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KI 2022: Advances in Artificial Intelligence

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Proceedings

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Preface

The proceedings volume contains the papers presented at the 45th German Conference on Artificial Intelligence (KI 2022), held as a virtual edition of this conference series during September 19–23, 2022, and hosted by the University of Trier, Germany.

KI 2022 was the 45th German Conference on Artificial Intelligence organized in cooperation with the German Section on Artificial Intelligence of the German Informatics Society (GI-FBKI, Fachbereich Künstliche Intelligenz der Gesellschaft für Informatik (GI) e.V.). The German AI Conference basically started 47 years ago with the first meeting of the national special interest group on AI within the GI on October 7, 1975. KI is one of the major European AI conferences and traditionally brings together academic and industrial researchers from all areas of AI, providing an ideal place for exchanging news and research results on theory and applications. While KI is primarily attended by researchers from Germany and neighboring countries, it warmly welcomes international participation.

The technical program of KI 2022 comprised paper as well a tutorial, a doctoral consortium, and workshops. Overall KI 2022 received about 47 submissions from authors in 18 countries, which were reviewed by three Program Committee members each. The Program Committee, comprising 58 experts from seven countries, accepted 12 full papers and five technical communications. As a highlight of this year's edition of the KI conference, the GI-FBKI and German's Platform for Artificial Intelligence PLS (Plattform Lernende Systeme) jointly organized a half-day event on privacy and data use, consisting of a keynote talk by Ahmad-Reza Sadeghi as well as a panel discussion. We were honored that very prominent researchers kindly agreed to give very interesting keynote talks (alphabetical order, see also the abstracts below):

– Bruce Edmonds, Manchester Metropolitan University, UK
– Eyke Hüllermeier, LMU Munich, Germany
– Sven Körner, thingsTHINKING GmbH, Germany
– Ahmad-Reza Sadeghi, TU Darmstadt, Germany
– Manuela Veloso, J. P. Morgan Chase AI Research, USA

As Program Committee (PC) chairs, we would like to thank our speakers for their interesting and inspirational talks, the Workshop Chair Dorothea Koert, the Doctoral Consortium Chair Mirjam Minor, the Industry Chair Stefan Wess, and our Local Chairs Stephanie Rodermund and Lukas Malburg. Our special gratitude goes to the Program Committee, whose sophisticated and conscientious judgement ensures the high quality of the KI conference. Without their substantial voluntary work, this conference would not have been possible.

In addition the following tutorial and workshops took place:

- Stephan Sahm: Tutorial on Universal Differential Equations in Julia (UDE 2022)
- Christoph Beierle, Marco Ragni, Kai Sauerwald, Frieder Stolzenburg, and Matthias Thimm: 8th Workshop on Formal and Cognitive Reasoning (FCR 2022)
- Ulrich Furbach, Alexandra Kirsch, Michael Sioutis, and Diedrich Wolter: Robust AI for High-Stakes Applications (RAIHS 2022)
- Martin Atzmueller, Tomáš Kliegr, and Ute Schmid: Explainable and Interpretable Machine Learning (XI-ML 2022)
- Mirko Lenz, Lorik Dumani, Philipp Heinrich, Nathan Dykes, Merlin Humml, Alexander Bondarenko, Shahbaz Syed, Adrian Ulges, Stephanie Evert, Lutz Schröder, Achim Rettinger, and Martin Vogt: Text Mining and Generation (TMG 2022)
- Sylvia Melzer, Stefan Thiemann, and Hagen Peukert: 2nd Workshop on Humanities-Centred AI (CHAI 2022)
- Lars Schaupeter, Felix Theusch, Achim Guldner, and Benjamin Weyers: AI and Cyber-Physical Process Systems Workshop 2022 (AI-CPPS 2022)
- Falco Nogatz and Mario Wenzel: 36th Workshop on (Constraint) Logic Programming (WLP 2022)
- Petra Gospodnetić, Claudia Redenbach, Niklas Rottmayer, and Katja Schladitz: Generating synthetic image data for AI (GSID-AI 2022)
- Jürgen Sauer and Stefan Edelkamp: 33rd Workshop Planning, Scheduling, Design and Configuration (PuK 2022)

Furthermore, we would like to thank our sponsors:

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July 2022

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Lukas Malburg
Stephanie Rodermund
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Abstracts of Invited Talks

Prospects for Using Context to Integrate Reasoning and Learning

Bruce Edmonds

Centre for Policy Modelling, Manchester Metropolitan University, UK

Whilst the AI and ML communities are no longer completely separate (as they were for 3 decades), principled ways of integrating them are still not common. I suggest that a kind of context-dependent cognition, that is suggested by human cognitive abilities could play this role. This approach is sketched, after briefly making clear what I mean by context. This move would also: make reasoning more feasible, belief revision more feasible, and provide principled strategies for dealing with the cases with over- or under-determined conclusions.

Representation and Quantification of Uncertainty in Machine Learning

Eyke Hüllermeier

Institute for Informatics, LMU Munich, Germany

Due to the steadily increasing relevance of machine learning for practical applications, many of which are coming with safety requirements, the notion of uncertainty has received increasing attention in machine learning research in the recent past. This talk will address questions regarding the representation and adequate handling of (predictive) uncertainty in (supervised) machine learning. A specific focus will be put on the distinction between two important types of uncertainty, often referred to as aleatoric and epistemic, and how to quantify these uncertainties in terms of suitable numerical measures. Roughly speaking, while aleatoric uncertainty is due to randomness inherent in the data generating process, epistemic uncertainty is caused by the learner's ignorance about the true underlying model. Going beyond purely conceptual considerations, the use of ensemble learning methods will be discussed as a concrete approach to uncertainty quantification in machine learning.

The First Rule of AI: Hard Things are Easy, Easy Things are Hard

Sven Körner

thingsTHINKING GmbH, Karlsruhe

Artificial intelligence is not only relevant for high-tech large corporations, but can be a game changer for different companies of all sizes. Nevertheless, smaller companies in particular do not use artificial intelligence in their value chain, and effective use tends to be rare, especially in the midmarket. Why is that? Often, there is a lack of appropriate know-how on how and in which processes the technology can be used at all. In my talk, I will discuss, how academia and industry can grow together, need each other, and should cooperate in making AI the pervasive technology that it already is.

Federated Learning: Promises, Opportunities and Security Challenges

Ahmad-Reza Sadeghi

Head of System Security Lab, TU Darmstadt, Germany

Federated Learning (FL) is a collaborative machine learning approach allowing the involved participants to jointly train a model without having to mutually share their private, potentially sensitive local datasets. As an enabling technology FL can benefit a variety of sensitive distributed applications in practice. However, despite its benefits, FL is shown to be susceptible to so-called backdoor attacks, in which an adversary injects manipulated model updates into the federated model aggregation process so that the resulting model provides targeted predictions for specific adversary-chosen inputs. In this talk, we present our research and experiences, also with industrial partners, in utilizing FL to enhance the security of large scale systems and applications, as well as in building FL systems that are resilient to backdoor attacks.

AI in Robotics and AI in Finance: Challenges, Contributions, and Discussion

Manuela Veloso

J. P. Morgan Chase AI Research, USA

My talk will follow up on my many years of research in AI and robotics and my few recent years of research in AI in finance. I will present challenges and solutions on the two areas, in data processing, reasoning, including planning and learning, and execution. I will conclude with a discussion of the future towards a lasting human-AI seamless interaction.

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