Learning with Temporal Knowledge Graphs

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Abstract
Temporal knowledge graphs, also known as episodic or time-dependent knowledge graphs, are large-scale event databases that describe temporally evolving multi-relational data. An episodic knowledge graph can be regarded as a sequence of semantic knowledge graphs incorporated with timestamps. In this talk, we review recently developed learning-based algorithms for temporal knowledge graphs completion and forecasting.

Keywords
Temporal Knowledge Graphs, Representation Learning

1. Learning with Knowledge Graphs

If political relations between two countries becomes more tense, will it affect the international trades between them? If yes, which industries will bear the brunt? Modeling the relevant events that can be temporarily affected by international relations is the key to answer this question. However, the issue of how to model these complicated temporal events is an intriguing question. A possible way is to embed events in a temporal knowledge graph, which is a graph-structured multi-relational database that stores an event in the form of a quadruple.

For instance, Global Database of Events, Language, and Tone (GDELT) [1] and Integrated Crisis Early Warning System (ICEWS) [2] are two available event-based temporal knowledge graphs that have been drawing attention in the community. In the pioneering work [3, 4], we investigate representation learning models of episodic knowledge graphs. To generalize the semantic models for knowledge graphs to temporal knowledge graphs, we introduce unique latent representations for each timestamp. The deep connections between temporal knowledge graphs and cognitive functions, e.g., semantic and episodic memory, will be elaborated in this talk [5].

Besides, we will introduce a non-parametric Graph Hawkes process for dynamic events forecasting in temporal knowledge graphs [6], and recent developments of explainable reasoning and forecasting on temporal knowledge graphs.

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