Advances in Knowledge-Based Technologies

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Software Competence Center Hagenberg
Softwarepark 21
A-4232 Hagenberg
Tel. +43 7236 3343 800
Fax +43 7236 3343 888
www.scch.at

Fuzzy Logic Laboratorium Linz
Softwarepark 21
A-4232 Hagenberg
Tel. +43 7236 3343 431
Fax +43 7236 3343 434
www.flll.jku.at

Program

Session 1. Chair: Roland Richter

9:00	Radko Mesiar:
	Integration and optimization
9:30	Thomas Vetterlein:
	The many possibilities to interpret “and” in fuzzy logic
10:00	Bernhard Moser:
	Metric Analysis of Delta Event Sequence Spaces

Session 2. Chair: Bernhard Moser

10:45	Jorge Martinez Gil:
	Ontology Matching: Current Trends & Perspectives
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	An Overview on Transfer Learning and its Application in Chemometrics

Integration and optimization

Radko Mesiar, STU Bratislava, Slovakia

November 19, 2012

Abstract

After a short historical overview of the roots of integration we introduce an optimization example based on standard arithmetical operations and with several modifications in constraints. Obtained optimal solutions can be seen as results of integration considering some particular integrals, such as Shilkret, Choquet (covering also Lebesgue integral), Pan-integral and Lehrer integral. Then all these integrals are discussed in more details, as well as some of their generalizations. For example, when considering idempotent pseudo-addition and pseudo-multiplication, all 4 previoulsy introduced intergals turn to the unique case - Sugeno integral. Some other integrals are discussed, too.

The many possibilities to interpret “and” in fuzzy logic

Thomas Vetterlein
Department of Knowledge-Based Mathematical Systems, JKU
Thomas.Vetterlein@jku.at

Fuzzy logic is distinguished from classical logic by its high flexibility. Fuzzy logic can deal with propositions that are not necessarily supposed to be assigned a simple “true” or “false”, but that are tolerated to be in an intermediate state. In fact, the primary scope of fuzzy logic has been the formal treatment of vague statements, that is, statements like for instance “P. is tall”. P. measuring, e.g., 178 cm, we might be undecided if we should call P. tall or not; but we might well say that the property of being tall fits to P. to a degree of, say, 0.8. Accordingly, in fuzzy logic all real values between 0 and 1 are used as truth degrees.

A proposition in fuzzy logic is, for example

$$\alpha \odot \beta \to \gamma. \tag{1}$$

Here, α, β, and γ are all supposed to model vague properties. The meaning of (1) is: the truth degree of γ is at least as large as the truth degree of $\alpha \odot \beta$, where “$\alpha \odot \beta$” is to be read “α and β”. Assume now that α holds to the degree s, and β holds to the degree t. How should we calculate the degree of $\alpha \odot \beta$ from s and t?

Thus we wonder how to interpret the conjunction in fuzzy logic, that is, how to identify the connective “and” with a two-placed real function. According to the common agreement, the interpreting function should be associative, commutative, monotonous, and have 1 as its neutral element. Furthermore, it should be left-continuous. To justify any other property seems to be impossible.

A lot of efforts have been made to understand the structure of left-continuous t-norms. We have contributed to this problem as well. The task is somewhat academical in nature, but certain approaches are amazingly intuitive. Our concern has been to give some rather “dry” algebraic results a geometric flavour.

References

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Metric Analysis of Delta Event Sequence Spaces

B. Moser

Software Competence Center Hagenberg (SCCH), Austria

The way in which biological neurons respond on stimuli follows a threshold-based sampling scheme. Rather than sampling equidistant in time, as classical sampling is designed, this sampling is triggered by the event whether the intensity of a signal surpasses a threshold or not. Inspired from biology this sampling principle has also been studied and used for technical applications. In the signal processing context this sampling principle is known as on-delta-send, Lebesgue, level or event based sampling [16, 15]. Reasons for studying and introducing level-based sampling are a) the reduction of the amount of data transfer e.g. in wireless sensor networks [6] and b) the realization of high-dynamic ranges for bio-inspired sensory systems like Silicon Retina [5, 4] or Silicon Cochlea [2].

First of all the geometric structure of the space of event sequences resulting from on-delta-send sampling is studied. It is shown that a recently published result from discrete geometry [8] can be applied in order to characterize its geometry which turns out to be closely related to the so-called discrepancy measure. The discrepancy measure goes back to Hermann Weyl [13] and was proposed in the context of measuring irregularities of probability distributions. It turns out that this measure satisfies the axioms of a norm which distinguishes by a monotonicity and a Lipschitz property of its auto-misalignment function [7, 9]. Applications of the discrepancy measure can be found in the field of numerical integration, especially for Monte Carlo methods in high dimensions [11] or in computational geometry [3] and image processing [1, 12].

The talk outlines the discrepancy norm from the point of view of clustering event sequences and, thereby, show up a new field of applications for this metric. For this on the basis of cluster validity measures it is investigated to which extent of noisy clusters of on-delta-send sampled signals can still be distinguished. It is shown that the discrepancy norm is robustly compliant with the so-called stochastic resonance effect which is inherently present in such non-linear sampling schemes [14, 10]. This effect is demonstrated and discussed on the basis of instructive computer simulations.

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Ontology Matching: Current Trends & Perspectives

Jorge Martinez Gil

November 19, 2012

Abstract

The problem of matching ontologies consists of providing corresponding entities in two or more knowledge models that belong to a same domain but have been developed separately. Nowadays there are a lot of techniques and tools for addressing this problem. However, the complex nature of the matching problem makes existing solutions for real situations may be not fully satisfactory. We will show here some of the current techniques we are using and some possible future lines of research.

Mining Rules Through Markov Logic Networks

Thomas Hoch, Andrea Serafini

November 19, 2012

Abstract

Given the spatial and temporal positions of the objects present on a football field, the aim of the authors is to build an inference system in order to obtain, possibly in real time, higher level informations about the game, such as who is marking who or the tactics used by one of the teams.

Because of the complexity of the environment, a difficulty encountered is how to model the rules to infer typical events, such as the use of a specific tactic. The idea is to model events automatically, by extracting the underlining rules from examples, through the use of Markov Logic Networks - a combination between first order logic and probabilistic reasoning. A Markov Logic Network is a collection of first order logic formulas along with their weights. The probability of a given state of things to be true is the weighted average of the formulas in the MLN which are true in that state of things. On the other hand, it is possible to extract a MLN given a collection of datas and trying to mine out the rules of the environment from which the events are taken. Examples of this process are shown, along with observations about how is possible to optimize the use of MLNs in our environment.

An Overview on Transfer Learning and its Application in Chemometrics

Birgit Zauner and Thomas Natschläger,

November 16th, 2012

Abstract

In my talk I will shortly present the project I am working in and describe the problem that arises when the measurement setup for gaining data changes.

As in practice an existing model wants to be kept and transferred to the new data situation instead of starting all over again, the topic of Transfer Learning arises.
I will mention a few details on the terminology in this field and present the three transfer situations most common in literature.

Afterwards, a concrete transfer problem arising in my project will be introduced and simple approaches to deal with it will be discussed. A focus will be on the limited availability of reference data in practice and ways how to avoid using them, as they are often hard or expensive to measure.

A spectral filter approach turns out to be useful in this application and is currently in progress to be improved.

I am looking forward to your inputs and ideas on this topic!