physics  
Plasma Physics and Fusion Energy

**Description**  
Course participation

**Related event**  
**Ph.D. School-Conference on “Mathematical Modeling of Complex Systems”**  
20/07/2014 → 30/07/2015  
Patras, Greece  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**CryptoForma Workshop**  
Period: 13 Jul 2015  
Omar Almousa (Speaker)  
Department of Applied Mathematics and Computer Science  
Language-Based Technology

**Description**  

**Related event**  
**CryptoForma Workshop**  
13/07/2015 → 14/07/2015  
Verona, Italy  
Activity: Talks and presentations › Conference presentations

**A Data-driven Bidding Model for a Cluster of Price-responsive Consumers of Electricity**  
Period: 12 Jul 2015 → 17 Jul 2015  
Juan Miguel Morales González (Invited speaker)  
Department of Applied Mathematics and Computer Science  
Dynamical Systems  
Centre for IT-Intelligent Energy Systems in Cities

**Related event**  
**22nd International Symposium on Mathematical Programming**  
12/07/2015 → 17/07/2015  
Pittsburgh, United States  
Activity: Talks and presentations › Conference presentations

**International Synthetic and Systems Biology Summer School**  
Period: 5 Jul 2015 → 9 Jul 2015  
Hasan Baig (Participant)  
Department of Applied Mathematics and Computer Science  
Embedded Systems Engineering
**Description**
Presented a poster in SSBSS (Synthetic and Systems Biology Summer School) 2015 in Taormina, Italy.

**Related event**

**International Synthetic and Systems Biology Summer School**
15/06/2014 → 19/06/2014
Taormina, Italy
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Daniella Kornelia Fußeder, TU Kaiserslautern (External organisation)**
Period: 1 Jul 2015 → 29 Oct 2015
Jens Gravesen (Participant)
Department of Applied Mathematics and Computer Science
Mathematics

**Description**
On the Ph.D. committee for Daniella Kornelia Fußeder, TU Kaiserslautern
Thesis: Isogeometric finite element methods for shape optimization

**Related external organisation**

**Montreal Clinical Research Institute (IRCM)**
Sabrina Lyngbye Wendt (Visiting researcher)
Department of Applied Mathematics and Computer Science
Scientific Computing

**Description**
External Research Stay
Activity: Visiting an external institution › Visiting another research institution

**Danish Exam - Novice Level**
Period: 10 Jun 2015
Sabrina Lyngbye Wendt (External examiner)
Department of Applied Mathematics and Computer Science
Scientific Computing

**Description**
Censor in oral and written test for Novice level.
Activity: Examinations and supervision › External examination

**ICES**
Period: 9 Jun 2015
Gilles Guillot (Participant)
Department of Applied Mathematics and Computer Science
Cognitive Systems
ICES working group on Spatial data

Description
ICES Working Group on Spatial Fisheries Data
08/06/2015 → 12/06/2015
Denmark, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Nordic Environmental Social Science Conference
Period: 9 Jun 2015 → 11 Jun 2015
Juan Miguel Morales González (Speaker)
Department of Applied Mathematics and Computer Science
Dynamical Systems
Centre for IT-Intelligent Energy Systems in Cities

Description
Speaker in the Nordic Environmental Social Science Conference

Related event
Nordic Environmental Social Science Conference: Energy Systems and Markets
09/06/2015 → 11/06/2015
Trondheim, Norway
Activity: Talks and presentations › Conference presentations

Introduction to applied statistics and R for PhD students (02935)
Period: 8 Jun 2015 → 26 Jun 2015
Anders Stockmarr (Lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Statistical Genetics (02938)
Period: 1 Jun 2015 → 19 Jun 2015
Anders Stockmarr (Lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Description
phd course
Lectured by Anders Stockmarr

Related event
Statistical Genetics
01/06/2015 → 19/06/2015
Kgs. Lyngby, Denmark
Activity: Other

Member of PhD committee (External organisation)
Period: May 2015
Gilles Guillot (Participant)
Department of Applied Mathematics and Computer Science

Cognitive Systems

**Description**

Member of PhD committee, mathematics department, Aalborg university

**Related external organisation**

**Member of PhD committee**

Activity: Membership › Membership in review committee

15th International Conference on Arithmetic, Geometry, Cryptography and Coding Theory

**Period:** 18 May 2015 → 22 May 2015

Nurdagül Anbar Meidl (Speaker)

Department of Applied Mathematics and Computer Science

Mathematics

**Description**

On idempotent quadratic functions and the weight distribution of subcodes of Reed-Muller codes

**Related event**

15th International Conference on Arithmetic, Geometry, Cryptography and Coding Theory

18/05/2015 → 22/05/2015

Marseille, France

Activity: Talks and presentations › Conference presentations

SIAM Conference on Applications of Dynamical Systems

**Period:** 17 May 2015 → 21 May 2015

Elena Bossolini (Participant)

Department of Applied Mathematics and Computer Science

Mathematics

**Description**

Slow-fast analysis of Earthquake Faulting

Description of the ongoing research on the model for earthquake faulting with the rate and state friction law.

Degree of recognition: International

Documents:

Poster_SIAMDS2015

**Related event**

SIAM Conference on Applications of Dynamical Systems

17/05/2015 → 21/05/2015

Snowbird, Utah, United States

Activity: Attending an event › Participating in or organising a conference

Statistical modelling for energy system planning

**Period:** 11 May 2015

Juan Miguel Morales González (Organizer)

Department of Applied Mathematics and Computer Science

Dynamical Systems

Centre for IT-Intelligent Energy Systems in Cities
**Related event**

*Statistical modelling for energy system planning*

- **Period:** 11/05/2015 → …
- **Location:** Kgs. Lyngby, Denmark
- **Activity:** Attending an event › Participating in or organising workshops, courses, seminars etc.

**Description**

“Statistical modelling for energy system planning” by Dr. Chris Dent, from the University of Durham

**Model and inference algorithm to combine genetic, phenotypic and geographic information**

- **Period:** 29 Apr 2015
- **Speaker:** Gilles Guillot (Invited speaker)
- **Location:** Department of Applied Mathematics and Computer Science
- **Cognitive Systems

**Description**

Recognition of evolutionary units (species, populations) requires integrating several kinds of data, such as genetic or phenotypic markers or spatial information in order to get a comprehensive view concerning the differentiation of the units. We propose a statistical model with a double original advantage: (i) it incorporates information about the spatial distribution of the samples, with the aim to increase inference power and to relate more explicitly observed patterns to geography and (ii) it allows one to analyze genetic and phenotypic data within a unified model and inference framework, thus opening the way to robust comparisons between markers and possibly combined analyses. We show from simulated data as well as real data that our method estimates parameters accurately and is an improvement over alternative approaches in many situations. The power of this method is exemplified using an intricate case of inter- and intraspecies differentiation based on an original data set of georeferenced genetic and morphometric markers obtained on Myodes voles from Sweden. A computer program is made available as an extension of the R package Geneland.

**Related event**

*Species delimitation in the age of genomics*

- **Period:** 28/04/2015 → 30/04/2015
- **Location:** Canberra, Australia
- **Activity:** Talks and presentations › Conference presentations

**University of Southern Denmark (External organisation)**

- **Period:** 23 Apr 2015 → 20 May 2015
- **Participant:** Jens Gravesen
- **Department:** Department of Applied Mathematics and Computer Science
- **Mathematics

**Description**

Assessment committee for position as Associate Professor in Applied Mathematics and Control, University of Southern Denmark

- **Related external organisation**
  - **University of Southern Denmark**
  - **Activity:** Membership › Membership in review committee

**Combining text mining and coordinate-based meta-analysis**

- **Period:** 21 Apr 2015
Finn Årup Nielsen (Invited speaker)
Department of Applied Mathematics and Computer Science
Cognitive Systems

Description
From invited talk given at Neuroimaging meta-analysis methods workshop in Paris and organized by Bertrand Thirion. 2015 April.
Documents:
NielsenF2015Combining_slides

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

9th International Workshop on Coding and Cryptography (WCC 2015)
Period: 13 Apr 2015 → 17 Apr 2015
Nurdagül Anbar Meidl (Speaker)
Department of Applied Mathematics and Computer Science
Mathematics

Description
On the nonlinearity of idempotent quadratic functions and the weight distribution of subcodes of Reed-Muller codes

Related event

9th International Workshop on Coding and Cryptography (WCC 2015)
13/04/2015 → 17/04/2015
Paris, France
Activity: Talks and presentations › Conference presentations

From non-smooth to smooth friction models, using regularisation and slow-fast theory
Elena Bossolini (Speaker)
Department of Applied Mathematics and Computer Science
Mathematics

Description
Presented the outline of the PhD project and preliminary results
Documents:
Poster_DCAMM2015

Related event

DCAMM 15th Internal Symposium
16/03/2015 → 18/03/2015
Horsens, Denmark
Activity: Talks and presentations › Conference presentations

Aerobiologica (Journal)
Anders Stockmarr (Reviewer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Related journal

Aerobiologica
Local database
Activity: Research › Peer review of manuscripts

**DI's arbejdsmiljøkonference 2015**
Period: 10 Mar 2015
Frank Huess Hedlund (Speaker)
Department of Applied Mathematics and Computer Science
Links:
http://di.dk/diuddannelse/Konferencer/Pages/DIsarbejdsmiljoeconference20151216-9723.aspx

**Related event**

**DI's arbejdsmiljøkonference 2015**
10/03/2015 → …
Odense, Denmark
Activity: Talks and presentations › Conference presentations

**KPI'er og strategisk arbejdsmiljøarbejde**
Period: 24 Feb 2015
Frank Huess Hedlund (Speaker)
Department of Applied Mathematics and Computer Science
Links:
https://ida.dk/event/312891

**Related event**

**KPI'er og strategisk arbejdsmiljøarbejde**
24/02/2015 → …
København, Denmark
Activity: Talks and presentations › Conference presentations

**February Fourier Talks**
Period: 23 Feb 2015 → 27 Feb 2015
Mads Sielemann Jakobsen (Participant)
Department of Applied Mathematics and Computer Science
Mathematics

**Description**
I presented a poster on "Generalized Translation Invariant Frames" at the February Fourier Talks at the Norbert Wiener Center for Applied Harmonic Analysis at the University of Maryland, College in the USA.

**Related event**

**February Fourier Talks**
23/02/2015 → 27/02/2015
College Park, Maryland, USA, United States
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Models and Modes of Audiovisual Integration**
Period: 18 Feb 2015
Tobias Andersen (Lecturer)
Department of Applied Mathematics and Computer Science
Cognitive Systems

**Description**
Invited lecture at Swansea University
Documents:
TobiasAndersenSwanseaTalk180215
Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Time Series Analysis (TSA): 02417
Period: 5 Feb 2015 → 30 Jun 2015
Anders Stockmarr (Lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Related event

Time Series Analysis
05/02/2015 → 30/06/2015
Kgs. Lyngby, Denmark
Activity: Other

NordSecMob Network meeting 2015 (Event)
Period: 29 Jan 2015 → 30 Jan 2015
Flemming Stassen (Reviewer)
Department of Applied Mathematics and Computer Science
Embedded Systems Engineering

Description
NordSecMob Network meeting

29 selection meeting

Related event

NordSecMob Network meeting 2015
29/01/2015 → …
Finland
Activity: Research › Peer review of manuscripts

The likelihood principle and its proof – a never-ending story…
Period: 27 Jan 2015
Thomas Martini Jørgensen (Lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Related event

37th Symposium i Anvendt Statistik 2015
26/01/2015 → 28/01/2015
Kongens Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Comparison of different methods for calculating usual intakes
Period: 26 Jan 2015 → 28 Jan 2015
Anja Pia Billoff-Jensen (Other)
Elisabeth Wreford Andersen (Speaker)
National Food Institute
Division of Risk Assessment and Nutrition
Description
Det 37. symposium i anvendt statistik 26.-28. januar 2015- Danmarks Tekniske Universitet

Related external organisation
Danmarks Statistik
Denmark
Activity: Talks and presentations › Conference presentations

Social inequality in obesity and the obesity epidemic for children: A review
Period: 26 Jan 2015
Anders Stockmarr (Speaker)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Documents:
Symposium i Anvendt Statistik 2015 ANST

Related event
37th Symposium i Anvendt Statistik 2015
26/01/2015 → 28/01/2015
Kongens Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

19th Nordic Process Control Workshop
Period: 16 Jan 2015
Dimitri Boiroux (Speaker)
Department of Applied Mathematics and Computer Science
Scientific Computing
Documents:
NPCW 2015 abstract

Related event
19th Nordic Process Control Workshop
13/01/2015 → 16/01/2015
Trondheim, Norway
Activity: Talks and presentations › Conference presentations

Sleep spindles: Breaking the methodological wall (Journal)
Period: 7 Jan 2015 → 1 Jun 2015
Sabrina Lyngbye Wendt (Reviewer)
Department of Applied Mathematics and Computer Science

Related journal
Sleep spindles: Breaking the methodological wall
Local database
Activity: Research › Peer review of manuscripts

10th Danish-French workshop in Spatial Statistics
Period: 2014
Gilles Guillot (Invited speaker)
Department of Applied Mathematics and Computer Science
Cognitive Systems

Description
10th Danish-French workshop in Spatial Statistics,

Related event
10th Danish-French workshop in Spatial Statistics
21/05/2014 → 23/05/2014
Aalborg, Denmark
Activity: Talks and presentations › Conference presentations

Global Energy Forecasting Competition 2014
Period: 2014 → …
Pierre Pinson (Participant)
Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets
Department of Applied Mathematics and Computer Science
Description
Global Energy Forecasting Competition 2014: GEFCom2014

Related event
Global Energy Forecasting Competition 2014
15/08/2015 → 15/12/2015
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

International Journal of Forecasting (Journal)
Period: 2014 → …
Pierre Pinson (Editor)
Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets
Department of Applied Mathematics and Computer Science
Related journal
International Journal of Forecasting
0169-2070
BFI (2018): BFI-level 2, Scopus rating (2017): CiteScore 2.65 SJR 1.879 SNIP 1.737, ISI indexed (2013): ISI indexed yes,
Web of Science (2018): Indexed yes
Central database
Activity: Research › Journal editor

Optical Coherence Tomography for biomedical imaging
Period: 12 Dec 2014
Thomas Martini Jørgensen (Lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Related event
Workshop on the use of large facilities for biomedical research: Copenhagen Imaging network
12/12/2014 → …
Optical Coherence Tomography for biomedical imaging
Period: 12 Dec 2014
Thomas Martini Jørgensen (Lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Description
Workshop held by the Copenhagen Imaging Network (CIN) on the use of large facilities for biomedical research, taking place on December 12th from 9.00 - 12.00. The venue is Copenhagen Admiral Hotel, Tolbodgade 24-28, 1253 Copenhagen.

Related event
Workshop on the use of large facilities for biomedical research: Copenhagen imaging network
12/12/2014 → …
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

Assessment committee PhD Scholarships, DTU compute (External organisation)
Period: 10 Nov 2014
Gilles Guillot (Participant)
Department of Applied Mathematics and Computer Science
Cognitive Systems

Related external organisation
Assessment committee PhD Scholarships, DTU compute
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Modeling categorial audiovisual perception: pitfalls and solutions
Period: 7 Nov 2014
Tobias Andersen (Lecturer)
Department of Applied Mathematics and Computer Science
Cognitive Systems

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Introduction to applied statistics and R for PhD students (02935)
Period: 3 Nov 2014 → 21 Nov 2014
Anders Stockmarr (Lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Workshop on effects of global change on species’ range fluctuations using intra-specific genetic variation in both phenotypic and molecular data
Related event

Workshop on effects of global change on species' range fluctuations using intra-specific genetic variation in both phenotypic and molecular data
23/10/2014 → 24/10/2014
Seville, Spain
Activity: Talks and presentations › Conference presentations

Mysterious fires in Moirans-en-Montagne checkmated the town's crisis management team: Theme: Crisis management
Period: 22 Oct 2014
Frank Hues Hedlund (Speaker)
Department of Applied Mathematics and Computer Science

Description
Kompetencedage autumn 2014. The biannual symposium "Kompetence Days" are organized by Samtænkning, a unit under the Ministry of Defence (Denmark). (www.samtaenkning.dk)
Documents:
Program for kompetenceudviklingsdage på Kastellet 22 og 23 oktober 2014

Related event

Kompetencedage efterår 2014: Tema: Krisestyring
22/10/2014 → 23/10/2014
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

Doctoral school course: Computational Harmonic Analysis - with applications
Mads Sielemann Jakobsen (Participant)
Department of Applied Mathematics and Computer Science
Mathematics

Description
Doctoral school with lectures, exercises and poster session at the CIRM in Marseille.

Related event

Doctoral school course: Computational Harmonic Analysis - with applications
20/10/2014 → 24/10/2014
Marseille, France
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Layered Surface Detection in Micro-CT Tetra Pak Data
Period: 7 Oct 2014
Vedrana Andersen Dahl (Invited speaker)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Documents:
ERFA_meeting_20141007_removed

Related event
MEK/Compute seminar
Period: 3 Oct 2014
Vedrana Andersen Dahl (Speaker)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Description
Surface Detection and Segmentation
Documents:
VAND_MEK
Related event
MEK/Compute seminar
03/10/2014 → …
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Advances in Architectural Geometry 2014
Period: 18 Sep 2014 → 21 Sep 2014
Toke Bjerge Nørbjerg (Participant)
Department of Applied Mathematics and Computer Science
Mathematics
Description
Participation in conference and presenting poster
Advances in Architectural Geometry conference
Documents:
AAGposter
Links:
http://www.architecturalgeometry.org/aag14/ (Conference homepage)
Related event
Advances in Architectural Geometry 2014
18/09/2014 → 21/09/2014
London, United Kingdom
Activity: Attending an event › Participating in or organising a conference

Technische Universität Graz
Period: 13 Sep 2014 → 13 Feb 2015
Toke Bjarne Nørbjerg (Visiting researcher)
Department of Applied Mathematics and Computer Science
Mathematics
Description
PhD research stay at the Institute of Geometry at TU Graz
Activity: Visiting an external institution › Visiting another research institution

Occupational health and safety management audit systems – developments, challenges and perspectives
Period: 10 Sep 2014
Frank Huess Hedlund (Speaker)
Related event

53rd Annual Occupational Risk Management Conference and Exhibition
09/09/2014 → 12/09/2014
South Africa
Activity: Talks and presentations › Conference presentations

National Academy Science Letters (Journal)
Period: 9 Sep 2014 → 23 Sep 2014
Anders Stockmarr (Reviewer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Related journal

National Academy Science Letters
Local database
Activity: Research › Peer review of manuscripts

An Introduction to Multisensory Perception
Period: 2 Sep 2014
Tobias Andersen (Lecturer)
Department of Applied Mathematics and Computer Science
Cognitive Systems

Related external organisation

University of Copenhagen
Thorvaldsensvej 40, DK-1871 Frederiksberg C, Copenhagen, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Statistical Genetics
Period: 1 Sep 2014 → 9 Dec 2014
Anders Stockmarr (Lecturer)
Department of Systems Biology
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Description
Lectured by Andres Stockmarr

Related event

Statistical Genetics
01/09/2014 → 09/12/2014
Kgs. Lyngby, Denmark
Activity: Other

36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society
Lærke Karen Krohne (Participant)
Department of Applied Mathematics and Computer Science
Cognitive Systems

Related event

36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society
26/08/2014 → 30/08/2014
Chicago, IL, United States
Activity: Attending an event › Participating in or organising a conference

51st Culham Plasma Physics Summer School
Magnus Dam (Participant)
Department of Applied Mathematics and Computer Science
Mathematics
Department of Physics
Plasma Physics and Fusion Energy

Description
Presented a poster.
Documents:
LH transition poster by M Dam (2014)

Related event

51st Culham Plasma Physics Summer School
14/07/2014 → 25/07/2014
Abingdon, Oxfordshire, United Kingdom
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Erhvervs- og Vækstministeriet (External organisation)
Period: 1 Jul 2014 → 30 Jun 2019
Flemming Stassen (Participant)
Department of Applied Mathematics and Computer Science
Embedded Systems Engineering

Description
Appeal Board of Patents and Trademarks
Technical reviewer (reappointment)
Body type: Appeal Board
Links:
http://www.pvanke.dk/pvanke/

Related external organisation

Erhvervs- og Vækstministeriet
Slotholmsgade 10-12, 1216, København K, Denmark
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Early Maximum-Likelihood Estimation as a model of audiovisual integration of speech
Period: 11 Jun 2014
Tobias Andersen (Lecturer)
Department of Applied Mathematics and Computer Science
Cognitive Systems

Related event

15th International Multisensory Research Forum
11/06/2014 → 14/06/2014
Amsterdam, Netherlands
Activity: Talks and presentations › Conference presentations

Weather Intelligence for Renewable Urban Areas
Period: 2 Jun 2014 → 3 Jun 2014
Anna Maria Sempreviva (Organizer)
Meteorology
Department of Wind Energy
Department of Informatics and Mathematical Modeling
Description
COST WIRE and CITIES WORKSHOP,
Documents:
Participants & Programme 29052014
Links:
http://www.wire1002.ch/ (COST ACTION E1002 Weather Intelligence for Renewable Energy)

Related event

Weather Intelligence for Renewable Urban Areas
02/06/2014 → 03/06/2014
Roskilde, Denmark
Activity: Attending an event › Participating in or organising a conference

Introduction to applied statistics and R for PhD students (02935)
Period: 21 May 2014 → 9 Jun 2014
Anders Stockmarr (Lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Lecture
Period: Apr 2014
Gilles Guillot (Lecturer)
Department of Applied Mathematics and Computer Science
Cognitive Systems

Related event

PhD course 2014: Institute Gulbenkian
17/03/2014 → 22/11/2014
Lisbon, Portugal
Activity: Talks and presentations › Conference presentations
Seminar of the Department of Biology
Period: Apr 2014
Gilles Guillot (Participant)
Department of Applied Mathematics and Computer Science
Cognitive Systems

Description
Seminar at the University of Bern

Related event
Seminar of the Department of Biology
07/04/2014 → 10/04/2014
Berne, Switzerland
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Programming in R
Period: 30 Apr 2014 → 2 May 2014
Anders Stockmarr (Participant)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Description
Continuing education course lectured by Anders Stockmarr and Kasper Kristensen

Related external organisation
Amadeus Scandinavia
Copenhagen, Denmark
Activity: Other

17th International Conference on Artificial Intelligence and Statistics
Sofie Therese Hansen (Participant)
Department of Applied Mathematics and Computer Science
Cognitive Systems

Description
Poster at 17th International Conference on Artificial Intelligence and Statistics
Documents:
poster_SofieAISTATS

Related event
17th International Conference on Artificial Intelligence and Statistics
22/04/2014 → 25/04/2014
Reykjavik, Iceland
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

National Academy Science Letters (Journal)
Period: 9 Apr 2014 → 13 May 2014
Anders Stockmarr (Reviewer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Related journal
Programming in R
Anders Stockmarr (Lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Description
3 day intensive course.
Course lectured by Anders Stockmarr and Kasper Kristensen.
Related event
Course: Programming in R
24/03/2014 → 26/03/2014
Lyngby, Denmark
Activity: Other

Sleep spindle scoring: performance of humans versus machines
Period: 21 Mar 2014
Sabrina Lyngbye Wendt (Speaker)
Department of Electrical Engineering
Department of Applied Mathematics and Computer Science
Links:
http://www.clinph-journal.com/article/S1388-2457(14)50141-1/abstract
http://dx.doi.org/10.1016/S1388-2457(14)50141-1
Related event
30th International Congress of Clinical Neurophysiology
19/03/2014 → 23/03/2014
Berlin, Germany
Activity: Talks and presentations › Conference presentations

Inverse scattering: from formulation to application
Period: 10 Mar 2014
Mirza Karamehmedovic (Invited speaker)
Department of Applied Mathematics and Computer Science
Scientific Computing
Department of Physics
Neutrons and X-rays for Materials Physics
Related event
Lecture at International University of Sarajevo
10/03/2014 → …
Sarajevo, Bosnia and Herzegovina
Activity: Talks and presentations › Conference presentations

Programming in R
Period: 4 Feb 2014 → 6 Feb 2014
Anders Stockmarr (Lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Description
3 day intensive course.

Course lectured by Anders Stockmarr and Kasper Kristensen.

Related event
Course: Programming in R
04/02/2014 → 06/02/2014
Denmark
Activity: Other

NordSecMob Network meeting 2014 (Event)
Period: 29 Jan 2014 → 30 Jan 2014
Flemming Stassen (Reviewer)
Department of Applied Mathematics and Computer Science
Embedded Systems Engineering

Description
NordSecMob Network meeting

27 selection meeting.

Related event
NordSecMob Network meeting 2014
29/01/2014 → …
Finland
Activity: Research › Peer review of manuscripts

Computational Models of Attention and Perception
Period: 28 Jan 2014
Tobias Andersen (Lecturer)
Department of Applied Mathematics and Computer Science
Cognitive Systems

Description
Neuroscience Seminar Series, Department of Experimental Psychology, University of Oxford

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Image reconstruction and analysis workshop
Period: 28 Jan 2014
Vedrana Andersen Dahl (Speaker)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Description
Two segmentation methods: 1) multiphase image segmentation using the deformable simplicial complex method, and 2) volumetric segmentation using mesh-based optimal graph search

Documents:
segmentation_slides

Related event

Image reconstruction and analysis workshop
28/01/2014 → 28/01/2014
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

Symposium i Anvendt Statistik
Period: 28 Jan 2014
Anders Stockmarr (Speaker)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Description
IC3 and IC4 Trains at risk for Blocking Their Wheels
Documents:
Symposium i Anvendt Statistik 28012014 ANST version 2

Related event

Symposium i Anvendt Statistik 2014
27/01/2014 → 29/03/2014
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

National Academy Science Letters (Journal)
Period: 25 Jan 2014 → 8 Feb 2014
Anders Stockmarr (Reviewer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Related journal

National Academy Science Letters
Local database
Activity: Research › Peer review of manuscripts

Adaptivity Framework: libpappadapt
Period: 22 Jan 2014
Lars Frydendal Bonnichsen (Speaker)
Department of Applied Mathematics and Computer Science
Language-Based Technology
Embedded Systems Engineering

Description
Præsentation af adaptivity biblioteket libpappadapt udviklet i PaPP projektet

PaPP tutorial presentation ved HiPEAC’14, se: http://www.hipeac.net/conference/vienna/tutorial/papp
Documents:
PaPP_Adaptivity_0.50_speed

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations
**NordSecMob Winter School on Innovation**  
Period: 6 Jan 2014 → 11 Jan 2014  
Flemming Stassen (Organizer)  
Department of Applied Mathematics and Computer Science  
Embedded Systems Engineering

**Description**  
Winter school for NordSecMob students, PhDs and Academics

NordSecMob Winter School on Innovation  
Documents:  
NSM14WS - Programme

**Related event**

**NordSecMob Winter School on Innovation: Security and Mobile Computing**  
06/01/2014 → 07/03/2014  
Kgs. Lyngby, Denmark  
Activity: Attending an event › Participating in or organising a conference

**Journal of the Royal Statistical Society (Journal)**  
Period: 1 Jan 2014 → 31 Dec 2014  
Gilles Guillot (Editor)  
Department of Applied Mathematics and Computer Science  
Cognitive Systems

**Description**  
Associate Editor, series A

**Related journal**

**Journal of the Royal Statistical Society**  
Local database  
Activity: Research › Journal editor

**Member of the Editorial Board Population Ecology (External organisation)**  
Period: 1 Jan 2014 → 31 Dec 2014  
Gilles Guillot (Participant)  
Department of Applied Mathematics and Computer Science  
Cognitive Systems

**Description**  
Body type: Journal

**Related external organisation**

**Member of the Editorial Board Population Ecology**  
Activity: Membership › Board duties in companies, associations, or public organisations

**Discrimination ability of the Energy score(s)**  
Period: 2013  
Pierre Pinson (Lecturer)  
Department of Electrical Engineering  
Center for Electric Power and Energy  
Department of Applied Mathematics and Computer Science
Description
Invited seminar at University of Heidelberg, Institute of Applied Mathematics, workshop on "Evaluation of multivariate probabilistic forecasts"

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Prevoir l'électricité produite par nos énergies renouvelables
Period: 2013
Pierre Pinson (Participant)

Department of Applied Mathematics and Computer Science
Department of Electrical Engineering
Center for Electric Power and Energy

Description
Broad-audience short letter (in French), for the French edition of Mathematics for Planet Earth (Mathematiques de la planete Terre), "Un jour, une breve", online at mpt2013.fr
Activity: Other

Rendre la consommation d'électricité plus flexible et controlable
Period: 2013
Pierre Pinson (Participant)

Department of Electrical Engineering
Center for Electric Power and Energy
Department of Applied Mathematics and Computer Science

Description
Broad-audience short letter (in French), for the French edition of Mathematics for Planet Earth (Mathematiques de la planete Terre), "Un jour, une breve", online at mpt2013.fr
Activity: Other

Renewable energy forecasts ought to be probabilistic!
Period: 2013
Pierre Pinson (Lecturer)

Department of Applied Mathematics and Computer Science
Department of Electrical Engineering
Center for Electric Power and Energy

Description
Invited lecture at "WIPFOR - Forecasting for the energy industry", Paris, France

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Renewables in electricity markets: Stochastic modelling and optimization
Period: 2013
Pierre Pinson (Lecturer)

Department of Applied Mathematics and Computer Science
Department of Electrical Engineering
Center for Electric Power and Energy
**Stochastic power generation from renewables: forecasting and optimization challenges for its optimal integration.**

*Period: 2013

Pierre Pinson (Lecturer)

Department of Applied Mathematics and Computer Science
Department of Electrical Engineering
Center for Electric Power and Energy

**The value of probabilistic information for energy applications - from theory to reality.**

*Period: 2013

Pierre Pinson (Lecturer)

Department of Electrical Engineering
Center for Electric Power and Energy
Department of Applied Mathematics and Computer Science

**Which distance measure is best for training and testing protein pair potentials?**

*Period: 3 Dec 2013

Peter Røgen (Lecturer)

Department of Applied Mathematics and Computer Science

Scientific Computing

Documents: abstractCarlsenRoegenKoehl2

**Arieties of cross-modal interactions and multi-sensory integration effects: Invited lecture at Otto-von-Guericke-Universität Magdeburg, Germany**

*Period: 29 Nov 2013

Tobias Andersen (Lecturer)
Description
When two or more senses provide information about a single attribute of the environment the brain can integrate information across the senses in a process of multisensory integration. This effect is particularly striking when it influences categorical judgments as in the McGurk illusion where an acoustic speech segment, which is clearly perceived as /ba/ can be perceived as /da/ when dubbed onto a video of a talker saying /ga/. In addition to multisensory integration, the senses influence each other in a number of ways. Information in one sensory modality can, for example, guide attention in another sensory modality. In this presentation I will go through a number of studies of audiovisual perception with categorical judgments. I will discuss how experimental design and computational modelling can help tease apart some of the many varieties of multisensory integration and cross-modal interactions.

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

SIAM conference on Geometric and Physical Modeling
Period: 12 Nov 2013 → 14 Nov 2013
Toke Bjarne Nørbjerg (Participant)
Department of Applied Mathematics and Computer Science
Mathematics

Description
Participation in conference and contribution to poster session

SIAM conference on Geometric and Physical Modeling
Documents:
Poster_for_SIAM_conference
Links:
http://www.siam.org/meetings/gdspm13/ (Conference homepage)

Related event
SIAM conference on Geometric and Physical Modeling
11/11/2013 → 14/11/2013
Denver, Colorado, United States
Activity: Attending an event › Participating in or organising a conference

ASME 2013 Rail Transportation Division
Daniele Bigoni (Speaker)
Department of Applied Mathematics and Computer Science
Scientific Computing

Description
Participation and presentation of a paper by the title: "Modern uncertainty quantification methods in railroad vehicle dynamics".
Documents:
Bigoni, Engsig-Karup, True - 2013 - Modern Uncertainty Quantification Methods in Railroad Vehicle Dynamics

Related event
ASME 2013 Rail Transportation Division Fall Technical Conference
15/10/2013 → 17/10/2013
Altoona, PA, United States
Activity: Talks and presentations › Conference presentations
**Design of Experiments**  
Period: Sep 2013 → …  
Camilla Thyregod (Lecturer)  
Department of Applied Mathematics and Computer Science  
Statistics and Data Analysis  

**Description**  
3 day course  
Activity: Other

**An Introduction to Multisensory Perception**  
Period: 9 Sep 2013  
Tobias Andersen (Guest lecturer)  
Department of Applied Mathematics and Computer Science  
Cognitive Systems  

**Description**  
Guest-lecture.

**Related external organisation**  
**University of Copenhagen**  
Thorvaldsensvej 40, DK-1871 Frederiksberg C, Copenhagen, Denmark  
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

**Statistical Genetics**  
Period: 2 Sep 2013 → 10 Dec 2013  
Anders Stockmarr (Lecturer)  
Department of Applied Mathematics and Computer Science  
Statistics and Data Analysis  
Center for Biological Sequence Analysis  

**Description**  
13 week course.

**Related event**  
**Statistical Genetics**  
02/09/2013 → 10/12/2013  
Lyngby, Denmark  
Activity: Talks and presentations › Conference presentations

**Statistical Genetics (02586)**  
Period: 2 Sep 2013 → 9 Dec 2013  
Anders Stockmarr (Other)  
Department of Applied Mathematics and Computer Science  
Statistics and Data Analysis  
Degree of recognition: Local  
Activity: Other

**Past explosive outbursts of entrapped carbon dioxide in salt mines provide a new perspective on the hazards of carbon dioxide.**  
Frank Huess Hedlund (Speaker)  
Department of Applied Mathematics and Computer Science
ABSTRACT: This paper reports on a source of past carbon dioxide accidents which so far has only been sporadically mentioned in the literature. Violent and highly destructive outbursts of hundreds of tons of CO2 occurred regularly, if not routinely, in the now closed salt mines of the former DDR. The Menzengraben mine experienced an extreme outburst in 1953, possibly involving a several thousand tons of carbon dioxide. This source of accidents fills an important gap in the available carbon dioxide accident history and may provide a unique empirical perspective on the hazards of handling very large amounts of CO2.

Related event

4th International Conference on Risk Analysis and Crisis Response: Intelligent Systems and Decision Making for Risk Analysis and Crisis Response
27/08/2013 → 29/08/2013
Istanbul, Turkey
Activity: Talks and presentations › Conference presentations

Frank Huess Hedlund (Speaker)
Department of Applied Mathematics and Computer Science

ABSTRACT: The paper examines recent evidence from Denmark and abroad with climate change projects that aim to reduce global carbon dioxide emissions by converting coal fired thermal power plants to solid biomass fuel. The paper argues that projects appear to be pursued narrow-mindedly with insufficient attention paid to safety and points to evidence of media-shifting - that the 'resolution' of a problem within the environmental domain creates a new problem in the workplace safety domain. The paper argues that biomass pellets qualify as an emerging risk for which proper control strategies have yet to be developed.

co-author: John Astad, Combustible Dust Institute, USA

Related event

4th International Conference on Risk Analysis and Crisis Response: Intelligent Systems and Decision Making for Risk Analysis and Crisis Response
27/08/2013 → 29/08/2013
Istanbul, Turkey
Activity: Talks and presentations › Conference presentations

23rd Symposium on Dynamics of Vehicles on Roads and Tracks (IAVSD 2013)
Period: 19 Aug 2013 → 23 Aug 2013
Daniele Bigoni (Speaker)
Department of Applied Mathematics and Computer Science
Scientific Computing

ABSTRACT: Participation and presentation of a paper by with title "SENSITIVITY ANALYSIS OF THE CRITICAL SPEED IN RAILWAY VEHICLE DYNAMICS".

Documents:
Bigoni, True, Engsøg-Karup - 2013 - Sensitivity Analysis of the critical speed in railway vehicle dynamics

Related event

23rd Symposium on Dynamics of Vehicles on Roads and Tracks (IAVSD 2013)
19/08/2013 → 23/08/2013
Qingdao, China
Activity: Talks and presentations › Conference presentations

Estimating the phylogenetic history for two related populations A Hidden Markov Model approach to finding phylogenetic trees: A Hidden Markov Model approach to finding phylogenetic trees
Period: Jul 2013
Gilles Guillot (Internal examiner)
Cognitive Systems
Department of Applied Mathematics and Computer Science

Description
Master thesis
Activity: Examinations and supervision › Internal examination

21st Annual International Conference on Intelligent Systems for Molecular Biology | 12th European Conference on Computational Biology
Period: 19 Jul 2013 → 23 Jul 2013
Martin Carlsen (Participant)
Department of Applied Mathematics and Computer Science
Scientific Computing

Description
Poster: On optimal metric training and testing of protein residue pair potentials

Related event
21st Annual International Conference on Intelligent Systems for Molecular Biology | 12th European Conference on Computational Biology
19/07/2013 → 23/07/2013
Berlin, Germany
Activity: Attending an event › Participating in or organising a conference

Investigating the use of stochastic forecast for RTC of urban drainage systems
Period: 25 Jun 2013
Roland Löwe (Lecturer)
Department of Applied Mathematics and Computer Science
Dynamical Systems
Urban Water Engineering

Related event
8th International Conference on Planning and Technologies for Sustainable Urban Water Management
23/06/2013 → 27/06/2013
Lyon, France
Activity: Talks and presentations › Conference presentations

Universiti Teknologi Malaysia
Period: 30 May 2013 → 29 Aug 2013
Francesc/François Antón Castro (Visiting researcher)
Department of Informatics and Mathematical Modeling
National Space Institute
Geodesy

Description
Visiting Full Professor

3D GIS Research Group at the Faculty of Geoinformation and Real Estate, UTM.
Activity: Visiting an external institution › Visiting another research institution

Light Scattering
Period: 27 May 2013 → 28 May 2013
Mirza Karamehmedovic (Participant)
Department of Applied Mathematics and Computer Science
Scientific Computing
Department of Physics

Description
1) Karamehmedović, M., A sparse numerical model for optical characterisation of nanoparticles on rough surfaces
2) Thomas, S., Matyssek, C., Hergert, W., Kiewidt, L., Karamehmedović, M., and Wriedt, T., Optimization of plasmonic nanostructures excited by light or electron beams: A Generalized Multiparticle Mie Solution study

Related event
Light Scattering: Simulation and inversion
27/05/2013 → 28/05/2013
Bremen, Germany
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Emerging risks from fires and explosions in solid biofuels - some evidence from Denmark: COWI/DTU
Period: 21 May 2013
Frank Huess Hedlund (Speaker)
Department of Applied Mathematics and Computer Science
Documents:
Hedlund_Stuttgart_rev1.pdf

Related event
5th iNTeg-Risk Conference: Risk Screening - Horizon 2020: From iNTeg-Risk to the E2R2 - European Emerging Risk Radar
21/05/2013 → 22/05/2013
Stuttgart, Germany
Activity: Talks and presentations › Conference presentations

University of California at Davis
Period: 21 Apr 2013 → 29 Apr 2013
Martin Carlsen (Visiting researcher)
Scientific Computing
Department of Applied Mathematics and Computer Science

Description
Forskningsophold i udlandet: Vejledelse af professor Patrice Koehl
Activity: Visiting an external institution › Visiting another research institution

Uncertainty in Reservoir Characterization
Period: 18 Apr 2013 → 19 Apr 2013
Daniele Bigoni (Speaker)
Department of Applied Mathematics and Computer Science
Scientific Computing

Description
Presentation with title: "Spectral Methods for Uncertainty Quantification".

Related event
Uncertainty in Reservoir Characterization
18/04/2013 → 19/04/2013
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations
Danvak Dagen 2013

Period: 10 Apr 2013

Tobias Gybel Hovgaard (Invited speaker)
Department of Applied Mathematics and Computer Science
Scientific Computing
Department of Electrical Engineering
Automation and Control

Description
Presentation given at "Danvak Dagen 2013" Invited talk after receiving "Prof. P.Ole Fangers Forskningslegat 2013".

Documents:
PDF

Related event

Danvak Dagen 2013
10/04/2013 → …
København, Denmark
Activity: Talks and presentations › Conference presentations

PMWS development in pigs from affected farms in Spain and Denmark
Period: 18 Mar 2013
Anders Stockmarr (Invited speaker)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Documents:
Hangzhou 18012013 ANST

Related event

BIT's 5th Annual World Congress of Vaccine
18/03/2013 → 20/03/2013
Hangzhou, China
Activity: Talks and presentations › Conference presentations

Ude af øje, ude af sind, ude af kontrol: -er det sådan vores afløbssystemer skal fungere?
Period: 13 Mar 2013
Roland Löwe (Lecturer)
Department of Applied Mathematics and Computer Science
Dynamical Systems
Urban Water Engineering

Related event

Ude af øje, ude af sind, ude af kontrol: - er det sådan vores afløbssystemer skal fungere?
13/03/2013 → …
Aalborg, Denmark
Activity: Talks and presentations › Conference presentations

Stochastic runoff forecasting and real time control of urban drainage systems
Period: 11 Mar 2013
Roland Löwe (Lecturer)
Department of Applied Mathematics and Computer Science
Dynamical Systems
Urban Water Engineering

Related event

Ude af øje, ude af sind, ude af kontrol: - er det sådan vores afløbssystemer skal fungere?  
11/03/2013 → …
Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Armax and Greybox Modeling in Water Systems
Period: 1 Mar 2013
Roland Löwe (Lecturer)

Dynamical Systems
Department of Applied Mathematics and Computer Science
Department of Environmental Engineering

Description
Lecture in Armax and Greybox Modeling as part of course 12342
Activity: Other

Time Series Analysis
Period: 7 Feb 2013 → 16 May 2013
Anders Stockmarr (Lecturer)

Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Stochastic runoff forecasting and real time control of urban drainage systems
Period: 31 Jan 2013
Roland Löwe (Lecturer)

Department of Informatics and Mathematical Modeling
Mathematical Statistics
Department of Mathematics
Urban Water Engineering

Department of Environmental Engineering
Links:
http://www.forskningsplatformen-vand.dk/Documents/Annual%20meeting%202013/index.html

Related event

7th Annual Meeting of the Danish Water Research and Innovation Platform
31/01/2013 → 31/01/2013
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Symposium i Anvendt Statistik 2013
Period: 28 Jan 2013 → 29 Jan 2013
Anders Stockmarr (Speaker)
Statistics and Data Analysis
Department of Applied Mathematics and Computer Science

**Description**
PMWS development in pigs from affected farms in Spain and Denmark

collection participation

Documents:
PMWS development in pigs from affected farms in Spain and Denmark

**Related event**

**Symposium i Anvendt Statistik 2013**
28/01/2013 → 29/01/2013
Århus, Denmark
Activity: Talks and presentations › Conference presentations

**NordSecMob Network meeting 2013 (Event)**
Period: 24 Jan 2013 → 25 Jan 2013
Flemming Stassen (Reviewer)

Department of Applied Mathematics and Computer Science

**Description**
NordSecMob Network meeting

25 selection meeting

**Related event**

**NordSecMob Network meeting 2013**
24/01/2013 → …
Finland
Activity: Research › Peer review of manuscripts

**Editorial Board, Journal of Statistical and Econometric Methods (Journal)**
Period: 2012 → …
Gilles Guillot (Editor)

Department of Informatics and Mathematical Modeling

Mathematical Statistics

**Related journal**

**Editorial Board, Journal of Statistical and Econometric Methods**

**Local database**
Activity: Research › Journal editor

**ICES - Baltic Fisheries Assessment Working Group - WGBFAS (External organisation)**
Period: 2012 → …
Anders Nielsen (Participant)

National Institute of Aquatic Resources

Section for Population Ecology and Genetics

Department of Informatics and Mathematical Modeling

Degree of recognition: International

**Related external organisation**
ICES - Baltic Fisheries Assessment Working Group - WGBFAS
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Inter Benchmark Protocol for Pandalus in Skagerrak and Norwegian Deep - IBPPand (External organisation)
Period: 2012 → …
Anders Nielsen (Participant)
National Institute of Aquatic Resources
Section for Population Ecology and Genetics
Department of Informatics and Mathematical Modeling
Degree of recognition: International

Related external organisation
ICES - Inter Benchmark Protocol for Pandalus in Skagerrak and Norwegian Deep - IBPPand
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Joint NAFO/ICES Pandalus Assessment Working Group - NIPAG (External organisation)
Period: 2012 → …
Anders Nielsen (Participant)
National Institute of Aquatic Resources
Section for Population Ecology and Genetics
Department of Informatics and Mathematical Modeling
Degree of recognition: International

Related external organisation
ICES - Joint NAFO/ICES Pandalus Assessment Working Group - NIPAG
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Symposium on "Forage fish interactions: Creating the tools for ecosystem based management of marine resources" (External organisation)
Period: 2012 → …
Anders Nielsen (Participant)
National Institute of Aquatic Resources
Section for Population Ecology and Genetics
Department of Informatics and Mathematical Modeling
Degree of recognition: International

Related external organisation
ICES - Symposium on "Forage fish interactions: Creating the tools for ecosystem based management of marine resources"
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Journal of the Royal Statistical Society, series A (Journal)
Period: 2012 → 2014
Gilles Guillot (Editor)
Department of Applied Mathematics and Computer Science
Cognitive Systems

Related journal
Journal of the Royal Statistical Society, series A
Local database
Activity: Research › Journal editor
Journal of the Royal Statistical Society, Series A (Journal)
Period: 2012 → …
Gilles Guillot (Editor)
Department of Informatics and Mathematical Modeling
Mathematical Statistics

Related journal

Journal of the Royal Statistical Society, Series A
1467-985X
Scopus rating (2017): CiteScore 2.3 SJR 1.982 SNIP 1.788, Web of Science (2018): Indexed yes
Local database
Activity: Research › Journal editor

Web-based wind power forecasting competition 2012 - Wind Forecasting
Period: 2012
Pierre Pinson (Organizer)
Department of Applied Mathematics and Computer Science
Department of Electrical Engineering
Center for Electric Power and Energy

Description
Global Energy Forecasting competition

Web-based wind power forecasting competition hosted by Kaggle.com (150 participants worldwide)

Related event

Web-based wind power forecasting competition 2012 - Wind Forecasting: A wind power forecasting problem: predicting hourly power generation up to 48 hours ahead at 7 wind farms
06/09/2012 → 31/10/2012
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Spatial Statistics Conference 2012
Period: Dec 2012
Gilles Guillot (Participant)
Department of Informatics and Mathematical Modeling
Mathematical Statistics

Description
Conference talk

Related event

Spatial Statistics Conference 2012
13/12/2012 → 15/12/2012
Miami, United States
Activity: Attending an event › Participating in or organising a conference

New Directions in Cryptography
Period: 7 Dec 2012
Christian Rechberger (Panel member)
Department of Mathematics
Discrete mathematics
New meet-in-the-middle attacks in symmetric cryptanalysis
Period: 30 Nov 2012
Christian Rechberger (Keynote speaker)
Department of Mathematics
Discrete mathematics

15th Annual International Conference on Information Security and Cryptology
28/11/2012 → 30/11/2012
Seoul, Korea, Republic of
Activity: Talks and presentations › Conference presentations

Assessment Committee for a post.doc. position (External organisation)
Period: 21 Nov 2012 → 21 Dec 2012
Anne Elisabeth Haxthausen (Participant)
Department of Informatics and Mathematical Modeling
Computer Science and Engineering
Software Engineering

PRINCE - A Low-latency Block Cipher for Pervasive Computing Applications
Period: 21 Nov 2012
Christian Rechberger (Invited speaker)
Department of Mathematics
Discrete mathematics

Workshop on Cryptography for the Internet of Things
20/11/2012 → 21/11/2012
Antwerp, Belgium
Activity: Talks and presentations › Conference presentations

Do provisions to advance chemical facility safety also advance chemical facility security?: An analysis of possible synergies
Period: 8 Nov 2012 → 9 Nov 2012
Frank Huess Hedlund (Invited speaker)
Department of Informatics and Mathematical Modeling
Mathematical Statistics

Description
More than 200 participants from 54 countries attended the event, which was organised by Poland and the OPCW in cooperation with the G8 Global Partnership and international partners.
Documents:
Synergy, safety, security

Links:
http://www.opcw.org/international-meeting-on-chemical-safety-and-security/ (Website)

**Related event**

**International Meeting on Chemical Safety and Security**
08/11/2012 → 09/11/2012
Tarnów, Poland
Activity: Talks and presentations › Conference presentations

**Statistikseminar**
Period: 6 Nov 2012
Anders Stockmarr (Speaker)
Statistics and Data Analysis
Department of Applied Mathematics and Computer Science

**Description**
Regressions modeller – Hvad regresserer vi på og hvorfor? (in danish)
Documents:
Regressions modeller – Hvad regresserer vi på og hvorfor?

**Related event**

**Statistikseminar**
06/11/2012 → 06/11/2012
Copenhagen, Denmark
Activity: Other

**Comparison of Classical and Modern Uncertainty Qualification Methods for the Calculation of Critical Speeds in Railway Vehicle Dynamics**
Period: 5 Nov 2012
Daniele Bigoni (Speaker)
Department of Informatics and Mathematical Modeling
Scientific Computing
Degree of recognition: International

**Related event**

**13th Mini Conference on Vehicle System Dynamics, Identification and Anomalies**
05/11/2012 → 07/11/2012
Budapest, Hungary
Activity: Talks and presentations › Conference presentations

**Related-key and Biclique cryptanalysis of AES**
Period: 18 Oct 2012
Christian Rechberger (Invited speaker)
Department of Mathematics
Discrete mathematics

**Related event**

**ECRYPT II AES Day 2012**
18/10/2012 → …
Brugges, Belgium
Activity: Talks and presentations › Conference presentations
7th Nordic Conference on Human-Computer Interaction (NordiCHI)
Camilla Birgitte Falk Jensen (Participant)
Department of Informatics and Mathematical Modeling
Cognitive Systems

Related event
7th Nordic Conference on Human-Computer Interaction (NordiCHI)
14/10/2012 → 17/10/2012
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Hvad har vi lært af ulykkerne?
Period: 12 Oct 2012
Frank Huess Hedlund (Lecturer)
Department of Applied Mathematics and Computer Science
Description
IDA, RISK - Selskab for risikovurdering. The Danish Society of Engineers, IDA

Related event
Seminar i RISK: Risikostyring som værktøj: Hvad har vi lært, og hvordan kommer vi videre?
23/10/2012 → …
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

Risikoanalyse og worst-case scenarier
Period: 30 Sep 2012
Frank Huess Hedlund (Lecturer)
Department of Applied Mathematics and Computer Science
Description
Oplæg på DTU masteruddannelse i miljø-og arbejdsmiljøledelse

Related external organisation
Technical University of Denmark
Kgs. Lyngby, Denmark
Activity: Other

Yet another cryptanalysis of the AES
Period: 27 Sep 2012
Christian Rechberger (Invited speaker)
Department of Mathematics
Discrete mathematics

Related event
6th Yet Another Conference on Cryptography 2012
24/09/2012 → 28/09/2012
Porquerolles Island, France
Activity: Talks and presentations › Conference presentations

The SHA-3 Competition
Period: 21 Sep 2012
Christian Rechberger (Keynote speaker)
On the Development of a Parallel Domain Decomposition Technique for Simulation of Nonlinear Water Waves
Period: 19 Sep 2012 → 21 Sep 2012
Stefan Lemvig Glimberg (Speaker)
Department of Informatics and Mathematical Modeling
Scientific Computing
Description
Presentation given at conference.

Emotional Brain
Period: 17 Sep 2012 → 21 Sep 2012
Camilla Birgitte Falk Jensen (Participant)
Department of Informatics and Mathematical Modeling
Cognitive Systems

Time Series Analysis
Period: 7 Sep 2012 → 7 Dec 2012
Anders Stockmarr (Lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Katastrofer, worst case - hvorfor sker de? Er det en blind plet fra evolutionens side? Hvad kan vi gøre?
Period: 29 Aug 2012
Frank Huess Hedlund (Lecturer)
Department of Applied Mathematics and Computer Science
Related event

Maritim Sikkerhed, Sundhed og Miljø (2012)
29/08/2012 → 31/08/2012
Nyborg, Denmark
Activity: Talks and presentations › Conference presentations

IEEE Engineering in Medicine and Biology Society
Camilla Birgitte Falk Jensen (Speaker)
Department of Informatics and Mathematical Modeling
Cognitive Systems

Related event

IEEE Engineering in Medicine and Biology Society
27/08/2012 → 30/11/2012
San Diego, United States
Activity: Talks and presentations › Conference presentations

BIT Circus 2012
Daniele Bigoni (Participant)
Scientific Computing
Department of Informatics and Mathematical Modeling

Description
Participation to the BIT Circus 2012 held in DTU. Talk on "Uncertainty quantification of critical speed for railway vehicle dynamics" by D. Bigoni, A.P. Engsig-Karup, H.True, J.S. Hesthaven.

Documents:
Uncertainty quantification of critical speed for railway vehicle dynamics

Related event

BIT Circus 2012: Numerical Mathematics and Computational Science
23/08/2012 → 24/08/2012
Lyngby, Denmark
Activity: Attending an event › Participating in or organising a conference

On the Dynamics of the Fermi-Bose model
Magnus Ögren (Lecturer)
Dynamical systems

Description
In this talk we formulate and prove results for the exponential matrix representing the dynamics of the Fermi-Bose model in an undepleted bosonic field approximation. A recent application of this model is molecular dimmers dissociating into its atomic compounds. The problem is solved in D spatial dimensions by dividing the system matrix into blocks with generalizations of Hankel matrices, here referred to as D-block Hankel-matrices. The method is practically useful for treating large systems, i.e. dense computational grids or higher spatial dimensions, either on a single standard computer or a cluster. In particular the results can be used for studies of threedimensional physical systems of arbitrary geometry. We illustrate the generality of our approach by giving numerical results for the dynamics of Glauber type atomic pair correlation functions for a non-isotropic three-dimensional harmonically trapped molecular Bose-Einstein condensate.

Documents:

Related event
Cryptanalytic ideas for SHA and AES
Period: 11 Aug 2012
Christian Rechberger (Keynote speaker)
Department of Mathematics
Discrete mathematics

Related event

Chinacrypt 2012
09/08/2012 → 12/08/2012
Hefei, China
Activity: Talks and presentations › Conference presentations

Associate Editor, Journal of the Royal Statistical Society, Series A (External organisation)
Period: Jun 2012 → …
Gilles Guillot (Participant)
Department of Informatics and Mathematical Modeling
Mathematical Statistics
Degree of recognition: International

Related external organisation

Associate Editor, Journal of the Royal Statistical Society, Series A
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

24th Nordic Conference in Mathematical Statistics
Period: 10 Jun 2012 → 14 Jun 2012
Anders Stockmarr (Participant)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Description
poster presenter
conference participation
Documents:
Detection of Dairy Herds at Risk for Changing Salmonella Dublin status

Related event

24th Nordic Conference in Mathematical Statistics
10/06/2012 → 14/06/2012
Umeå, Sweden
Activity: Attending an event › Participating in or organising a conference

6th ACM/IEEE International Symposium on Networks-on-Chip
Period: 9 May 2012 → 11 May 2012
Flemming Stassen (Organizer)
Department of Applied Mathematics and Computer Science
Embedded Systems Engineering
6th ACM/IEEE International Symposium on Networks-on-Chip  
Period: 09/05/2012 → 11/05/2012  
Lyngby, Denmark  
Activity: Attending an event › Participating in or organising a conference

Danish Railway Conference 2012  
Period: 9 May 2012  
Anne Elisabeth Haxthausen (Participant)  
Department of Informatics and Mathematical Modeling  
Computer Science and Engineering  
Software Engineering  
Description  
Poster presentation at a DTU stand for the RobustRailS research project.

18th IEEE International Symposium on Asynchronous Circuits and Systems  
Period: 7 May 2012 → 9 May 2012  
Flemming Stassen (Organizer)  
Department of Informatics and Mathematical Modeling  
Computer Science and Engineering  
Embedded Systems Engineering  
Description  
Finance chair

How do university students solve problems in vector calculus? Evidence from eye tracking.  
Period: 2 May 2012 → 4 May 2012  
Magnus Ögren (Lecturer)  
Dynamical systems  

The Scandinavian Workshop on Applied Eye Tracking  
Period: 02/05/2012 → 04/05/2012  
Stockholm, Sweden  
Activity: Talks and presentations › Conference presentations
Uncertainty Quantification for High-Performance Computing Workshop
Period: 2 May 2012 → 4 May 2012
Daniele Bigoni (Participant)
Scientific Computing
Department of Informatics and Mathematical Modeling

Description
Participation to the workshop and poster presentation with title: "Uncertainty Quantification on High Speed Railway Dynamics" by D. Bigoni, A.P. Engsig-Karup, H. True.
Documents:
Uncertainty Quantification on High Speed Railway Dynamics

Related event

Uncertainty Quantification for High-Performance Computing Workshop
02/05/2012 → 04/05/2012
Oak Ridge, TN, United States
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Når planlægningen fejler
Period: 19 Apr 2012
Frank Huess Hedlund (Lecturer)
Department of Applied Mathematics and Computer Science
Documents:
Program

Related event

Kompetenceudviklingsdage på Kastellet (4-2012): TEMA - netværk og uhåndgribelige risici
18/04/2012 → 19/04/2012
København, Denmark
Activity: Talks and presentations › Conference presentations

Conference on European Rail Traffic Management System
Period: 17 Apr 2012
Anne Elisabeth Haxthausen (Participant)
Department of Informatics and Mathematical Modeling
Computer Science and Engineering
Software Engineering

Description
Invited by Banedanmark
An ERTMS conference in Copenhagen

Related event

Conference on European Rail Traffic Management System
16/04/2012 → 17/04/2012
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Narrow-Bicliques: Cryptanalysis of Full IDEA
Period: 17 Apr 2012
Christian Rechberger (Speaker)
Department of Mathematics
Discrete mathematics
Related event

**EUROCRYPT 2012**
15/04/2012 → 19/04/2012
Cambridge, United Kingdom
Activity: Talks and presentations › Conference presentations

**Raingain Workshop**
Period: 16 Apr 2012
Roland Löwe (Participant)
Department of Informatics and Mathematical Modeling
Mathematical Statistics

**Description**
Participation in discussion on integration of radar rainfall and raingauge measurements

Workshop on finescale radar rainfall measurements in urban areas
Links:

Related event

**Raingain Workshop**
16/04/2012 → ...
Leuven, Belgium
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Inverse Problems and Numerical Methods in Applications**
Period: 8 Mar 2012 → 9 Mar 2012
Mirza Karamehmedovic (Organizer)
Department of Applied Mathematics and Computer Science
Scientific Computing
Department of Physics
Documents:
Book_of_Abstracts

Related event

**Inverse Problems and Numerical Methods in Applications**
08/03/2012 → 09/03/2012
Bremen, Germany
Activity: Attending an event › Participating in or organising a conference

**Time Series Analysis**
Period: 2 Feb 2012 → 3 May 2012
Anders Stockmarr (Lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Related event

**Time Series Analysis**
02/02/2012 → 03/05/2012
Kgs. Lyngby, Denmark
Activity: Other
NordSecMob Network meeting 2012 (Event)
Period: 1 Feb 2012 → 2 Feb 2012
Flemming Stassen (Reviewer)
Department of Applied Mathematics and Computer Science
Embedded Systems Engineering

Description
NordSecMob Network meeting
23 selection meeting

Related event
NordSecMob Network meeting 2012
01/02/2012 → 02/02/2012
Finland
Activity: Research › Peer review of manuscripts

34th Symposium i Anvendt Statistik 2012
Anders Stockmarr (Speaker)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Description
conference participation
Documents:
Detection of Dairy Herds at risk for changing Salmonella Dublin status

Related event
34th Symposium i Anvendt Statistik 2012
01/01/2012 → 25/01/2012
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

Statistikseminar
Period: 16 Jan 2012
Anders Stockmarr (Speaker)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Description
Optimal combinations of acute phase proteins for detecting infectious disease in pigs

seminar participation
Documents:
Optimal combinations of acute phase proteins for detecting infectious disease in pigs

Related event
Statistikseminar
16/01/2012 → 16/01/2012
Copenhagen, Denmark
Activity: Other

Population Ecology (External organisation)
Period: 1 Jan 2012 → 31 Dec 2012
Gilles Guillot (Participant)
Department of Informatics and Mathematical Modeling
Mathematical Statistics

Description
Member of the Editorial Board

Editing scientific articles
Degree of recognition: International

Related external organisation

Population Ecology
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

The Geneland program
Period: 1 Jan 2012 → 31 Dec 2012
Gilles Guillot (Participant)
Department of Informatics and Mathematical Modeling
Mathematical Statistics

Description
Maintenance of R package
Activity: Other

The Open Statistics and Probability Journal (External organisation)
Period: 1 Jan 2012 → 31 Dec 2100
Gilles Guillot (Participant)
Department of Informatics and Mathematical Modeling
Mathematical Statistics

Description
Member of the editorial board
Degree of recognition: International

Related external organisation

The Open Statistics and Probability Journal
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

IEEE Transactions on Power Systems (Journal)
Period: 2011 → …
Pierre Pinson (Editor)
Department of Electrical Engineering
Center for Electric Power and Energy
Department of Applied Mathematics and Computer Science

Related journal

IEEE Transactions on Power Systems
0885-8950
Central database
Activity: Research › Journal editor

Population Ecology (Journal)
Period: 2011 → 2012
Gilles Guillot (Reviewer)
Department of Informatics and Mathematical Modeling
Mathematical Statistics

Description
Population Ecology

Related journal
Population Ecology
1438-3896
Scopus rating (2017): CiteScore 1.5 SJR 0.955 SNIP 0.737, Web of Science (2018): Indexed yes
Local database

Expert Workshop on Risk Modelling using R
Period: 21 Nov 2011 → 22 Nov 2011
Anders Stockmarr (Participant)
Statistics and Data Analysis
Department of Applied Mathematics and Computer Science

Description
Bundesinstitut für Risikobewertung (BfR)
workshop

Related event
Expert Workshop on Risk Modelling using R
Berlin, Germany
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Workshop Integrale Abflusssteuerung DWA-AG ES-2.4
Period: 14 Nov 2011
Roland Löwe (Speaker)
Department of Informatics and Mathematical Modeling
Mathematical Statistics

Related event
Workshop Integrale Abflusssteuerung DWA-AG ES-2.4
14/11/2011 → 14/11/2011
Köln, Germany
Activity: Talks and presentations › Conference presentations

Regularization in Isogeometric Shape Optimization for Fluids: Poster presented at SIAM Conference on Geometric and Physical Modeling
Peter Nørtoft (Speaker)
Department of Mathematics

Description
The goal in shape optimization for fluids is to find an optimal boundary of the flow domain that minimizes a prescribed objective, while satisfying suitable constraints. Inclusion of an artificial objective term is often needed to avoid inappropriate boundary parametrizations and thereby regularize the optimization problem. This work uses isogeometric analysis as framework for the numerical method and discusses various regularizations by comparing their effects in different examples.
Place: Orlando, Florida, USA
**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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**SIAM Conference on Geometric and Physical Modeling**
Jens Gravesen (Participant)
Department of Mathematics

**Description**
Regularization in Isogeometric Shape Optimization for Fluids: Poster presented at SIAM Conference on Geometric and Physical Modeling

The goal in shape optimization for fluids is to find an optimal boundary of the flow domain that minimizes a prescribed objective, while satisfying suitable constraints. Inclusion of an artificial objective term is often needed to avoid inappropriate boundary parametrizations and thereby regularize the optimization problem. This work uses isogeometric analysis as framework for the numerical method and discusses various regularizations by comparing their effects in different examples.
Place: Orlando, Florida, USA

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**Related event**

**SIAM Conference on Geometric and Physical Modeling**
24/10/2011 → 27/10/2011
Orlando, United States
Activity: Attending an event › Participating in or organising a conference

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**An Introduction to Formal Methods for Software Development**
Period: 7 Oct 2011
Anne Elisabeth Haxthausen (Consultant)
Department of Informatics and Mathematical Modeling

**Description**
Note: This lecture was given as a part of the Public Sector Consultancy service offered by the Technical University of Denmark.

**Related external organisation**

**Banedanmark, Copenhagen**
Activity: Public and private sector consultancy › Public sector consultancy

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**A Model-based Tool Set for Simulation and Verification of Relay Interlocking Systems**
Period: 27 Sep 2011
Anne Elisabeth Haxthausen (Speaker)
Department of Informatics and Mathematical Modeling

**Related external organisation**

**The Danish Society of Engineers, IDA**
Kalvebod Brygge 31-33, DK-1780, Copenhagen V, Denmark
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

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**Isogeometric Analysis of Sound Propagation through Flow in 2-Dimensional Ducts: Talk given at the fall school "Shapes, Geometry and Algebra (SAGA)"**
Period: 27 Sep 2011 → 30 Sep 2011
Peter Nørtoft (Speaker)
Department of Mathematics

**Description**
The aim of this work is to use isogeometric analysis, a unification of finite element methods (FEM) and computer aided design (CAD), to solve the coupled flow-acoustic problem that governs the propagation of sound through flow in ducts. The background flow in the duct is governed by the steady-state, incompressible Navier-Stokes equation, while the sound propagation is governed by the advected Helmholtz equation. The crux of isogeometric analysis is to approximate the flow fields and the acoustic pressure by B-splines. The accurate geometry representation and high degree of continuity of the state variables are some of the method's advantages. We firstly review the concepts of how to apply isogeometric analysis to the coupled flow-acoustic problem, and we then report on the effects of the flow field and of the duct geometry on the acoustic response.

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

SAGA Fall School 2011
Period: 27 Sep 2011 → 30 Sep 2011
Jens Gravesen (Participant)
Department of Mathematics

Description
Isogeometric Analysis of Sound Propagation through Flow in 2-Dimensional Ducts: Talk given at the fall school "Shapes, Geometry and Algebra (SAGA)"

The aim of this work is to use isogeometric analysis, a unification of finite element methods (FEM) and computer aided design (CAD), to solve the coupled flow-acoustic problem that governs the propagation of sound through flow in ducts. The background flow in the duct is governed by the steady-state, incompressible Navier-Stokes equation, while the sound propagation is governed by the advected Helmholtz equation. The crux of isogeometric analysis is to approximate the flow fields and the acoustic pressure by B-splines. The accurate geometry representation and high degree of continuity of the state variables are some of the method's advantages. We firstly review the concepts of how to apply isogeometric analysis to the coupled flow-acoustic problem, and we then report on the effects of the flow field and of the duct geometry on the acoustic response.

Related event

SAGA Fall School 2011: Shapes, Geometry and Algebra
Vilnius, Lithuania
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Time Series Analysis (TSA); 02417
Period: 2 Sep 2011 → 2 Dec 2011
Anders Stockmarr (Lecturer)
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis

Related event

Time Series Analysis
02/09/2011 → 02/12/2011
Kgs. Lyngby, Denmark
Activity: Other

Risikoanalyse og worst-case scenarier
Period: 27 Aug 2011
Frank Huess Hedlund (Speaker)
Department of Applied Mathematics and Computer Science

Description
Oplæg på DTU masteruddannelse i miljø-og arbejdsmiljøledelse

Related external organisation
GPU Computing Today and Tomorrow: A high performance GPU-based framework for PDE prototyping  
**Period:** 18 Aug 2011  
**Stefan Lemvig Glimberg** (Speaker)  
Department of Informatics and Mathematical Modeling  
Scientific Computing  
**Description**  
Place: DTU Informatics  
**Related external organisation**  
Unknown external organisation  
Activity: Talks and presentations › Conference presentations

The 2011 Fluid•DTU Summer School  
**Period:** 7 Aug 2011 → 13 Aug 2011  
**Øistein Wind-Willassen** (Participant)  
Department of Mathematics  
Department of Applied Mathematics and Computer Science  
**Description**  
Complex motion in fluids  
Place: Krogerup Højskole  
**Related event**  
The 2011 Fluid•DTU Summer School: The 2011 Fluid•DTU Summer School Complex Motion in Fluids  
07/08/2011 → 13/08/2011  
Krogerup, Denmark  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Multi-spectral Imaging as a Method for Automatic Quality Control of Fish Fillet and Fish Feed  
**Period:** 24 Jun 2011  
**Martin Georg Ljungqvist** (Speaker)  
Department of Informatics and Mathematical Modeling  
DTU Data Analysis  
FoodDTU  
**Description**  
Place: Igarashi Lab, Tokyo University, Tokyo, Japan  
**Related external organisation**  
Unknown external organisation  
Activity: Talks and presentations › Conference presentations

Towards a Semantics for VDM Core  
**Period:** 20 Jun 2011  
**Anne Elisabeth Haxthausen** (Speaker)  
Department of Informatics and Mathematical Modeling  
**Description**
Related event

Towards a Semantics for VDM Core
20/06/2011 → 20/06/2011
University of Limerick, Ireland
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Life as a Ph.D. student at DTU Mathematics: Talk given at inspiration event for undergraduate students at DTU Mathematics
Period: 15 Jun 2011
Peter Nørtoft (Speaker)
Department of Mathematics

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Multi-spectral Image Analysis for Astaxanthin Coating Classification
Period: 27 May 2011
Martin Georg Ljungqvist (Speaker)
Department of Informatics and Mathematical Modeling
DTU Data Analysis
FoodDTU

Description
Place: Scandinavian Workshop on Imaging Food Quality (SWIFQ), Ystad, Sweden

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Hvordan kan vi undgå worst-case?
Period: 10 May 2011
Frank Huess Hedlund (Lecturer)
Department of Applied Mathematics and Computer Science

Related event

Hvordan kan vi undgå worst-case?
10/05/2011 → …
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

MicroSoft Research Software Summit
Period: 13 Apr 2011 → 15 Apr 2011
Anne Elisabeth Haxthausen (Participant)
Department of Informatics and Mathematical Modeling
Software Engineering

Related event

MicroSoft Research Software Summit
13/04/2011 → 15/04/2011
Activity: Attending an event › Participating in or organising a conference
**Nano Structures on Surfaces and Light Scattering**


Mirza Karamehmedovic (Participant)

Department of Applied Mathematics and Computer Science
Scientific Computing

Department of Physics

**Description**

M. Karamehmedović and T. Wriedt. Sizing of highly conductive nanowires on substrates

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**Related event**

Nano Structures on Surfaces and Light Scattering
24/03/2011 → 25/03/2011
Bremen, Germany

Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

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**Isogeometric Shape Optimization for Fluids: Talk given at the workshop "New Trends in Applied Geometry"**

Period: 20 Feb 2011 → 25 Feb 2011

Peter Nørtoft (Speaker)

Department of Mathematics

**Description**

The aim of this work is to use isogeometric analysis, a unification of finite element methods (FEM) and computer aided design (CAD), to solve shape optimization problems within fluid mechanics. The flow problems considered are governed by the 2-dimensional steady-state, incompressible Navier-Stokes equations. The crux of isogeometric analysis is to approximate the fluid velocity and pressure fields by B-splines. The accurate geometry representation and high degree of continuity of the flow fields are some of the method’s advantages. In shape optimization for fluids we search for an optimal design of the flow domain that minimizes a prescribed objective, while satisfying suitable constraints. The design variables in the isogeometric approach are the coordinates of control points that define the boundary of the domain. With the ability to represent complex shapes in few design variables, and the unification of the analysis and geometry models, isogeometric analysis is highly suited for shape optimization purposes. The methodology is firstly presented through a simple example in which a pipe bend is designed to minimize the drag with a constraint on the area of the pipe. The basics of how to apply isogeometric analysis to the Navier-Stokes equations are briefly covered, some regularization methods to ensure good boundary parametrizations during optimization are discussed, and different design results for a range of Reynolds numbers are presented. Lastly, we present results for a simple airfoil optimization, in which an airfoil is designed to minimize the drag with a constraint on the lift and the size of the wing.

Place: Hurdalsjoen, Norway

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**New Trends in Applied Geometry**

Period: 20 Feb 2011 → 25 Feb 2011

Jens Gravesen (Participant)

Department of Mathematics

**Description**

Isogeometric Shape Optimization for Fluids: Talk given at the workshop "New Trends in Applied Geometry"

The aim of this work is to use isogeometric analysis, a unification of finite element methods (FEM) and computer aided design (CAD), to solve shape optimization problems within fluid mechanics. The flow problems considered are governed by the 2-dimensional steady-state, incompressible Navier-Stokes equations. The crux of isogeometric analysis is to approximate the fluid velocity and pressure fields by B-splines. The accurate geometry representation and high degree of continuity of the flow fields are some of the method’s advantages. In shape optimization for fluids we search for an optimal design of the flow domain that minimizes a prescribed objective, while satisfying suitable constraints. The design variables in the isogeometric approach are the coordinates of control points that define the boundary of the domain. With the ability to represent complex shapes in few design variables, and the unification of the analysis and geometry models, isogeometric
analysis is highly suited for shape optimization purposes. The methodology is firstly presented through a simple example in which a pipe bend is designed to minimize the drag with a constraint on the area of the pipe. The basics of how to apply isogeometric analysis to the Navier-Stokes equations are briefly covered, some regularization methods to ensure good boundary parametrizations during optimization are discussed, and different design results for a range of Reynolds numbers are presented. Lastly, we present results for a simple airfoil optimization, in which an airfoil is designed to minimize the drag with a constraint on the lift and the size of the wing.

Place: Hurdalsjoen, Norway

Related event
New Trends in Applied Geometry
20/02/2011 → 25/02/2011
Hurdalsjoen, Norway
Activity: Attending an event › Participating in or organising a conference

Time Series Analysis (TSA); 02417
Period: 3 Feb 2011 → 5 May 2011
Anders Stockmarr (Lecturer)
Section for Veterinary Epidemiology and public sector consultancy
Department of Applied Mathematics and Computer Science

Related event
Time Series Analysis
03/02/2011 → 05/05/2011
Kgs. Lyngby, Denmark
Activity: Other

NordSecMob Network meeting 2011 (Event)
Period: 26 Jan 2011 → 28 Jan 2011
Flemming Stassen (Reviewer)
Department of Informatics and Mathematical Modeling
Embedded Systems Engineering
Description
NordSecMob Network meeting: 21 Selection meeting

Related event
NordSecMob Network meeting 2011
26/01/2011 → …
Finland
Activity: Research › Peer review of manuscripts

Effective Development and Verification of Railway Control Software
Period: 21 Jan 2011
Anne Elisabeth Haxthausen (Speaker)
Department of Informatics and Mathematical Modeling
Software Engineering
Description
This course module presents a method for effective development of software for a product line of similar railway control systems. The software is constructed in three steps: first a specifications in a domain-specific language is created, then a formal behavioural controller model is automatically created from the specification, and finally the model is compiled into executable object code. Formal verification is performed automatically by tools at three levels: (1) the specification is checked to follow the rules of the domain, (2) the controller model is checked to ensure safety, and (3) the object code is verified to be a correct implementation of the controller model.

Note: This seminar was given as a part of the Public Sector Consultancy service offered by the Technical University of Denmark.

Place: Banedanmark, Copenhagen
Isogeometric Shape Optimization for Fluids: Talk given at the workshop "Isogeometric Analysis 2011: Integrating Design and Analysis"

Period: 14 Jan 2011

Peter Nørtoft (Speaker)

Department of Mathematics

Description

The aim of this work is to use the unification of finite element methods (FEM) and computer aided design (CAD) embedded in isogeometric analysis to solve shape optimization problems within fluid mechanics. The flow problems considered are governed by the 2-dimensional steady-state, incompressible Navier-Stokes equations. These partial differential equations are solved for fluid velocity and pressure using B-spline based isogeometric analysis. The accurate geometry representation and high degree of continuity of the flow fields are some of the method's advantages. To ensure stable discretizations, though, care has to taken in the choice of polynomial degrees and knots vectors for the velocity and pressure approximations. In shape optimization for fluids we search for an optimal design of the flow domain that minimizes a prescribed objective, while satisfying suitable constraints. With the ability to represent complex shapes in few design variables, and the unification of the analysis and geometry models, isogeometric analysis is highly suited for shape optimization purposes. The design variables are the coordinates of control points that define the boundary of the domain. As the optimizer moves the control points around, though, control points are sometimes seen to coalesce and the control net might even fold over severely, causing an improper design and the analysis to break down. Regularization methods to ensure a good boundary representation are therefore often needed. The methodology is presented through a simple example in which a pipe bend is designed to minimize the drag with a constraint on the area of the pipe. The basics of the analysis of the Navier-Stokes equations are briefly covered, some regularization methods to ensure good boundary parametrisations during optimization are discussed, and different design results for a range of Reynolds numbers are presented.

Place: Austin, Texas, USA

New Trends in Applied Geometry

Period: 14 Jan 2011

Jens Gravesen (Participant)

Department of Mathematics

Description

Isogeometric Shape Optimization for Fluids: Talk given at the workshop "Isogeometric Analysis 2011: Integrating Design and Analysis"

The aim of this work is to use the unification of finite element methods (FEM) and computer aided design (CAD) embedded in isogeometric analysis to solve shape optimization problems within fluid mechanics. The flow problems considered are governed by the 2-dimensional steady-state, incompressible Navier-Stokes equations. These partial differential equations are solved for fluid velocity and pressure using B-spline based isogeometric analysis. The accurate geometry representation and high degree of continuity of the flow fields are some of the method's advantages. To ensure stable discretizations, though, care has to taken in the choice of polynomial degrees and knots vectors for the velocity and pressure approximations. In shape optimization for fluids we search for an optimal design of the flow domain that minimizes a prescribed objective, while satisfying suitable constraints. With the ability to represent complex shapes in few design variables, and the unification of the analysis and geometry models, isogeometric analysis is highly suited for shape optimization purposes. The design variables are the coordinates of control points that define the boundary of the domain. As the optimizer moves the control points around, though, control points are sometimes seen to coalesce and the control net might even fold over severely, causing an improper design and the analysis to break down. Regularization methods to ensure a good boundary representation are therefore often needed. The methodology is presented through a simple example in which a pipe bend is designed to minimize the drag with a constraint on the area of the pipe. The basics of the analysis of the Navier-Stokes equations are briefly covered, some regularization methods to ensure good boundary parametrisations during optimization are discussed, and different design results for a range of Reynolds numbers are presented.

Place: Austin, Texas, USA
**Related event**

**New Trends in Applied Geometry**  
20/02/2011 → 25/02/2011  
Hurdalsjoen, Norway  
Activity: Attending an event › Participating in or organising a conference

**Fast Software Encryption 2011 (Journal)**  
Period: 1 Jan 2011 → …  
Søren Steffen Thomsen (Reviewer)  
Department of Mathematics

**Related journal**

**Fast Software Encryption 2011**  
Local database  
Activity: Research › Peer review of manuscripts

**Associate Editor, Population Ecology (External organisation)**  
Period: 2010 → …  
Gilles Guillot (Participant)  
Department of Informatics and Mathematical Modeling  
Mathematical Statistics  
Degree of recognition: International

**Related external organisation**

**Associate Editor, Population Ecology**  
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

**Population Ecology (Journal)**  
Period: 2010 → …  
Gilles Guillot (Editor)  
Department of Informatics and Mathematical Modeling  
Mathematical Statistics

**Related journal**

**Population Ecology**  
1438-3896  
Scopus rating (2017): CiteScore 1.5 SJR 0.955 SNIP 0.737, Web of Science (2018): Indexed yes  
Local database  
Activity: Research › Journal editor

**The Open Statistics & Probability Journal (Journal)**  
Period: 2010 → …  
Gilles Guillot (Editor)  
Department of Informatics and Mathematical Modeling  
Mathematical Statistics

**Description**  
Editorial Board, The Open Statistics and Probability Journal

**Related journal**

**The Open Statistics & Probability Journal**  
1876-5270  
ISI indexed (2013): ISI indexed no
Central database
Activity: Research › Journal editor

**Wind Energy (Journal)**
*Period: 2010 → …*

Pierre Pinson (Editor)

Department of Electrical Engineering
Center for Electric Power and Energy
Department of Applied Mathematics and Computer Science

**Related journal**

Wind Energy
1095-4244

Central database
Activity: Research › Journal editor

**Challenges in risk assessment - Insidious erosion of safety margins over time**
*Period: 23 Nov 2010*

Frank Huess Hedlund (Invited speaker)

Department of Applied Mathematics and Computer Science

**Related event**

2nd International Safety Conference in the North Sea Offshore Authorities Forum (NSOAF)
*22/11/2010 → 23/11/2010*
Aberdeen, United Kingdom

Activity: Talks and presentations › Conference presentations

**Member of the review board for a VIP position at Engineering College of Århus (External organisation)**
*Period: 22 Nov 2010 → 1 Dec 2010*

Anne Elisabeth Haxthausen (Member)

Department of Informatics and Mathematical Modeling
Software Engineering

**Related external organisation**

**Member of the review board for a VIP position at Engineering College of Århus**
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

**Formal Methods: A Tutorial on Model-oriented Specification**
*Period: 14 Oct 2010*

Anne Elisabeth Haxthausen (Consultant)

Department of Informatics and Mathematical Modeling
Software Engineering

**Description**

Note: This lecture was given as a part of the Public Sector Consultancy service offered by the Technical University of Denmark.

**Related external organisation**

**Unknown external organisation**
Korean Advanced Institute of Science and Technology (KAIST)
Flemming Stassen (Visiting researcher)
Department of Informatics and Mathematical Modeling
Embedded Systems Engineering

Description
Official visit DTU KAIST (Republic of Korea)
Activity: Visiting an external institution › Visiting another research institution

Workshop on AUTO, CoCo and Matlab
Period: 11 Oct 2010 → 12 Oct 2010
Frank Schilder (Speaker)
Department of Mathematics
Dynamical systems

Description
Note: One-day lecture on continuation using the continuation package COCO.
Links:
http://sourceforge.net/projects/cocotools (REL-OA)

Related external organisation
University of Bristol
United Kingdom
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Analysis of Astaxanthin in Fish Feed Pellets
Period: 4 Oct 2010
Martin Georg Ljungqvist (Speaker)
Department of Informatics and Mathematical Modeling
DTU Data Analysis

Description
Place: WEFTA, Cesme, Turkey

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Time Series Analysis (TSA); 02417
Period: 3 Sep 2010 → 3 Dec 2010
Anders Stockmarr (Lecturer)
Section for Epidemiology
Department of Applied Mathematics and Computer Science

Description
Place: DTU Informatics

Related event
Time Series Analysis
03/09/2010 → 03/12/2010
Kgs. Lyngby, Denmark
An Introduction to Formal Methods for the Development of Safety-critical Applications
Period: 1 Sep 2010
Anne Elisabeth Haxthausen (Consultant)
Department of Informatics and Mathematical Modeling
Software Engineering

Description
Note: This lecture was given as a part of the Public Sector Consultancy service offered by the Technical University of Denmark.

Related external organisation

Trafikstyrelsen (Danish Transport Authority)
Activity: Public and private sector consultancy › Public sector consultancy

73rd Annual Meeting of the Institute of Mathematical Statistics
Gilles Guillot (Chairman)
Department of Informatics and Mathematical Modeling
Mathematical Statistics

Related event

73rd Annual Meeting of the Institute of Mathematical Statistics: Session on model selecion
09/08/2010 → 13/08/2010
Gothenburg, Sweden
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

An Introduction to Formal Methods for Software Development
Period: 25 Jun 2010
Anne Elisabeth Haxthausen (Consultant)
Department of Informatics and Mathematical Modeling
Software Engineering

Description
Note: This lecture was given as a part of the Public Sector Consultancy service offered by the Technical University of Denmark.

Related external organisation

Banedanmark (Rail Net Denmark)
Activity: Public and private sector consultancy › Public sector consultancy

KAIST-DTU Dual Degree Master Program in Computer Science
Period: 19 Jun 2010 → 31 Jul 2017
Flemming Stassen (Other)
Department of Applied Mathematics and Computer Science
Embedded Systems Engineering

Description
Coordinated by Flemming Stassen
Links:
http://www.dtu.dk/english/Education/msc/Programmes/computer_science_and_engineering

Related external organisation
5-års seminar om Lavenergihuset i Sisimiut
Period: 2 Jun 2010
Henrik Madsen (Speaker)
Department of Informatics and Mathematical Modeling
Mathematical Statistics
Arctic Technology Centre
Links:

Related event
5-års seminar om Lavenergihuset i Sisimiut
02/06/2010 → 02/06/2010
DTU Mødecenter
Activity: Other

5-års seminar om Lavenergihuset i Sisimiut
Period: 2 Jun 2010
Philip Hvidthøft Delff Andersen (Speaker)
Department of Informatics and Mathematical Modeling
Mathematical Statistics
Arctic Technology Centre
Links:

Related event
5-års seminar om Lavenergihuset i Sisimiut
02/06/2010 → 02/06/2010
DTU Mødecenter
Activity: Other

Talentudvikling og karriererådgivning
Period: 17 May 2010 → 7 Dec 2010
Anne Elisabeth Haxthausen (Participant)
Department of Informatics and Mathematical Modeling
Software Engineering

Description
Talentudvikling og karriererådgivning

Place: Technical University of Denmark, Lyngby
Degree of recognition: Local

Related event
Talentudvikling og karriererådgivning
17/05/2010 → 07/12/2010
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

NordSecMob Network meeting
Period: 6 May 2010
Flemming Stassen (Participant)
Department of Informatics and Mathematical Modeling
Embedded Systems Engineering

Description
NordSecMob Network meeting: 19 Supplementary Selection meeting

Related event
NordSecMob Network meeting: 19 Supplementary Selection meeting
06/05/2010 → 06/05/2010
Finland
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Period: 1 Apr 2010 → 31 Aug 2017
Flemming Stassen (Other)
Department of Applied Mathematics and Computer Science
Embedded Systems Engineering

Description
Coordinated by Flemming Stassen
Links:
Activity: Other

Nano Particles, Nano Structures and Near Field Computation
Period: 11 Mar 2010 → 12 Mar 2010
Mirza Karamehmedovic (Participant)
Department of Applied Mathematics and Computer Science
Scientific Computing
Department of Physics

Description
1) M. Karamehmedović, R. Schuh and V. Schmidt. Comparison of numerical methods for near-field computation
2) M. Karamehmedović. Solution of defect-detection inverse problems of Optical Diffraction Microscopy using the Method of Fundamental Solutions

Related event
Nano Particles, Nano Structures and Near Field Computation
11/03/2010 → 12/03/2010
Bremen, Germany
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

JAIST Advanced School on Formal Specification and Systems Verification 2010 ( JAIST-FSSV2010)
Period: 1 Mar 2010 → 5 Mar 2010
Anne Elisabeth Haxthausen (Participant)
Department of Informatics and Mathematical Modeling
Software Engineering

Related event
JAIST Advanced School on Formal Specification and Systems Verification 2010 ( JAIST-FSSV2010)
01/03/2010 → 05/03/2010
Kanazawa, Japan
Activity: Attending an event › Participating in or organising a conference

**NordSecMob Network meeting**
*Period: 18 Jan 2010 → 19 Jan 2010*
Flemming Stassen (Participant)
Department of Informatics and Mathematical Modeling
Embedded Systems Engineering

**Description**
NordSecMob Network meeting: 17 Selection meeting

**Related event**

**NordSecMob Network meeting: 17 Selection meeting**
18/01/2010 → 19/01/2010
Finland
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Population Ecology (Journal)**
*Period: 1 Jan 2010 → …*
Gilles Guillot (Editor)
Department of Informatics and Mathematical Modeling
Mathematical Statistics

**Description**
Associate Editor

**Related journal**

**Population Ecology**
1438-3896
Scopus rating (2017): CiteScore 1.5 SJR 0.955 SNIP 0.737, Web of Science (2018): Indexed yes
Local database

Activity: Research › Journal editor

*Period: 1 Jan 2010 → 31 Dec 2010*
Gilles Guillot (Reviewer)
Department of Informatics and Mathematical Modeling
Mathematical Statistics

**Related journal**

**The Open Statistics & Probability Journal (Journal)**
*Period: 1 Jan 2010 → …*
Gilles Guillot (Editor)
Department of Informatics and Mathematical Modeling
Mathematical Statistics

**Description**
Associate Editor

**Related journal**
The Open Statistics & Probability Journal
1876-5270
ISI indexed (2013): ISI indexed no
Central database
Activity: Research › Journal editor

Open Statistics and Probability Journal (External organisation)
Period: 2009 → …
Gilles Guillot (Participant)
Department of Informatics and Mathematical Modeling
Mathematical Statistics

**Description**
Member of the Editorial Board

**Related external organisation**
Open Statistics and Probability Journal
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

**Introduction to non-linear models in food science**
Period: 6 Dec 2009
Gilles Guillot (Participant)
Department of Informatics and Mathematical Modeling
Mathematical Statistics

**Description**
Course lecturer

**Related event**
Introduction to non-linear models in food science
06/12/2009 → 06/12/2009
Activity: Other

**Member of the review board of a Ph.D. thesis entitled “Domain-specific Modelling of Railway Control Systems with Integrated Verification and Validation”, by Kirsten Mewes, Bremen University (External organisation)**
Period: 12 Nov 2009
Anne Elisabeth Haxthausen (External examiner)
Department of Informatics and Mathematical Modeling
Software Engineering
Activity: Examinations and supervision › External examination

**Towards a Framework for Modelling and Verification of Relay Interlocking Systems**
Period: 11 Nov 2009
Anne Elisabeth Haxthausen (Speaker)
Department of Informatics and Mathematical Modeling
Software Engineering
This talk describes a framework currently under development for modelling, simulation and verification of relay interlocking systems as used by the Danish railways. The framework is centered around a domain-specific language (DSL) for describing such systems, and provides (1) graphical editors for creating DSL descriptions, (2) a validator for checking that DSL descriptions are statically well-formed (follow structural rules of the domain), (3) a graphical simulator for simulating the dynamic behaviour of relay interlocking systems, and (4) generators that from a DSL description can derive a state transition system model for the dynamic behaviour of the described relay interlocking system and its physical environment, as well as safety conditions (a model checker can then be applied to verify that the system satisfies the safe conditions). A description in the language consists of a track layout for the station under control, train route tables, and circuit diagrams describing the static layout of the circuits implementing the relay interlocking system. The talk will finally touch upon how the framework is formally developed using the RAISE formal method.

Note: Invited seminar talk.
Place: Universität Bremen

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Meta-analysis and databasing of neuroimaging studies
Period: 7 Oct 2009
Finn Årup Nielsen (Speaker)
Department of Informatics and Mathematical Modeling
Cognitive Systems

Description
Note: From PhD course Advances in magnetic resonance imaging of human brain structure and function at Hvidovre Hospital, University of Copenhagen.
Place: Hvidovre Hospital, Denmark
Documents:
NielsenF2009MetaAnalysis.pdf
Links:

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Erhvervs- og Vækstministeriet (External organisation)
Period: 1 Jul 2009 → 30 Jun 2014
Flemming Stassen (Participant)
Department of Applied Mathematics and Computer Science
Embedded Systems Engineering

Description
Appeal Board of Patents and Trademarks

Technical reviewer (reappointment)

Body type: Appeal Board
Links:
http://www.pvanke.dk/pvanke/

Related external organisation
Erhvervs- og Vækstministeriet
Slootholmsgade 10-12, 1216, København K, Denmark
Activity: Membership › Membership of commitees, commissions, boards, councils, associations, organisations, or similar
International Symposium on Voronoi Diagrams in science and engineering (External organisation)
Period: 23 Jun 2009 → …
Francesc/François Antón Castro (Participant)
National Space Institute
Geodesy
Department of Informatics and Mathematical Modeling
Image Analysis and Computer Graphics

Description
Body type: Steering Committee
Degree of recognition: International

Related external organisation
International Symposium on Voronoi Diagrams in science and engineering
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Cryptographic hash functions: Invited talk at Univerzita Karlova v Praze
Period: 16 Jun 2009
Praveen Gauravaram (Speaker)
Department of Mathematics
Discrete mathematics

Description
This talk is on several aspects of cryptographic hash functions. The talk covers popular hash function designs and their security analysis. The talk also covers some important applications of hash functions and the impact of the security of the hash functions on the applications.

Related external organisation
Charles University
Czech Republic
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

On randomizing hash functions to strengthen the security of digital signatures
Period: 20 Mar 2009
Praveen Gauravaram (Speaker)
Department of Mathematics
Discrete mathematics

Related external organisation
Nanyang Technological University
Singapore, Singapore
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

A Domain-specific, Model-based Approach for Construction and Verification of Railway Control Systems
Period: 23 Jan 2009
Anne Elisabeth Haxthausen (Speaker)
Department of Informatics and Mathematical Modeling
Software Engineering

Description
This talk describes a complete model-based development and verification approach for railway control systems. For each control system to be generated, the user makes a description of the application-specific parameters in a domain-specific language. This description is automatically transformed into an executable control system model expressed in SystemC. This model is then compiled into object code. Verification is performed at different levels: (0) The domain-specific description is validated wrt. internal consistency by static analysis. (1) The crucial safety properties are verified for the
SystemC model by means of bounded model checking. (2) The object code is verified to be I/O behavioural equivalent to the SystemC model from which it was compiled.
Note: Invited seminar talk
Place: Christian-Albrechts-Universität zu Kiel

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Nordic Master School in Innovative ICT (NMS iICT) (External organisation)
Period: 16 Jan 2009 → 31 Aug 2014
Flemming Stassen (Participant)
Department of Applied Mathematics and Computer Science
Embedded Systems Engineering

Description
NMS iICT - Nordic Master School in Innovative Information and Communication Technologies

Related external organisation

Nordic Master School in Innovative ICT (NMS iICT)
Turku, Finland
Activity: Membership › Membership of research networks or expert groups

Associate Editor Molecular Ecology (External organisation)
Period: 1 Jan 2009 → …
Gilles Guillot (Participant)
Department of Informatics and Mathematical Modeling
Mathematical Statistics

Related external organisation

Associate Editor Molecular Ecology
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Reviewer for Global Ecology and BioGeography, Biometrics, Conservation Genetics (Journal)
Period: 1 Jan 2009 → 31 Dec 2009
Gilles Guillot (Reviewer)
Department of Informatics and Mathematical Modeling
Mathematical Statistics

Related journal

Reviewer for Global Ecology and BioGeography, Biometrics, Conservation Genetics
Local database
Activity: Research › Peer review of manuscripts

An on-line birthday forgery attack on some randomize hash then sign signature algorithms: ECRYPT-II Kickoff meeting at K.U.Leuven, Leuven, Belgium
Period: 25 Nov 2008
Praveen Gauravaram (Speaker)
Department of Mathematics
Discrete mathematics

Description
Place: K.U.Leuven, Leuven, Belgium
Cognitive Component Analysis
Period: 31 Oct 2008
Ling Feng (Speaker)
Department of Informatics and Mathematical Modeling

Description
It concerns the investigation of the consistency of statistical regularities in a signaling ecology and human cognition, while inferring appropriate actions for a speech-based perceptual task. It is based on unsupervised Independent Component Analysis providing a rich spectrum of audio contexts along with pattern recognition methods to map components to known contexts. It also involves looking for the right representations for auditory inputs, i.e. the data analytic processing pipelines invoked by human brains. The main ideas refer to Cognitive Component Analysis, defined as the process of unsupervised grouping of generic data such that the ensuing group structure is well-aligned with that resulting from human cognitive activity. Its hypothesis runs ecologically: features which are essentially independent in a context defined ensemble, can be efficiently coded as sparse independent component representations. The focus has been to construct a preprocessing pipeline for COCA to search for the ‘cognitive structure’, and to measure the alignment of the resulting from unsupervised learning and human cognition. Based on the nature of human auditory system and psychoacoustics, we have constructed the pipeline: feature extraction; feature integration; energy based sparsification; and principal component analysis. To test whether human uses information theoretically optimal ICA methods in higher cognitive functions, is the main concern in this thesis. It is well-documented that unsupervised learning discovers statistical regularities. However human cognition is too complicated and not yet fully understood. Nevertheless, in our approach we represent human cognitive processes as a classification rule in supervised learning. Thus we have devised a testable protocol to test the consistency of statistical properties and human cognitive activity, i.e. unsupervised learning of perceptual inputs and supervised learning of inputs together with manually obtained labels. The comparison has been carried out at different levels. This protocol has successfully revealed the consistency of two classifications via several speech-based cognitive tasks.

Note: It is the presentation from the author's Ph. D. defense
Place: DTU Informatics, building 321, lecture room 053
Documents:
Cognitive Component Analysis.pdf
Links:
Our muscles are metabolically flexible, i.e., they are capable of 'switching' between two types of oxidation: (1) when fasting, a predominantly lipid oxidation with high rates of fatty acid uptake, and (2) when fed, suppression of lipid oxidation in favour of increased glucose uptake, oxidation and storage, in response to insulin. One of the many manifestations of obesity and Type 2 diabetes is an insulin resistance of the skeletal muscles, which suppresses this metabolic switch. This talk describes recent development of a low-dimensional system of ODEs that model the metabolic switch, displaying a sensitivity to insulin concentration which matches well with clinical data.

Place: ISABEL, Aalborg University, Oct 25-28, 2008
World in a Natural Science Perspective: Lectures at the Open University, Folkeuniversitetet i København
Period: 1 Sep 2008 → 31 Dec 2008
Poul G. Hjorth (Lecturer)
Department of Mathematics
Dynamical systems
Links:
http://www.fukoebenhavn.dk/default.aspx?pagetype=9&ListType=3&ID=25 (Link til linjestudiet: "Verden i Naturvidenskabeligt Perspektiv")

Related external organisation
Folkeuniversitetet i København
Læderstræde 34, 2, 1201, København, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

European Study Group for Industry (ESGI); 66
Mads Peter Sørensen (Participant)
Department of Mathematics
Dynamical systems

Related event
European Study Group for Industry (ESGI); 66
18/08/2008 → 22/08/2008
Technical University of Denmark, Kongens Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Clustering of scientific citations in Wikipedia: Wikimania 2008
Period: 19 Jun 2008
Finn Årup Nielsen (Speaker)
Department of Informatics and Mathematical Modeling
Cognitive Systems

Description
The instances of templates in Wikipedia form an interesting data set of structured information. Here I focus on the cite journal template that is primarily used for citation to articles in scientific journals. These citations can be extracted and analyzed: Non-negative matrix factorization is performed on a (article x journal) matrix resulting in a soft clustering of Wikipedia articles and scientific journals, each cluster more or less representing a scientific topic.
Place: Bibliotheca Alexandrina, Alexandria, Egypt
Documents:
Nielsen2008Clustering_slides.pdf
Links:

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

User Conference Danish Center for Scientific Computing
Period: 1 Apr 2008
Mads Peter Sørensen (Participant)
Department of Mathematics
Dynamical systems

Description
Poster: The Ginzburg-Landau equation solved by the finite element method.
Documents:
GinzburgLandau.ppt

Related event

User Conference Danish Center for Scientific Computing
01/04/2008 → 01/04/2008
Technical University of Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

HiPEAC - European Network of Excellence on High Performance and Embedded Architecture and Compilation (External organisation)
Period: 27 Jan 2008 → 31 Dec 2018
Sven Karlsson (Participant)
Department of Applied Mathematics and Computer Science
Embedded Systems Engineering
Degree of recognition: International

Related external organisation

HiPEAC - European Network of Excellence on High Performance and Embedded Architecture and Compilation
Activity: Membership › Membership of research networks or expert groups

Control Theory
Period: 9 Jan 2008 → 31 Dec 2008
Poul G. Hjorth (Supervisor)
Department of Mathematics
Dynamical systems

Description
Medvejledning af Speciale på Matematisk Institut, Københavns Universitet
Activity: Examinations and supervision › Supervisor activities

Echternach Symmetric Crypto seminar (ESC); 1
Period: 7 Jan 2008 → 11 Jan 2008
Erik Zenner (Speaker)
Department of Mathematics
Discrete mathematics

Description
Cache Timing Attacks have been primarily discussed in connection with the Advanced Encryption Standard (AES), where they are applicable in a very straightforward way. However, the underlying techniques can be applied to other cryptographic building blocks too, as becomes obvious when considering e.g. the AES-based stream cipher LEX. In this talk, we will briefly review cache timing attacks and discuss their significance. We will then present some findings from our analysis of eStream finalist stream ciphers. While these findings do not seem to endanger the practical security of the ciphers considered, they illustrate some design techniques that help preventing cache timing attacks. In addition, they may give rise to some deeper questions about what is usually considered a success in the more standard areas of cryptanalysis.
Place: Echternach (Luxembourg)

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations
An Introduction to Multisensory Perception
Period: 1 Jan 2008 → …
Tobias Andersen (Speaker)
Department of Informatics and Mathematical Modeling
Cognitive Systems

Related external organisation

Aalborg University
A.C. Meyers Vænge 15, 2450 Copenhagen SV, Aalborg, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Impact Theory
Period: 1 Jan 2008 → 31 Dec 2008
Marie Bro Duun (Participant)
Department of Mathematics
Dynamical systems

Related event

Impact Theory
01/01/2008 → 31/12/2008
DTU Matematik
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Impact Theory
Period: 1 Jan 2008 → 31 Dec 2008
Poul G. Hjorth (Participant)
Department of Mathematics
Dynamical systems

Description
Course lecturer

Related event

Impact Theory
01/01/2008 → 31/12/2008
DTU Matematik
Activity: Other

Fundamentals of Information Security and Cryptology
Period: 27 Dec 2007
Praveen Gauravaram (Invited speaker)
Department of Mathematics
Discrete mathematics

Description
This lecture gives an overview of the fundamental concepts in information security and cryptology.
Note: This is an invited lecture at SVUCE in Tirupati in Andhra Pradesh state, India

Related external organisation

Sri Venkateswara University College of Engineering
Tirupati, India
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities
Cryptographic Hash Functions: Cryptanalysis, Design and Applications
Period: 19 Dec 2007
Praveen Gauravaram (Speaker)
Department of Mathematics
Discrete mathematics

Description
In this talk, I have outlined the state of art in the cryptanalysis, design and applications of cryptographic hash functions.
Note: This is an invited talk at NTRO, New Delhi
Place: National Technology Research Organisation (NTRO), New Delhi, India

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

NDRF Post Graduate Education Seminar
Jan Larsen (Participant)
Department of Informatics and Mathematical Modeling
Cognitive Systems

Description
Statistical framework for decision making in mine action
Links:
http://www2.imm.dtu.dk/pubdb/views/publication_details.php?id=5491

Related event
NDRF Post Graduate Education Seminar
06/10/2007 → 07/10/2007
Hevring, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Workshop and ph.d. course on symbolic dynamics in complex dynamics
Christian Henriksen (Participant)
Department of Mathematics
Dynamical systems

Related event
Workshop and ph.d. course on symbolic dynamics in complex dynamics
04/10/2007 → 07/10/2007
Sea Mining Station, Hillerød
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Workshop "Kryptologie in Theorie und Praxis"; 2
Period: 27 Sep 2007
Erik Zenner (Organizer)
Department of Mathematics
Discrete mathematics

Related event
Workshop "Kryptologie in Theorie und Praxis"; 2
Bremen (Germany)  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Verden i Naturvidenskabeligt Perspektiv**  
Period: 1 Sep 2007 → 10 Dec 2007  
Poul G. Hjorth (Organizer)  
Department of Mathematics  
Dynamical systems  
Links:  

**Related event**

**Verden i Naturvidenskabeligt Perspektiv**  
01/09/2007 → 10/12/2007  
København, Denmark  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Forum Digital Sikkerhed**  
Period: 20 Jun 2007  
Erik Zenner (Speaker)  
Department of Mathematics  
Discrete mathematics  

**Description**  
Report of the 34th meeting of ISO/IEC JTC1/Sc 27 in Russia  
Place: Charlottenlund  
Documents:  
report_iso_meeting_34.pdf

**Related external organisation**

**Unknown external organisation**  
Activity: Talks and presentations › Conference presentations

**Workshop on Analysis and Control of Complex Networks**  
Rainer Berkemer (Participant)  
Department of Mathematics  
Dynamical systems  
Links:  
http://www.sicc-it.org/SICC_Drupal_i18n/?q=it/node/177 (Analysis and Control of Complex Networks | Società Italiana Caos e Complessità)

**Related event**

**Workshop on Analysis and Control of Complex Networks**  
24/05/2007 → 26/05/2007  
Milano, Italy  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**An Introduction to Multisensory Perception**  
Period: 1 Jan 2007 → …  
Tobias Andersen (Speaker)  
Department of Informatics and Mathematical Modeling
Related external organisation

Aalborg University
A.C. Meyers Vænge 15, 2450 Copenhagen SV, Aalborg, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Audiovisual perception
Period: 1 Jan 2007 → …
Tobias Andersen (Speaker)
Department of Informatics and Mathematical Modeling

Description
Place: Audio Signal Processing Network in Denmark (ASIP), Seminar on Audio Perception and Evaluation, GN ReSound, Ballerup, Denmark

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Generalizing the spider algorithm
Period: 1 Jan 2007 → …
Christian Henriksen (Speaker)
Department of Mathematics

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Risk assessment in food allergy: Benchmark dose and margin of exposure
Period: 1 Jan 2007 → …
Per B. Brockhoff (Speaker)
Department of Informatics and Mathematical Modeling

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Evaluation of factors affecting the analytical sensitivity of bacteriological methods for investigation of S. Dublin in bovine faecal samples
Period: 10 May 2006 → 12 May 2006
Annette Kjær Ersbøll (Speaker)
Department of Informatics and Mathematical Modeling

Description
Place: The I3S International Symposium Salmonella and Salmonellosis, Saint-Malo, France

Related external organisation
Unknown external organisation
Odds model med ordinal polynomial respons til testning af effekten af interventioner omhandlende sund mad på arbejdspladsen
Period: 1 Jan 2006 → …
Jens Strodl Andersen (Speaker)
Department of Informatics and Mathematical Modeling

Description
Place: Symposium i Anvendt Statistik, København, Danmark

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Erasmus Mundus Master's Programme in Security and Mobile Computing
Period: 1 Aug 2005 → 31 Aug 2012
Flemming Stassen (Organizer)
Department of Informatics and Mathematical Modeling
Embedded Systems Engineering

Description
Erasmus Mundus Master's Programme in Security and Mobile Computing: National coordinator
Links: http://www.imm.dtu.dk/English/Teaching/MSc/Erasmus_Mundus.aspx (EXT-OA)

Related event

Erasmus Mundus Master's Programme in Security and Mobile Computing
01/08/2005 → …
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Økonomi- og Erhvervsmæssig Ministeriet (External organisation)
Period: 1 Jul 2004 → 30 Jun 2009
Flemming Stassen (Participant)
Department of Applied Mathematics and Computer Science
Embedded Systems Engineering

Description
Appeal Board of Patents and Trademarks

Technical reviewer (reappointment)

Body type: Appeal board
Links: http://www.pvanke.dk/pvanke

Related external organisation

Økonomi- og Erhvervsmæssig Ministeriet
Slotsholmgade 12, 1216, København K, Denmark
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

President of the International Association of Vehicle System Dynamics (External organisation)
Period: Aug 2003 → Aug 2017
Hans True (Chairman)
Department of Informatics and Mathematical Modeling
President of the International Association of Vehicle System Dynamics
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Ankenævnet for Patenter og Varemærker (External organisation)
Period: 1 Jul 1999 → 30 Jun 2004
Flemming Stassen (Participant)
Department of Informatics and Mathematical Modeling
Embedded Systems Engineering

Best Demo Award
Andrea Burattin (Recipient)
Department of Applied Mathematics and Computer Science , Software and Process Engineering

Best Process Mining Dissertation Award
Andrea Burattin (Recipient)
Department of Applied Mathematics and Computer Science , Software and Process Engineering

FOKOS Award 2013: "Publication reporting most striking discovery in the field of complex systems"
Erik Andreas Martens (Recipient)
Department of Applied Mathematics and Computer Science
FOKOS Award 2013 for the "Publication reporting most striking discovery in the field of complex systems": Martens et al., "Chimera states in mechanical oscillator networks", PNAS (2013)

Details
Awarded date: 2013
Granting Organisations: Freunde der Forschung an komplexen Systemen (FOKOS)
Prize: Prizes, scholarships, distinctions

Frie Forskningsråds Ung Eliteforskerpris: EliteForsk-konference
Praveen Gauravaram (Recipient)
Department of Mathematics, Discrete mathematics

Description

Details
Awarded date: 27 Jan 2010
Granting Organisations: Ny Carlsberg Glyptotek
Prize: Prizes, scholarships, distinctions

Green Tech Challenge - Master Thesis
Peter Alexander Stentoft (Recipient)
Department of Applied Mathematics and Computer Science, Dynamical Systems

Details
Awarded date: 23 Jun 2017
Degree of recognition: National
Granting Organisations: Technical University of Denmark
Prize: Prizes, scholarships, distinctions

Honorary Mention
Behnaz Pirzamanbein (Recipient)
Department of Applied Mathematics and Computer Science

Description
My paper "Modelling Spatial Compositional Data: Reconstructions of past land cover and uncertainties" recognized with an Honorary Mention in the Section on Statistics and the Environment (ENVR), in the student paper competition at the joint statistical meeting, ASA, 2016.

Details
Awarded date: Aug 2016
Degree of recognition: International
Granting Organisations: American Statistical Association
Event: Joint Statistical meeting
Prize: Prizes, scholarships, distinctions

Life long Honarary Member of 'The International Association of Vehicle Systems Dynamics' (IAVSD)
Hans True (Recipient)
Department of Applied Mathematics and Computer Science

Details
Awarded date: 15 Aug 2017
Degree of recognition: International
Granting Organisations: The International Association of Vehicle Systems Dynamics
Prize: Prizes, scholarships, distinctions

**Molecular Ecology best reviewer 2013**
Gilles Guillot (Recipient)
Department of Applied Mathematics and Computer Science, Cognitive Systems

**Details**
Awarded date: Jan 2013
Granting Organisations: Molecular Ecology
Prize: Prizes, scholarships, distinctions

**Otto Mønsteds Fund: Travel grant**
Hugo-Andrés López-Acosta (Recipient)
Department of Applied Mathematics and Computer Science, Language-Based Technology

**Description**
Travel grant to support the presentation of a paper at the 2015 ACM SIGPLAN International Conference on Object-Oriented Programming, Systems, Languages, and Applications, OOPSLA 2015, part of (SLASH) 2015. Pittsburgh, PA, USA, October 25-30, 2015

**Details**
Awarded date: 25 Oct 2015
Granting Organisations: Otto Mønsteds Fond
Prize: Prizes, scholarships, distinctions

**Outstanding Bayesian research applied to climate science**
Behnaz Pirzamanbein (Recipient)
Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics

**Description**
Outstanding Bayesian research applied to climate science in the Section on Bayesian Statistical Science (SBSS), and also recognized with an Honorary Mention in the Section on Statistics and the Environment (ENVR), in the student paper competition at the joint statistical meeting, ASA, 2016.

**Details**
Awarded date: Aug 2016
Degree of recognition: International
Granting Organisations: American Statistical Association
event: Joint Statistical meeting
Prize: Prizes, scholarships, distinctions

**The TIM Division Award for Best Reviewer 2017 (AOM)**
Sabrina Woltmann (Recipient)
Department of Applied Mathematics and Computer Science, Department of Management Engineering, Technology and Innovation Management

**Description**
TIM reviewers that distinguished themselves for the timeliness and constructiveness of their comments. It is based both on authors' evaluation and the TIM officers' own reading of your reports.

**Details**
Awarded date: 8 Aug 2017
event: 77th Annual meeting of the Academy of Management
Prize: Prizes, scholarships, distinctions
**Veolia Trophees Performance**  
Peter Alexander Stentoft (Recipient)  
Department of Applied Mathematics and Computer Science, Dynamical Systems  

**Details**  
Awarded date: 5 Dec 2017  
Degree of recognition: International  
Granting Organisations: VEOLIA  
Prize: Prizes, scholarships, distinctions  

**Press clippings:**

**An Overview of 3D X-ray Microscopy**  
Lars Pilgaard Mikkelsen  
19/02/2018  

**Description**  
Customer profiles: Dr. Lars Pilgaard Mikkelsen with online interview  
Department of Wind Energy, Composites and Materials Mechanics, Department of Applied Mathematics and Computer Science  

**Media contribution (1)**  
An Overview of 3D X-ray Microscopy  
19/02/2018  
Microscopy And Analysis, Denmark  
Wiley  
4:13  
https://microscopy-analysis.com/zeiss-xrm-overview  
Lars Pilgaard Mikkelsen  
Department of Applied Mathematics and Computer Science, Department of Wind Energy, Composites and Materials Mechanics  
Press / Media  

**Forskningens døgn - forskning for fremtiden**  
Lars Pilgaard Mikkelsen  
29/04/2017  

**Description**  
Forskningens døgn er en årlig tilbagevendende begivenhed, der afholdes over hele landet. I Roskilde har forskellige uddannelsesinstitutioner og foreninger opslået en række teltet, og viser eksempler på, hvad de arbejder med.  
Department of Wind Energy, Composites and Materials Mechanics, Department of Applied Mathematics and Computer Science  

**Forskningens døgn i Roskilde 2017**  
Event: Exhibition  

**Media coverage (1)**  
Forskningens døgn i Roskilde  
29/04/2017  
Kanal Roskilde (Local), Denmark, Television  
29 min.  
https://www.youtube.com/watch?v=hVh8FuWcy-k&t=880s  
Lars Pilgaard Mikkelsen  
Press / Media  

**Ekspert_ Forebyggelse af arbejdssulykker kræver ordentlig udredning**  
Frank Huess Hedlund  
26/01/2017  

**Subject**
Myndighederne bør have mere fokus på at opklare og lære af dødsulykker frem for straf og ansvar, mener risikoekspert.

Department of Applied Mathematics and Computer Science, Dynamical Systems, Statistics and Data Analysis

**Media contribution (1)**

**Ekspert: Forebyggelse af arbejdsulykker kræver ordentlig udredning**
26/01/2017
Fagbladet 3F, Print
https://www.fagbladet3f.dk/artikel/ekspert-forebyggelse-af-arbejdsulykker-kraeven-ordentlig-udredning
Frank Huess Hedlund
Department of Applied Mathematics and Computer Science, Dynamical Systems, Statistics and Data Analysis

**Relations**
Research outputs:
Erfaringer frem for ansvar.
Kraftig eksplosion efter sammenblanding af salpetersyre og 2-propanol
Støveeksplosion ødelægger dansk træpillefabrik - igen

**Risikoekspert: Hvor mange skal dø, før vi lærer noget?**
Frank Huess Hedlund
25/01/2017
Department of Applied Mathematics and Computer Science, Dynamical Systems, Statistics and Data Analysis

**Media contribution (1)**

**Risikoekspert: Hvor mange skal dø, før vi lærer noget?**
25/01/2017
Fagbladet 3F, Print
https://www.fagbladet3f.dk/artikel/risikoeksperthvormangeskaldevilaerernoget
Frank Huess Hedlund
Department of Applied Mathematics and Computer Science, Dynamical Systems, Statistics and Data Analysis

**Universiteter: Vi skal uddanne Big data-eksperter**
Helle Rootzén
06/12/2016
Department of Applied Mathematics and Computer Science, Statistics and Data Analysis

**Media contribution (1)**

**Universiteter: Vi skal uddanne Big data-eksperter**
06/12/2016
Berse, Print
Ernst Poulsen
Helle Rootzén
Department of Applied Mathematics and Computer Science, Statistics and Data Analysis

**Universiteter: Vi skal uddanne Big data-eksperter**
Helle Rootzén
06/12/2016
Department of Applied Mathematics and Computer Science, Statistics and Data Analysis

**Media contribution (1)**

**Universiteter: Vi skal uddanne Big data-eksperter**
06/12/2016
Berse, Print
Ernst Poulsen
Helle Rootzén
Department of Applied Mathematics and Computer Science, Statistics and Data Analysis

**Press / Media**
Universiteter: Vi skal uddanne Big data-ekspert -
Helle Rootzén
06/12/2016
Department of Applied Mathematics and Computer Science, Statistics and Data Analysis

Media contribution (1)

Universiteter: Vi skal uddanne Big data-ekspert -
06/12/2016
Børsen, Print
Ernst Poulsen
Helle Rootzén
Department of Applied Mathematics and Computer Science, Statistics and Data Analysis

Nyt center skal koble læring med teknologi
Helle Rootzén
01/12/2016
Department of Applied Mathematics and Computer Science, Statistics and Data Analysis

Media contribution (1)

Nyt center skal koble læring med teknologi
01/12/2016
DTU Avisen, Print
Henrik Larsen
Helle Rootzén
Department of Applied Mathematics and Computer Science, Statistics and Data Analysis

Er vi klar til et nyt læringskoncept?
Helle Rootzén
15/11/2016
Department of Applied Mathematics and Computer Science, Statistics and Data Analysis

Media contribution (1)

Er vi klar til et nyt læringskoncept?
15/11/2016
Version2, Web
https://www.version2.dk/blog/vi-klar-nyt-laeringskoncept-1039447
Helle Rootzén
Department of Applied Mathematics and Computer Science, Statistics and Data Analysis

Can I use mathematics to win in Lotto?
Anders Stockmarr
25/04/2016
Department of Applied Mathematics and Computer Science, Statistics and Data Analysis

Media contribution (1)

Can I use mathematics to win in Lotto?
25/04/2016
Videnskab.dk, Web
http://videnskab.dk/sporg-videnskaben/kan-jeg-bruge-matematik-til-vinde-i-lotto
Anders Stockmarr
Department of Applied Mathematics and Computer Science, Statistics and Data Analysis
800.000 gode grunde til datalogi i skolen
Helle Rootzén
20/04/2016
Department of Applied Mathematics and Computer Science , Statistics and Data Analysis

Media contribution (1)

800.000 gode grunde til datalogi i skolen
Helle Rootzén
20/04/2016
Print
Stephen Alstrup, Ole Lehrmann Madsen, and Helle Rootzén
Helle Rootzén
Department of Applied Mathematics and Computer Science , Statistics and Data Analysis
Press / Media

800.000 gode grunde til datalogi i skolen
Helle Rootzén
20/04/2016
Department of Applied Mathematics and Computer Science , Statistics and Data Analysis

Media contribution (1)

Returning to the Rails.: Rail Safety: Back in the Spotlight.
Anne Elisabeth Haxthausen
18/03/2016

Description
Article and interview made by Jean Christophe-Piot.

Subject
Rail safety.
Department of Applied Mathematics and Computer Science , Software and Process Engineering

Media contribution (1)

Returning to the Rails.: Rail Safety: Back in the Spotlight.
18/03/2016
Technologist magazine issue no.9, pages 42-43, July 2016, Print
EuroTech Universities
Printed in July 2016.
http://www.technologist.eu/returning-to-the-rails/
Anne Elisabeth Haxthausen
Department of Applied Mathematics and Computer Science , Software and Process Engineering
Press / Media

Google-computers triumf er et lille skridt mod store samfundsomvæltninger
Thomas Bolander
16/03/2016
Department of Applied Mathematics and Computer Science , Algorithms and Logic

Media contribution (1)

Google-computers triumf er et lille skridt mod store samfundsomvæltninger
16/03/2016
videnskab.dk, Web
http://videnskab.dk/teknologi/google-computers-triumf-er-et-lille-skridt-mod-store-samfundsomvaeltninger
Thomas Bolander
Department of Applied Mathematics and Computer Science, Algorithms and Logic
Press / Media

**De fleste har jo tre-fire milliarder linjer kunstig intelligens-kode i lommen**
Thomas Bolander
15/02/2016
Department of Applied Mathematics and Computer Science, Algorithms and Logic

**Media contribution (1)**

**Ekspert om tysk togkollision: ”Besynderlig ulykke”**
Anne Elisabeth Haxthausen
09/02/2016

**Description**
Interviewed for an article in the Danish newspaper Politiken concerning a train accident in Germany

**Subject**
A train accident in Germany
Department of Applied Mathematics and Computer Science, Software and Process Engineering

**Media contribution (1)**

**Dagen gryr for kunstig intelligens på de finansielle markeder**
Thomas Bolander
08/02/2016
Department of Applied Mathematics and Computer Science, Algorithms and Logic

**Media contribution (1)**

**Safety expert doubtful if root causes will be identified after Fredericia fire**
Frank Huess Hedlund
05/02/2016

**Description**
Major fire in palm oil tank, possibly initiated by explosion of solution of urea ammonium nitrate, although many details are vague at this point in time

**Subject**
http://ing.dk/artikel/sikkerhedsekspert-tror-ikke-paa-opklaring-af-branden-i-fredericia-182045
Safety expert doubtful if root causes will be identified after Fredericia fire
05/02/2016
Ingeniøren, Print
Frank Huess Hedlund
Department of Applied Mathematics and Computer Science, Dynamical Systems, Statistics and Data Analysis

Wolfgang Puffitsch
03/02/2016

Description
Department of Applied Mathematics and Computer Science, Embedded Systems Engineering

Nu tager robotterne også specialistjob
Thomas Bolander
29/01/2016
Department of Applied Mathematics and Computer Science, Algorithms and Logic

Om Star Wars, robotter og kunstig intelligens
Thomas Bolander
16/12/2015
Department of Applied Mathematics and Computer Science, Algorithms and Logic
Matematik mindsker risiko for togkollision
Anne Elisabeth Haxthausen
01/12/2015
Department of Applied Mathematics and Computer Science, Software and Process Engineering

Media contribution (1)

Matematik mindsker risiko for togkollision
01/12/2015
Dynamo nr. 43, Print
Iben Julie Schmidt
Anne Elisabeth Haxthausen
Department of Applied Mathematics and Computer Science, Software and Process Engineering

Har din robot forstået dig i dag?
Thomas Bolander
30/10/2015
Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)

Har din robot forstået dig i dag?
30/10/2015
Ingeniøren, Print
Thomas Bolander
Department of Applied Mathematics and Computer Science, Algorithms and Logic

Matematisk gennembrud øger tog sikkerheden
Anne Elisabeth Haxthausen
01/09/2015
Department of Applied Mathematics and Computer Science, Software and Process Engineering

Media contribution (1)

Matematisk gennembrud øger tog sikkerheden
01/09/2015
DTU Avisen, Print
Iben Julie Schmidt
Anne Elisabeth Haxthausen
Department of Applied Mathematics and Computer Science, Software and Process Engineering

Skal vi frygte robotter?
Thomas Bolander
02/08/2015
Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)

Skal vi frygte robotter?
02/08/2015
BT, Print
Thomas Bolander
Department of Applied Mathematics and Computer Science, Algorithms and Logic
Memristor-hjerne kan revolutionere kunstig intelligens
Thomas Bolander
15/05/2015
Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)

Om Blade Runner og menneskelig vs. kunstig intelligens
Thomas Bolander
07/05/2015
Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)

Owners of wood pellet stoves risk carbon monoxide poisoning in poorly ventilated pellet storage rooms
Frank Huess Hedlund
03/05/2015
Subject
Nordjyske Stiftstidende, Søndag 3. maj 2015, Erhverv s38
Department of Applied Mathematics and Computer Science

Media contribution (1)

Private households with wood pellet stoves face risk of carbon monoxide poisoning
Frank Huess Hedlund
29/04/2015
Department of Applied Mathematics and Computer Science

Media contribution (1)

Kunstig intelligens får højere IQ
Thomas Bolander
07/04/2015
Department of Applied Mathematics and Computer Science, Algorithms and Logic
### Kunstig intelligens får højere IQ
07/04/2015
DR P1, Radio
Thomas Bolander
Department of Applied Mathematics and Computer Science, Algorithms and Logic

### Skal vi bekymrede for udviklingen indenfor kunstig intelligens?
12/03/2015
Department of Applied Mathematics and Computer Science, Algorithms and Logic

### Om DeepMind og kunstig intelligens
03/03/2015
Radio 24syv, Radio

### Glem domnedagsprofetierne om kunstig intelligens
13/02/2015

### Jeg skulle lige udfordre mig selv en gang til
01/02/2015

### Subject
Campusliv / Campus Life
Department of Applied Mathematics and Computer Science
Når våben bestemmer over liv og død
Thomas Bolander
19/12/2014
Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)

30 år efter giftudslip lider Bhopal stadig
Frank Huess Hedlund
04/12/2014

Subject
Politiken 4 dec 2014, 1. sektion, side 2, notis om 30-årsdagen for Bhopal ulykken
Department of Applied Mathematics and Computer Science

Media contribution (1)

Center for Cybersikkerhed efter sen Shellshock-advarsel: »Ikke vores opgave at informere bredt om nye sårbarheder«
Luke Thomas Herbert
03/11/2014
Department of Applied Mathematics and Computer Science, Embedded Systems Engineering

Media contribution (1)

Professionelle hackere kunne trække stikket til Europa
Luke Thomas Herbert
24/10/2014
Department of Applied Mathematics and Computer Science, Embedded Systems Engineering

Media contribution (1)
**DR2 Dagen**
Thomas Bolander
20/10/2014

**Subject**
Om kunstig intelligens og fremtidens robotter
Office for Study Programmes and Student Affairs, Department of Applied Mathematics and Computer Science, Algorithms and Logic

**Media contribution (1)**

**Kunstig intelligens og fremtidens robotter**
Thomas Bolander
20/10/2014
Department of Applied Mathematics and Computer Science, Algorithms and Logic

**Media contribution (1)**

**Politiets IT er guf for hackere**
Luke Thomas Herbert
07/10/2014
Department of Applied Mathematics and Computer Science, Embedded Systems Engineering

**Media contribution (1)**

**Kulturen på NEWS: Computeren har narret mennesket**
Thomas Bolander
06/10/2014
Office for Study Programmes and Student Affairs, Department of Applied Mathematics and Computer Science, Algorithms and Logic

**Media contribution (1)**
**Hacker-angreb går efter energisektoren**
Luke Thomas Herbert
04/10/2014
Department of Applied Mathematics and Computer Science, Embedded Systems Engineering

**Media contribution (1)**

**Hacker-angreb går efter energisektoren**
04/10/2014
Version2, Web
Luke Thomas Herbert
Department of Applied Mathematics and Computer Science, Embedded Systems Engineering
Press / Media

**Hacker angreb debat**
Luke Thomas Herbert
04/10/2014

**Subject**
Radio programme about it-security with a focus on hacker attacks
Department of Applied Mathematics and Computer Science, Embedded Systems Engineering

**Media contribution (1)**

**Hacker angreb debat**
04/10/2014
P4, Radio
1 hour
Luke Thomas Herbert
Department of Applied Mathematics and Computer Science, Embedded Systems Engineering
Press / Media

**Efterretningsskilder: Russiske cyberkrigere vil mørklægge Europa**
Luke Thomas Herbert
03/10/2014
Department of Applied Mathematics and Computer Science, Embedded Systems Engineering

**Media contribution (1)**

**Efterretningsskilder: Russiske cyberkrigere vil mørklægge Europa**
03/10/2014
Web
http://www.dr.dk/Nyheder/Penge/2014/11/03/195731.htm
Luke Thomas Herbert
Department of Applied Mathematics and Computer Science, Embedded Systems Engineering
Press / Media

**Hackere angriber energinettet**
Luke Thomas Herbert
03/10/2014
Department of Applied Mathematics and Computer Science, Embedded Systems Engineering

**Media contribution (1)**

**Hackere angriber energinettet**
03/10/2014
DR, Television
Luke Thomas Herbert
Department of Applied Mathematics and Computer Science, Embedded Systems Engineering
Press / Media
Patch-kaos i kølvandet på Shellshock: Flere sikkerhedshuller skaber forvirring  
Luke Thomas Herbert  
01/10/2014  
Department of Applied Mathematics and Computer Science, Embedded Systems Engineering

Media contribution (1)

Patch-kaos i kølvandet på Shellshock: Flere sikkerhedshuller skaber forvirring  
01/10/2014  
Version2.dk, Web  
Luke Thomas Herbert  
Department of Applied Mathematics and Computer Science, Embedded Systems Engineering

Press / Media

AK24syv på Radio 24syv: Om sociale robotter og etik  
Thomas Bolander  
17/09/2014  
Office for Study Programmes and Student Affairs, Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)

AK24syv på Radio 24syv: Om sociale robotter og etik  
17/09/2014  
Radio 24syv, Radio  
Thomas Bolander  
Department of Applied Mathematics and Computer Science, Algorithms and Logic, Office for Study Programmes and Student Affairs

Press / Media

Om sociale robotter og etik  
Thomas Bolander  
17/09/2014  
Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)

Om sociale robotter og etik  
17/09/2014  
Radio 24syv, Radio  
Thomas Bolander  
Department of Applied Mathematics and Computer Science, Algorithms and Logic

Press / Media

Om fremtidens dræberrobotter  
Thomas Bolander  
09/09/2014  
Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)

Om fremtidens dræberrobotter  
09/09/2014  
DR P3, Radio  
Thomas Bolander  
Department of Applied Mathematics and Computer Science, Algorithms and Logic

Press / Media

Ghandi på P3: Om fremtidens dræberrobotter  
Thomas Bolander  
09/09/2014  
Office for Study Programmes and Student Affairs, Department of Applied Mathematics and Computer Science, Algorithms and Logic
Ghandi på P3: Om fremtidens dræberrobotter
09/09/2014
DR P3, Radio
Thomas Bolander
Department of Applied Mathematics and Computer Science, Algorithms and Logic, Office for Study Programmes and Student Affairs
Press / Media

Computeren har narret mennesket
10/06/2014
Department of Applied Mathematics and Computer Science, Algorithms and Logic

Computer består afgørende mennesketest
10/06/2014
Department of Applied Mathematics and Computer Science, Algorithms and Logic

Supercomputer Narrer menneske
10/06/2014
Department of Applied Mathematics and Computer Science, Algorithms and Logic

Computer består afgørende mennesketest
10/06/2014
Office for Study Programmes and Student Affairs, Department of Applied Mathematics and Computer Science, Algorithms and Logic

Supercomputer Narrer menneske
10/06/2014
Department of Applied Mathematics and Computer Science, Algorithms and Logic
24syv Morgen: Supercomputer narrer menneske
Thomas Bolander
10/06/2014
Office for Study Programmes and Student Affairs, Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)

24syv Morgen: Supercomputer narrer menneske
10/06/2014
Radio 24syv, Radio
Thomas Bolander
Department of Applied Mathematics and Computer Science, Algorithms and Logic, Office for Study Programmes and Student Affairs
Press / Media

It-sikkerhed, især i forhold til offentlige data
Luke Thomas Herbert
07/05/2014
Department of Applied Mathematics and Computer Science, Embedded Systems Engineering

Media contribution (1)

It-sikkerhed, især i forhold til offentlige data
07/05/2014
Nyhederne kl. 19, Television
TV2
Luke Thomas Herbert
Embedded Systems Engineering, Department of Applied Mathematics and Computer Science
Press / Media

It-sikkerhed, især i forhold til offentlige data
Luke Thomas Herbert
07/05/2014
Department of Applied Mathematics and Computer Science, Embedded Systems Engineering

Media contribution (1)

It-sikkerhed, især i forhold til offentlige data
07/05/2014
Nyhederne kl. 20, Television
TV2 News
Luke Thomas Herbert
Embedded Systems Engineering, Department of Applied Mathematics and Computer Science
Press / Media

Professor: Vores samfund har taget for let på al persondatasikkerhed: Personfølsomme oplysninger er blevet kompromitteret
Luke Thomas Herbert
07/05/2014
Department of Applied Mathematics and Computer Science, Embedded Systems Engineering

Media contribution (1)

Professor: Vores samfund har taget for let på al persondatasikkerhed: Personfølsomme oplysninger er blevet kompromitteret
07/05/2014
Politiken.dk, Web
Thomas Bolander on self-reference and agent introspection
Thomas Bolander
13/04/2014
Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)

Thomas Bolander on self-reference and agent introspection
13/04/2014
Blog of MIRI, Machine Intelligence Research Institute, Web
https://intelligence.org/2014/04/13/thomas-bolander/
Thomas Bolander
Department of Applied Mathematics and Computer Science, Algorithms and Logic
Press / Media

Hvordan bestemmes sudokus sværhedsgrad?
Thomas Bolander
16/03/2014
Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)

Hvordan bestemmes sudokus sværhedsgrad?
16/03/2014
Jyllands-Posten, Print
Thomas Bolander
Department of Applied Mathematics and Computer Science, Algorithms and Logic
Press / Media

Hvordan bestemmes sudokus sværhedsgrad?
Thomas Bolander
16/03/2014
Office for Study Programmes and Student Affairs, Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)

Hvordan bestemmes sudokus sværhedsgrad?
16/03/2014
Jyllands-Posten, Print
Thomas Bolander
Department of Applied Mathematics and Computer Science, Algorithms and Logic, Office for Study Programmes and Student Affairs
Press / Media

IBM satser på kommerciel kunstig intelligens
Thomas Bolander
11/03/2014
Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)

IBM satser på kommerciel kunstig intelligens
11/03/2014
DR P1, Radio
Thomas Bolander
Department of Applied Mathematics and Computer Science, Algorithms and Logic
Press / Media
Orientering på P1: IBM satser på kommerciel kunstig intelligens
Thomas Bolander
11/03/2014
Office for Study Programmes and Student Affairs, Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)

Orientering på P1: IBM satser på kommerciel kunstig intelligens
11/03/2014
P1, Radio
Thomas Bolander
Department of Applied Mathematics and Computer Science, Algorithms and Logic, Office for Study Programmes and Student Affairs
Press / Media

Risiko-ekspert: Vi ignorerer eksplosionsfaren fra træpille-støv
Frank Huess Hedlund
10/03/2014
Department of Applied Mathematics and Computer Science

Media contribution (1)

Risiko-ekspert: Vi ignorerer eksplosionsfaren fra træpille-støv
10/03/2014
Ugeavisen Ingeniøren, Print
http://ing.dk/artikel/risiko-ekspert-vi-ignorerer-eksplosionsfaren-fra-traepille-stoev-166499
Frank Huess Hedlund
Department of Applied Mathematics and Computer Science
Press / Media

Intelligens og maskiner
Thomas Bolander
05/03/2014
Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)

Intelligens og maskiner
05/03/2014
DR P1, Radio
Thomas Bolander
Department of Applied Mathematics and Computer Science, Algorithms and Logic
Press / Media

Apropos på P1: Intelligens og maskiner
Thomas Bolander
05/03/2014
Office for Study Programmes and Student Affairs, Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)

Apropos på P1: Intelligens og maskiner
05/03/2014
P1, Television
Thomas Bolander
Algorithms and Logic, Department of Applied Mathematics and Computer Science, Office for Study Programmes and Student Affairs
Press / Media
Når robotten bliver en ven
Thomas Bolander
28/02/2014
Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)

Når robotten bliver en ven
28/02/2014
DR2, Television
Thomas Bolander
Department of Applied Mathematics and Computer Science, Algorithms and Logic
Press / Media

DR2 Dagen: Når robotten bliver en ven
Thomas Bolander
28/02/2014
Office for Study Programmes and Student Affairs, Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)

Drop kæresten - elsk dit styresystem i stedet
Thomas Bolander
27/02/2014
Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)

Drop kæresten - elsk dit styresystem i stedet
27/02/2014
Politiken, Print
Thomas Bolander
Department of Applied Mathematics and Computer Science, Algorithms and Logic
Press / Media

Drop kæresten - elsk dit styresystem i stedet
Thomas Bolander
27/02/2014
Office for Study Programmes and Student Affairs, Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)

Drop kæresten - elsk dit styresystem i stedet
27/02/2014
Politiken, Print
Thomas Bolander
Department of Applied Mathematics and Computer Science, Algorithms and Logic, Office for Study Programmes and Student Affairs
Press / Media

Kan man elske sit styresystem
Thomas Bolander
26/02/2014
Kan man elske sit styresystem?
Thomas Bolander
26/02/2014
Department of Applied Mathematics and Computer Science, Algorithms and Logic

Dagens citat
Thomas Bolander
16/02/2014
Department of Applied Mathematics and Computer Science, Algorithms and Logic

Nye robotter udfordrer etikken
Thomas Bolander
14/02/2014
Department of Applied Mathematics and Computer Science, Algorithms and Logic
Nye robotter udfordrer etikken
14/02/2014
Kristeligt Dagblad, Print
Thomas Bolander
Department of Applied Mathematics and Computer Science, Algorithms and Logic, Office for Study Programmes and Student Affairs
Press / Media

Nye robotter udfordrer etikken
Thomas Bolander
14/02/2014
Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)

Kultursøndag på P1: Om kunstig intelligens i sociale medier
Thomas Bolander
10/02/2014
Office for Study Programmes and Student Affairs, Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)

AK 24syv
Thomas Bolander
03/02/2014

Subject
Om kunstig intelligens og Spike Jonze-filmen "Her" ("Hende").
Office for Study Programmes and Student Affairs, Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)

Banksy in Boston? Nope, just bots in Copenhagen
Sune Lehmann Jørgensen
04/12/2013
Department of Applied Mathematics and Computer Science, Cognitive Systems
Banksy in Boston? Nope, just bots in Copenhagen
04/12/2013
Boston.com, Web
Andrew Tran
http://www.boston.com/business/innovation/blogs/inside-the-hive/2013/12/04/banksy-boston-nope-just-bots-copenhagen/q3PbxYRh1kMSlJfdebS2I/blog.html
Link to full text
Sune Lehmann Jørgensen
Department of Applied Mathematics and Computer Science, Cognitive Systems
Press / Media

Mørkenettet flyder med børneporno og narko
Luke Thomas Herbert
13/11/2013
Description
Quoted in the Danish newspaper Politiken on it-security.

Subject
it-security
Department of Applied Mathematics and Computer Science, Embedded Systems Engineering

Videnskabens Verden på P1
Thomas Bolander
22/10/2013
Subject
Robotter, kunstig intelligens og social perspektivtagning.
Office for Study Programmes and Student Affairs, Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)
Zum Glück blieb bereits 1953 die große Katastrophe aus
Frank Huess Hedlund
17/04/2013
Department of Applied Mathematics and Computer Science

Media contribution (1)

Zum Glück blieb bereits 1953 die große Katastrophe aus
17/04/2013
Freis Wort (Südthüringen.de), Print
Link to article.
Frank Huess Hedlund
Department of Applied Mathematics and Computer Science

Hjernekassen på P1
Thomas Bolander
15/04/2013
Subject
Kunstig intelligens
Office for Study Programmes and Student Affairs, Department of Applied Mathematics and Computer Science, Algorithms and Logic

Media contribution (1)

Hjernekassen på P1
15/04/2013
DR P1, Radio
Peter Lund Madsen
Thomas Bolander
Department of Applied Mathematics and Computer Science, Algorithms and Logic, Office for Study Programmes and Student Affairs

The Dane’s Academy: Ph.d. in 3 minutes: Optimal Flows
Peter Nørtoft
05/04/2013
Subject
Formidling af ph.d.-afhandling
Department of Applied Mathematics and Computer Science, Scientific Computing

Media contribution (1)

The Dane’s Academy: Ph.d. in 3 minutes: Optimal Flows
05/04/2013
DR, Television
3 min
http://www.dr.dk/DR2/Danskekemus+akademi/Ph.d._Cup_2013/Programmer/Optimale_Stromninger.htm
Peter Nørtoft
Department of Applied Mathematics and Computer Science, Scientific Computing
Ph.d. Cup 2013: Using a computer to find the best shapes in flows
Peter Nørtoft
01/03/2013

Description
Article for the national Ph.d. Cup 2013

Subject
Formidling af ph.d.-afhandling
Department of Applied Mathematics and Computer Science , Scientific Computing

Media contribution (1)
Ph.d. Cup 2013: Using a computer to find the best shapes in flows
01/03/2013
Information / iBureauet, Web
http://phdcup.dk/skribenter/
Peter Nørtoft
Department of Applied Mathematics and Computer Science , Scientific Computing

Relations
Research outputs:
Med computeren på jagt efter gode former i strømninger
Press / Media

AK24syv
Thomas Bolander
29/11/2012
Department of Informatics and Mathematical Modeling, Office for Study Programmes and Student Affairs, Computer Science and Engineering, Algorithms and Logic

Media contribution (1)
AK24syv
29/11/2012
Radio 24syv, Radio
Anders Christiansen
40 minutter
Thomas Bolander
Office for Study Programmes and Student Affairs, Department of Informatics and Mathematical Modeling, Algorithms and Logic, Computer Science and Engineering
Press / Media
When disaster strikes: Hurricane Katrina,
Frank Huess Hedlund
15/06/2012

Description
Striking a balance between, on the one hand, the need for centralization of the disaster emergency response, and on the other hand, the ability to achieve a flexible and improvised response, that uses scarce resources in an optimal manner – a flexibility which by nature requires decentralization.

Subject
disaster response, resilience
Department of Applied Mathematics and Computer Science

Media contribution (1)

When disaster strikes: Hurricane Katrina,
15/06/2012
Magasinet Samtænkning, Print
Virksomhedshjemmeværet (Ministry of defence)
Frank Huess Hedlund
Department of Applied Mathematics and Computer Science

Videnskabernes Verden på P1
Thomas Bolander
06/03/2012
Department of Informatics and Mathematical Modeling, Computer Science and Engineering, Algorithms and Logic

Media contribution (1)

Videnskabernes Verden på P1
06/03/2012
P1, Danmarks Radio, Radio
Thomas Bolander
Department of Informatics and Mathematical Modeling, Algorithms and Logic, Computer Science and Engineering

Deadline 17 på DR2
Thomas Bolander
10/01/2012
Department of Informatics and Mathematical Modeling, Office for Study Programmes and Student Affairs, LearningLab DTU, Computer Science and Engineering, Algorithms and Logic

Media contribution (1)

Deadline 17 på DR2
10/01/2012
DR2, Danmarks Radio, Television
Thomas Bolander
Office for Study Programmes and Student Affairs, LearningLab DTU, Department of Informatics and Mathematical Modeling, Algorithms and Logic, Computer Science and Engineering

Detektor på P1
Vagn Lundsgaard Hansen
28/09/2011
Geometry, Department of Mathematics

Media contribution (1)

Detektor på P1
28/09/2011
Danmarks Radio P1, Radio
Kunstig intelligens: Foredrag i Danskernes Akademi på DR2
Thomas Bolander
11/04/2011
Department of Informatics and Mathematical Modeling, Algorithms and Logic

Media contribution (1)

Viden om -Naturens skjulte mønstre
Vagn Lundsgaard Hansen
06/03/2011
Geometry, Department of Mathematics

Media contribution (1)

Dengang Jorden var flad
Vagn Lundsgaard Hansen
28/02/2011
Geometry, Department of Mathematics

Media contribution (1)

Dengang Jorden var flad
28/02/2011
Danmarks Radio P1, Radio
http://www.dr.dk/design/www/AudioMiniPlayer/miniplayer_window.html?test=0&mediaQid=2024613&ErrorCode=true&title=Hør+udsendelsen
PUB-OA
Vagn Lundsgaard Hansen
Department of Mathematics, Geometry
Press / Media

Dengang... jorden var blommen i et æg
Vagn Lundsgaard Hansen
28/02/2011
Department of Mathematics

Media contribution (1)
Dengang... jorden var blommen i et æg
28/02/2011
Radio
Vagn Lundsgaard Hansen
Department of Mathematics
Press / Media

Sociale robotter i støbeskeen: Artikel om min forskning på videnskab.dk
Thomas Bolander
02/09/2010
Department of Informatics and Mathematical Modeling, Computer Science and Engineering

Media contribution (1)

Sociale robotter i støbeskeen: Artikel om min forskning på videnskab.dk
02/09/2010
Print
http://videnskab.dk/teknologi/sociale-robotter-i-stobeskeen
PUB-OA
Thomas Bolander
Department of Informatics and Mathematical Modeling, Computer Science and Engineering
Press / Media

Gas rail tank cars are bombs on wheels
Frank Huess Hedlund
25/09/2009

Description
Liquefied petroleum gas
Department of Applied Mathematics and Computer Science

Media contribution (1)

Gas rail tank cars are bombs on wheels
25/09/2009
Nyhedsmagasinet Ingeniøren, Print
The Engineer
http://ing.dk/artikel/gasvogne-pa-jernbanen-er-trillende-bomber-102663
Frank Huess Hedlund
Department of Applied Mathematics and Computer Science
Press / Media

Poor levels of safety for rail tank cars - Gas explosion could take place in Denmark
Frank Huess Hedlund
31/07/2009

Description
Liquefied petroleum gas
Department of Applied Mathematics and Computer Science

Media contribution (1)

Poor levels of safety for rail tank cars - Gas explosion could take place in Denmark
31/07/2009
Nyhedsmagasinet Ingeniøren, Print
http://ing.dk/artikel/elendig-tog-sikkerhed-gaseksplosion-kan ogsa ske i danmark-99854
Frank Huess Hedlund
Department of Applied Mathematics and Computer Science
Press / Media

Roskilde Damradio
Poul G. Hjorth
01/08/2007
Dynamical systems, Department of Mathematics

**Media contribution (1)**

**Røskilde Damradio**
01/08/2007
Radio
Poul G. Hjorth
Department of Mathematics, Dynamical systems
Press / Media

**Danske Lokalradioer**
Poul G. Hjorth
04/01/2007
Dynamical systems, Department of Mathematics

**Media contribution (1)**

**Danske Lokalradioer**
04/01/2007
Radio
Poul G. Hjorth
Department of Mathematics, Dynamical systems
Press / Media

**Viden om: Naturens skjulte mønstre**
Vagn Lundsgaard Hansen
27/03/2001

**Description**
Hvorfor sidder solsikkens frø altid på samme måde? Og hvorfor består biernes tavler af sekskanter? Tag med på rejse i de smukke mønstre og hør om de klare regler bag det hele, når Viden Om i denne uge ser på den håndgribelige matematik, der ligger skjult bag mange af naturens tilsyneladende tilfældige former og mønstre.
Department of Mathematics

**Media contribution (1)**

**Viden om: Naturens skjulte mønstre**
27/03/2001
København, Danmark, Television
http://www.dr.dk/DR2/VidenOm/Programmer/2001/03/20071217152104.htm
PUB-OA
Vagn Lundsgaard Hansen
Department of Mathematics
Press / Media