A Verified Simple Prover for First-Order Logic

We present a simple prover for first-order logic with certified soundness and completeness in Isabelle/HOL, taking formalizations by Tom Ridge and others as the starting point, but with the aim of using the approach for teaching logic and verification to computer science students at the bachelor level. The prover is simple in the following sense: It is purely functional and can be executed with rewriting rules or as code generation to a number of functional programming languages. The prover uses no higher-order functions, that is, no function takes a function as argument or returns a function as its result. This is advantageous when students perform rewriting steps by hand. The prover uses the logic of first-order logic on negation normal form with a term language consisting of only variables. This subset of the full syntax of first-order logic allows for a simple proof system without resorting to the much weaker propositional logic.

General Information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Technical University of Denmark
Contributors: Villadsen, J., Schlichtkrull, A., From, A. H.
Pages: 88—104
Publication date: 2018

Host publication information
Title of host publication: Proceedings of the 6th Workshop on Practical Aspects of Automated Reasoning (PAAR)
Publisher: CEUR-WS
Editors: Konev, B., Urban, J., Rümmer, P.
Electronic versions:
paper_08.pdf
URLs:
http://ceur-ws.org/Vol-2162/#paper-08
URLs:
https://easychair.org/smart-slide/slide/M6k3# (Easychair Smart slide)
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
Contributors: From, A. H., Schlichtkrull, A., Villadsen, J.
Number of pages: 7
Publication date: 2018

Host publication information
Title of host publication: Proceedings of the Isabelle Workshop 2018
Electronic versions:
Drawing_Trees.pdf

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: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Technical University of Denmark
Contributors: Villadsen, J., Fleckenstein, O., Hatteland, H., Larsen, J. B.
Pages: 57–74
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Annals of Mathematics and Artificial Intelligence
Volume: 84
Issue number: 1-2
ISSN (Print): 1012-2443
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.21 SJR 0.413 SNIP 1.046
Web of Science (2017): Impact factor 0.899
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.27 SJR 0.438 SNIP 0.982
Web of Science (2016): Impact factor 0.807
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 0.93 SJR 0.562 SNIP 0.94
Web of Science (2015): Impact factor 0.944
Formalization of First-Order Syntactic Unification

We present a new formalization in the Isabelle proof assistant of first-order syntactic unification, including a proof of termination. Our formalization follows, almost down to the letter, the ML-code from Baader and Nipkow's book "Term Rewriting and All That" (1998). Correctness is implied by the formalization's similarity to Baader and Nipkow's ML-code, but we have yet to formalize the correctness of the unification algorithm.
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.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, KTH - Royal Institute of Technology, Aalto University
Pages: 49-65
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Tertiary Education and Management
Volume: 24
Issue number: 1
ISSN (Print): 1358-3883
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.16 SJR 0.644 SNIP 0.819
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.91 SJR 0.336 SNIP 0.553
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.07 SJR 0.918 SNIP 1.313
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 0.51 SJR 0.342 SNIP 0.395
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 0.71 SJR 0.671 SNIP 0.875
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 0.33 SJR 0.303 SNIP 0.486
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 0.4 SJR 0.441 SNIP 0.422
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.327 SNIP 0.477
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.438 SNIP 0.643
BFI (2008): BFI-level 1
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
Contributors: Villadsen, J., From, A. H., Jacobi, S., Larsen, N. N.
Pages: 86-100
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: International Journal of Agent-Oriented Software Engineering
Volume: 6
Issue number: 1
ISSN (Print): 1746-1375
Ratings:
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
BFI (2015): BFI-level 1
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.119 SNIP 1.248
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.395 SNIP 3.067
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.253 SNIP 1.375
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.402 SNIP 1.831
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.697 SNIP 1.386
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.473 SNIP 3.005
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.222 SNIP 0.808
Original language: English
Keywords: Multi-agent systems, MAS programming, Contest
Electronic versions: main.pdf
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.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Technical University of Denmark
Contributors: Villadsen, J., From, A. H., Schlichtkrull, A.
Pages: 140-155
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Electronic Proceedings in Theoretical Computer Science
Volume: 267
ISSN (Print): 2075-2180
Ratings:
Web of Science (2019): Indexed yes
Web of Science (2018): Indexed yes
Scopus rating (2017): SJR 0.231 SNIP 0.473
Web of Science (2017): Indexed yes
Scopus rating (2016): SJR 0.315 SNIP 0.63
Scopus rating (2015): SJR 0.312 SNIP 0.522
Scopus rating (2014): SJR 0.36 SNIP 0.723
Scopus rating (2013): SJR 0.312 SNIP 0.599
ISI indexed (2013): ISI indexed no
Scopus rating (2012): SJR 0.409 SNIP 0.712
ISI indexed (2012): ISI indexed no
Scopus rating (2011): SJR 0.253 SNIP 0.575
ISI indexed (2011): ISI indexed no
Original language: English
Electronic versions:
NaDeA.pdf
DOIs:
10.4204/EPTCS.267.9
Source: FindIt
Source-ID: 2396851948
Research output: Research - peer-review; Journal article – Annual report year: 2018

Natural Deduction Assistant (NaDeA)

We present the Natural Deduction Assistant (NaDeA) and discuss its advantages and disadvantages as a tool for teaching logic. In particular we compare our approach to natural deduction in the Isabelle proof assistant. NaDeA is available online: https://nadea.compute.dtu.dk/

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Technical University of Denmark
Contributors: Villadsen, J., From, A. H., Schlichtkrull, A.
Number of pages: 6
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).
Web of Science (2011): Impact factor 0.5
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.454 SNIP 0.995
Web of Science (2010): Impact factor 0.837
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.583 SNIP 1.663
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.431 SNIP 0.842
Scopus rating (2007): SJR 0.359 SNIP 1.214
Scopus rating (2006): SJR 0.247 SNIP 0.859
Scopus rating (2005): SJR 0.541 SNIP 1.04
Scopus rating (2004): SJR 0.295 SNIP 1.144
Scopus rating (2003): SJR 0.614 SNIP 1.549
Scopus rating (2002): SJR 0.388 SNIP 1.287
Scopus rating (2001): SJR 0.456 SNIP 1.455
Scopus rating (2000): SJR 0.192 SNIP 1.879
Scopus rating (1999): SJR 0.184 SNIP 0.966

Original language: English
Keywords: Isabelle, Verification, Declarative proofs for first-order logic with equality, Soundness, LCF-style prover

Electronic versions:
AIComm.pdf

DOIs:
10.3233/AIC-180764

Source: PublicationPreSubmission
Source-ID: 149078624
Research output: Research - peer-review › Journal article – Annual report year: 2018

**Proving in the Isabelle Proof Assistant that the Set of Real Numbers is not Countable**
We present a new succinct proof of the uncountability of the real numbers – optimized for clarity – based on the proof by Benjamin Porter in the Isabelle Analysis theory.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Contributors: Villadsen, J.
Number of pages: 6
Publication date: 2018
Peer-reviewed: Yes
Electronic versions: paper7.pdf
Research output: Research - peer-review › Paper – 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
Students' Proof Assistant (SPA)
The Students' Proof Assistant (SPA) aims to both teach how to use a proof assistant like Isabelle but also to teach how reliable proof assistants are built. Technically it is a miniature proof assistant inside the Isabelle proof assistant. In addition we conjecture that a good way to teach structured proving is with a concrete prover where the connection between semantics, proof system, and prover is clear. In fact, the proofs in Lamport's TLAPS proof assistant have a very similar structure to those in the declarative prover SPA. To illustrate this we compare a proof of Pelletier's problem 43 in TLAPS, Isabelle/Isar and SPA.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Technical University of Denmark
Contributors: Schlichtkrull, A., Villadsen, J., From, A. H.
Number of pages: 6
Publication date: 2018
Peer-reviewed: Yes
Electronic versions:
paper6.pdf
Research output: Research - peer-review » Paper – Annual report year: 2018

Substitutionless First-Order Logic: A Formal Soundness Proof
Substitution under quantifiers is non-trivial and may obscure a proof system for newcomers. Monk (Arch. Math. Log. Grundl. 1965) successfully eliminates substitution via identities and also uses a so-called normalization of formulas as a further simplification. We formalize the substitutionless proof system in Isabelle/HOL, spelling out its side conditions explicitly and verifying its soundness.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Technical University of Denmark
Contributors: From, A. H., Larsen, J. B., Schlichtkrull, A., Villadsen, J.
Number of pages: 3
Publication date: 2018

Host publication information
Title of host publication: Proceedings of the Isabelle Workshop 2018
Electronic versions:
Substitutionless_First_Order_Logic.pdf
Source: PublicationPreSubmission
Source-ID: 149537504
Research output: Research - peer-review » Article in proceedings – 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/.

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.
Scopus rating (2017): CiteScore 2.3 SJR 0.429 SNIP 1.53
Web of Science (2017): Impact factor 1.176
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.19 SJR 0.531 SNIP 1.595
Web of Science (2016): Impact factor 1.606
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.17 SJR 0.731 SNIP 1.831
Web of Science (2015): Impact factor 1.417
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.44 SJR 0.837 SNIP 2.5
Web of Science (2014): Impact factor 1.254
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.7 SJR 0.846 SNIP 2.754
Web of Science (2013): Impact factor 1.108
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.21 SJR 0.742 SNIP 3.396
Web of Science (2012): Impact factor 0.79
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 3.33 SJR 0.9 SNIP 3.528
Web of Science (2011): Impact factor 1.213
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.162 SNIP 3.24
Web of Science (2010): Impact factor 2.103
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
Keywords: Operational semantics, Organization-aware agents, Organizational reasoning
Electronic versions:
jaamas_corrected.pdf
DOIs:
10.1007/s10458-015-9324-2
Source: FindIt
Source-ID: 2290393255
Research output: Research - peer-review > Journal article – Annual report year: 2016

An Approach for Hospital Planning with Multi-Agent Organizations
The background for this paper is a development that the Danish hospitals are undertaking which requires the establishment of a common emergency department. It is uncertain exactly what and how many resources the department needs and so resources are assigned dynamically as seen necessary by the staff. Such dynamic adjustments pose a challenge in predicting what consequences these adjustments may lead to. We propose an approach to deal with this
challenge that applies simulation with intelligent agents and logics for organizational reasoning. We present some of the
expected obstacles with this approach and potential ways to overcome them.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Contributors: Larsen, J. B., Villadsen, J.
Pages: 454-465
Publication date: 2017

**Host publication information**
Title of host publication: Rough Sets
Volume: 10314
Publisher: Springer
ISBN (Print): 978-3-319-60839-6
(Lecture Notes in Computer Science, Vol. 10314).
Keywords: Computer Science, Artificial Intelligence (incl. Robotics), Database Management, Information Systems
Applications (incl. Internet), Information Storage and Retrieval, Multi-agent organizations, Logic, Simulation, Soft
computing, Process mining
Electronic versions:
approach_hospital_planning.pdf
DOIs:
10.1007/978-3-319-60840-2_33
Source: FindIt
Source-ID: 2372495948
Research output: Research - peer-review › Article in proceedings – Annual report year: 2017

**An Approach for Hospital Planning with Multi-Agent Organizations**

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Contributors: Larsen, J. B., Villadsen, J.
Pages: 383-385
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
Source: PublicationPreSubmission
Source-ID: 139212683
Research output: Research - peer-review › Article in proceedings – Annual report year: 2017

**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.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Contributors: Jensen, A. B., Schlichtkrull, A., Villadsen, J.
Pages: 1-66
Publication date: 2017
Peer-reviewed: Yes

**Publication information**
Journal: Archive of Formal Proofs
ISSN (Print): 2150-914X
Original language: English
Electronic versions:
document.pdf
URLs:
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
Contributors: Villadsen, J., Schlichtkrull, A.
Pages: 219-256
Publication date: 2017

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.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Contributors: Villadsen, J., Schlichtkrull, A.
Pages: 92-122
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: LNCS Transactions on Large-Scale Data- and Knowledge-Centered Systems
Volume: 34
ISSN (Print): 1869-1994
Ratings:
BFI (2019): BFI-level 1
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
Original language: English
Keywords: Paraconsistent logic, Many-valued logic, Formalization, Isabelle proof assistant, Inconsistency, Paraconsistency
Electronic versions: TLDKS.pdf
Logical Entity Level Sentiment Analysis
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.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Department of Management Engineering, Transport Modelling, Algorithms and Logic, Technical University of Denmark
Contributors: Petersen, N. C., Villadsen, J.
Pages: 54-71
Publication date: 2017

Host publication information
Title of host publication: International Conference on Formal Grammar
Publisher: Springer
Editors: Foret, A., Muskens, R., Pogodalla, S.
(Lecture Notes in Computer Science, Vol. 10686).

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.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Contributors: Villadsen, J., Jensen, A. B., Schlichtkrull, A.
Pages: 55-82
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: IfCoLog Journal of Logics and their Applications
Volume: 4
Issue number: 1
ISSN (Print): 2055-3714
Original language: English
Keywords: Natural Deduction, Formalization, Isabelle Proof Assistant, First-Order Logic, Higher-Order Logic
Electronic versions: ifcolog00010.pdf
URLs:
http://www.collegepublications.co.uk/journals/ifcolog/?00010

Bibliographical note
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].

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Delft University of Technology
Contributors: Jensen, A. S., Dignum, V., Villadsen, J.
Pages: 1133-1134
Publication date: 2016

Host publication information
Title of host publication: Proceedings of the 15th International Conference on Autonomous Agents & Multiagent Systems (AAMAS 2016)
Publisher: Association for Computing Machinery
ISBN (Print): 978-1-4503-4239-1
Electronic versions:
p1133.pdf
URLs:
http://www.ifaamas.org/Proceedings/aamas2016/forms/index.htm

Bibliographical note
Learning I: Agent Societies
Source: PublicationPreSubmission
Source-ID: 127721309
Research output: Research - peer-review › Conference abstract in proceedings – Annual report year: 2016

Code Generation for a Simple First-Order Prover

We present Standard ML code generation in Isabelle/HOL of a sound and complete prover for first-order logic, taking formalizations by Tom Ridge and others as the starting point. We also define a set of so-called unfolding rules and show how to use these as a simple prover, with the aim of using the approach for teaching logic and verification to computer science students at the bachelor level.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Technical University of Denmark
Contributors: Villadsen, J., Schlichtkrull, A., From, A. H.
Number of pages: 15
Publication date: 2016

Host publication information
Title of host publication: Proceedings of the Isabelle Workshop 2016
Keywords: Isabelle/HOL, First-order logic, Soundness, Completeness, Code generation, Unfolding rules, Standard ML, Isabelle/ML
Electronic versions:
Isabelle2016_12.pdf
URLs:
http://www21.in.tum.de/~nipkow/Isabelle2016/
Source: PublicationPreSubmission
Source-ID: 127746975
Research output: Research - peer-review › Article in proceedings – Annual report year: 2016

Paraconsistency

Paraconsistency is about handling inconsistency in a coherent way. In classical and intuitionistic logic everything follows from an inconsistent theory. A paraconsistent logic avoids the explosion. Quite a few applications in computer science and engineering are discussed in the Intelligent Systems Reference Library Volume 110: Towards Paraconsistent Engineering
(Springer 2016). We formalize a paraconsistent many-valued logic that we motivated and described in a special issue on logical approaches to paraconsistency (Journal of Applied Non-Classical Logics 2005). We limit ourselves to the propositional fragment of the higher-order logic. The logic is based on so-called key equalities and has a countably infinite number of truth values. We prove theorems in the logic using the definition of validity. We verify truth tables and also counterexamples for non-theorems. We prove meta-theorems about the logic and finally we investigate a case study.

ProofJudge: Automated Proof Judging Tool for Learning Mathematical Logic
Today we have software in many artefacts, from medical devices to cars and airplanes, and the software must not only be efficient and intelligent but also reliable and secure. Tests can show the presence of bugs but cannot guarantee their absence. A machine-checked proof using mathematical logic provides strong evidence for software correctness but it is requires advanced knowledge and skills. We have developed a tool which helps the student to practice their skills and also allows a better conceptual understanding of state-of-the-art proof assistants. Previously the proofs has been carried out using pen and paper because no adequate tool was available. The learning problem is how to make abstract concepts of logic as concrete as possible.

ProofJudge is a computer system and teaching approach for teaching mathematical logic and automated reasoning which augments the e-learning tool NaDeA (Natural Deduction Assistant). We believe that automatic feedback on student assignments would allow the students to enhance their skill in natural deduction proofs which are fundamental in formal verification and artificial intelligence applications. The teachers will benefit too and can put more emphasis on the semantics. Natural deduction is taught at most if not all universities but few tools exist. Initially we plan to have former students on the course to evaluate ProofJudge and later it will be employed in the course.
Running a Prover in a Prover - Isabelle as a Meta-Logic
Isabelle provides a foundation of mathematics and I show how you can run your own verified prover directly in the Isabelle prover or as a stand-alone program. I describe the formalization of syntax and semantics and discuss the proof of soundness and completeness for a simple prover for first-order logic.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Contributors: Villadsen, J.
Number of pages: 1
Publication date: 2016
Peer-reviewed: Yes
Event: Abstract from CADILLAC Workshop, Copenhagen, Denmark.
Electronic versions:
Villadsen.pdf
Source: PublicationPreSubmission
Source-ID: 127747358
Research output: Research - peer-review › Conference abstract for conference – Annual report year: 2016

Verification of an LCF-Style First-Order Prover with Equality
We formalize in Isabelle/HOL the kernel of an LCF-style prover for first-order logic with equality from John Harrison's Handbook of Practical Logic and Automated Reasoning. We prove the kernel sound and generate Standard ML code from the formalization. The generated code can then serve as a verified kernel. By doing this we also obtain verified components such as derived rules, a tableau prover, tactics, and a small declarative interactive theorem prover. We test that the kernel and the components give the same results as Harrison's original on all the examples from his book. The formalization is 600 lines and is available online.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Contributors: Jensen, A. B., Schlichtkrull, A., Villadsen, J.
Number of pages: 15
Publication date: 2016

Host publication information
Title of host publication: Proceedings of the Isabelle Workshop 2016
Keywords: Isabelle/HOL, Verification, First-order logic, Equality, Soundness, LCF-style prover, OCaml, Code generation, Standard ML (SML), Isabelle/ML
Electronic versions:
Isabelle2016_10.pdf
URLs:
http://www21.in.tum.de/~nipkow/Isabelle2016/
Source: PublicationPreSubmission
Source-ID: 127746966
Research output: Research - peer-review › Article in proceedings – Annual report year: 2016

Interfacing Agents to Real-Time Strategy Games
In real-time strategy games players make decisions and control their units simultaneously. Players are required to make decisions under time pressure and should be able to control multiple units at once in order to be successful. We present the design and implementation of a multi-agent interface for the real-time strategy game STARCASTER: BROOD WAR. This makes it possible to build agents that control each of the units in a game. We make use of the Environment Interface Standard, thus enabling different agent programming languages to use our interface, and we show how agents can control the units in the game in the Jason and GOAL agent programming languages.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Technical University of Denmark
Contributors: Jensen, A. S., Kayse-Rørdam, C., Villadsen, J.
Pages: 68-77
Publication date: 2015

Host publication information
Title of host publication: Proceedings of the 13th Scandinavian Conference on Artificial Intelligence (SCAI 2015)
Meta-Logical Reasoning in Higher-Order Logic

The semantics of first-order logic (FOL) can be described in the meta-language of higher-order logic (HOL). Using HOL one can prove key properties of FOL such as soundness and completeness. Furthermore, one can prove sentences in FOL valid using the formalized FOL semantics. To aid in the construction of the proof an interactive proof assistant like Isabelle can be used. The proof assistant can even automate simple proofs using the formalized FOL semantics.

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 undergraduate computer science 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.

Plan-Belief Revision in Jason

When information is shared between agents of unknown reliability, it is possible that their belief bases become inconsistent. In such cases, the belief base must be revised to restore consistency, so that the agent is able to reason. In some cases the inconsistent information may be due to use of incorrect plans. We extend work by Alechina et al. to revise belief bases in which plans can be dynamically added and removed. We present an implementation of the algorithm in the
AgentSpeak implementation Jason.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Contributors: Jensen, A. S., Villadsen, J.
Pages: 182-189
Publication date: 2015

**Host publication information**
Title of host publication: Proceedings of the 7th International Conference on Agents and Artificial Intelligence (ICAART-2015)
ISBN (Print): 978-989-758-073-4
Keywords: AgentSpeak, Jason, Plan-belief Revision
Electronic versions:
ICAART_2015_print.pdf
Source: PublicationPreSubmission
Source-ID: 104789380
Research output: Research - peer-review » Article in proceedings – Annual report year: 2015

**ProofJudge: Automated Proof Judging Tool for Learning Mathematical Logic**
Today we have software in many artefacts, from medical devices to cars and airplanes, and the software must not only be efficient and intelligent but also reliable and secure. Tests can show the presence of bugs but cannot guarantee their absence. A machine-checked proof using mathematical logic provides strong evidence for software correctness but it requires advanced knowledge and skills. We have developed a tool which helps the student to practice their skills and also allows a better conceptual understanding of state-of-the-art proof assistants. Previously the proofs has been carried out using pen and paper because no adequate tool was available. The learning problem is how to make abstract concepts of logic as concrete as possible.

ProofJudge is a computer system and teaching approach for teaching mathematical logic and automated reasoning which augments the e-learning tool NaDeA (Natural Deduction Assistant). We believe that automatic feedback on student assignments would allow the students to enhance their skill in natural deduction proofs which are fundamental in formal verification and artificial intelligence applications. The teachers will benefit too and can put more emphasis on the semantics. Natural deduction is taught at most if not all universities but few tools exist. Initially we plan to have former students on the course to evaluate ProofJudge and later it will be employed in the course.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Contributors: Villadsen, J.
Pages: 141-148
Publication date: 2015

**Host publication information**
Title of host publication: Exploring Teaching for Active Learning in Engineering Education (ETALEE 2015) : Book of Abstracts
Publisher: IUPN - Ingeniør Uddannelsesernes Pædagogiske Netværk
Keywords: E-Learning, Automated Tool, Mathematical Logic, Computer Science
Electronic versions:
Pages_from_book_of_abstracts_2.pdf
Source: PublicationPreSubmission
Source-ID: 118838837
Research output: Research - peer-review » Article in proceedings – Annual report year: 2015

**The AORTA Reasoning Framework - Adding Organizational Reasoning to Agents**
Intelligent agents are entities defined by, among other things, autonomy. In systems of many agents, the agents’ individual autonomy can lead to uncertainty since their behavior cannot always be predicted. Usually, this kind of uncertainty is accommodated by imposing an organization upon the system; an organization that defines expected behavior of the agents and attempts to restrict the agents’ behavior to let it match the expectations. Restrictions can lead to a decrease in autonomy, contradicting one of the pillars of intelligent agents.

This thesis presents the AORTA reasoning framework, which is a practical component (founded in logic) that enriches intelligent agents with organizational reasoning capabilities. We take the agent’s perspective by devising a component that integrates with the agent’s usual reasoning capabilities in a non-intrusive way. This results in agents that are both organization-aware and autonomous. The reasoning component makes them organization-aware, and their autonomy is intact because the component does not change the existing reasoning mechanisms. As such, it allows the agents to
decide whether to adhere to the system’s expectations. The ability to reason about organizations has previously been successfully integrated into agent programming languages. However, the operationalization of an organization is usually tailored to a specific language. This makes it hard to apply the same approach to other languages and platforms. The AORTA reasoning framework distinguishes itself by being a generic framework that allows different kinds of agents to reason about different kinds of organizations. We present our results in three main parts. In the first part, we present the theoretical foundations for the AORTA framework, which consists of semantics of norms, an organizational metamodel, and the AORTA reasoning component. The reasoning component is characterized by being completely decoupled from the cognitive agent, by its automated reasoning about norms and organizational options, and by the reasoning rules specified by the designer to act upon norms and options. We specify the reasoning component using structural operational semantics providing us with a formal, rigid description of the behavior of the component during execution. This enables us to precisely specify each reasoning phases (using transition rules), and it makes the implementation of the system quite straightforward.

The second part moves from theory to practice: we present an implementation of the framework and integrate it into various agent platforms. We show that the same configuration of the component can be used for different agent platforms, providing evidence for its use a general tool for organization-awareness. Furthermore, we use practical verification to show various properties of an implementation of agents and of the system in general.

In the last part, we discuss a potential issue with our framework. The possibility to commit to organizational objectives can affect the agent’s autonomy, which contradicts our main goal. We propose a model that solves this problem by adding a filter to the agent’s decision procedure that takes consequences of fulfilling a goal into account before deciding to commit to it. By considering both the agent’s preferences and the expected outcome of fulfilling the goal, we show that it was possible for the agents to make qualified context-dependent decisions.

We claim that by using the AORTA reasoning framework, agents become organization-aware. The reasoning component provides capabilities to reason about organizations and our decision procedure ensures that the autonomy of the agents is still intact.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Contributors: Jensen, A. S., Villadsen, J.
Number of pages: 197
Publication date: 2015

Publication information
Place of publication: Kgs. Lyngby
Publisher: Danmarks Tekniske Universitet (DTU)
Original language: English
Electronic versions:
phd372_Jensen_AS.pdf
Research output: Research › Ph.D. thesis – Annual report year: 2015

Combining Formal Logic and Machine Learning for Sentiment Analysis
This paper presents a formal logical method for deep structural analysis of the syntactical properties of texts using machine learning techniques for efficient syntactical tagging. To evaluate the method it is used for entity level sentiment analysis as an alternative to pure machine learning methods for sentiment analysis, which often work on sentence or word level, and are argued to have difficulties in capturing long distance dependencies.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Technical University of Denmark
Contributors: Petersen, N. C., Villadsen, J.
Pages: 375-384
Publication date: 2014

Host publication information
Title of host publication: Foundations of Intelligent Systems
Publisher: Springer
Editors: Andreassen, T., Christiansen, H., Cubero, J., Ras, Z.
ISBN (Print): 978-3-319-08325-4
(Lecture Notes in Computer Science, Vol. 8502).
Source: PublicationPreSubmission
Source-ID: 96583152
Research output: Research - peer-review › Article in proceedings – Annual report year: 2014
The AORTA Architecture: Integrating Organizational Reasoning in Jason

Open systems are characterized by a diversity of heterogeneous and autonomous agents that act according to private goals, and with a behavior that is hard to predict. They can be regulated through organizations similar to human organizations, which regulate the agents’ behavior space and describe the expected behavior of the agents. Agents need to be able to reason about the regulations, so that they can act within the expected boundaries and work towards the objectives of the organization. In this paper, we propose the AORTA architecture for making agents organization-aware. It is designed such that it provides organizational reasoning capabilities to agents implemented in existing agent programming languages without being tied to a specific organizational model. We show how it can be integrated in the Jason agent programming language, and discuss how the agents can coordinate their organizational tasks using AORTA.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Delft University of Technology
Contributors: Jensen, A. S., Dignum, V., Villadsen, J.
The AORTA Architecture: Integrating Organizational Reasoning in Jason

Open systems are characterized by a diversity of heterogeneous and autonomous agents that act according to private goals, and with a behavior that is hard to predict. They can be regulated through organizations similar to human organizations, which regulate the agents' behavior space and describe the expected behavior of the agents. Agents need to be able to reason about the regulations, so that they can act within the expected boundaries and work towards the objectives of the organization. In this paper, we describe the AORTA (Adding Organizational Reasoning to Agents) architecture for making agents organization-aware. It is designed such that it provides organizational reasoning capabilities to agents implemented in existing agent programming languages without being tied to a specific organizational model. We show how it can be integrated in the Jason agent programming language, and discuss how the agents can coordinate their organizational tasks using AORTA.

A Comparison of Organization-Centered and Agent-Centered Multi-Agent Systems

Whereas most classical multi-agent systems have the agent in center, there has recently been a development towards focusing more on the organization of the system, thereby allowing the designer to focus on what the system goals are, without considering how the goals should be fulfilled.

We have developed and evaluated two teams of agents for a variant of the well-known Bomberman computer game. One team is based on the basic Jason system, which is an implementation in Java of an extension of the logic-based agent-oriented programming language AgentSpeak. The other team is based on the organizational model Moise+, which is combined with Jason in the middleware called J-Moise+.

We have investigated whether taking the organization-oriented approach had any clear advantages to the classical way of implementing multi-agent systems. Although not decisive the investigation did indicate that the agent-oriented approach has a number of advantages when it comes to game-like scenarios with just a few different character types.
Belief Revision in the GOAL Agent Programming Language

Agents in a multiagent system may in many cases find themselves in situations where inconsistencies arise. In order to properly deal with these, a good belief revision procedure is required. This paper illustrates the usefulness of such a procedure: a certain belief revision algorithm is considered in order to deal with inconsistencies and, particularly, the issue of inconsistencies, and belief revision is examined in relation to the GOAL agent programming language.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Technical University of Denmark
Contributors: Spurkeland, J. S., Jensen, A. S., Villadsen, J.
Number of pages: 11
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: ISRN Artificial Intelligence
Volume: 2013
Article number: 632319
ISSN (Print): 2090-7435
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
Original language: English
Electronic versions:
632319.pdf
DOI:
10.1155/2013/632319

Bibliographical note
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Research output: Research - peer-review › Journal article – Annual report year: 2013

Engineering a Multi-Agent System in GOAL

We provide a brief description of the GOAL-DTU system, including the overall design, the tools and the algorithms that we used in the Multi-Agent Programming Contest 2013. We focus on a description of the strategies and on an analysis of the
matches. We also evaluate our experiences with the GOAL agent programming language. Our strategies worked well in general and we earned a second place in the contest only losing to the winning team. Finally we provide some suggestions for future contests.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Technical University of Denmark
Pages: 329-338
Publication date: 2013

Host publication information
Title of host publication: Engineering Multi-Agent Systems: First International Workshop, EMAS 2013, St. Paul, MN, USA, May 6-7, 2013, Revised Selected Papers
Publisher: Springer
ISBN (Print): 978-3-642-45342-7
ISBN (Electronic): 978-3-642-45343-4
(Lecture Notes in Computer Science, Vol. 8245).
DOIs: 10.1007/978-3-642-45343-4_18
Source: dtu
Source-ID: u::9969
Research output: Research - peer-review › Article in proceedings – Annual report year: 2013

Formalizing Theatrical Performances Using Multi-Agent Organizations
Theatrical performances usually follow strict scripts and actors are not allowed to deviate. A Danish theatrical group, Theater 770° Celsius, has invented a new method called In Real Life, in which only certain events in the storyline are specified and the actors are supposed to improvise to reach these events. The method bears a resemblance to multi-agent systems and we show how it can be formalized using the multi-agent organizational model OperA.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Technical University of Denmark
Contributors: Jensen, A. S., Spurkeland, J. S., Villadsen, J.
Pages: 135-144
Publication date: 2013

Host publication information
Title of host publication: Twelfth Scandinavian Conference on Artificial Intelligence
Publisher: IOS Press
Editor: Jaeger, M.
(Frontiers in Artificial Intelligence and Applications, Vol. 257).
DOIs: 10.3233/978-1-61499-330-8-135
Source: dtu
Source-ID: u::9712
Research output: Research - peer-review › Article in proceedings – Annual report year: 2013

Java to C: A Primer
This book is designed to be used as a quick introduction to C for programmers already familiar with Java. It is not a replacement for a reference book on C but is instead a supplement.

For the programmer already familiar with Java, the typical book on C requires the reader to wade through many details of already-familiar material. In this book, we quickly present the main concepts needed to begin writing serious programs in C, highlighting the differences between C and Java.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic
Contributors: McDowell, C., Villadsen, J.
Number of pages: 105
Multi-Agent Programming Contest 2013: The Teams and the Design of Their Systems

Five teams participated in the Multi-Agent Programming Contest in 2013: All of them gained experience in 2012 already. In order to better understand which paradigms they used, which techniques they considered important and how much work they invested, the organisers of the contest compiled together a detailed list of questions (circa 50). This paper collects all answers to these questions as given by the teams.

Program Leadership from a Nordic Perspective - Program Leaders’ Power to Influence Their Program

In this paper a continuation research at five technical universities in Nordic countries (N5T network) in 2012 is presented, where the aim was to find out how the program leaders conceived their function, role and mandate, and the work situations between the universities were compared. The previous research demonstrated that program leaders have quite different positions, strategies and methods when it comes to monitoring and developing their programs. In this paper, a deeper investigation is carried out of the (im-) possibilities to make real influence on the study courses that constitutes the respective Engineering study programs. Eight program leaders from the five N5T universities have been interviewed, and the analysis of these studies, has culminated in a model for the analysis of program leadership for Engineering education development.
Reimplementing a Multi-Agent System in Python

We provide a brief description of our Python-DTU system, including the overall design, the tools and the algorithms that we used in the Multi-Agent Programming Contest 2012, where the scenario was called Agents on Mars like in 2011. Our solution is an improvement of our Python-DTU system from last year. Our team ended in second place after winning at least one match against every opponent and we only lost to the winner of the tournament. We briefly describe our experiments with the Moise organizational model. Finally we propose a few areas of improvement, both with regards to our system and to the contest.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Technical University of Denmark
Contributors: Villadsen, J., Jensen, A. S., Ettienne, M. B., Vester, S., Andersen, K. B., Frøsig, A.
Pages: 67-84
Publication date: 2013

Host publication information
Title of host publication: The Multi-Agent Programming Contest 2012 Edition Evaluation and Team Descriptions
Publisher: Technische Universität Clausthal
Editors: Köster, M., Schlesinger, F., Dix, J.
URLs:
http://www.in.tu-clausthal.de/fileadmin/homes/techreports/ifi1301koester.pdf
Research output: Research - peer-review › Report chapter – Annual report year: 2013

Reimplementing a Multi-Agent System in Python

We provide a brief description of our Python-DTU system, including the overall design, the tools and the algorithms that we used in the Multi-Agent Programming Contest 2012, where the scenario was called Agents on Mars like in 2011. Our solution is an improvement of our Python-DTU system from last year. Our team ended in second place after winning at least one match against every opponent and we only lost to the winner of the tournament. We briefly describe our experiments with the Moise organizational model. Finally we propose a few areas of improvement, both with regards to our system and to the contest.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Technical University of Denmark
Contributors: Villadsen, J., Jensen, A. S., Ettienne, M. B., Vester, S., Andersen, K. B., Frøsig, A.
Pages: 205-216
Publication date: 2013

Host publication information
Title of host publication: Programming Multi-Agent Systems : 10th International Workshop, ProMAS 2012, Valencia, Spain, June 5, 2012, Revised Selected Papers
Publisher: Springer
Editors: Dastani, M., Hübner, J. F., Logan, B.
ISBN (Print): 978-3-642-38699-2
ISBN (Electronic): 978-3-642-38700-5
(Lecture Notes in Computer Science, Vol. 7837).
DOI:
10.1007/978-3-642-38700-5_13
Research output: Research - peer-review › Article in proceedings – Annual report year: 2013

Engineering Multiagent Systems - Reflections

In the first part I look at a theater performance by artistic director Troels Christian Jakobsen as a multiagent system. It is designed as a self-organising critical system using a framework where within its borders but without a script there is real
interaction between the elements of the performance. In the second part I discuss the ideas behind my recent monograph on propositional attitudes and inconsistency tolerance. Natural language sentences are parsed using a categorial grammar and correctness of arguments are decided using a paraconsistent logic. In the third part I present a curriculum for the MSc in Computer Science and Engineering program at the Technical University of Denmark with a focus on multiagent systems. As the director of studies I have observed that the students are working hard and with much creativity in advanced courses and projects involving intelligent agents, in particular in the agent contest 2009-2012.

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling, Algorithms and Logic
Contributors: Villadsen, J.
Number of pages: 1
Pages: 87
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Dagstuhl Reports
Volume: 2
Issue number: 8
ISSN (Print): 2192-5283
Original language: English
Electronic versions:
dagrep_v002_i008_p74_s12342.pdf
DOIs:
10.4230/DagRep.2.8.74

Bibliographical note
Except where otherwise noted, content of this report is licensed under a Creative Commons BY-NC-ND 3.0.
Source: dtu
Source-ID: u::6508
Research output: Research - peer-review › Conference abstract in journal – Annual report year: 2012

Implementing a Multi-Agent System in Python
We describe the solution used by the Python-DTU team in the Multi-Agent Programming Contest 2011, where the scenario was called Agents on Mars. We present our auction-based agreement, area controlling and pathfinding algorithms and discuss our chosen strategy and our choice of technology used for implementing the system. Finally, we present an analysis of the results of the competition as well as propose areas of improvement.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Algorithms and Logic, Department of Informatics and Mathematical Modeling, Algorithms and Logic
Contributors: Ettienne, M. B., Vester, S., Villadsen, J.
Pages: 147-179
Publication date: 2012

Host publication information
Title of host publication: Multi-Agent Programming Contest 2011 Edition Evaluation and Team Descriptions
Publisher: Technische Universität Clausthal
Editors: Behrens, T., Dix, J., Köster, M., Schlesinger, F.
(Iifi Technical Report Series; No. Ifi-12-02).
URLs:
http://www.in.tu-clausthal.de/fileadmin/homes/techreports/ifi1202behrens.pdf
Research output: Research - peer-review › Report chapter – Annual report year: 2012

Implementing a Multi-Agent System in Python with an Auction-Based Agreement Approach
We describe the solution used by the Python-DTU team in the Multi-Agent Programming Contest 2011, where the scenario was called Agents on Mars. We present our auction-based agreement algorithm and discuss our chosen strategy and our choice of technology used for implementing the system. Finally, we present an analysis of the results of the competition as well as propose areas of improvement.

General information
State: Published
Multi-Agent Programming Contest 2012 - The Python-DTU Team

We provide a brief description of the Python-DTU system, including the overall design, the tools and the algorithms that we plan to use in the agent contest.

Paraconsistent Computational Logic

In classical logic everything follows from inconsistency and this makes classical logic problematic in areas of computer science where contradictions seem unavoidable. We describe a many-valued paraconsistent logic, discuss the truth tables and include a small case study.
Program Leadership from a Nordic Perspective - Managing Education Development

In this paper we focus on university educational development issues by investigating the program leadership at five Nordic technical universities. Specifically, the paper compares definitions, views and experiences of education leadership in the Nordic Five Tech (N5T) universities. The paper does this by, first, reviewing the definitions of roles and responsibilities for program directors at each university, and second, by presenting results from a survey carried out in March 2012 among program directors at the N5T universities. Based on this data, we analyze how program directors experience their role, their possibilities to lead, and their opportunities of learning to lead. How is time for reflection and development as leaders handled at the different universities? The paper goes on to consider what impact the mandate of the leadership role has on the possibilities for developing educational programs. For instance, how can program directors ensure that learning objectives concerning generic skills and abilities are reached? How can program directors drive implementation of integrative and value-oriented topics such as sustainable development, innovation and entrepreneurship?

General information
State: Published
Organisations: Office for Study Programmes and Student Affairs, Department of Informatics and Mathematical Modeling, Algorithms and Logic, Computer Science and Engineering, KTH - Royal Institute of Technology, Aalto University, Chalmers University of Technology, Norwegian University of Science and Technology
Number of pages: 20
Publication date: 2012

Host publication information
Title of host publication: Proceedings of the 8th International CDIO Conference
Keywords: Education development, Leadership, Program management, Program development, Nordic Five Tech
Electronic versions:
programme_leadership_CDIO2012.pdf
URLs:
http://cdio2012.com/

Bibliographical note
Nordic Five Tech (N5T) is a strategic alliance between five technical universities in Denmark, Finland, Norway and Sweden. The overall aim is to "utilize shared and complementary strengths and create synergy within education, research and innovation".
Source: dtu
Source-ID: u::5393
Research output: Research - peer-review › Article in proceedings – Annual report year: 2012

Improving Multi-Agent Systems Using Jason
We describe the approach used to develop the multi-agent system of herders that competed as the Jason-DTU team at the Multi-Agent Programming Contest 2010. We also participated in 2009 with a system developed in the agent-oriented programming language Jason which is an extension of AgentSpeak. We used the implementation from 2009 as a foundation and therefore much of the work done this year was on improving that implementation. We present a description which includes design and analysis of the system as well as the main features of our agent team strategy. In addition we discuss the technologies used to develop this system as well as our future goals in the area.

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling, Algorithms and Logic, Technical University of Denmark
Contributors: Vester, S., Boss, N. S., Jensen, A. S., Villadsen, J.
Pages: 297-307
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Annals of Mathematics and Artificial Intelligence
Volume: 61
Issue number: 4
ISSN (Print): 1012-2443
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Multi-Agent Programming Contest 2011 - The Python-DTU Team
We provide a brief description of the Python-DTU system, including the overall design, the tools and the algorithms that we plan to use in the agent contest.

General information
State: Published
Organisations: Algorithms and Logic, Department of Informatics and Mathematical Modeling, Department of Applied Mathematics and Computer Science, Algorithms and Logic
Contributors: Villadsen, J., Ettienne, M. B., Vester, S.
Number of pages: 4
Publication date: 2011

Publication information
Publisher: Technical University of Denmark (DTU)
Original language: English
Electronic versions: 4D93Ed01.pdf
URLs:
http://arxiv.org/abs/1110.0105
http://multiagentcontest.org/
Source: orbit
Source-ID: 316093
Research output: Research - peer-review › Report – Annual report year: 2011

Proceedings of the 6th International Workshop on Constraints and Language Processing: Preface

General information
State: Published
Organisations: Algorithms and Logic, Department of Informatics and Mathematical Modeling
Number of pages: 68
Publication date: 2011

Host publication information
Title of host publication: Proceedings of the 6th International Workshop on Constraints and Language Processing
Place of publication: Roskilde
Publisher: Roskilde University
(Computer Science Research Report; No. 134).
Source: orbit
Source-ID: 316385
Research output: Research › Book chapter – Annual report year: 2011

SyntaxTrain: Relieving the pain of learning syntax
SyntaxTrain parses a Java program and displays the syntax diagrams associated with a syntax error.

General information
State: Published
Organisations: Algorithms and Logic, Department of Informatics and Mathematical Modeling, Technical University of Denmark, Weizmann Institute of Science
Contributors: Moth, A. L. A., Villadsen, J., Ben-Ari, M.
Publication date: 2011

Host publication information
Title of host publication: ITICSE’11 - Proceedings of the 16th Annual Conference on Innovation and Technology in Computer Science
ISBN (Print): 9781450308878
DOIs: 10.1145/1999747.1999900
URLs:
http://www.iticse2011.tu-darmstadt.de/
Source: orbit
Source-ID: 279532
Building Multi-Agent Systems Using Jason
We provide a detailed description of the Jason-DTU system, including the used methodology, tools as well as team strategy. We also discuss the experience gathered in the contest. In spring 2009 the course "Artificial Intelligence and Multi-Agent Systems" was held for the first time on the Technical University of Denmark (DTU). A part of this course was a short introduction to the multi-agent framework Jason, which is an interpreter for AgentSpeak, an agent-oriented programming language. As the final project in this course a solution to the Multi-Agent Programming Contest from 2007, the Gold Miners scenario, was implemented. Finally we decided to participate in this year’s contest with an implementation made in Jason as well.

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling, Algorithms and Logic, Technical University of Denmark
Contributors: Boss, N. S., Jensen, A. S., Villadsen, J.
Pages: 373-388
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Annals of Mathematics and Artificial Intelligence
Volume: 59
Issue number: 3-4
ISSN (Print): 1012-2443
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.21 SJR 0.413 SNIP 1.046
Web of Science (2017): Impact factor 0.899
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.27 SJR 0.438 SNIP 0.982
Web of Science (2016): Impact factor 0.807
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 0.93 SJR 0.562 SNIP 0.94
Web of Science (2015): Impact factor 0.944
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.08 SJR 0.532 SNIP 1.333
Web of Science (2014): Impact factor 0.691
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 0.94 SJR 0.405 SNIP 0.89
Web of Science (2013): Impact factor 0.488
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 0.65 SJR 0.367 SNIP 1.012
Web of Science (2012): Impact factor 0.2
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 0.78 SJR 0.416 SNIP 1.084
Web of Science (2011): Impact factor 0.358
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): Impact factor 0.43
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
Scopus rating (2001): SJR 0.747 SNIP 1.592
Scopus rating (2000): SJR 0.266 SNIP 0.779
Scopus rating (1999): SJR 0.252 SNIP 0.646
Original language: English
Keywords: Multi-agent programming contest, Jason, AgentSpeak, Multi-agent systems
DOI:
10.1007/s10472-010-9181-2
URLs:
http://www.springerlink.com/content/y14221051142xp1w/
Source: orbit
Source-ID: 274544
Research output: Research - peer-review › Journal article – Annual report year: 2010

Multi-Agent Programming Contest 2010 - The Jason-DTU Team

General information
State: Published
Organisations: Algorithms and Logic, Department of Informatics and Mathematical Modeling, Technical University of Denmark
Contributors: Villadsen, J., Boss, N. S., Jensen, A. S., Vester, S.
Number of pages: 4
Publication date: 2010

Publication information
Publisher: Technical University of Denmark (DTU)
Original language: English

Bibliographical note
Edition: 1010.0145.
Source: orbit
Source-ID: 274550
Research output: Research - peer-review › Report – Annual report year: 2010

Nabla: A Linguistic System Based on Type Theory

General information
State: Published
Organisations: Algorithms and Logic, Department of Informatics and Mathematical Modeling
Contributors: Villadsen, J.
Number of pages: 232
Publication date: 2010

Publication information
Publisher: LIT Verlag
ISBN (Print): 9783825892753
Original language: English
Nominalistic Logic

General information
State: Published
Organisations: Algorithms and Logic, Department of Informatics and Mathematical Modeling
Contributors: Villadsen, J.
Pages: 84-85
Publication date: 2010

Host publication information
Title of host publication: World Congress and School on Universal Logic
Source: orbit
Source-ID: 274549
Research output: Research - peer-review › Conference abstract in proceedings – Annual report year: 2010

Developing Artificial Herders Using Jason

General information
State: Published
Organisations: Algorithms and Logic, Department of Informatics and Mathematical Modeling, Technical University of Denmark
Contributors: Boss, N. S., Jensen, A. S., Villadsen, J.
Pages: 193-197
Publication date: 2009

Host publication information
Title of host publication: Proceedings of the 10th International Workshop on Computational Logic in Multi-Agent Systems 2009
Place of publication: Clausthal, Germany
Publisher: IfI
Editors: Dix, J., Fisher, M., Novák, P.
Source: orbit
Source-ID: 256989
Research output: Research - peer-review › Book chapter – Annual report year: 2009

Infinite-Valued Propositional Type Theory for Semantics

General information
State: Published
Organisations: Algorithms and Logic, Department of Informatics and Mathematical Modeling
Contributors: Villadsen, J.
Pages: 277-297
Publication date: 2009

Host publication information
Title of host publication: Dimensions of Logical Concepts
Place of publication: Campinas, Brazil
Publisher: UNICAMP
Editors: Béziau, J., Costa-Leite, A.
ISBN (Print): 978-85-86497-05-6
(Coleção CLE; No. 54).
Source: orbit
Source-ID: 256986
Research output: Research - peer-review › Book chapter – Annual report year: 2009

Logik, computere og kunstig intelligens

General information
Nominalistic Logic (Extended Abstract)

General information
State: Published
Organisations: Algorithms and Logic, Department of Informatics and Mathematical Modeling
Contributors: Villadsen, J.
Publication date: 2008

Publication information
Publisher: Computing Research Repository (CoRR)
Original language: English
Source: orbit
Source-ID: 233582
Research output: Research - peer-review › Report – Annual report year: 2008

Nominalistic Logic: From Naive Set Theory to Intensional Type Theory

General information
State: Published
Organisations: Algorithms and Logic, Department of Informatics and Mathematical Modeling
Contributors: Villadsen, J.
Number of pages: 196
Pages: 57-85
Publication date: 2008

Host publication information
Title of host publication: New Approaches to Classes and Concepts — Studies in Logic
Volume: 14
Publisher: College Publications
Editor: Robering, K.
ISBN (Print): 978-1-904987-85-7
Source: orbit
Source-ID: 233581
Research output: Research - peer-review › Book chapter – Annual report year: 2008

Proceedings of the 5th International Workshop on Constraints and Language Processing (CSLP 2008)

General information
State: Published
Organisations: Algorithms and Logic, Department of Informatics and Mathematical Modeling, Roskilde University
Number of pages: 94
Publication date: 2008

Publication information
Publisher: Roskilde University
Original language: English
(Computer Science Research Reports; No. 122).
URLs:
Many-Valued Modal Logic

General information
State: Published
Organisations: Computer Science and Engineering, Department of Informatics and Mathematical Modeling
Contributors: Villadsen, J.
Publication date: 2007

Event information
Event: Hybrid Logic Workshop
Location: Roskilde University
Source: orbit
Source-ID: 208455
Research output: Research › Sound/Visual production (digital) – Annual report year: 2007

Preface: For the proceedings of the International Workshop on Hybrid Logic 2006 (HyLo)

General information
State: Published
Organisations: Algorithms and Logic, Department of Informatics and Mathematical Modeling
Contributors: Blackburn, P., Bolander, T., Braüner, T., de Paiva, V., Villadsen, J.
Pages: 1–2
Publication date: 2007
Peer-reviewed: Yes

Publication information
Journal: Electronic Notes in Theoretical Computer Science
Volume: 174
Issue number: 6
ISSN (Print): 1571-0661
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 0.66 SJR 0.287 SNIP 0.578
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.66 SJR 0.261 SNIP 0.588
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 0.67 SJR 0.383 SNIP 0.769
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 0.6 SJR 0.371 SNIP 0.727
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 0.55 SJR 0.334 SNIP 0.684
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 0.55 SJR 0.409 SNIP 0.629
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 0.57 SJR 0.348 SNIP 0.621
ISI indexed (2011): ISI indexed no
Proceedings of the 4th International Workshop on Constraints and Language Processing (CSLP 2007)

General information
State: Published
Organisations: Computer Science and Engineering, Department of Informatics and Mathematical Modeling, Roskilde University
Number of pages: 101
Publication date: 2007

Publication information
Publisher: Roskilde University
Original language: English
(Computer Science Research Reports; No. 113).
URLs:
http://www.ruc.dk/dat_en/research/reports/authors/jv/
Source: orbit
Source-ID: 208454
Research output: Research - peer-review › Book – Annual report year: 2007

Proceedings of the International Workshop on Hybrid Logic (HyLo 2006)

General information
State: Published
Organisations: Computer Science and Engineering, Department of Informatics and Mathematical Modeling, Algorithms and Logic
Publication date: 2007

Publication information
Publisher: Elsevier
Original language: English
(Electronic Notes in Theoretical Computer Science; No. 174).
Source: orbit
Source-ID: 209908
Research output: Research - peer-review › Book – Annual report year: 2007
Proceedings of the International Workshop on Hybrid Logic (HyLo 2007)

General information
State: Published
Organisations: Computer Science and Engineering, Department of Informatics and Mathematical Modeling, Roskilde University
Number of pages: 90
Publication date: 2007

Publication information
Publisher: Trinity College Dublin
Original language: English
URLs:
https://www.cs.tcd.ie/esslli2007/content/CD_Contents/
Source: orbit
Source-ID: 208453
Research output: Research - peer-review › Book – Annual report year: 2007

Natural Language Processing Using Lexical and Logical Combinators

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling
Contributors: Ortiz, J. F., Villadsen, J.
Pages: 444-446
Publication date: 2006

Host publication information
Title of host publication: International Conference on Logic Programming
Volume: Lecture Notes in Computer Science, vol. 4079
URLs:
http://www2.imm.dtu.dk/pubdb/views/publication_details.php?id=5041
Source: orbit
Source-ID: 195630
Research output: Research - peer-review › Article in proceedings – Annual report year: 2006

Nominalization in Intensional Type Theory

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling
Contributors: Villadsen, J.
Publication date: 2006

Host publication information
Title of host publication: IEEE Symposium on Logic in Computer Science - Short Presentation
Source: orbit
Source-ID: 195667
Research output: Research - peer-review › Article in proceedings – Annual report year: 2006

Proceedings of the International Workshop on Hybrid Logic: Federated Logic Conference, Seattle, USA

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling
Publication date: 2006

Publication information
Publisher: Federated Logic Conference, Seattle, USA
Original language: English
Source: orbit
Supra-logic: using transfinite type theory with type variables for paraconsistency

We define the paraconsistent supra-logic $P_\sigma$ by a type-shift from the booleans $o$ of propositional logic $P_0$ to the supra-booleans $\sigma$ of the propositional type logic $P$ obtained as the propositional fragment of the transfinite type theory $Q$ defined by Peter Andrews (North-Holland Studies in Logic 1965) as a classical foundation of mathematics. The supra-logic is in a sense a propositional logic only, but since there is an infinite number of supra-booleans and arithmetical operations are available for this and other types, virtually anything can be specified. The supra-logic is a generalization of Lukasiewicz's three-valued logic, with the intermediate value duplicated many times and ordered such that none of the copies of this value imply other ones, but it differs from Lukasiewicz's many-valued logics as well as from logics based on bilattices. There are several automated theorem provers for classical higher order logic (finite type theory) and it should be possible to modify these to our needs.
A Paraconsistent Higher Order Logic

Abstract. Classical logic predicts that everything (thus nothing useful at all) follows from inconsistency. A paraconsistent logic is a logic where an inconsistency does not lead to such an explosion, and since in practice consistency is difficult to achieve there are many potential applications of paraconsistent logics in knowledge-based systems, logical semantics of natural language, etc. Higher order logics have the advantages of being expressive and with several automated theorem provers available. Also the type system can be helpful. We present a concise description of a paraconsistent higher order logic with countable infinite indeterminacy, where each basic formula can get its own indeterminate truth value (or as we prefer: truth code). The meaning of the logical operators is new and rather different from traditional many-valued logics as well as from logics based on bilattices. The adequacy of the logic is examined by a case study in the domain of medicine. Thus we try to build a bridge between the HOL and MVL communities. A sequent calculus is proposed based on recent work by Muskens. Many non-classical logics are, at the propositional level, funny toys which work quite good, but when one wants to extend them to higher levels to get a real logic that would enable one to do mathematics or other more sophisticated reasonings, sometimes dramatic troubles appear.
**A Paraconsistent Higher Order Logic**

Classical logic predicts that everything (thus nothing useful at all) follows from inconsistency. A paraconsistent logic is a logic where an inconsistency does not lead to such an explosion, and since in practice consistency is difficult to achieve there are many potential applications of paraconsistent logics in knowledge-based systems, logical semantics of natural language, etc. Higher order logics have the advantages of being expressive and with several automated theorem provers available. Also the type system can be helpful. We present a concise description of a paraconsistent higher order logic with countably infinite indeterminacy, where each basic formula can get its own indeterminate truth value. The meaning of the logical operators is new and rather different from traditional many-valued logics as well as from logics based on bilattices. Thus we try to build a bridge between the communities of higher order logic and many-valued logic. A case study is studied and a sequent calculus is proposed based on recent work by Muskens.

**General information**

State: Published  
Organisations: Roskilde University  
Contributors: Villadsen, J.  
Pages: 38-51  
Publication date: 2004

**Host publication information**

Title of host publication: *A Paraconsistent Higher Order Logic: Artificial Intelligence and Symbolic Computation* 
Publisher: Springer  
ISBN (Print): 978-3-540-23212-4  
(Lecture Notes in Computer Science, Vol. 3249).

DOIs:  
10.1007/978-3-540-30210-0_5  
Source: dtu  
Source-ID: n::oai:DTIC-ART:isi/247595341::25162

Research output: Research - peer-review › Article in proceedings – Annual report year: 2004

**Paraconsistent Assertions**

Classical logic predicts that everything (thus nothing useful at all) follows from inconsistency. A paraconsistent logic is a logic where inconsistency does not lead to such an explosion. We argue that paraconsistent logics are especially advantageous in order to deal with assertions made by intelligent agents. Other propositional attitudes like knowledge and beliefs can in principle be treated along the same lines. We propose a many-valued paraconsistent logic based on a simple notion of indeterminacy. The proposed paraconsistent logic has a semantics that extends the one of classical logic and it is described using key equalities for the logical operators. A case study is included. We briefly compare with logics based on bilattices. We finally investigate how to translate the paraconsistent logic into classical predicate logic thereby allowing us to make use of automated deduction of classical logic in the future. We base our initial translation on recent work by Muskens. Our final translation is polynomial in the size of the translated formula and follows the semantics for the paraconsistent logic directly. © Springer-Verlag Berlin Heidelberg 2004.

**General information**

State: Published  
Organisations: Roskilde University  
Contributors: Villadsen, J.  
Pages: 99-113  
Publication date: 2004

**Host publication information**

Publisher: Springer  
ISBN (Print): 978-3-540-23222-3  
(Lecture Notes in Computer Science, Vol. 3187).

DOIs:  
10.1007/978-3-540-30082-3_8  
Source: dtu  
Source-ID: n::oai:DTIC-ART:compendex/105739688::25163

Research output: Research - peer-review › Article in proceedings – Annual report year: 2004

**Operational Semantics of an Imperative Language in Definite Clauses**

We present the “big-step” operational semantics of a small programming language NIL (Natural Imperative Language) in definite clauses, thus building on the fixpoint semantics of logic programs. NIL operates on a state which is just a sequence of counters. As basic statements NIL has incrementation, decrementation and test for null. NIL allows for
sequential composition and non-deterministic choice of statements as well as mutually recursive definitions of procedures, which we find support our long-term aim of formalizing and reasoning about specific actions and planning tasks for rational agents. A novelty is the use of the de Bruijn notation instead of names. To our knowledge the operational semantics of an imperative language like NIL have not been given in definite clauses, although it is well-known that it is possible.

General information
State: Published
Organisations: Roskilde University
Contributors: Villadsen, J.
Pages: 337-349
Publication date: 2003

Host publication information
Title of host publication: 2003 Joint Conference on Declarative Programming, AGP-2003, Reggio Calabria, Italy, September 3-5, 2003
Editor: Buccafurri, F.
Electronic versions:
agp2003.pdf
Source: Bibtex
Source-ID: urn:a8a103cc3522271573d666f9b68078fb
Research output: Research - peer-review › Article in proceedings – Annual report year: 2003

User Interfaces for Automated Reasoning Systems
The ease of use of automated reasoning systems is perhaps lower than for any other type of computing system available! In general, while anyone can use a word processor, almost no one but an expert can use a proof checker to check a difficult theorem. Perhaps this can be explained by the fact that the designers of such systems have had to put so much of their energies and attention into rigor, that they simply did not have enough energy left for good interface design.

General information
State: Published
Organisations: Roskilde University
Contributors: Villadsen, J.
Pages: 95-98
Publication date: 2003

Host publication information
Title of host publication: Proceedings of the Third Danish Human-Computer Interaction Research Symposium
URLs:
Research output: Research - peer-review › Article in proceedings – Annual report year: 2003

International Workshop on Paraconsistent Computational Logic

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling
Contributors: Decker, H., Villadsen, J., Waragai, T.
Publication date: 2002

Host publication information
Title of host publication: Proceedings of the International Workshop on Paraconsistent Computational Logic
Publisher: Datalogiske tidsskrifter, Roskilde University, Denmark
URLs:
Source: orbit
Source-ID: 58166
Research output: Research - peer-review › Article in proceedings – Annual report year: 2002

Paraconsistent Knowledge Bases and Many-Valued Logic

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling
Contributors: Villadsen, J., Haav, H. (ed.)
Combinators for Paraconsistent Attitudes

In order to analyse the semantics of natural language sentences a translation into a partial type logic using lexical and logical combinators is presented. The sentences cover a fragment of English with propositional attitudes like knowledge, belief and assertion. A combinator is a closed term of the lambda calculus possibly containing lexical and/or logical constants. Such combinators seem promising from both a cognitive and computational point of view. There is approximately one lexical combinator for each word, but just eleven logical combinators for the present fragment. The partiality is only used for embedded sentences expressing propositional attitudes, thereby allowing for inconsistency without explosion (also called paraconsistency), and is based on a few key equalities for the connectives giving four truth values (truth, falsehood, and undefinedness with negative and positive polarity; only the first truth value is designated, i.e. yields the logical truths).

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling
Contributors: Villadsen, J.
Pages: 261-278
Publication date: 2001

Host publication information
Publisher: Springer
Editors: de Groote, P., Morrill, G., Retoré, C.
ISBN (Print): 978-3-540-42273-0
ISBN (Electronic): 978-3-540-48199-7
DOIs: 10.1007/3-540-48199-0_16
Source: orbit
Source-ID: 57890
Research output: Research - peer-review › Article in proceedings – Annual report year: 2001
Meaning and Partiality Revised

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling
Contributors: Villadsen, J., Lund et al., H. (ed.)
Pages: 163-164
Publication date: 2001

Host publication information
Title of host publication: Seventh Scandinavian Conference on Artificial Intelligence, SCAI'01
Publisher: IOS Press
URLs:
Source: orbit
Source-ID: 57892
Research output: Research - peer-review › Article in proceedings – Annual report year: 2001

On Programs in Rational Agents

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling
Contributors: Villadsen, J.
Number of pages: 8
Publication date: 2001

Host publication information
Title of host publication: NWPT'01 Nordic Workshop on Programming Theory, 10-12 October, 2001, Technical University of Denmark
URLs:
Source: orbit
Source-ID: 57891
Research output: Research - peer-review › Article in proceedings – Annual report year: 2001

Projects:

Logical Foundations of AI Algorithms
Jensen, A. B., PhD Student, Department of Applied Mathematics and Computer Science
Villadsen, J., Main Supervisor, Department of Applied Mathematics and Computer Science
Mödersheim, S. A., Supervisor, Department of Applied Mathematics and Computer Science
01/02/2019 → 31/01/2022
Project: PhD

Hospital Staff Planning with Multi-Agent Goals
Larsen, J. B., PhD Student
Villadsen, J., Main Supervisor
Carstens, N., Supervisor
Holst, C. K., Supervisor
Industrial PhD
01/09/2016 → 31/08/2019
Award relations: Hospital Staff Planning with Multi-Agent Goals
Project: PhD

Composec: Secure Composition of Distributed Systems
Hess, A. V., PhD Student, Department of Applied Mathematics and Computer Science
Mödersheim, S. A., Main Supervisor, Department of Applied Mathematics and Computer Science
Villadsen, J., Supervisor, Department of Applied Mathematics and Computer Science
Lluch Lafuente, A., Examiner, Department of Applied Mathematics and Computer Science
Gutman, J. D., Examiner
Sprenger, C., Examiner
Formalization of Algorithms and Logical inference Systems in Proof Assistants
Schlichtkrull, A., PhD Student, Department of Applied Mathematics and Computer Science
Villadsen, J., Main Supervisor, Department of Applied Mathematics and Computer Science
Blanchette, J. C., Supervisor
Bolander, T., Supervisor, Department of Applied Mathematics and Computer Science
Mödersheim, S. A., Examiner, Department of Applied Mathematics and Computer Science
Bengtson, J., Examiner
Nipkow, T., Examiner
Bengtson, J., Examiner
Nipkow, T., Examiner
Institut stipendie (DTU)
15/09/2015 → 14/11/2018
Award relations: Formalization of Algorithms and Logical inference Systems in Proof Assistants
Project: PhD

Geodata-Infrastruktur
Christensen, J. V., PhD Student, Department of Informatics and Mathematical Modeling
Nilsson, J. F., Main Supervisor, Department of Applied Mathematics and Computer Science
Bjørner, D., Supervisor, Department of Applied Mathematics and Computer Science
Frederiksen, P., Supervisor, Department of Planning
Jacobi, O. I., Supervisor, Department of Planning
Villadsen, J., Examiner, Department of Applied Mathematics and Computer Science
Andreasen, T., Examiner
Östman, A., Examiner
Ansat ekstern
01/02/2002 → 01/08/2007
Award relations: Geodata-Infrastruktur
Project: PhD

Formal Ontologies + Natural language semantics = Ontological semantics
Szymczak, B. A., PhD Student, Department of Informatics and Mathematical Modeling
Nilsson, J. F., Main Supervisor, Department of Informatics and Mathematical Modeling
Jensen, P. A., Supervisor
Villadsen, J., Examiner, Department of Informatics and Mathematical Modeling
Dybkaer, H., Examiner
Lenci, A., Examiner
DTU, Samfinansiering
01/10/2007 → 22/06/2011
Award relations: Formal Ontologies + Natural language semantics = Ontological semantics
Project: PhD

Organization-Oriented Programming in Multi-Agent Systems
Jensen, A. S., PhD Student
Villadsen, J., Main Supervisor
Bolander, T., Examiner
Christiansen, H., Examiner
Hindriks, K. V., Examiner
Institut stipendie (DTU)
15/03/2012 → 21/09/2015
Award relations: Organization-Oriented Programming in Multi-Agent Systems
Project: PhD