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INTETAIN 2009 Conference

Dimensionality Reduction Symposium

ILP-MLG-SRL 2009

News from the Benelux Association for Artificial Intelligence

After DEEP BLUE: WATSON

Editor-in-chief

After IBM's milestone set by defeating World Chess Champion Gary Kasparov in 1997, IBM revealed a new challenge for their supercomputer, as I became aware of in *IEEE Intelligent Systems*, Vol. 24, No. 3 (May/June 2009), pp. 8-9: WATSON to appear on *Jeopardy!* In a press release of April 27, 2009 and in a video promoting the supercomputer (and posted on YouTube), some of the details are uncovered.

From the press release: "For nearly two years, IBM scientists have been working on a highly advanced Question Answering (QA) system, codenamed WATSON. The scientists believe that the computing system will be able to understand complex questions and answer with enough precision and speed to compete on *Jeopardy!*

Produced by Sony Pictures Television and distributed by CBS Television Distribution, *Jeopardy!* is a game demanding knowledge and quick recall, covering a broad range of topics, such as history, literature, politics, film, pop culture, and science. It poses a grand challenge for a computing system due to the variety of subject matter, the speed at which contestants must provide accurate responses, and because the clues given to contestants involve analyzing subtle meaning, irony, riddles, and other complexities at which humans excel and computers traditionally do not. WATSON will incorporate massively parallel analytical capabilities and, just like human competitors, WATSON will not be connected to the Internet or have any other outside assistance."

"The research underlying WATSON is expected to elevate computer intelligence and human-to-computer communication to unprecedented levels. IBM intends to apply the unique technological capabilities being developed for WATSON to help clients across a wide variety of industries answer business questions quickly and accurately."

If the milestones of this new challenge are reached, this certainly will be a big step forwards in several AI domains, like data/text mining, natural language processing, human-computer interaction, knowledge representation and reasoning, and more. Stay tuned!

WATSON, presented by IBM scientist and project director, Dave Ferrucci.

WATSON on YouTube: **http://www.youtube.com/watch?v=3e22ufcqfTs**
IBM's full press release: **http://www-304.ibm.com/jct03001c/press/us/en/pressrelease/27324.wss**
More on WATSON: **http://researchweb.watson.ibm.com/deepqa/index.shtml**

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The photographs in this issue are by courtesy of Jeopardy Productions Inc. (front cover), IBM (p. 46), Dennis Reidsma (p. 48), Anton Nijholt (p. 49), and Joaquin Vanschoren and Ingo Thon (pp. 51-52).

Front cover: The *Jeopardy!* set (see editorial).

The deadline for the next issue is: **August 15, 2009**.

BNVKI-Board News

Antal van den Bosch

This part of the summer is that time of year when everyone who is not in academia thinks all academics are out there in the garden watering the apple trees. Instead, many of us experience the busiest times of the year. Master's students and Ph.D. students alike show no mercy on their supervisors by handing in their theses just before they go on their well-deserved holidays, leaving their supervisors with, well, a big pile of well-deserved work. Once a staff member, you slowly forget how real holidays felt like. Look at it from the bright side: you will have something to read in your beach chair.

Another nice type of reward that compensates the lack of a carefree summer comes from the news that the Royal Netherlands Academy of Arts the and Sciences (KNAW) has re-accredited SIKS, the Netherlands-based School for Information and Knowledge Systems, as an official KNAW research school for the next six years. The BNVKI congratulates SIKS with this great accomplishment, and looks forward to a continued close cooperation.

Back to work now; the BNVKI board wishes you a fruitful summer. Keep watering those apple trees!

INTETAIN 2009

Anton Nijholt, Dennis Reidsma and Hendri Hondorp
Conference Chair and Local Chairs

The third edition of the International Conference on Intelligent Technologies for Interactive Entertainment (INTETAIN 09) was held in Amsterdam from 22 to 24 June, 2009. The theme of this edition was "Playful interaction, with others and with the environment". The focus of many submitted papers was on topics such as emergent games, exertion interfaces and embodied interaction, but there were also plenty that covered important topics of the previous editions, such as affective user interfaces, story telling, sensors, tele-presence in entertainment, animation, edutainment, and (interactive) art. The invited lectures presented a much broader view of the field while managing to go into depth on topics such as interactive art and storytelling, human music interaction, and new dimensions in entertainment computing. The result is an interesting and varied proceedings published by Springer.

Anton Nijholt.

Even more importantly, the theme was not just reflected in the content of the proceedings but also in the sessions and activities during the conference. It has always been a goal of the INTETAIN series to stimulate interaction between researchers and practitioners from different fields touching on technology and entertainment. We feel that this year's INTETAIN was very successful in that respect. The presentations drew a lot of questions and discussion. Three sessions are worth mentioning separately:

The amount of time reserved for the session for posters and interactive demonstrations made it possible for the participants of the conference not only to visit, and try out, all of the interactive installations, but also to spend some time in discussion with the presenters and with each other. This resulted in a highly engaged session with discussions extending into the coffee break.

During the session dedicated to the Dutch GATE project, different aspects of the project were presented by representatives from Utrecht University, the University of Twente and the Waag Society.

The third session that we mention here is the hands-on activity, the organization of which was inspired by a similar event during the first edition of INTETAIN. The goal of this session was to get all participants to join in a design activity in which they had to design some kind of interactive entertainment. This year the task was to design an interactive board game using models of emergence in game mechanics. Joris Dormans of the Hogeschool van Amsterdam, assisted by Remco van Swieten, first presented the ideas behind these models, and the types of interactions and feedback loops one can design into a game to make the interaction more interesting. After that, the audience split up into small groups to design their own games. During the conference dinner, the results

were presented in a highly interactive discussion in which most people participated even though the working day should, by rights, have been over.

In time, special issues of two journals dedicated to INTETAIN 09 will appear. After that, this year's INTETAIN can truly be said to be over. We hope that the contacts made between participants during the event will remain and that the diverse interactions seen during INTETAIN 09 will give inspiration for new work to be presented at the next edition.

Designing emergent games.

We would like to thank the BNVKI for their generosity in sponsoring INTETAIN 09.

Dimensionality Reduction Symposium

Laurens van der Maaten
Tilburg University

In collaboration with NWO and SIKS, the TiCC institute at Tilburg University organized a successful symposium on dimensionality reduction in honor of the doctoral defense of Laurens van der Maaten. Approximately 30 participants listened to four interesting talks and participated in the lively discussions afterwards. An outline of the four talks is presented below.

JOHN ALDO LEE (UC LOUVAIN, FNRS)

Together with Michel Verleysen, John Aldo Lee recently wrote a textbook on dimensionality reduction. Just like in the textbook, Lee's talk gave a historical overview of the development of dimensionality-reduction techniques, starting with the traditional Principal Components Analysis, and finishing with recently proposed manifold learners such as Isomap and LLE-like techniques. Also, the talk addressed some of Lee's own work on CCA, which is a nonlinear multidimensional scaling variant that works better than, say, Sammon mapping on certain types of manifold. In addition, Lee provided some recommendations for future work on dimensionality reduction.

MAX WELLING (UC IRVINE)

Max Welling presented joint work with Felix Agakov, Chris Williams, and Yutian Chen on (Bayesian) Extreme Components Analysis. Welling started his talk by convincing the participants that the minor (and not the principal) components of data often contain structure that is relevant to, e.g., classifications. For instance, in vision systems researchers often strive for invariances: as the main variations are typically contained in the principal components, the minor components are what we are really after.

Extreme Components Analysis constructs a linear mapping of the data that combines the principal and minor components of the data. Herein, an important question is how many principal and how many minor components should be taken into account. Welling presented a sophisticated Bayesian approach to address this problem.

JAN KOENDERINK (DELFT UNIVERSITY OF TECHNOLOGY)

Jan Koenderink gave a very interesting talk about a very extreme case of dimensionality reduction: the reduction from an infinite-dimensional object such as a function to a low-dimensional representation. Koenderink addressed the question how it is possible that object-reflectance spectra (which are essentially infinite-dimensional objects) can be reduced to color spaces that typically exhibit only three dimensions (such as the RGB-space that is used in computer monitors). He also visualized which parts of color spectra are lost in such a low-dimensional color space. The main reason extreme dimensionality reduction is possible in color is the *smooth* nature of natural reflectance spectra: the strong correlations between 'neighboring' spectral values allows us to represent color in an efficient representation.

LAURENS VAN DER MAATEN (TILBURG UNIVERSITY)

Laurens van der Maaten gave a short talk in which he outlined the differences between convex and non-convex techniques for dimensionality reduction. He explained how almost all convex dimensionality-reduction techniques are similar in that they optimize a Rayleigh quotient, and he revealed two problematic characteristics of Rayleigh quotients. Next, van der Maaten argued that by dropping the convexity requirement, designers of dimensionality-reduction techniques obtain much more freedom in the design of a suitable cost function. He proved his point by showing some impressive visualization

results that were obtained with a non-convex dimensionality-reduction technique, called t-SNE, that he recently developed in collaboration with Geoffrey Hinton.

The symposium was closed with a lunch, which was the perfect time for lively discussions. After the lunch, all participants were invited to attend the defense of the doctoral thesis 'Feature Extraction from Visual Data' by Laurens van der Maaten, which (among others) presents his work on the new dimensionality-reduction technique t-SNE. The participants witnessed a successful thesis defense: van der Maaten received his doctoral degree *cum laude*.

ILP-MLG-SRL 2009

Conference Report

Dries Van Dyck,
Hasselt University and
Transnational University of Limburg

INTRODUCTION

The ILP-MLG-SRL conference took place in Leuven, Belgium, from July 2 to July 4 and combined the 19th International Conference on Inductive Logic Programming (ILP), the 7th International Workshop on Mining and Learning with Graphs (MLG) and the 6th International Workshop on Statistical Relational Learning (SRL). The STUK cultural center located close to the town center was chosen as venue. The ILP conference series has been the premier forum for work on logic-based approaches to learning for almost two decades. It has recently reached out to other forms of relational learning and to probabilistic approaches. The MLG workshop series focuses on graph-based approaches to machine learning and data mining; since its conception in 2003, attendance numbers have consistently increased, and it now enjoys worldwide recognition. The SRL workshop series focuses on statistical inference and learning with relational and first-order logical representations. The combination of probability theory with relational (or first-order logic) knowledge representations has been the subject of much recent research.

Although each event has its own specific focus and audience, it has become clear over the years that the research areas of each community and the problems studied by them overlap significantly. The growing interest in logical and relational learning, mining and learning with graphs, statistical relational learning and probabilistic logic widened each field in the directions of the others. As a result it becomes harder and harder to draw borders separating each research area. Nevertheless, the corresponding research communities do not always find each other and bringing them together was the main motivation for co-locating the events. For that reason, the program committee decided to encourage synergies between the communities by organizing the sessions with regular contributions thematically which effectively brought the attendees of the different workshops together.

Submissions to the events are under the form of extended abstracts, which are informally published online in order to also attract high-quality contributions that are already accepted or published. Original work is encouraged by a joint special issue of the *Machine Learning Journal* in which authors of selected papers will be invited to publish an extended version of their work.

A wide variety of researchers consisting of enthusiastic Ph.D. students, more experienced PostDocs and established scholars attended the conference, summing up to approximately 130 participants. The program consisted of six invited speakers, 30 oral presentations carefully selected from about 100 submissions and an extensive poster program to further foster interaction between the respective communities. In addition, a rich and interesting program of social events guaranteed opportunities for contacts in an informal context.

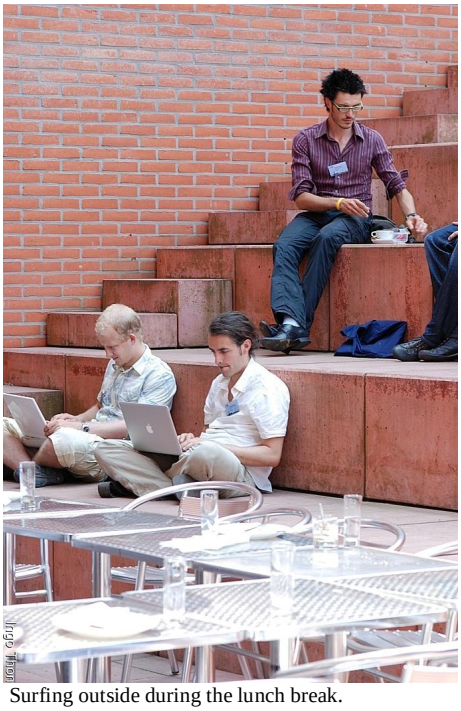
CONFERENCE OVERVIEW

The social programme of the conference already started wednesday evening with an opening reception in the magnificent gothic city hall of Leuven. The venue was beautiful, the drinks and snacks a testimony to Belgian gastronomy and the guests eager to (re)connect.

The conference opened officially on Thursday morning with an invited talk by Philip Yu of the University of Illinois at Chicago on the power of links in the analysis of Information Networks – a hot, fast growing topic both in academic and industrial circles, including interest from large, multinational companies such as Yahoo!, Google, IBM, … He gave a detailed overview on how links can be used to improve the effectiveness and efficiency of typical data-analysis tasks such as data cleaning and truth validation in information integration, on-line analytical processing with an emphasis on applications in multi-relational databases and the World Wide Web.

After a tasteful coffee break, the program continued with two parallel sessions of regular contributions: an ILP session in the main auditorium and a

combined SRL-MLG session in the Verbeeck room. After a gastronomic lunch on site, it was time for the second invited speaker: Raymond Mooney from the University of Texas at Austin with a talk on bottom-up search and transfer learning in SRL. Inspired by recent research, he advocated for data-driven, bottom-up search strategies to learn the structure of SRL models and showed its value with an overview of recent bottom-up search-based structure-learning methods for Markov Logic Networks. He also showed the power of transfer learning to reduce the data and computational demands by learning a SRL model from small amounts of in-domain training data and transferring the obtained model by an induced predicate mapping between seemingly disparate domains. The approach was illustrated by a reasonably successful transfer of a model learned from data from a CS department to IMDB movie data.



Surfing outside during the lunch break.

The first-day schedule closed with a joint poster spotlight session in which authors of accepted posters advertised their poster in two-minute slots, immediately followed by the first poster reception. Afterwards the social program took over with a guided tour through the historic centre of Leuven. The walk ended in the beautifully conserved Groot Begijnhof (Beguinage) which hosts the Faculty Club restaurant, the venue for the conference dinner indulging the participants in Belgian gastronomy (including their famous beers).

Day Two, Friday, fired up with an invited talk by Jure Leskovec, a young rising star in large-network analysis from Cornell University. A packed auditorium listened to a presentation of his recent work on clustering/community in large networks that revealed the difference in clustering structure between well-studied small social networks and the contemporary large-scale networks with millions of nodes. He showed that the core-periphery structure of these large-scale networks can be described efficiently by a model based on Kronecker products which could become the paradigm of choice for data analysis in sparse and noisy high-dimensional social and informations networks. The morning schedule continued with two regular parallel sessions. The auditorium was dedicated to MLG while the Verbeeck room hosted a combined ILP/SRL session.

After lunch, the afternoon schedule opened with the fourth invited talk by James Cussens from the University of York. He gave a tutorial on logic based approaches to SRL in which the idea is to define a distribution over 'possible worlds' and infer a model by picking the possible world that maximizes the probability of having generated the data. The technique was illustrated by applying it to Markov logic networks and PRISM programs. The second joint poster spotlight session and poster reception concluded the day. A large delegation departed on foot for the evening programme: a visit to the Stella Artois brewery to discover how one of Belgium's most appreciated export products is brewed and bottled or canned. Of course, some beer tasting at the end of the visit was necessary for a scientific worthy validation of the brewing process – an endeavor which some scientists took very seriously. The Jazz enthusiasts concluded the night with Beleuvenissen, a free Jazz festival on several podia scattered throughout the historic centre.

Saturday, the final day, started with an invited talk by Scot Scanner from NICTA, Australia, on first-order models and algorithms for sequential decision-making. The emphasis was on the insights underlying those approaches that admit exact lifted solutions. He also discussed a variety of extensions of the first-order Markov decision process and shared the algorithmic tricks-of-the-trade to apply these models in practice. The last two parallel sessions of contributed talks followed after some caffeine-intake. ILP shared the Auditorium with SRL while the Verbeeck room was completely dedicated to ILP.

After the final lunch on site, Jason Eisner from Johns Hopkins University was up for the last, but certainly not least, invited talk with title *Weighted Deduction as an Abstract Level for AI*. He presented Dyna, a declarative programming language combining logic and functional programming that allows to hide many common implementation

details behind a new level of abstraction. He showed how it can be used as deductive database, theorem prover, truth maintenance system or equation solver and illustrated how easily the typical computational combinatorial structures of AI can be specified in Dyna. He also sketched some implementation strategies to make computations in Dyna fast and memory-efficient.

The final day concluded with a panel and business meeting.

The banquet.

CONCLUSION

The colocated ILP-MLG-SRL conference succeeded in its main objective: bringing the three communities, which are historically split by their own conferences and workshops, together to interact and discuss the common problems they work on in an open atmosphere. We certainly hope that synergies between the communities will continue to develop and that multi-disciplinary collaboration will become the norm for research on the problems overlapping the respective domains.

The STUK cultural centre in Leuven proved itself as an ideal venue for conference of this size: the cafe allows lunches on site and the structure of the building with its two-level inside court invites researchers to separate themselves from the group to discuss new ideas and research opportunities. It is also close to the historic centre of Leuven which allows a rich and diverse social program without the need for organized transport.

Taking a selection of regular talks to include in this report would do injustice to the consistent high quality of all regular talks and for that reason I choose to focus on the invited talks. I can only encourage the reader to browse through the extended abstracts which are all available on the conference website: http://www.cs.kuleuven.be/~dtai/ilp-mlg-srl/.

Hence, I will conclude this report by noting a few trends. Biological applications found their way into all three events and Markov logic networks seems the most popular work horse in ILP and SRL. Classification problems dominate all events and are clearly located in the grey zone where the research domains overlap. ILP remains the largest event covering more or less half of the regular talks and accepted posters.

ACKNOWLEDGEMENTS

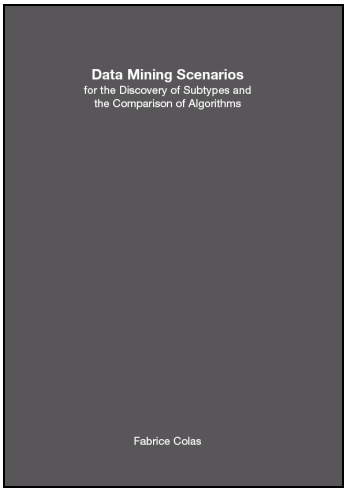
I would like to thank Ph.D. students Jonny Daenen and Joris Gillis for taking notes for this report and the PASCAL-2 network of excellence and the Fund for Scientific Research of Flanders (FWO-Vlaanderen) for sponsoring ILP-MLG-SRL 2009. Also thanks to Joaquin Vanschoren and Ingo Thon for providing the complementary pictures.

PH.D. THESIS ABSTRACTS

Data Mining Scenarios for the Discovery of Subtypes and the Comparison of Algorithms

Ph.D. thesis abstract
Fabrice Colas

Promotor: Prof.dr. J.N. Kok
Date of defense: March 4, 2009



1) In research on diseases presenting clinical heterogeneity or on complex psychiatric disorders, the development of new drug treatments demands a precise understanding of the underlying pathological mechanisms. To help elucidate them, more sensitive classifications of the patients are searched for. As a

result, with clinical research as primary application not withstanding however its generality, we established a logical sequence of steps to infer subtypes in data.

This sequence is referred to as the subtype discovery data mining scenario, it is implemented as an R package called SubtypeDiscovery.

The scenario enables to perform several draft analyses to select individuals and features, and to select a particular data preparation.

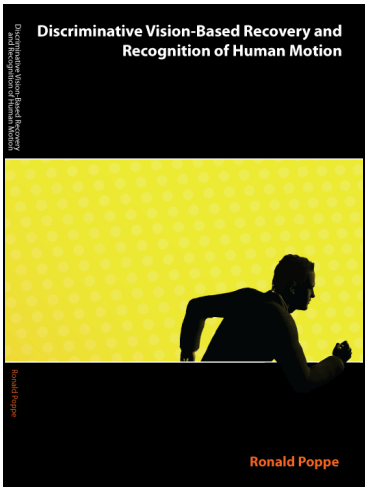
It also provides means to select the most likely cluster result by repeated cluster modeling, to assess their reliability against noise addition, to characterize them visually and statistically, and to validate them by testing for their clinical relevance or their target-specificity. More information on the R SubtypeDiscovery can be obtained from its home page at https://gforge.nbic.nl/projects/subtypediscover/.

2) The Comparison of Algorithms Scenario was designed to compare text-classification algorithms under an extensive set of experimental settings. The result of our experiments shows that common classifiers SVM, kNN and naive Bayes achieve comparable performance on most problems although, tightly constrained SVM solutions are found to be high performers in small feature spaces. However, in that case, the solutions of SVM are essentially characterized by bounded support vectors and therefore, SVM reduces to a nearest mean classifier which does not require any training. In addition, SVM is also shown to suffer from performance deterioration for particular combinations of training set size/number of features.

Discriminative Vision-Based Recovery and Recognition of Human Motion

Ph.D. thesis abstract
Ronald Poppe

Promotor: Prof.dr.ir. A. Nijholt
Co-promotor: Dr. M. Poel
Date of defense: April 2, 2009



The automatic analysis of human motion from images and video opens up the way for many applications in the domains of security and surveillance, human-computer interaction, animation, retrieval and sports motion analysis, to name a few. As the analysis of human motion comprises many aspects, in this dissertation, the focus is limited to human pose recovery and human action recognition. The former is a regression task where the aim is to determine the locations or angles of key joints in the human body, given an image of a human figure. The latter is the process of labeling image sequences with action labels, which is a classification task. The focus is on robust and fast recovery and recognition of human motion. The work is evaluated extensively on publicly available datasets.

An example-based pose-recovery approach is introduced where a variant of histograms of oriented gradients (HOG) is used as the image descriptor. It is assumed that a region of interest (ROI) containing a human subject is available, and that the foreground labeling can be determined. Given an unseen image, the ROI is represented as a HOG descriptor. From an example database containing thousands of HOG-pose pairs, the visually closest examples are selected. Weighted interpolation of the corresponding poses is used to obtain the pose estimate, represented as the 3D locations of 20 key joints in the human body. This approach is fast due to the use of a low-cost distance function. Experiments have been carried out on the HumanEva dataset. When using a single camera, mean 3D relative errors of 65 mm per joint were obtained, and 45 mm per joint on walking and jogging sequences. Combining the input from multiple views slightly decreased the estimation error. In additional experiments, the effect on the accuracy was examined when varying the HOG grid size and the number of examples in the example set.

Partial occlusion of the human figure in the image is a common problem in realistic settings, but has largely been ignored in pose-recovery approaches. In this work, the issue is explicitly addressed and it is assumed that a prediction of the occluded areas can be obtained together with a ROI estimate. The example-based approach is adapted to cope with these partial occlusions. The normalization and matching of the HOG descriptors was changed from global to the cell level. The approach was used for recovery of human poses without adjusting the example set and matching process to the occlusion condition. Experiments on the HumanEva dataset with simulated occlusion showed that occlusions affected the recovery accuracy but only moderately.

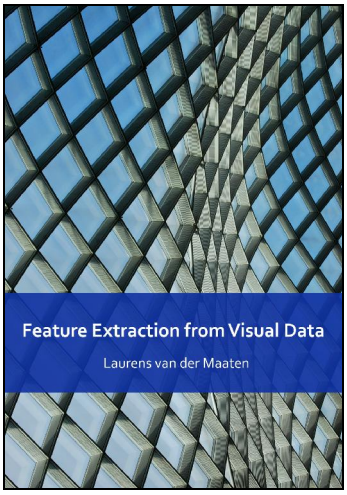
For the recognition of human actions, again a variant of HOG descriptors is used to encode the ROI of an image containing a human subject. Simple functions are used to discriminate between two classes after applying a common spatial patterns (CSP) transform on sequences of these HOG descriptors. In the transform, the difference in variance between two classes is maximized. Each of the discriminative functions softly votes into the two classes. After evaluation of all pairwise functions, the action class that receives most of the voting mass is the estimated class. Using this approach, approximately 95% was classified correctly on the Weizmann human action dataset and showed that state-of-the-art performance can be obtained with low training requirements. Additional experiments showed that walking motion could be recognized even for moderate viewpoint changes and with several image deformations. Also, good results were reported when shorter sequences were used.

To deal with different viewpoints and partial occlusion of the human figure in the image, the example-based pose-recovery approach is combined with the CSP-based human-action-recognition approach. The resulting approach was able to simultaneously recover human poses and recognize the action over a sequence of frames. Specifically, the recovered 3D poses were normalized for rotation and body size of the subject and used as input for the CSP classifier. Again, the HumanEva dataset was used for experiments. Thanks to the rotation normalization, actions could be recognized from arbitrary viewpoints. By handling occlusions in the pose recovery step, actions could be recognized from image observations where occlusion was simulated. Finally, the potential of this approach for temporal action segmentation was demonstrated.

Feature Extraction from Visual Data

Ph.D. thesis abstract
Laurens van der Maaten

Promotores: Prof.dr. E.O. Postma, Prof.dr. H.J. van den Herik
Date of defense: June 23, 2009



The extraction of informative features from visual data is one of the most important problems in the development of computer vision systems. Feature extraction is necessary in order to address the two main problems of image-space representations: (1) the dimensionality problem, i.e., the high dimensionality of image-space representations and (2) the variance problem, i.e., the susceptibility of image-space representations to variations in natural images. The dimensionality problem is due to the large number of pixels that constitute an image. The variance problem is due to the drastic changes individual pixel values may undergo under the presence of variations such as rotations, changes in viewpoint, and scale changes. Feature extraction aims to resolve the two weaknesses of image-space representations by extracting invariant informative features from the visual data. Over the last few decades, a large number of studies have resulted in the development of a variety of features, some of which we aim to improve in this thesis. The problem statement of the thesis reads:

> *How can we mitigate the dimensionality and variance problems in computer vision systems?*

The thesis investigates two types of features that address the two weaknesses of image-space representations: (1) dimensionality-reduction features and (2) texture features. Dimensionality-reduction features mitigate the dimensionality of

image-space representations by building a representation that exploits the (non)linear relations between the values of individual pixels. Texture features are an important example of image features that aim to construct invariant representations for the texture of surfaces. The problem statement of the thesis is translated into the following two research questions.

- **Research question 1**: *How can we improve existing dimensionality-reduction features?*
- **Research question 2:** *How can existing texture features be adapted to be invariant to variations that occur in uncontrolled environments, such as rotations, rescalings, and lighting changes?*

We start our research in Chapter 2, in which we focus on the first research question: How can we improve existing dimensionality-reduction features? The chapter presents an extensive comparative review of state-of-the-art dimensionality-reduction features with experiments on a variety of datasets, and identifies the most important weaknesses and limitations of the underlying techniques. In particular, we conclude that existing dimensionality-reduction techniques that focus on retaining the local structure of a data manifold are hampered by flaws in their objective functions that are the result of the convex nature of these functions.

Chapter 3 presents and investigates a new dimensionality-reduction technique, called t-Distributed Stochastic Neighbor Embedding (t-SNE), that addresses some of the weaknesses that were identified in Chapter 2. The experiments in Chapter 3 reveal the strong performance of t-SNE in a number of visualization experiments.

In Chapter 4, we present two extensions of t-SNE that aim to extend the technique to two new learning settings in which: (1) a parametric mapping from the high-dimensional to the low-dimensional space is required, and (2) the extracted features need to be non-metric. The chapter presents illustrative experiments for both extensions of t-SNE. We argue that the second extension gives rise to a computational model for semantic representation.

In Chapter 5, we shift our focus to the second research question: How can existing texture features be adapted to be invariant to variations that occur in uncontrolled environments, such as rotations, rescalings, and lighting changes? The chapter presents a literature overview of state-of-the-art texture features, which can be subdivided into four main types. The chapter concludes that one of these types, the so-called texton-based texture features, is an interesting type of features that have not yet been investigated in sufficient detail. In particular, two important issues need to be addressed: (1) the performance of image-based textons compared to filter-based textons in terms of performance in classification experiments is unclear and (2) current texton-based texture features are hampered by the second weakness of image-space representations, which is their susceptibility to variations in natural images.

Chapter 6 attempts to resolve the two issues that were raised in Chapter 5. The first issue is addressed by performing a range of experiments in which we compare image-based textons with a variety of filter-based textons. From results of these experiments, we conclude image-based textons may slightly outperform filter-based textons, and offer important computational advantages. The second issue is addressed by the development of three new texton-based texture features, two of which are invariant under rotations, and one of which is invariant under local affine transformations. The chapter presents experiments with the new invariant texture features that reveal the merits of the new texture features.

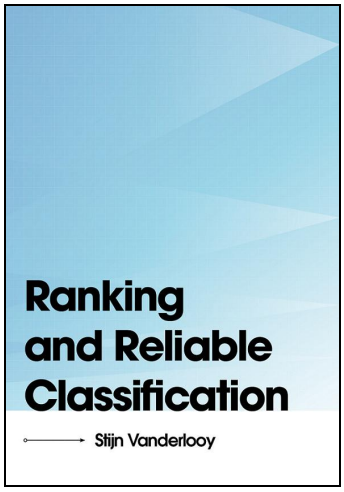
In Chapter 7, we investigate the new features developed in the previous chapters in two real-world computer vision tasks. First, we investigate the application of a combination of t-SNE and texton-based texture features in the assessment of paintings by Van Gogh and his contemporaries. The results of our experiments reveal that our approach is capable of identifying forged Van Gogh paintings and paintings by his contemporaries in a collection of Van Gogh and non-Van Gogh paintings. Second, we investigate the application of a combination of t-SNE and texton-based texture features in the recognition of seeds based on photographic reproductions. The results of this study reveal that our approach is promising, in particular, when it is combined with relevant domain knowledge.

Chapter 8 concludes the thesis by answering the two research questions and the problem statement. We conclude the dimensionality problem can successfully be addressed using novel dimensionality-reduction techniques such as t-SNE, and that the variance problem may be addressed by identifying affine-covariant image regions and using the Fourier coefficients of polar image representations. In addition to the conclusions, Chapter 8 presents guidelines for future work.

Ranking and Reliable Classification

Ph.D. thesis abstract
Stijn Vanderlooy

Promotores: Prof.dr. H.J. van den Herik, Prof.mr. Th.A. de Roos, Prof.dr.rer.nat. E. Hüllermeijer
Date of defense: July 1, 2009



Machine learning has been promoted many times as an important tool that can be used by law enforcement agencies to prevent crime and provide security to civilians. We fully agree and mention in Chapter 1 several examples of the important use of classifiers in the law enforcement field. Nonetheless, when we consider the implementations in practice, we may conclude that classifiers are only used for relatively easy tasks. We analyse why this is the case and present three domain-specific problems that should be alleviated or overcome. The key message is that conventional classifiers have difficulties to guarantee legally correct decisions and a correct treatment of civilians. Classifiers are not considered to be "reliable". Therefore, we have formulated the following problem statement: *To what extent can machine-learning classifiers be used to increase the effectiveness and efficiency of law enforcement?* We note that, despite our motivation, the research presented in this thesis is also important for all other application fields.

After providing some background in Chapter 2, we start our research in Chapter 3 by studying RQ 1: *To what extent is the area under the ROC curve an effective performance metric for bipartite ranking when compared to its variants that consider the absolute values of the scores?* Assuming two possible class labels (positive and negative), we focus on ranking instances from most likely positive to most likely negative based on their scores, which are estimations of the probability that the instances are in fact positive instances. The ranking setting has large benefits for practical applications, especially in the field of law enforcement where predicting the most likely class label is not always sufficient. The area under the ROC curve, abbreviated AUC, has been widely used to measure the ranking performance, but recently, it was conjectured to have a drawback since it does not consider the absolute values of the scores. Instead, it simply considers the sign of the difference in scores between pairs of positive and negative instances. It was, however, argued by several authors that smaller differences should be treated with more caution since they are less reliable than large differences. Several variants of the AUC estimate have been proposed for this reason. To answer RQ 1, we present a unified framework for the estimate and its variants. From our theoretical results, we may conclude that the variants are all biased and their variance can go in either direction. The net effect of the quality of the estimations is thus not clear. In addition, experiments with synthetic data show that the AUC is the most effective performance metric for model evaluation and selection. Our experimental analysis with benchmark data sets confirms these findings: dependent on the model-selection scenario, the AUC is competitive with its variants or it clearly outperforms the variants.

Subsequently, in Chapter 4, we are interested in RQ 2: *How can the AUC of an interpretable and comprehensible classifier, such as decision trees, be optimised?* Decision trees, trained in the usual way as a classifier, can be used for ranking by scoring an instance in terms of the frequency of positive training examples in the leaf to which the instance is assigned. However, several experimental results indicate that decision trees perform poorly in ranking instances, although the definition of the score is clearly reasonable. To answer RQ 2, we first replicate and extend previous empirical studies about approaches (which are not formally well-founded) to improve the AUC of decision trees. Analysing the results does not only improve the understanding of earlier approaches, but also corrects some implicit assumptions and conjectures that have been made by several authors. For example, the effect of Laplace correction was so far featured to an increased reliability in the sense that it considers scores of small leafs to be not as reliable as scores of large leafs. Our experiments, on the other hand, show that the benefit of Laplace correction comes from a reasonable local tie-breaking effect that comes along with an increased number of distinct scores. From the theoretical results and accompanying simulation studies, we can confirm that the (empirical) AUC increases with the number of scores produced by the tree, at least

when these scores are better than random approximations of the true conditional probabilities. Indeed, leaf-splitting seems to be tolerant toward estimation errors of probabilities for the positive class in the sense that only the ordering of scores is important. Even more important for practical purposes, we present a simple but very efficient and effective method for AUC-optimising decision trees. Our findings generalise in a straightforward way to other classifiers, as we illustrate with a weighted nearest neighbour classifier.

In Chapter 5 we study RQ 3: *Can we develop a feasible approach by which a classifier is constructed that guarantees a preset classification performance on each class?* Our answer to the research question is based on the concept of self-awareness in the following way. Instead of restricting the classifier to predict always one of the possible class labels, the classifier is given the option to say "I do not know" and consequently it refrains from classifying an instance (for which it is uncertain). The goal is then to design an approach for which the number of classification rejections is minimal, and yet, the desired performance values are guaranteed. Since we know *a priori* what we can expect from the classifier, we call it a reliable classifier. We provide an affirmative answer to the research question by means of introducing the ROC isometrics approach. This is an effective and generally applicable approach that has several advantages over other approaches that try to boost classification performance. A formal analysis was presented when performance is defined in terms of the following metrics: precision, accuracy, F-measure, and *m*-estimate. The implicit assumption of the approach is that the empirical ROC curve is an accurate estimate of the true curve. The validity of the approach is also tested using benchmark data sets. From the results, we may conclude that the ROC isometrics approach indeed results in classifiers that are reliable, at least, when sufficient instances are being processed.

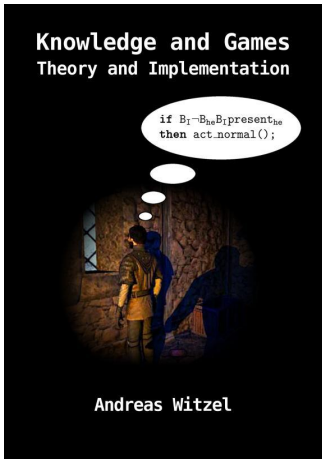
So far, we have considered ranking and binary classification problems. A common strategy to solve a multi-class problem is to decompose it into a series of binary problems and to learn a set of corresponding base classifiers. The question is then how to aggregate the predictions of these base classifiers into a single final classification. Therefore, in Chapter 6 we study RQ 4: *Can we develop an aggregation strategy that is feasible in practice and shown to be optimal under reasonable conditions?* Using the setting of label ranking, we develop an aggregation strategy that takes the strength of the base classifiers into account. In this way, classifiers with high performance are seen as more reliable than classifiers with lower performance, and the aggregation strategy becomes less susceptible to (likely incorrect) outputs from the weak and unreliable classifiers. This strategy is called adaptive voting and shown to be optimal in the sense of yielding a maximum *a posteriori* prediction of the class label of a test instance. The conditions for this optimality are clearly stated and shown to be reasonable for actual implementation in practice. Next to this important contribution, we offer hitherto missing theoretical arguments in favour of the simple weighted voting, a strategy which has shown very good performance in practice. So far, weighted voting was considered to be ad hoc since no theoretical results concerning its performance existed. We show that weighted voting approximates the optimal adaptive voting prediction, and moreover, it has the advantage of being more robust when the model assumptions of adaptive voting are violated. From our experimental results with synthetic and real benchmark data sets, we can verify all these results in a consistent way.

Finally, in Chapter 7 we restate briefly our answers to the four research questions and formulate a conclusive answer to the problem statement. We may conclude that the research presented in this thesis results in a safer and more reliable use of machine-learning classifiers in the field of law enforcement. The proposed approaches suggest a large step toward the implementation of intelligence led policing, eventually resulting in an increased effectiveness and efficiency of law enforcement. We end with several directions for future research to improve on the results of this thesis.

Knowledge and Games: Theory and Implementation

Ph.D. thesis abstract
Andreas Witzel

Promotor: Prof.dr. K.R. Apt
Date of defense: September 3, 2009



Does she know what he knows? And if so, *what is she going to do?*

This dissertation takes a computer science perspective on questions of knowledge and interaction and presents approaches for endowing artificial agents with corresponding reasoning capabilities.

To this end, we restrict general frameworks of epistemic logic and game theory in order to obtain practical implementations grounded in theory.

The basic idea of the main part of the dissertation (Chapters 1 to 3) is to view computer processes, or otherwise *distributed* programs, as players in a game-theoretic setting with incomplete information. As such, they should be able to communicate in order to obtain information, and to perform game-theoretic algorithms.

In Chapter 1, we establish the technical foundations to support implementation of synchronous communication, and thus the attainment of common knowledge, among computer processes representing players. To this end, we examine dialects of the process calculus CSP, which is available in the form of programming languages. We argue that for our purposes the process system needs to exhibit a certain symmetry, and show that to satisfy this requirement we need a certain guard construct in the language. Since this construct is not commonly provided, our result practically identifies a unique programming language suitable for our purposes.

In Chapter 2, we define what we call interaction structures, a concrete class of communication networks. We specify what kind of communication scenario we focus on, and study properties of the knowledge that results from such communication. These properties can be used to simplify reasoning about knowledge in our setting.

In Chapter 3, we study games in the presence of an interaction structure, which allows players to communicate their preferences, assuming that each player initially only knows his own preferences. We study the outcomes of iterated elimination of strictly dominated strategies that can be obtained in any given state of communication. The insights from the previous chapters are used in order to provide an epistemic basis for our results and to show a distributed algorithm that implements the procedures locally in each player process.

After this main part of the dissertation, we continue with more loosely related satellite chapters.

Chapter 4 is close to the main part in spirit, with the difference that it focuses on a centralized rather than a distributed approach, and that it considers computer games rather than games in the strict sense of game theory. We argue that reasoning about knowledge, including about each other's knowledge, plays a crucial role in real-life strategic and social interaction. We survey existing literature and games which simulate such interaction, and show that this issue is currently neglected. We give concrete scenarios from existing computer games which could profit from incorporating such reasoning techniques, and substantiate one of them by describing a simple implementation intended for experimental evaluation.

In Chapter 5, we propose an abstract approach to coalition formation that focuses on simple merge and split rules transforming partitions of a group of players. We identify conditions under which every iteration of these rules yields a unique partition. The main conceptual tool is a specific notion of a stable partition. The results are parameterized by a preference relation between partitions of a group of players and naturally apply to coalitional TU-games, hedonic games and exchange economy games.

In Chapter 6, we extend the existing framework of mixed multi-unit combinatorial auctions to include time constraints, present an expressive bidding language, and show how to solve the winner determination problem for such auctions using an integer programming implementation. Mixed multi-unit combinatorial auctions are auctions where bidders can offer combinations of transformations of goods rather than just simple goods. For example, a transformation might take dough and water and yield bread. This model has great potential for applications in the context of supply chain formation, which is further enhanced by the integration of time constraints.

Finally, in Chapter 7 we give an outlook on possible future directions for implementing epistemic logic.

A Flood of News Items

Jaap van den Herik
TiCC, Tilburg University

This announcement of Ph.D. Defences, Inaugural Addresses, and Appointments will be remarkable for at least three reasons. Let us start to remark that there is a common trait, that is "length". All three lists are longer than ever before. Of course, this may point to an explosion of activities. In a time of financial and economic crises, it is fascinating to see

(1) that the research power of the Ph.D. students is not flawed in any way, (2) that the newly appointed professors take it as their duty to deliver an inaugural speech, and (3) that the Boards of the University Authorities see many opportunities for expansion and for strengthening their research groups with new appointments. All these new items may sound wonderful – and they actually are – but a deeper analysis reveals that there are some side-effects that help enormously to arrive at this situation. The main point is owing to the publication dates of the Newsletter. The current (and hopefully temporarily) infrequent occurrence of the Newsletter leads to a saving of announcements over a longer period than usual. So, we are now able to inform you on Ph.D. defences ranging from June to December 2009 (actually from March to December, since we have also post-anouncements).

A close inspection shows that counting by month is already amazing. So, in the month June we count twelve Ph.D. defences and even in the holiday month of July, we see three Ph.D. defences. In this flood of defences we are still alert and we aim at informing our readership as best as possible. Therefore we also announce in this June issue four Ph.D. defences belonging to our research community which were not earlier included in these pages. They are dated March, April, and May. With the publication we have completed our overview so far. After the holidays, we are now envisaging twenty-one Ph.D. defences, but we are sure that there will be more. All in all, it seems that AI research in the Netherlands is flourishing.

SIKS RECOGNITION

The successful development is for a part due to the activities employed by SIKS, the Graduate School for Information and Knowledge Systems. Many of the Ph.D. theses mentioned in the announcement list are produced under the aegis of SIKS. The members of the ECOS (Erkenningscommissie Onderzoek-scholen) of the KNAW (Koninklijke Nederlandse Academie voor Wetenschappen) have taken the SIKS successes into account too. Recently, we were informed that SIKS has been re-accredited by the KNAW as an official Research School for the next six years, being from 2009 to 2015. A compliment for and congratulations to the SIKS Chairman Professor Roel Wieringa and the Director Dr. Richard Starmans are due, in particular for their efforts over the last six years. SIKS received a special compliment by the ECOS committee for bringing back the "aio-duration" from almost six years to some 4.5 years. Indeed, a considerable reduction.

INAUGURAL ADDRESSES

The list of inaugural addresses is the second remarkable issue, since it contains no less than five announcements. We congratulate the professors Desain, Kraaij, Van Oortmerssen, Heskes, and Verbrugge wholeheartedly with the official acceptance of their appointment. According to the old habit in academic circles, professors are only "really" worth to carry the title "professor" after their inaugural address. In previous times, it was also not allowed to act as a supervisor as long as one had not officially accepted the appointment by an inaugural address. These times have been passed, as well as the times that the University (in particular the private universities) would not pay the professors their salary if they had not delivered their inaugural addresses. In these times an appointment was still a life appointment, which implied that there were no farewell speeches by the professors. And this implied that the Universities had to pay their professors also in their eighties and nineties, up to their life end. That was a golden time for my former colleagues.

NEW APPOINTMENTS

The third remarkable issue is that Tilburg University (UvT) has so soon a worthy successor in the Groningen University (RUG). Like the UvT last year in May, the RUG announced in May 2009 the appointment of two new professors in the AI group headed by Professor Lambert Schomaker. The new professors are Dr. Rineke Verbrugge and Dr. Niels Taatgen. Some brief background items are appended with their names and references under the heading Appointments. Dr. Verbrugge informed us already on the date of her inaugural address. The Editorial Board wishes Dr. Verbrugge and Dr. Taatgen much success in their new jobs, in particular we wish them to have many Ph.D. students, and a fruitful cooperation with other AI researchers in the Netherlands. The Groningen University is congratulated with their choices and also with their success as breeding place for new talented educators.

ADDITIONAL PH.D. THESES (2009)

Fabrice Colas (March 4, 2009). *Data Mining Scenarios for the Discovery of Subtypes and the Comparison of Algorithms.* Leiden University, LIACS. Promotor: Prof.dr. J.N. Kok (UL).

Benjamin Kanagwa (April 21, 2009). *Design, Discovery and Construction of Service-Oriented Systems.* Radboud University Nijmegen. Promotor: Prof.dr.ir. Th. van de Weide (RUN).

Richard Notebaart (May 6, 2009). *Integrative Bioinformatics of Metabolic Networks.* CMBI, Radboud University Nijmegen. Promotores:

Prof.dr. B. Teusink (RUN) and Prof.dr. R. Siezen (RUN).

Meinou de Vries (May 21, 2009). *Implicit Learning of Artificial Grammars: Its Neural Mechanism and its Implications for Natural Language Research.* Münster University. Promotores: Prof.dr. P. Zwitserlood (Münster University) and Prof.dr. S. Knecht (Münster University).

CURRENT LIST OF PH.D. THESES (2009)

Hans Fokker (June 2, 2009). *E-Arbitrage.* Leiden University. Promotores: Prof.mr. H.J. Snijders (UL) and Prof.mr. A.H.J. Schmidt (UL).

André de Vries (June 3, 2009). *The Value of Haplotypes.* Groningen University. Promotor: Prof.dr. R.M.W. Hofstra (RUG).

Steven de Jong (June 4, 2009). *Fairness in Multi-Agent Systems.* Maastricht University. Promotores: Prof.dr. H.J. van den Herik (UvT) and Prof.dr. E.O. Postma (UvT). Copromotor: Dr. K. Tuyls (TU/e).

Anan Gaval (June 8, 2009). *Bayesian Networks for Omics Data Analysis.* Wageningen University. Promotores: Prof.dr. J.A.M. Leunissen (WU) and Prof.dr. M. Muller (WU).

Fabian Groffen (June 10, 2009). *Armada, an Evolving Database System*. University of Amsterdam. Promotor: Prof.dr. M.I. Kersten (CWI/UvA). Copromotor: Dr. S. Manegold (CWI).

Jan Wielemaker (June 12, 2009). *Logic Programming for Knowledge-Intensive Interactive Applications.* University of Amsterdam. Promotores: Prof.dr. B.J. Wielinga (UvA) and Prof.dr. A. Th. Schreiber (VU).

Fritz Reul (June 17, 2009). *New Architectures for Computer Chess*. Tilburg University. Promotor: Prof.dr. H.J. van den Herik (UvT). Copromotor: Dr. J.W.H.M. Uiterwijk (UM).

Maksym Korotkiy (June 18, 2009). *From Ontology-enabled Services to Service-enabled Ontologies (making ontologies work in e-science with ONTO-SOA).* VU Amsterdam. Promotor: Prof.dr. J. Top (VU).

Serge Smeets (June 22, 2009**).** *Genetic and Functional Analysis of Head and Neck Carcinogenesis*. VU Amsterdam. Promotores: Prof.dr. C.R. Leemans (VU) and Prof.dr. R.H. Brakenhoff (VU).

Laurens van der Maaten (June 23, 2009). *Feature Extraction from Visual Data.* Tilburg University. Promotores: Prof.dr. E.O. Postma (UvT) and Prof.dr. H.J. van den Herik (UvT). Copromotor: Dr. A.G. Lange (RCE, previously RACM).

Pavel Serdyukov (June 24, 2009) *Search for Expertise: Going beyond direct evidence.* Twente University. Promotor: Prof.dr. P.M.G. Apers (UT). Copromotor: Dr. D. Hiemstra (UT).

Alexander Boer (June 25, 2009). *Legal Theory, Sources of Law & the Semantic Web***.** University of Amsterdam. Promotor: Prof.dr. T.M. van Engers (UvA). Copromotores: Prof.dr. J.A.P.J. Breuker (UvA) and Dr. R.G.F. Winkels (UvA).

Stijn Vanderlooy (July 1, 2009). *Ranking and Reliable Classicifation*. Maastricht University. Promotores: Prof.dr. H.J. van den Herik (UvT), Prof.mr. Th.A. de Roos (UvT) and Prof.dr. F. Hüllermeier (University of Marburg).

Valentin Robu (July 2, 2009). *Modeling Preferences, Strategic Reasoning and Collaboration in Agent-Mediated Electronic Markets*. TU/e. Promotor: Prof.dr. H. La Poutré (CWI/TU/e).

Bob van der Vecht (July 6, 2009). *Adjustable Autonomy: Controlling Influences on Decision Making*. Utrecht University. Promotor: Prof.dr. J.-J. Ch. Meyer (UU). Copromotor: Dr. F.Dignum (UU).

Khiet Truong (August 27, 2009). *How Does Real Affect Affect Affect Recognition In Speech?* Twente University. Promotor: Prof.dr. F.M.G. de Jong (UT) and Prof.dr.ir. D.A. van Leeuwen (RUN).

Andreas Witzel (September 3, 2009). *Knowledge and Games: Theory and Implementation.* Promotor: Prof.dr. K.R. Apt (UvA).

Inge van de Weerd (September 9, 2009). *Advancing in Software Product Management: An Incremental Method Engineering Approach.* Utrecht University. Promotor: Prof.dr. S. Brinkkemper (UU). Copromotor: Dr.ir. J. Versendaal (UU).

Sofiya Katrenko (September 10, 2009). *A Closer Look at Learning Relations from Text.* University of Amsterdam. Promotor: Prof.dr. P.W. Adriaans (UvA).

Annerieke Heuvelink (September 11, 2009). *Cognitive Models for Training Simulations.* VU Amsterdam. Promotor: Prof.dr. J. Treur (VU). Copromotores: Dr. K. van den Bosch (TNO) and Dr. M.C.A. Klein (VU).

Marcin Zukowski (September 11, 2009). *Balancing Vectorized Query Execution with Bandwidth-Optimized Storage.* University of Amsterdam. Promotor: Prof.dr. M.L. Kersten (CWI/UvA). Copromotor: Dr. P.A. Boncz (CWI).

Alex van Ballegooij (September 17, 2009). *RAM: Array Database Management through Relational Mapping*). University of Amsterdam. Promotor: Prof.dr. M.L.Kersten (CWI/UvA). Copromotor: Prof.dr. A.P. de Vries (TUD).

Rinke Hoekstra (September 18, 2009). *Ontology Representation – Design Patterns and Ontologies that Make Sense.* University of Amsterdam. Promotor: Prof.dr. J.A.P.J. Breuker (UvA). Copromotores: Prof.dr. T.M. van Engers (UvA) and Dr. R.G.F. Winkels (UvA).

Christian Glahn (September 18, 2009). *Contextual Support of Social Engagement and Reflection on the Web*. Open Unversity. Promotores: Prof.dr. E.J.R. Koper (OU) and Prof.dr. M. Specht (OU).

Sander Evers (September 25, 2009). *Sensor Data Management with Probabilistic Models.* Twente University. Promotores: Prof.dr.ir. P.M.G. Apers (UT). Copromotor: Prof.dr. L. Feng (Tsinghua University, China).

Fernando Koch (October 5, 2009). *An Agent-Based Model for the Development of Intelligent Mobile Services.*Utrecht University. Promotores: Prof.dr. J.-J. Ch. Meyer (UU) and Prof.dr. E. Sonenberg (University of Melbourne). Copromotor: Dr. F. Dignum (UU).

Rik Farenhorst and Remco de Boer (October 5, 2009). *Architectural Knowledge Management: Supporting Architects and Auditors.* VU Amsterdam. Promotor: Prof.dr. J.C. van Vliet (VU). Copromotor: Dr. P. Lago (VU).

Peter Hofgesang (October 8, 2009). *Modelling Web Usage in a Changing Environment.* VU Amsterdam. Promotor: Prof.dr. A.E. Eiben (VU). Copromotor: Dr. W. Kowalczyk (VU).

Stanislav Pokraev (October 22, 2009). *Model-Driven Semantic Integration of Service-Oriented Applications.* Twente University. Promotor: Prof.dr.ir. R. J. Wieringa (UT). Co-promotor: Prof.dr. M. Reichert (University of Ulm). Assistent promotor: Dr.ir. M. W. A. Steen (Novay).

Datcu Dragos (October 27, 2009). *Multi-Model Recognition of Emotions.* Delft University of Technology. Promotores: Prof.dr. H. Koppelaar (DUT) and Prof.dr.drs. L.J.M. Rothkrantz (KMA).

Zhenke Yang (October 29, 2009). *Multi-Modal Data Fusion for Aggression Detection in Dutch Train Compartments.* Delft University of Technology. Promotor: Prof.dr. H. Koppelaar (DUT). Copromotor: Prof.dr.drs. L.J.M. Rothkrantz (KMA).

Wouter Koelewijn (November 4, 2009). *Privacy en Politiegegevens* .Leiden University. Promotores: Prof.dr. H.J. van den Herik (UL/UvT), Prof.dr. A.H.J. Schmidt (UL). Copromotor: Dr. L. Mommers (UL) .

Stephan Raaijmakers (December 1, 2009). *Multinomial Language Learning: Investigations into the Geometry of Language*. Tilburg University. Promotores: Prof.dr. W.M.P. Daelemans (Antwerpen University) and Prof.dr. A.P.J. van den Bosch (UvT).

Igor Berezhnoy (December 7, 2009). *Digital Analysis of Paintings.* Tilburg University. Promotores: Prof.dr. E.O. Postma (UvT) and Prof.dr. H.J. van den Herik (UvT).

Toine Bogers (December 8, 2009). *Recommender Systems for Social Bookmarking.* Tilburg University. Promotor: Prof.dr. A.P.J. van den Bosch (UvT).

Dory Reiling (December 11, 2009). *Technology for Justice, how information technology can support judicial reform.* VU University Amsterdam. Promotores: Prof.mr. A. Oskamp (VU) and Prof.dr. A. Harding (University of Victoria, Canada).

INAUGURAL ADDRESSES

In the next months the following inaugural addresses will take place.

Dr. P. Desain (June 12, 2009). *Hoofd- en bijzaken*. Radboud University Nijmegen.

Dr.ir. W. Kraaij (June 25, 2009). *Information Filtering and Aggregation.* Radboud University Nijmegen.

Dr.ir. G. van Oortmerssen (September 9, 2009). *Darwin and the Internet.* Tilburg University.

Dr. T.M. Heskes (October 8, 2009) *Computers met hersenen.* Radboud University Nijmegen.

Dr. R. Verbrugge (May 25, 2010). Title to be announced. Groningen University.

APPOINTMENTS

Rineke Verbrugge: appointed as full professor of "Logic and Cognition" at ALICE (Artificial Intelligence and Cognitive Engineering) in the Faculty of Mathematics and Natural Sciences, Groningen University. She will carry out her recently awarded VICI project *Cognitive systems in interaction: Logical and computational models of higher-order social cognition.*

Niels Taatgen: appointed as full professor of "Computer simulation of human intelligence" at ALICE (Artificial Intelligence and Cognitive Engineering) in the Faculty of Mathematics and Natural Sciences, Groningen University.

Section Editor
Richard Starmans

Agent Summer School for SIKS-Ph.D. Students

From Aug 31 - Sept 4, 2009 the eleventh edition of the European Agent Systems Summer School (EASSS 2008) takes place in Torino, Italy. Details on program and location can be found at http://agents009.di.unito.it/EASSS.html.

As a result of the cooperation between SIKS and the EASSS 2009 organisation, SIKS will reimburse the entrance fee for a fixed number of its Ph.D. students.

The summer school is part of the Advanced Components stage of the school's educational program and therefore Ph.D. students working in the field of (multi-)agent systems are strongly encouraged to participate. A free participation as a SIKS-Ph.D. student is only possible by sending an e-mail to office@siks.nl and inform Mrs. Corine Jolles that you want to participate. Ph.D. students will receive a notification whether they can participate as soon as possible.

For all questions regarding SIKS and its educational program, please contact office@siks.nl.

EASSS'08 will comprise the following courses:

- action selection and planning in (multi-)agent systems
- adaptation, evolution and learning in (multi-) agent systems
- agent-based simulation and modeling
- agent communication, agent dialogues and agent argumentation
- agents, ontologies, web services and semantic web
- agent-oriented software engineering and development methodologies
- agent programming languages and development tools
- agent standardizations in industry and commerce
- applications and deployment for agents and multi-agent systems
- architectures for multi-agent systems
- artificial market systems, auctions, trading agents and electronic commerce, electronic institutions
- autonomous robots and robot teams
- believability, human-like qualities of synthetic agents, humanoid and sociable robots
- game theory and coalition formation for agent-based systems
- computational complexity in agent systems
- conventions, commitments, norms, social laws and legal issues in multi-agent systems
- coordination, cooperation, and collaboration in multi-agent systems
- emergence, self-organisation and collective behavior in agent-based systems
- foundational issues and theories of agency
- information agents, routers, brokering and matchmaking
- logics for specification, verification and validation of multi-agent systems
- mobile agents
- negotiation, task and resource allocation, and conflict handling in multi-agent systems
- privacy, safety and security in multi-agent systems
- scalability, robustness and dependability of multi-agent systems
- social and cognitive models for agents
- social and organizational structures of multi-agent systems
- trust and reputation in multi-agent systems

More information can be found at the webpage.

Workshops / Tutorial Program of BPM 2009 for SIKS-Ph.D. Students

From September 8-10, 2009 the Business Process Management Conference 2009 (BPM 2009) will be held at the Ulm University, Germany. The workshop program of BPM 2009 takes place at September 7, 2009. BPM 2009 is the seventh conference in a series that provides the most distinguished specialized forum for researchers and practitioners in business process management (BPM). The conference has a record of attracting innovative research of highest quality related to all aspects of business process management including theory, frameworks, methods, techniques, architectures, and empirical findings.

As a result of the cooperation between SIKS and the BPM 2009 organisation, SIKS-Ph.D. students can participate for free in the workshops and tutorial program of the conference. There is a fixed number of places available for SIKS. The workshops / tutorials are part of the Advanced Components stage of the school's educational program. Therefore, Ph.D. students working in the field of Enterprise Information Systems are strongly encouraged to participate.

The tutorial chairs have accepted 4 tutorials which will take place from September 8-9 (Tue + Wed). These 4 tutorials cover the following topics:

- Process Model Comprehension (see http://www. uni-ulm.de/in/iui-bpm09/tutorials-panels/ process-model-comprehension.html)
- Business Process Modeling Notation (BPMN 2.0) (see http://www.uni-ulm.de/in/iui-bpm09/ tutorials-panels/bpmn20.html)
- Flexibility in Process-aware Information Systems (see http://www.uni-ulm.de/in/iui-bpm09/ tutorials-panels/processflexibility.html)
- Process Modeling (see http://www.uni-ulm.de/in/iui-bpm09/tutorials-panels/ businessprocessmodeling.html

The day before the tutorials start (i.e., Sept 7) eight international workshops on different BPM topics will take place (see http://www.uni-ulm.de/in/iui-bpm09/workshops.html for an overview). Covered topics include, for example, process design & modeling, business process intelligence, processes in healthcare, and collaborative process management. Finally, we will have 3 excellent keynotes at the conference (http://www.uni-ulm.de/in/iui-bpm09/keynote.html), a high quality scientific program, and about 10 demos of innovative BPM tools. You can find the tentative schedule for the whole week via the following link: http://www.uni-ulm.de/in/iui-bpm09/program.html.

The special package for SIKS-Ph.D. students comprises participation at:
- BPM workshops (including a printout of the proceedings of one selected workshop)
- Tutorials (including printouts for all tutorials)
- Conference keynotes
- Conference paper sessions
- Conference demo session

For each day, the package also includes free lunch, free coffee breaks, and free bus tickets (for the city of Ulm).

A free participation as a SIKS-Ph.D. student is only possible by sending an e-mail to office@siks.nl and inform Mrs. Corine Jolles that you want to participate. Ph.D. students will receive a notification whether they can participate as soon as possible.

Deadline: August 10, 2009

For all questions regarding SIKS and its educational program, please contact office@siks.nl.

SIKS Symposium "Method Engineering in Software Product Management"

Date/Time: September 9, 2009, 10:00-14:30 hours

Location: Academiegebouw Utrecht University, room Belle van Zuylen, Domplein 29. 3512 JE Utrecht, The Netherlands.

SYMPOSIUM ABSTRACT

Requirements gathering and managing, release scoping, and decisions related to software products are major challenges in today's software industry. Around these challenges a symposium is organized on Software Product Management and its relation to Method Engineering. Four speakers will present their vision on the topic.

PROGRAM

10:00-10:25 Reception and coffee/tea
10:25-10:30 Introduction
10:30-11:15 Applying A Method Engineering Technique to Security Requirements Elicitation – Prof. dr. Motoshi Saeki, Tokyo Institute of Technology
11:15-12:00 Knowledge Management of Global Work – Prof. dr. Frank Harmsen, Capgemini & Maastricht University
12:00-12:45 Lunch
12:45-13:30 Quality Performance (QUPER) Model – Supporting Roadmapping of Quality

Requirements – Prof. dr. Björn Regnell, Lund University

13:30-14:00 Advancing in Software Product Management: An Incremental Method Engineering Approach – Inge van de Weerd

14:00 Closure

16:15 The symposium is concluded by the dissertation (Ph.D.) defence of Inge van de Weerd, also in the Academiegebouw, starting 16:15 precise.

There is no admission fee, however space is limited. Request to register by sending an e-mail to Sandra Verdonk (sandra@cs.uu.nl) with subject 'Symposium ME in SPM'.

Abstract presentation of Professor Saeki
The elicitation of security requirements (SRs) is a crucial issue to develop secure information systems of high quality. Although we have several requirements elicitation methods, most of them do not provide sufficient supports to identify security threats, security objectives and security functions. Our proposed technique is to assemble through Common Criteria two types of elicitation methods; one is any existing functional requirements elicitation method and the other is a typical method for eliciting security functional requirements so that we can have a powerful method.

Abstract presentation of Professor Harmsen
The importance of knowledge as a key enterprise asset is still increasing. In our networked, "flat" world, knowledge management seems to be easier than ever. Web technology and other infrastructural facilities enable us to convey data, information and knowledge in split-seconds around the globe. Still, global companies are struggling with knowledge management. Globally distributed outsourcing arrangements often fail due to miscommunication, cultural barriers and high expectations. This presentation outlines the latest developments in knowledge management of global work, both from a process, a people and a technology view. Method Engineering principles are used to construct a framework that supports organizations in organizing their globally distributed knowledge, with the distance factor playing a key role.

Abstract presentation of Professor Regnell
QUPER (Quality Performance) helps with estimating cost and benefit of non-functional requirements. While functional requirements are scoped in release plans, quality aspects must also be considered in order to balance the market expectations and opportunities with costs of development. QUPER makes roadmapping of quality aspects more explicit. Assessment and prioritisation is supported by a simple and yet comprehensive model based on quality breakpoints and cost barriers. QUPER model experiences from deployment at Sony Ericsson are provided.

Abstract presentation of Inge van de Weerd
The software business has made a shift from developing software for one customer to developing standard software for an entire market. This shift from customized software to product software brings new challenges, especially concerning the processes for managing the product; the domain of Software Product Management (SPM). In this presentation, an approach on how to address a company's maturity of product management processes is sketched.

Advanced SIKS Course on "The Semantic Web"

INTRODUCTION

On September 24 and 25, 2009 the School for Information and Knowledge Systems (SIKS) will organize an advanced course on "The Semantic Web". The course takes two days, will be given in English and is part of the so-called Advanced Components Stage of the Educational Program for SIKS-Ph.D. students. Although these courses are primarily intended for SIKS-Ph.D. students, other participants are not excluded. However, their number of passes will be restricted and depends on the number of students taking the course. The course is given by experienced lecturers actively involved in the research areas related to the topics of the course.

Since the seminal paper on the "Semantic Web" by Tim Berners-Lee, James Handler and Ora Lassila, appeared in *Scientific American* in 2001, a lot of progress has been made. The Semantic Web community has developed a standard language for representing ontologies on the Web (OWL) as well as Semantic Web specific query languages such as SPARQL. Further, there are recent developments which aim at bringing together more closely the Semantic Web with traditional web architecture, e.g. RDFa, POWDER, the open linked data movement, etc.

In this advanced course on Semantic Web we intend to give an overview of recent developments in the field. The first day of the course will cover advances in reasoning, including the new OWL2 standard as well as OWL rules and other extensions to OWL. The second day of the course will deal with other recent developments such as SKOS and RDF-a. On this second day we will also cover the relation of the

Semantic Web with the Media Web as well as the "Human Web" which still relies heavily on content expressed by means of natural language. At the end of the second day we will discuss recent and exciting applications of Semantic Technologies in various fields.

Especially Ph.D. students working on the SIKS-foci "Web-based Systems", "Knowledge Representation and Reasoning" and "Data Management, Storage and Retrieval" are strongly encouraged to participate.

LOCATION

Conference center Hotel Mitland in Utrecht.

SCIENTIFIC DIRECTORS

- Dr. Philipp Cimiano (TUD)
- Dr. S. Schlobach (VU)
- Dr. Shenghui Wang (VU)

PROGRAM

Day 1 (Ontologies, Semantic Web Languages and Reasoning)
Morning (Ontologies and SW Languages)
10:15-10:30: Introduction
10:30-11:30: Ontologies & Ontology Engineering (Laura Hollink / Willem Robert van Hage, VU)
11:30-11:45: Coffee Break
11:45-12:45: Semantic Web Languages: from RDF to OWL and back (Stefan Schlobach, VU)
12:45-13:45 Lunch

Afternoon (Advanced Issues in Reasoning):
13:45-14:45 Reasoning with OWL (Sebastian Rudolph, AIFB Karlsruhe)
14:45-15:00 Tea break
15:00-16:00 OWL 2 (Jeff Pan , Univ. Aberdeen)
16:00-16:15 Break
16:15-17:15 OWL Rules (Sebastian Rudolph, AIFB Karlsruhe)
17:15-17:30 Tea Break
17:30-18:30 OWL Extensions (Jeff Pan, Univ. Aberdeen)

Day 2 (Advanced Topics)
Morning (The Semantic Web beyond RDF and OWL)
9:00-10:00: SKOS & RDFa (Antoine Isaac, VU)
10:00-10:15 Tea break
10:15-11:15 Ontologies and Natural Language Processing (Paul Buitelaar, DERI Galway)
11:15-12:15 Semantic Technologies in Cultural Heritage (Jacco van Ossenbruggen, CWI & VU)
12:15-13:15 Lunch

Afternoon (Applications)
13:15-14:15: Semantic Media Web (Lynda Hardman, CWI & UvA)
14:15-15:15 Web Engineering in the SW Era (Kees van der Sluijs, TU/e)
15:15-15:30 Tea break
15:30-16:30 Semantic Technologies in the Life Sciences (M. Scott Marshall, UvA)
16:30-17:30 Knowledge Models in Public Administration (Freek van Teeseling / Jan Verbeek, Be Informed) Organizers Philipp Cimiano (TU Delft) Shengui Wang (VU Amsterdam)

REGISTRATION

In the conference center there is a limited number of places and there is interest from other groups in the topic as well. Therefore, an early registration is required.

Deadline for registration for SIKS-Ph.D. students: September 1, 2009. After that date, applications to participate will be honoured in a first-come first-serve manner. Of course, applications to participate from other interested groups are welcome already. They will receive a notification whether they can participate as soon as possible.

Advanced SIKS Course on "AI for Games"

INTRODUCTION

On October 6 and 7, 2009 the School for Information and Knowledge Systems (SIKS) will organize an advanced course on "AI for Games". The course takes two days, will be given in English and is part of the so-called Advanced Components Stage of the Educational Program for SIKS-Ph.D. students. Although these courses are primarily intended for SIKS-Ph.D. students, other participants are not excluded. However, their number of passes will be restricted and depends on the number of students taking the course. The course is given by experienced lecturers actively involved in the research areas related to the topics of the course.

The course focuses on advanced AI-techniques in modern video games. It is based on the book *Artificial Intelligence for Games* written by Ian Millington (2006). However, it is not required to purchase the book.

Especially Ph.D. students working on the SIKS-foci "Computational Intelligence" and "Agent Systems" are strongly encouraged to participate.

Location: The Open University in Eindhoven

Course Director: Dr. P. Spronck (UvT)

PROGRAM

Day 1:

10:00-12:00 (15 minutes break included): *Decision making in games*.
Topics: Complexity fallacy; Heuristics and cheats; Decision trees; State machines; Fuzzy logic; Markov systems; Goal-oriented behaviour; Rule-based systems; Blackboard systems; Scripting

12:15-13:00 *NWScript*
Introduction to the programming language NWScript and practicum requirements.

13:00-14:00 Lunch

14:00-18:00 Practicum
The practicum-assignment mimics a battleground in WORLD OF WARCRAFT, programmed in NEVERWINTER NIGHTS. Students are asked to collaborate in small groups (2, 3 or 4) using the programming language NWScript, which is sufficiently powerful to implement all techniques that were taught in the morning session.

Day 2:

10:00-10:45 *Tactics and strategies.*
Topics: Waypoint tactics; Tactical movement; Tactical analyses; Influence maps; Group decisions and cooperation.

11:00-11:45 *Learning in games*.
Topics: Parameter modification; Hillclimbing; Annealing; N-grams; Decision tree learning; Reinforcement learning; Dynamic scripting

12:00-12:45 Practicum

13:00-14:00 Lunch

14:00-16:45 Practicum

17:00-18:00 Tournament
Two teams of students compete in 5 minute sessions. All teams combat each other. Points gained in the 5-minute sessions are added and the team with the highest total score wins the tournament. The winning team will be asked to give a short presentation, revealing the chosen strategy and tactics. At the end the price giving will take place.

REGISTRATION

In the conference center there is a limited number of places and there is interest from other groups in the topic as well. Therefore, an early registration is required. For registration you are kindly requested to fill in the registration form.

Deadline for registration for SIKS-Ph.D. students: September 14, 2009.

After that date, applications to participate will be honoured in a first-come first-serve manner. Of course, applications to participate from other interested groups are welcome already. They will receive a notification whether they can participate as soon as possible.

4th SIKS Conference on Enterprise Information Systems (EIS 2009)

Nijmegen, October 23, 2009

Theme: Return on Modelling Effort

For the fourth time, the Dutch Research School SIKS organizes a Dutch/Belgian Conference on Enterprise Information Systems (EIS). The purpose of EIS is to bring together Dutch/Belgian researchers interested in the advances and business applications of information systems – a broad field, including topics such as Management Information Systems, E-Business, IS Analysis and Design, Requirements Engineering, Business Innovation, Knowledge Management, Business Process Management, Product Software Development, Coordination and Communication, Collaborative Information Systems, Business/IT Alignment, Enterprise Engineering, Architectures for IKS, and many others.

EIS 2009 is organized by SIKS (School for Information and Knowledge Systems) in cooperation with BENAIS (the Benelux Chapter of the Association for Information Systems) and NAF (Netherlands Architecture Forum) and offers a unique opportunity for research groups from both the Computer Science-side and the Management-side to report research, meet and interact. We also welcome practitioners with an interest in research and innovation.

Keynote Speaker will be Prof. dr. Anne Persson of the University of Skövde, Sweden.

IMPORTANT DATES

August 3	Submission deadline for category A papers (see below)
August 24	Submission deadline for category B papers
September 7	Notification of acceptance
October 23	EIS 2009, Nijmegen, the Netherlands

TYPES OF CONTRIBUTION

Type A: REGULAR PAPERS
Papers presenting new original work. Submitted papers should not exceed a length of 10 pages. These papers will be reviewed on overall quality and relevance. All accepted papers will be fully published in the proceedings.

Type B: COMPRESSED CONTRIBUTIONS
Papers that have been accepted after September 2008 for IS-related refereed conferences or journals can be resubmitted and will be accepted as compressed contributions. Authors are invited to submit the officially published version (without page restriction) together with a one or two-page abstract (Please put both files in a single zip file and upload the zip file.). B-Papers will be accepted for either brief oral or poster presentation. An extended abstract of the paper will be published in the proceedings. Every author may submit at most one B-paper of which they are the corresponding author, and only if they do not submit any A-paper as corresponding author.

SUBMISSION DETAILS

Paper submissions must be formatted in the (Proceedings) style of the Springer Publications format for Lecture Notes in Computer Science (LNCS). For complete details, see Springer's Author Instructions. Authors keep the copyright of their submissions. The EIS Proceedings will be digital, and will carry an ISSN series number, just like journals, magazines and series of technical reports. To submit your paper, go to http://www.easychair.org/conferences/?conf=eis09 (if necessary, create an account first).

ORGANISATION

Stijn Hoppenbrouwers (Radboud University Nijmegen), Richard Starmans (SIKS)

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MORE INFORMATION

For more information, go to www.cs.ru.nl/eis09, or contact Stijn Hoppenbrouwers (stijnh@cs.ru.nl) or Irma Haerkens (i.haerkens@cs.ru.nl).

CONFERENCES, SYMPOSIA, WORKSHOPS

JULY 13, 2009
IJCAI-09 workshop on Cross-media Information Access and Mining (CIAM 2009). Pasadena, CA, USA.
http://www.cs.kuleuven.be/~liir/conferences/CIAM2009/index.php

JULY 23-25, 2009
MLDM 2009: the 6th International Conference on Machine Learning and Data Mining. Leipzig, Germany.
http://www.mldm.de

JULY 25-27, 2009
DMAMH'2009: 4th Workshop on Digital Media and its Application in Museum & Heritage. Qingdao, China.
http://cise.sdkd.net.cn/dmamh

AUGUST 6, 2009
KRAQ09: Knowledge and Reasoning for Answering Questions. ACL-IJCNLP 2009 workshop. Singapore.
http://www.irit.fr/recherches/ILPL/kraq09.html

AUGUST 9-11, 2009
The 4th International Conference on E-Learning and Games (Edutainment 2009). Banff, Canada.
http://www.ask4research.info/edutainment/2009

OCTOBER 29-30, 2009
21st Benelux Conference on Artificial Intelligence (BNAIC2009). Eindhoven, The Netherlands.
http://wwwis.win.tue.nl/bnaic2009/

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COPY

The editorial board welcomes product announcements, book reviews, product reviews, overviews of AI education, AI research in business, and interviews. Contributions stating controversial opinions or otherwise stimulating discussions are highly encouraged. Please send your submission by E-mail (MS Word or text) to newsletter@maastrichtuniversity.nl.

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