KI - Künstliche Intelligenz (2020) 34:285–286
https://doi.org/10.1007/s13218-020-00688-1

EDITORIAL

Editorial

Bernd Ludwig[1]

Dear readers,

Recently, in one of my courses the students had the task to parse natural language recipe instructions and transform them into pseudo code that could be executed by a simulated kitchen robot. Many of the students started to develop solutions based on state-of-the-art deep learning models for NLP such as BERT—they had learned about BERT on another course and speech and text technology and felt sure to succeed quickly in mapping embeddings of recipe instructions to pseudo code statements.

However, even the sub-task of entity extraction showed to be much harder than expected. The students could not find a standard toolkit or language model for all the ingredients, kitchen tools, recipe names, and in particular for the relationship between extracted entities. Should the kitchen robot chop the onion, or should the onion chop the robot? Such relations, although very common and well-known in linguistics, are not part of BERT's knowledge. Even more tricky were all the presuppositions, anaphoric references, and concept changes of entities as a consequence of the cooking process: E.g. in the instruction "Put the pasta in boiling water and cook it", it is presupposed that the reader knows that one needs a pot, has to fill it with water (has to know how to do that), has to put the pot on the oven, has to turn the oven on etc. Later in the recipe, an instruction says to "put aside some of the pasta water"—how can one know that it's the same water that was filled in the pot earlier?

In order to overcome these challenges, the students analysed their annotations (i.e. pseudo code statements) of the recipe instructions, assigned concepts to certain code elements (i.e. ingredients), developed regular expressions for them that were used later to extract examples from the original instructions to receive a data corpus for training a deep neural network to extract entities that belong to the cooking ontology the students had created before. This ontology also comprised rules that "meat" is called "roast" after having been roasted—an issue that looks quite trivial, but is a hard challenge if one wants to implement a tracking algorithm that can monitor what happens to all the ingredients on the recipe's ingredient lists during the cooking process.

This anecdotal example is to illustrate that in many interesting applications of AI—and I assume here that AI based assistance during cooking is one of them—knowledge engineering using formal methods and tools still is a key to successful solutions, in particular if combined appropriate and cleverly with (stochastic) learning approaches. Formal logics build a well-defined, theoretical foundation for engineering taxonomies, plan operators, constraints, and other knowledge that actually does not lead to noisy data. On the other hand, however, in many applications instances of such knowledge are available in unstructured representations only—the recipe instructions are a typical example. Consequently, research on symbolic methods in AI has to address issues such as incompleteness, uncertainty, ambiguity, reliability and heterogeneity of data.

In the present volume, the authors address many of these problems in the area of ontology and data management and thereby illustrate that symbolic AI and numeric machine learning are indeed companion technologies—you may dive deeply into these details in the present and in the next volume. Enjoy learning about the latest developments!

1 Forthcoming Special Issues

1.1 Developmental Robotics

Guest Editors: Manfred Eppe, Verena V. Hafner, Yukie Nagai, Stefan Wermter

Human intelligence develops through experience, robot intelligence is engineered—is it? At least in the mainstream approaches based on classical Artificial Intelligence (AI) and Machine Learning (ML) the robotic engineering approach is pursued and data- or knowledge-based algorithms are

✉ Bernd Ludwig
Bernd.Ludwig@sprachlit.uni-regensburg.de

1 Lehrstuhl für Informationswissenschaft, Universität Regensburg, 93053 Regensburg, Germany

designed to improve a robot's problem-solving performance. Based on this engineering perspective of classical AI/ML approaches plenty of valuable application-specific impact has been achieved. Yet, the achievements are often subject to restrictions that involve domain knowledge as well as constraints concerning application domains and computational hardware.

Developmental Robotics seeks to extend this constrained perspective of engineered artificial robotic cognition, by building on inspiration from biological developmental processes to design robots that learn in an open-ended continuous fashion. Developmental Robotics considers cognitive domains that involve problem-solving, self-perception, developmental disorders and embodied cognition.

This perspective helps to improve the performance of intelligent robotic agents, and it has already led to significant contributions that inspired cutting-edge application-oriented Machine Learning technology. In addition, Developmental Robotics also provides functional computational models that help to understand and to investigate embodied cognitive processes.

For this special issue, we welcome contributions that include, but are not limited to the following topics:

Robotic self-perception and body representation; Typical development and developmental disorders; Neural foundations of development and learning; Continual learning; Transfer learning; Embodied cognition; Problem-solving; Predictive models; Intrinsic motivation; Language learning.

1.2 Education in Artificial Intelligence K-12

Guest Editors: Gerald Steinbauer, Martin Kandlhofer, Tara Chklovski, Fredrik Heintz, Sven Koenig

The upcoming special issue of the KI Magazin addresses the emerging topic of education in Artificial Intelligence (AI) at the K-12 level. In recent years, Artificial Intelligence (AI) has attracted a lot of attention from the public, and become a major topic of economic and societal discussion. AI already has a significant influence on various areas of life and across different sectors and fields. The speed and force with which AI is impacting our work and everyday life poses a tremendous challenge for our society and educational system. Teaching fundamental AI concepts and techniques has traditionally been done at the university level. However, in recent years several initiatives and projects pursuing the mission of K-12 AI education have emerged. In this context we also see education organizations and AI experts as well as governments developing and deploying AI-curricula and programs for a K-12 audience. The aim of this special issue is to provide a compact overview over this growing field. We invite contributions from researchers, practitioners, and educators interested in education in AI at K-12 level.

1.3 Special Issue: NLP and Semantics

Guest Editors: Daniel Hershcovich, Lucia Donatelli and Stephan Oepen

Making computers as intelligent as humans has been argued to be as difficult as making them understand human language, which is one of the focus points of Natural Language Processing (NLP). The field has been changing over the past decades, generally moving from rule-based methods to statistical ones. Machine learning (ML) methods, in particular deep learning, are today omnipresent, challenging methods based on linguistic theories by fully end-to-end data-driven modeling. However, combining powerful ML models with flexible pipelines and frameworks based on human and linguistic insight is an exciting development promising the best of both worlds.

NLP applications are abundant, and are already changing people's lives, enabling effortless translation, learning and interaction with human-centric systems in robotics and virtual assistants. While many classical NLP problems deal with modeling the surface form of linguistic utterances, general natural language understanding and generation depend on explicit or implicit modeling of semantics, including meaning, communicative intent, and the complex mapping to the linguistic form. Computational semantics is the study of how to automate the process of constructing and reasoning with meaning representations of natural language expressions, which can take many forms, such as continuous vectors or discrete graphs.

For this special issue, we welcome contributions including, but not limited to the following topics: lexical semantics, compositional semantics, cross-lingual semantics, semantic parsing, syntax-semantics interface, semantic role labeling, textual inference, formal semantics, coreference, discourse, reading comprehension, knowledge acquisition, common sense reasoning, summarization, multimodal semantics, semantic annotation, ethical aspects in semantic representations, underspecification, ontologies, sentiment analysis, stylistic analysis, argument mining, and human-robot interaction

Acknowledgments Open Access funding provided by Projekt DEAL.