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Topic: A Semantic Loss Function for Deep Learning with Symbolic Knowledge

https://arxiv.org/pdf/1711.11157.pdf

What is the problem discussed in the paper?

When representation learning succeeded at the highest level, the most important question for Artificial Intelligence tasks is to know to which it is susceptible. Is it to deep learning or classical model-based symbolic reasoning or to integrate both approaches?

The neuro-symbolic approaches targets to simulate or learn symbolic reasoning in an end-to-end neural network or capture symbolic knowledge in a vector space embedding. During this process of making reasoning differentiable, the accurate logical meaning of the knowledge is lost. So, the paper focused on addressing this problem in a unique approach using the semantic loss.

Why is it important?

The goal is to constrain the neural network outputs using computational logic. To solve the tasks which are handled by symbolic methods, in recent years very important efforts have gone in direction of understanding multiple ways of using representation learning. Neural computers or differentiable programming, relational embeddings or deep learning for graph data, neural theorem proving and learning with constraints. All these were in the direction of solving tasks with representation learning. So, it is important to understand a better approach which involves the core idea of these which can be applied on the Artificial Intelligence tasks.

What are the main ideas of the proposed solution for the problem?

In this approach, we have symbolic knowledge connecting the different outputs of neural networks which helps the learning in domains. The knowledge can be taken of the form constraint in the Boolean logic. The end goal is to augment the neural networks with the ability to learn how to make predictions subject to these constraints and make the best out of symbolic knowledge to improve the learning performance.

A unique approach is followed in the paper to handle the problem of differentiable but sound logical reasoning from first principles. The semantic loss is derived by using a set of intuitive axioms. This loss function gives us how well the outputs of a neural network match a given constraint. The semantic loss is independent of syntax, and it gives accurate meaning of the constraint. From the experiment results, they understand the benefits of semantic loss for learning tasks with highly structured output such as preference learning and path prediction in a graph.

Reference citation:
https://www.bing.com/videos/search?q=A+Semantic+Loss+Function+for+Deep+Learning+with+Symbolic+Knowledge&docid=607987594964056327&mid=374F1F7AA35F5B262147374F1F7AA35F5B262147&view=detail&FORM=VIRE