Making AI Smarter

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Dear Reader,

We are living in the golden age of AI. Sustained algorithmic advances coupled with the availability of massive datasets and fast parallel computing have led to breakthroughs in applications that would have been considered science fiction even a few years ago. Over the past 5 years, voice-controlled per-

sonal assistants have become commonplace, image recognition systems have reached human performance, and autonomous vehicles are rapidly becoming a reality. Given these successes, there is no doubt that AI will transform many areas of our economy and society. AI and Machine Learning (ML) are the fuel for growth.

Germany is no exception, and I am really glad to see that it plans to start to play catch-up with China and the US by running several AI initiatives. For example, the Enquete Commission on “Artificial Intelligence—Social Responsibility and Economic Potential” had its constituent meeting on 27 September 2018. The mission of the 19 members of the Bundestag and 19 experts is to examine the opportunities and potential but also the challenges of AI, and to develop answers to the many technical, legal, political and ethical questions in the context of AI. The KI Journal wishes the Commission all the best during this exciting and important mission.

However, it should be allowed to ask, whether AI = ML, as suggested by many newspapers, broadcasters, and blogs that talk about AI? Indeed, AI and ML are both about constructing intelligent computer programs respectively

machines. Using ML algorithms, we replace the complexity of writing algorithms that cover every eventuality with the complexity of finding the right general outline of the algorithms—in the form of, e.g., a deep neural network—and processing data. By virtue of the generality of neural networks—they are general function approximators—training them is in many cases quite an effort. Benchmark training sets for object recognition, for example, store hundreds or thousands of examples per class. In contrast, writing an algorithm that covers every eventuality of a task we want to solve—say, computing the shortest way to get to an airport—might be a lot of manual work but we know what the algorithm does by design and we can study and understand more easily the complexity of the problem it solves.

In other words, ML and AI are indeed very similar, but not quite the same. The easiest way to think of their relationship is to visualize them as concentric circles with AI first and ML sitting inside: ML also requires to write algorithms that cover every eventuality, namely, of the learning process. The crucial point is that they share the idea of using computation as the common language for perception, reading, learning, reasoning and acting. Yes, ML has made striking advances in enabling computers to perform relatively narrow tasks, like recognizing cats or objects. But while many of these focused systems work incredibly well and are having a huge impact, researchers have not succeeded in emulating the general, flexible intelligence that lets people solve problems without being specifically trained to do so. Better understanding human intelligence and building more human-like intelligence in machines are twin goals, and computation is the key to this endeavour.

With your high-quality contributions to the KI Journal, you contribute to the computational view on intelligent behaviour, making AI smarter. Thank you!

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1 Unterschrift

1.1 Intentional Forgetting

Guest Editors

Christoph Beierle (FernUniversität in Hagen) and Ingo J. Timm (Trier University).

Current trends, like the digital transformation and ubiquitous computing, yield in a massive increase in available data and information. On the other hand, in Artificial Intelligence systems, capacity of knowledge bases is limited due to computational complexity of many inference algorithms. Consequently, continuously sampling information and unfiltered storing in knowledge bases does not seem to be a promising or even feasible strategy.

In human evolution, learning and forgetting have evolved as advantageous strategies for coping with available information by adding new knowledge to and removing irrelevant information from the human memory. Learning has been adopted in AI systems in various algorithms and applications. Forgetting, however, especially intentional forgetting, has gained much less attention, despite the potential forgetting can provide for coping with the seemingly ever increasing information overload observed in current systems.

The aim of this special issue is to provide an overview on available theories and methods as well as ongoing research on forgetting and intentional forgetting relevant for the theory and practice of AI and AI systems from different perspectives like, e.g., knowledge representation, cognition, ontologies, reasoning, machine learning, self-organization, distributed AI, etc.

Topics.

Submissions are solicited in all areas of forgetting and intentional forgetting relevant for AI, including but not restricted to:

- Foundations of (intentional) forgetting and terminology.
- Formal considerations/Specification of (intentional) forgetting.
- Operationalization of (intentional) forgetting in AI systems.
- Complexity and efficiency considerations in reasoning.
- Cognitive aspects of (intentional) forgetting for AI systems.
- Applications with concepts of (intentional) forgetting.
- We welcome submissions from any fields of AI, e.g.,
- Knowledge representation and belief revision.
- Cognitive systems.
- Ontologies.
- Reasoning.
- Planning.
- Machine learning and data mining.
- Self-organization.

Distributed AI and intelligent agents.

If you consider submitting a paper or if you have any questions regarding this special issue, please, contact the guest editors (beierle@fernuni-hagen.de).

1.2 Smart Production

Guest Editors

Martin Ruskowski (TU Kaiserslautern), Michael Beetz (Universität Bremen) and Georg Bartels (Universität Bremen).

Smart Production is key for industrial and societal growth, providing opportunities for designing our future work life. This special issue targets to illustrate the requirements and challenges of a smart production which targets not only cyber-physical systems as enabler technology and AI-based robots in production but also solutions for supporting humans in production. For a beneficial use of AI, the necessary infrastructure must be provided. This includes currently used communication protocols and proposed architectures, as well as production systems. Also, contributions concerning the role of AI in context of robots and human workers, respectively, and industrial use-cases are invited.

Contributions to the following topics are sought:

Methodological and technological prerequisite for smart production from an AI perspective.

Lean automation as a base concept for self-organizing factory.

Edge computing and architecture.

Intelligent production control/semantic OPC-UA.

Base system for production plants for an efficient variability of a production process.

Current AI applications from research and industry.

Smart HMI.

Advanced analytics und predictive maintenance.

AI-based robotics in production.

Robot assembly/disassembly planning.

Knowledge representation and processing for robots.

Cognition-enabled manipulation.

Robot safety.

Robotic logistics processes.

Perception for grasping and manipulation.

Force and tactile sensing in robot assembly.

Compliant assembly.

If you are interested in contributing to this special issue, please contact one of the guest editors.

1.3 Cognitive Reasoning

Guest Editors

Ulrich Furbach (Universität Koblenz-Landau), Steffen Hölldobler (TU Dresden), Frieder Stolzenburg (Harz University of Applied Sciences).

Human reasoning or the psychology of deduction is well researched in cognitive psychology and in cognitive science. There are many findings which are based on experimental data about human reasoning tasks. Among others, models for the Wason selection task or the suppression task are discussed by psychologists and cognitive scientists. However, only few of these models are computational and often models are modified when applied to a different task.

Automated deduction, on the other hand, mainly focuses on the automated proof search in formal, logical calculi. Indeed, there is tremendous success during the last decades, and automated deduction systems are used in many industrial applications. However, most automated deduction systems are not really concerned with human reasoning tasks. Recently, a coupling of the areas of cognitive science and automated reasoning is addressed in several approaches. For example, there is increasing interest in modeling human reasoning tasks within automated reasoning systems based on answer set programming, deontic logic, abductive logic programming, and various other AI approaches.

This special issue of the *Künstliche Intelligenz Journal* aims to foster the synergies between cognitive science and automated deduction. The topics of interest for the special issue of the *Künstliche Intelligenz Journal* include, but are not limited to:

- Limits and differences between automated deduction and human reasoning
- Automated deduction and the psychology of deduction
- Automated deduction and (preferred) mental models
- Common sense reasoning, cognitive science and automated deduction
- Modeling human reasoning tasks using (classical, non-monotonic or defeasible) logics
- Modeling human reasoning tasks using automated reasoning systems
- Modeling human reasoning tasks using inductive reasoning systems
- Modeling human reasoning tasks using probabilistic reasoning systems
- Applications

If you are interested in contributing to this special issue, please contact one of the guest editors.

1.4 Artificial Intelligence in Games

Guest Editors

Sebastian Risi (IT University of Copenhagen) and Mike Preuss (University of Münster).

This special issue focuses on artificial intelligence (AI) methods applied in and for different types of games (e.g., board games, video games, serious games). Games have been shown to be the perfect testbed for advanced AI methods. AI in games is now a well established research area with two dedicated conferences and as well as a dedicated journal. Especially deep learning methods have recently proven to beat the best human experts in Atari video games and the game Go. Other methods such as evolutionary computation have been shown to allow complete new types of games through procedural content generation. While there has been much progress in game AI recently, some games such as StarCraft remain beyond even the most advanced AI algorithms. The goal of this special issue is to present a survey of the current research in Game AI and emerging trends in this area.

Some key topics of interest include:

- Procedural content generation
- Games as AI testbeds
- AI for NPCs (non-player characters)
- Player modelling
- Game mining
- Self-play
- Game balancing
- Human-computer interaction
- Human-based computation in games.

If you are interested in contributing to this special issue, please contact one of the guest editors.