Zhi-Hua Zhou

The name ‘machine learning’ was coined in 1959 [1], while the most widely quoted formal definition—‘A computer program is said to learn from experience $E$ with respect to some class of tasks $T$ and performance measure $P$ if its performance at tasks in $T$, as measured by $P$, improves with experience $E$’—was given in the first textbook about machine learning by T. Mitchell in 1997 [2]. Roughly speaking, machine learning aims to enable computers to improve performance by experience. As experience usually appear as data examples, the main focus of machine learning is actually about the study and construction of learning algorithms that are able to build predictive or descriptive models from data. With the increasing demand of computerized data analysis, machine learning becomes more and more important, and stirs up the current artificial intelligence (AI) boom.

To reflect the state-of-the-art research progress in the field of machine learning in China and beyond, this special section of the National Science Review presents several timely technical reviews and perspectives, along with a research highlight and an interview.

In ‘Learning representations on graphs’, Zhu highlights recent effort about learning with network data that are typically represented as graphs.

In the perspective ‘Model-driven deep learning’, Xu and Sun present their recent study about trying to design neural network topology with theoretical foundations, and make the network structure explainable and predictable.

In the perspective ‘Deep learning for natural language processing’, Li summarizes the five major tasks in natural language processing, and discusses the advantages and challenges of deep learning.

Causality plays an important role in explanation, prediction, decision making, etc., and it is desirable to learn causal knowledge from data. In the third perspective, Zhang et al. summarize their recent progress along this direction.

Zhang and Yang offer an overview of multi-task learning, which aims to improve the performance of multiple related learning tasks by leveraging useful information among them.

Due to the high cost of data-labeling process, in many tasks, it is desirable to do weakly supervised learning. Zhou provides an introduction to this direction.

The special topic ends with an interview with T. Dietterich, the former president of the Association for the Advancement of Artificial Intelligence (AAAI) (the most prestigious association in the field of AI) and the founding president of the International Machine Learning Society, about exciting recent advances and technical challenges of machine learning, as well as its big impact on the world.

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REFERENCES