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CS549 – ST/Scalable Querying & ML – Spring 2022

Topic:

DeepProbLog: Neural Probabilistic Logic Programming

https://arxiv.org/pdf/1805.10872.pdf

What is the problem discussed in the paper?

In artificial intelligence, one of the challenges in the field is the integration of low-level perception with high-level reasoning. Currently, the low-level perception is taken care by deep learning and neural networks and high-level reasoning is handled using logical and probabilistic representations and inferences. Although much research is going on, still joining the high-level probabilistic reasoning with deep neural network is still an unsolved problem. To handle this issue, an approach is proposed in the paper in a different perspective. An existing probabilistic logic programming language is taken, and it is extended with the capability to process neural predicates.

Why is it important?

With the current state of the art,

- ✓ The logic is made less expressive
- ✓ Unclear semantics
- ✓ The logic is pushed into the neural network and disappears after training

So, with DeepProbLog, it helped and improved the drawbacks.

- ✓ Fully expressive logic
- ✓ Probabilistic logic with a well-defined semantics
- ✓ Distinction between the logic and the neural network

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

Problog is a probabilistic logic programming language and when it is mixed with neural predicates it is defined as "DeepProbLog".

DeepProbLog = Problog + Neural Predicates

Described the steps followed in answering a query in a ProbLog program as below.

1. Grounding the program with respective to the query
2. Rewrite the ground logic program into a propositional logic formula
3. Compile the formula into an arithmetic circuit
4. Evaluate the arithmetic circuit

The same procedure is followed with DeepProbLog with only exception on the forward pass where we encounter a neural predicate during ground, we will perform the forward pass on the neural network components.

Implementing the DeepProbLog involves evaluating the neural network and performing back propagation in the neural networks. Using the learning from entailment setting, the parameters of probabilistic facts and neural networks in DeepProbLog programs are trained jointly.

Gradient descent for DeepProbLog, the probabilities of the neural predicates are represented as a function of the neural network parameters.

The experimental results show comparatively positive results even when they considered noisy data in the dataset.

Reference citation: [Robin Manhaeve - DeepProbLog: Neural Probabilistic Logic Programming - YouTube](#)