Preface: Combining Machine Learning with Knowledge Engineering (AAAI-MAKE 2019)

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The AAAI 2019 spring symposium on combining machine learning with knowledge engineering, which was held at Stanford University, Palo Alto, California, USA, from 25 to 27 March 2019, brought together researchers and practitioners from various communities working together on joint AI that is explainable, compliant and grounded in domain knowledge.

The symposium aimed to combine machine learning with knowledge engineering. Machine learning helps to solve complex tasks based on real-world data instead of pure intuition. It is most suitable for building AI systems when knowledge is not known, or knowledge is tacit. Many business cases and real-life scenarios using machine learning methods, however, demand explanations of results and behaviour. This is particularly the case where decisions can have serious consequences. Furthermore, application areas such as banking, insurance and medicine, are highly regulated and require compliance with law and regulations. This specific application knowledge cannot be learned but needs to be represented, which is the area of knowledge engineering.

Knowledge engineering, on the other hand, is appropriate for representing expert knowledge, which people are aware of and that has to be considered for compliance reasons or explanations. Knowledge-based systems that make knowledge explicit are often based on logic and thus can explain their conclusions. These systems typically require a higher initial effort during development than systems that use machine learning approaches. However, symbolic machine learning and ontology learning approaches are promising for reducing the effort of knowledge engineering.

Because of their complementary strengths and weaknesses, there is an increasing demand for the integration of knowledge engineering and machine learning. Conclusively, recent results indicate that explicitly represented application knowledge could assist data-driven machine-learning approaches to converge faster on sparse data and to be more robust against noise.

The over 70 participants of the AAAI-MAKE symposium contributed to the intense discussion during the presentation of the 28 position and full papers, and four posters and demonstrations.

Most notably, the participants had the opportunity to attend several keynotes. On the first day, Doug Lenat emphasised a need for a more expressive logic language in his keynote presentation. He gave a recap on the Cyc knowledge-based and showed ways to connect knowledge-based systems with machine learning. Then on the second day, Frank van Harmelen showed the limitations of machine learning, in particular in areas where not much knowledge is available like the recognition of rare diseases. He introduced the concept of boxology to represent the re-usable architectural patterns for combining learning and reasoning.

In the plenary session on day two, Aurona Gerber gave a short and witty overview of the AAAI-MAKE symposium by using the analogy to Asterix.

On the final day, the co-chairs Knut Hinkelmann and Andreas Martin concluded the symposium and emphasised a concluding discussion on how this new joint community should continue contributing further on this topic.