Flemming Møller - DTU Orbit (26/02/2018)

Organisations

Department of Informatics and Mathematical Modeling
03/12/2008 → 03/09/2013 Former
flemo@imm.dtu.dk
VIP

PhD Student, Department of Applied Mathematics and Computer Science
27/12/2012 → 03/09/2013 Former
flemo@dtu.dk
VIP

PhD Student, Department of Informatics and Mathematical Modeling
03/12/2008 → 03/09/2013 Former
flemo@imm.dtu.dk
VIP

Image Analysis & Computer Graphics
18/02/2013 → 02/09/2013 Former
VIP

Image Analysis and Computer Graphics
25/02/2012 → 18/02/2013 Former
VIP

Publications:

Systems analysis approach to the design of efficient water pricing policies under the EU water framework directive
Economic theory suggests that water pricing can contribute to efficient management of water scarcity. The European Union (EU) Water Framework Directive (WFD) is a major legislative effort to introduce the use of economic instruments to encourage efficient water use and achieve environmental management objectives. However, the design and implementation of economic instruments for water management, including water pricing, has emerged as a challenging aspect of WFD implementation. This study demonstrates the use of a systems analysis approach to designing and comparing two economic approaches to efficient management of groundwater and surface water given EU WFD ecological flow requirements. Under the first approach, all wholesale water users in a river basin face the same volumetric price for water. This water price does not vary in space or in time, and surface water and groundwater are priced at the same rate. Under the second approach, surface water is priced using a volumetric price, while groundwater use is controlled through adjustments to the price of energy, which is assumed to control the cost of groundwater pumping. For both pricing policies, optimization is used to identify optimal prices, with the objective of maximizing welfare while reducing human water use in order to meet constraints associated with EU WFD ecological and groundwater sustainability objectives. The systems analysis approach demonstrates the successful integration of economic, hydrologic, and environmental components into an integrated framework for the design and testing of water pricing policies. In comparison to the first pricing policy, the second pricing policy, in which the energy price is used as a surrogate for a groundwater price, shifts a portion of costs imposed by higher water prices from low-value crops to high-value crops and from small urban/domestic locations to larger locations. Because growers of low-value crops will suffer the most from water price increases, the use of energy costs to control groundwater use offers the advantage of reducing this burden. © 2013 American Society of Civil Engineers.
Imaging and spectroscopy have long been established methods for food quality control both in the laboratories and online. An ever increasing number of analytical techniques are being developed into imaging methods and existing imaging methods to contain spectral information. Images and especially spectral images contain large amounts of data which should be analysed appropriately by techniques combining structure and spectral information.
This dissertation deals with how different types of food quality can be measured by imaging techniques, analysed with appropriate image analysis techniques and finally use the image data to predict or visualise food quality.

A range of different food quality parameters was addressed, i.e. water distribution in bread throughout storage, time series analysis of chocolate milk stability, yoghurt glossiness, graininess and dullness and finally structure and meat colour of dry fermented sausages. The imaging techniques ranged from single wavelength images, multispectral to hyperspectral images. The effect of different light geometries were utilised in measuring the light reflection of yoghurt surfaces.

What the best imaging technique for a given problem is, should be addressed by visually evaluation of a detectable difference between known samples. While doing image analysis, it was found to be advantageous to combine several small models. The combined model was used for extraction of object relevant information, i.e. spectral, texture or size. The data extracted was used for explorative or predictive data analysis.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics
Authors: Møller, F. (Intern), Larsen, R. (Intern), Carstensen, J. M. (Intern)
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Supercontinuum Light Sources for Hyperspectral Subsurface Laser Scattering: Applications for Food Inspection

A material's structural and chemical composition influences its optical scattering properties. In this paper we investigate the use of subsurface laser scattering (SLS) for inferring structural and chemical information of food products. We have constructed a computer vision system based on a supercontinuum laser light source and an Acousto-Optic Tunable Filter (AOTF) to provide a collimated light source, which can be tuned to any wavelength in the range from 480 to 900 nm. We present the newly developed hyperspectral vision system together with a proof-of-principle study of its ability to discriminate between dairy products with either similar chemical or structural composition. The combined vision system is a new way for industrial food inspection allowing non-intrusive online process inspection of parameters that is hard with existing technology.

Visualization of water distribution in bread by NIR imaging

Laserlys afslører fødevarekvalitet
Online monitoring of food processes using subsurface laser scattering

Online monitoring of physical parameters during food production is not a trivial task, but promising results can often be obtained with Subsurface Laser Scattering (SLS). The first SLS instruments are on the market today, and studies are needed to assess the potential of the technology. SLS can monitor particle changes and gelation formation in a fast and non-invasive manner during production of most food products. SLS is correlated to classical particle sizing parameters, i.e. size, number of light scatters and refractive index, as well as sensoric parameters like mouthfeel. The background of the SLS technology is explained, and results from yoghurt fermentation and foaming of a dairy dessert product is presented.

Quantifying graininess of glossy food products

The sensory quality of yoghurt can be altered when changing the milk composition or processing conditions. Part of the sensory quality may be assessed visually. It is described how a non-contact method for quantifying surface gloss and grains in yoghurt can be made. It was found that the standard deviation of the entire image evaluated at different scales in a Gaussian Image Pyramid was a measure for graininess of yoghurt. This methodology is used to predict graininess (or grittiness) and to evaluate effect of yoghurt composition and processing.

Projects:

Billeder som objektivt mål for fødevarekvalitet

Department of Informatics and Mathematical Modeling
Period: 01/12/2008 → 19/04/2013
Number of participants: 7
Phd Student:
Møller Flemming (Intern)
Supervisor:
Carstensen, Jens Michael (Intern)
Olesen, Susanne K. (Ekstern)
Main Supervisor:
Larsen, Rasmus (Intern)
Examiner:
Conradsen, Knut (Intern)
Hansen, Per W. (Ekstern)
Parker, Alan (Ekstern)

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