Learning and Reasoning with Logic Tensor Networks: The Framework and an Application (Abstract of Invited Talk

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Logic Tensor Networks (LTN) is a theoretical framework and an experimental platform that integrates learning based on tensor neural networks with reasoning using first-order many-valued/fuzzy logic. LTN supports a wide range of reasoning and learning tasks with logical knowledge and data using rich symbolic knowledge representation in first-order logic (FOL) to be combined with efficient data-driven machine learning based on the manipulation of real-valued vectors. In practice, FOL reasoning including function symbols is approximated through the usual iterative deepening of clause depth. Given data available in the form of real-valued vectors, logical soft and hard constraints and relations which apply to certain subsets of the vectors can be specified compactly in FOL. All the different tasks can be represented in LTN as a form of approximated satisfiability, reasoning can help improve learning, and learning from new data may revise the constraints thus modifying reasoning. We apply LTNs to Semantic Image Interpretation (SII) in order to solve the following tasks: (i) the classification of an image's bounding boxes and (ii) the detection of the relevant part-of relations between objects. The results shows that the usage of background knowledge improves the performance of pure machine learning data driven methods.

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