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# KI 2013: Advances in Artificial Intelligence

36th Annual German Conference on AI
Koblenz, Germany, September 16-20, 2013
Proceedings

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# Preface

This volume contains the conference proceedings of the 36th Annual German Conference on Artificial Intelligence (KI 2013) held September 16-20, 2013, at University of Koblenz, Germany. Initiated by the German Workshop on AI (GWAI) in 1975, the annual German Conference on Artificial Intelligence is the premier forum for German research in artificial intelligence, and attracts numerous international guests, too. The conference traditionally brings together academic and industrial researchers from all areas of AI. The conference is organized by the Special Interest Group on Artificial Intelligence of the German Informatics Society (Fachbereich Künstliche Intelligenz der Gesellschaft für Informatik e.V.). Next to KI 2013, five co-located conferences took place, including the 43rd annual German conference on informatics (Informatik2013) and the 11th MATES 2013 (German Conference on Multi-Agent System Technologies), which is jointly held with the 4th JAWS (Joint Agent Workshops in Synergy). Together, this makes a perfect basis for interesting discussions and information exchange within the AI community and to the other communities.

Over the years, artificial intelligence has become a major field in computer science in Germany, involving numerous successful projects and applications. Its applications and methods have influenced many domains and research areas, like business informatics, logistics, eHumanities, finance, cognitive sciences, and medicine. These applications become feasible on the basis of sophisticated theoretical and methodological efforts and successes in the German AI community. Thus, the theme of KI 2013 is "From Research to Innovation and Practical Applications".

The review process was very selective. Out of 70 contributions submitted this year, the international Program Committee accepted 24 as full papers and 8 conditionally as short (poster) papers leading to an acceptance ratio of 46%. Each submission received at least three reviews and the members of the Program Committee invested considerable effort in the discussion of the submissions. The contributions cover a range of topics from agents, robotics, cognitive sciences, machine learning, swarm intelligence, planning, knowledge modeling, reasoning, and ontologies.

Together with MATES 2013, we were pleased to host four prominent invited speakers in the agent and AI community: "The Headaches of a Negotiation Support Agent" by Catholjin M. Jonker from TU Delft, "AI – Research and the Future of Automobiles" by Raúl Rojas from the Free University Berlin, and "Autonomous Systems Inspired by Biology" by Gerhard Weiss from Maastricht University.

In the first two days of the conference, five workshops with many additional presentations took place:

- Gabriele Kern-Isberner and Christoph Beierle organized the 4th Workshop on Dynamics of Knowledge and Belief
- Dirk Reichardt organized the 7th Workshop on Emotion and Computing – Current Research and Future Impact
- Joachim Baumeister and Grzegrz J. Nalepa organized the International Workshop on Knowledge Engineering and Software Engineering
- Stefan Edelkamp, Bernd Schattenberg and Jürgen Sauer organized the 27th Workshop on "Planen, Scheduling und Konfigurieren, Entwerfen"
- Marco Ragni, Michael Raschke and Frieder Stolzenburg organized the Workshop on Visual and Spatial Cognition

Additionally, together with the Informatik 2013, a doctoral mentoring program was offered at the beginning of the conference.

We would like to thank the authors and reviewers for their excellent work. Furthermore, we would like to thank Björn Pelzer, Ralf Schepers, Fabian Lorig, Ruth Ehrenstein, and Sarah Piller for their support in the organization of KI 2013. As chairs of the special interest group on AI (GI Fachbereich Künstliche Intelligenz), Antonio Krüger and Stefan Wölfl provided invaluable support in organizing KI 2013 – thank you. Last but not least, we thank the members of the KI 2013 Organizing Committee:

- Stefan Kirn
  (Industry Chair, University of Hohenheim)
- Andreas D. Lattner
  (Doctorial Consortium Chair, Goethe University Frankfurt)
- Jürgen Sauer
  (Tutorial Chair, University of Oldenburg)
- Ute Schmid
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July 2013

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# Invited Talks

# Autonomous Systems Inspired by Biology

Gerhard Weiss

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**Abstract.** We can currently see the rapid formation of an exciting multidisciplinary field focusing on the application of biological principles and mechanisms to develop autonomous systems – software agents and robots – that act highly flexible and robust in the face of environmental contingency and uncertainty. In this talk I will give an overview of various aspects of this field. The state of the art will be illustrated with divers examples of bio-inspired approaches to system adaptivity, functional and structural optimization, collective and swarm behavior, locomotion, sensor-motor control, and (co )evolution. A focus will be on representative work on biologically inspired autonomous systems done at the Swarmlab of Maastricht University, including recent research motivated by the behavior of social insects such as bees and ants.

## About the Speaker

Gerhard Weiss is full professor of artificial intelligence and computer science and Head of the Department of Knowledge Engineering (DKE), Faculty of Humanities and Sciences, Maastricht University. Before joining Maastricht University in 2009, he was the Scientific Director of Software Competence Center Hagenberg GmbH, Austria, and Assistant Professor at the Department of Computer Science of Technical University Munich, Germany. He received his PhD (Dr. rer. nat.) in computer science from Technical University Munich and his Habilitation degree from Johannes-Kepler University Linz, Austria. His main interests are in the foundations and in practical applications of artificial intelligence, multi-agent technology, and autonomous and cooperative systems. He is editorial board member of several journals related to his research fields, and he has been in the program and steering committees of various international conferences and workshops. He was a Board member of the International Foundation for Autonomous Agents and Multi-agent Systems (IFAAMAS) and of two European networks of excellence (Agentlink and Exystence). Professor Weiss has served as a reviewer for several national, European and international research funding organizations and has been engaged as a scientific consultant and advisor for industry. See also http://www.weiss-gerhard.info.

# AI – Research and the Future of Automobiles

Raúl Rojas

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**Abstract.** In this talk I will reflect on the development of autonomous cars during the last ten years, and also on the open research problems for the next decade. As we will see, accurate sensing is not a problem for mobile robots. Laser scanners and video cameras provide more than enough data for the purposes of safe navigation. However, making sense of this data is still a hard problem in some situations in real traffic. Humans are good at recognizing and predicting intentions and behavior – computers are still bad at this task. I will show videos of our experiments in the field driving in three countries and will speculate about the possible avenues of research for making robotic cars a reality.

## About the Speaker

Raúl Rojas has been a full professor of Artificial Intelligence and Robotics since 1997 at Freie Universität Berlin. He received his PhD and venia legendi (habilitation) at this university. He studied mathematics and physics, as well as economics, in Mexico City. After the habilitation, he was appointed visiting professor in Viena and later professor of Artificial Intelligence at Martin-Luther-University Halle (1994-1997). Raúl Rojas' initial research was dedicated to the design and the construction of Prolog computers for Artificial Intelligence at GMD-FIRST. Today, he is working on a broad field of pattern recognition topics with special focus on neural networks and developing robots for various applications. With the FU-Fighters he won the world championship in RoboCup in 2004 and 2005. From 2006 on, he and his team have been developing autonomous vehicles, which were certified for city traffic in 2011. For his research on computer vision, Raúl Rojas received the Technology Transfer Award from the Technologiestiftung Berlin (Foundation for Innovation and Technology). He was appointed a member of the Mexican Academy of Sciences in 2011.

# The Headaches of a Negotiation Support Agent

Catholijn M. Jonker

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**Abstract.** Negotiation is a complex process as it poses challenges to the negotiator on both the emotional plane as well as on the computational plane. Human negotiators are known to leave money on the table, have trouble getting a clear view of their own preferences and those of their negotiation partner, and sometimes find it difficult to deal with their own emotions and those of their negotiation partner. In this talk I will briefly outline the Pocket Negotiator project and it's prototype. I will show some solutions developed during the project and will discuss some of the open challenges. In terms of research fields, I combine Artificial Intelligence, Affective Computing, and Human Computer Interaction.

To find out more about the Pocket Negotiator project, please visit http://mmi.tudelft.nl/negotiation/index.php/Pocket_Negotiator

To try out the prototype, please use Chrome or FireFox to visit http://ii.tudelft.nl:8080/PocketNegotiator/index.jsp

## About the Speaker

Catholijn Jonker (1967) is full professor of Man-Machine Interaction at the Faculty of Electrical Engineering, Mathematics and Computer Science of the Delft University of Technology. She studied computer science, and did her PhD studies at Utrecht University. After a post-doc position in Bern, Switzerland, she became assistant (later associate) professor at the Department of Artificial Intelligence of the Vrije Universiteit Amsterdam. From September 2004 until September 2006 she was a full professor of Artificial Intelligence / Cognitive Science at the Nijmegen Institute of Cognition and Information of the Radboud University Nijmegen. She chaired De Jonge Akademie (Young Academy) of the KNAW (The Royal Netherlands Society of Arts and Sciences) in 2005 and 2006, and she was a member of the same organization from 2005 to 2010. She is a board member of the National Network Female Professors (LNVH) in The Netherlands. Her publications address cognitive processes and concepts such as trust, negotiation, teamwork and the dynamics of individual agents and organizations. In Delft she works with an interdisciplinary team to create synergy between humans and technology by understanding, shaping and using fundamentals of intelligence and interaction. End 2007 her NWO-STW VICI project "Pocket Negotiator" was awarded. In this project she develops intelligent decision support systems for negotiation. See also http://ii.tudelft.nl/~catholijn.

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