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Multiagent System Technologies

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Proceedings

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Preface

In 2017, MATES, the German Conference on Multiagent System Technologies, celebrated its 15th edition—a blessed age in a fast-changing and moving field like computer science. Over these 15 years, the MATES conference series has been aiming at the promotion of and the cross-fertilization between theory and application of intelligent agents and multi-agent systems. In all these years, numerous brilliant, renowned keynote speakers, Program Committee (PC) chairs, and honorary chairs helped to promote MATES and to lift it to an internationally highly respected and accepted conference level. This year was no exception as can easily be seen from the list of keynote speakers. Thus, it was no surprise that Springer decided to publish the proceedings ab initio in its *Lecture Notes in Artificial Intelligence* (LNAI) series. And of course, 2017 was no exception.

MATES celebrated its significant birthday during August 23–26, 2017, in Leipzig, Germany, in conjunction with the 2017 IEEE/WIC/ACM International Conference on Web Intelligence (WI 2017). This was seen as a dignified location and setting for this event given the fact that the Steering Committee (SC) of MATES had decided to end this conference series with this event. It was an affair of the heart for the SC to end this series as long as it is still going strong and the SC came to the conclusion that the 15th edition is the right time and location to execute this decision. Of course, now that MATES leaves the stage with its head held high we would like to thank all those who have contributed to the enormous success of MATES, especially Matthias Klusch, as one of the most active founding members of MATES, and Springer for their excellent support of this conference during all these years. We are very grateful to all those who did the work, the PC and honorary chairs, the keynote speakers, the many PC members, the even bigger number of authors. A toast to all.

This year, the combined event of MATES and Web Intelligence offered six excellent keynote talks by renowned scientists and expert practitioners. In particular, distinguished cognitive science scholar Cristiano Castelfranchi contributed his views on the problems of mixed reality and hybrid societies consisting of natural and artificial intelligences. Turing Award winner Raj Reddy extended this vision by discussing the benefits and potentials of computational social science. These positions were complemented by Amit Sheth's talk about the background and applications of semantic, cognitive, and perceptual computing. Frank Leymann bridged the gap between agent-based and Web technologies with his discussion of architectures for loose coupling of systems. Finally, both Christine Preisach and Matthias Klusch focused in their keynotes on the highly timely and exciting topics of the Internet of Things and Industry 4.0. They addressed these emerging technologies from a machine-learning as well as an agent-based computing perspective, respectively.

In addition, both MATES and WI conferences shared a doctoral consortium (DC) program, chaired by Alexander Pokahr and René Schumann. This program offered PhD students a platform to present and to discuss their work in an academic

professional environment. Students presented their PhD projects, receiving feedback and suggestions from both their peers and experienced researchers. Moreover, each PhD student was assigned to an expert in the respective field as a mentor for individual interaction.

As conference chairs and on behalf of the MATES SC, we are very grateful to the authors and keynote speakers for contributing to the success of this conference. Moreover, we would like to express our thanks to the PC members and additional reviewers for their timely and helpful reviews of the submissions, as well as to the local organization team at the University of Leipzig. Besides, we are indebted to the Springer LNAI team for their kind and excellent support in publishing these proceedings.

Finally, we hope that all attendees enjoyed MATES 2017 and had interesting inspiration and exciting insights from attending the conference.

June 2017

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Paolo Petta
Rainer Unland

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Keynotes Abstracts

Semantic, Cognitive, and Perceptual Computing – Three Intertwined Strands of A Golden Braid of Intelligent Computing

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Abstract. While Bill Gates, Stephen Hawking, Elon Musk, Peter Thiel, and others engage in OpenAI discussions of whether or not AI, robots, and machines will replace humans, proponents of human-centric computing continue to extend work in which humans and machine partner in contextualized and personalized processing of multimodal data to derive actionable information. In this talk, we discuss how maturing towards the emerging paradigms of semantic computing (SC), cognitive computing (CC), and perceptual computing (PC) provides a continuum through which to exploit the ever-increasing and growing diversity of data that could enhance people's daily lives. SC and CC sift through raw data to personalize it according to context and individual users, creating abstractions that move the data closer to what humans can readily understand and apply in decision-making. PC, which interacts with the surrounding environment to collect data that is relevant and useful in understanding the outside world, is characterized by interpretative and exploratory activities that are supported by the use of prior/background knowledge. Using the examples of personalized digital health and a smart city, we will demonstrate how the trio of these computing paradigms form complementary capabilities that will enable the development of the next generation of intelligent systems.

AI and Machine Learning in IoT

Christine Preisach

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Abstract. Machine Learning is a hot topic in general, but even more in the area of Internet of Things because of the huge amount of data collected and the necessity to extract insights from it. Example use cases are predictive quality in manufacturing, predictive maintenance for machines, smart buildings, smart cities, smart logistics and many more. In this talk we will discuss why Machine Learning is important and focus on how Machine Learning can be successfully integrated into IoT applications and provide an outlook in the future of AI and Machine Learning in the space of IoT.

Cognition and Self-organization in a Hybrid Society and Coupled Reality: The Role of AI

Cristiano Castelfranchi

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Abstract. We are not just building a new technology but a new Socio-Cognitive-Technical System, a new form of society, an anthropological revolution. We are social engineers. Are we aware of? I will focus on some problems and dangers of the Digital and WEB Revolution and of the “mixed” (virtual and physical) reality and “hybrid” society (natural and artificial intelligences) we will live in. Not just Privacy, Security, War and Artificial soldiers/arms, Ethics inside Artificial creatures and algorithms and so on, but less discussed problems, like the need for a decentralized control, for a understanding and dealing with self-organization, for becoming aware of the interest behind the “invisible hand” and the “spontaneous” emerging “order”. The possibility to improve human intelligence of social dynamics, an effective democracy, and reducing manipulation and alienation. The role of distributed intelligences and of computer modeling and social simulation, as a collective “imagination” power for planning, participation, and policies decisions. The need for dis-agreement technologies, defense of user’s interests, supporting and managing conflicts. The role of Intelligent social “presences” in our life and home; guardian angels and tempting devils. The need for a tutelary non-manipulative role.

The Ultimate Web Intelligence: Computational Social Science

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Abstract. Computational Social Science (CSS) is the use of Web Intelligence and the tools and technology capable of monitoring, analyzing, diagnosing, and resolving day-to-day problems of society. CSS is the development of intelligent systems and solutions to address the critical problems of the society such as poverty and hunger, slavery and torture, disease and suffering, and create tools that enable an illiterate person to be as productive as a PhD. Computer Science and Artificial Intelligence must embrace CSS as the next frontier in Web intelligence and Web Intelligence and WIC need to be at the forefront of inventing that future.

Loose Coupling and Architectural Implications

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Abstract. Loose coupling is a key architectural principle for ensuring a range of non-functional properties. It is extensively and successfully used in message queuing since many decades. In this talk we will show that service computing (in both styles, i.e. SOA-based as well as REST-based) is enabling loose coupling too. Based on this, the talk will argue why microservices is nothing really new. Best practices (aka patterns) will be discussed that help building loosely coupled applications for the cloud. The use of patterns in architecting applications will reveal some opportunities for future research.

Intelligent Agents and Semantic Technologies for Industry 4.0: Showcases and Challenges

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Abstract. About a decade ago, the fourth industrial revolution, also known as Industry 4.0, has been ushered by the introduction of the Internet of Things and Services into the manufacturing environment. Industry 4.0 is focused on creating smart products and processes flexibly in dynamic, real-time optimised and self-organising value chains, and profitably even down to production lot size of one. To rise up to this challenge, Industry 4.0 applications basically operate on the principles and use of autonomous cyber-physical systems with self-* properties for integrated production across the entire value chain. In particular, the IP-networked and sensor-equipped machinery, systems, vehicles and devices of smart factories are vertically and horizontally integrated with service-based business processes both within a company and inter-company value networks. Besides, cyber-physical production systems are envisioned to not only cooperate with each other but also with humans on a new level of sociotechnical interaction. From a holistic perspective, Industry 4.0 connects smart production closely with the areas of smart transport and logistics, smart buildings, and smart energy, while keeping humans in the loop via smart multimodal assistance in modern working environments. In this context, agent-based and semantic computing both with deep roots in AI are considered as keys to implement intelligent cyber-physical systems for Industry 4.0 scenarios in the future Internet. In this talk, I will present selected showcases of leveraging intelligent agents and semantic technologies for different Industry 4.0 applications, and discuss related research and societal challenges.

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