JSEEGraph: Joint Structured Event Extraction as Graph Parsing

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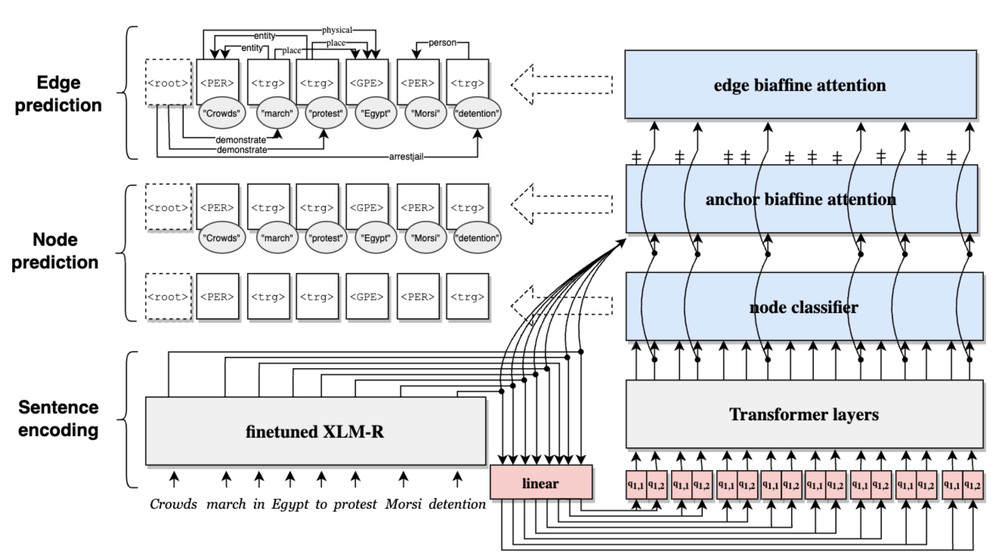

Figure 1: An illustration of our JSEEGraph parsing the sentence "Crowds march in Egypt to protest Morsi detention" from Rich ERE.

Abstract

We propose a graph-based event extraction framework JSEEGraph that approaches the task of event extraction as general graph parsing in the tradition of Meaning Representation Parsing. It explicitly encodes entities and events in a single semantic graph, and further has the flexibility to encode a wider range of additional IE relations and jointly infer individual tasks.

Multiple IE tasks

Event Extraction is the task of extracting events into structured forms, namely event triggers and their arguments. An event trigger is the word(s) that most clearly describes an event, such as “buy”, which evokes a transferownership and an transfermoney event in Figure 1. Event arguments are the participants and attributes of an event, and can be tagged as entities at the same time, as demonstrated in Figure 2.

Entity Extraction is to identify entity mentions from text and classify them into types according to a pre-defined ontology. For example, in Figure 2, “district” is an organization (ORG) entity.

Relation Extraction aims to assign a relation type to an ordered pair of entity mentions, based on a pre-defined relation ontology. For example, in Figure 2, the relation between PER “officials” and ORG “district” is orgaffiliation.

JSEEGraph

Our JSEEGraph framework is a text-to-graph parser.

Sentence encoding: We use XLM-R to obtain the contextualized embeddings of the input sequence. Each contextual embedding is mapped into queries via a linear layer, and further transformed into hidden features.

Node prediction: The node prediction module consists of a node label classifier and an anchor biaffine attention classifier. The node label classifier is a linear classifier classifying each query into a node in the graph. Node anchoring is performed by biaffine attention between the contextual embeddings and hidden feature of queries to map each node to surface tokens.

Edge prediction: Edge prediction between nodes is performed with two deep biaffine classifiers. one to predict edge presence between a pair of nodes and the other to predict the corresponding edge label.

Experiments

We experiment on two benchmark datasets of varying structural complexities; ACE05 and Rich ERE, covering three languages: English, Chinese, and Spanish.

We find that our proposed JSEEGraph is robust in solving nested event structures, and is especially strong in event argument extraction. We further demonstrate that it is beneficial to jointly perform EE with other IE tasks, and event argument extraction especially gains from entity extraction.

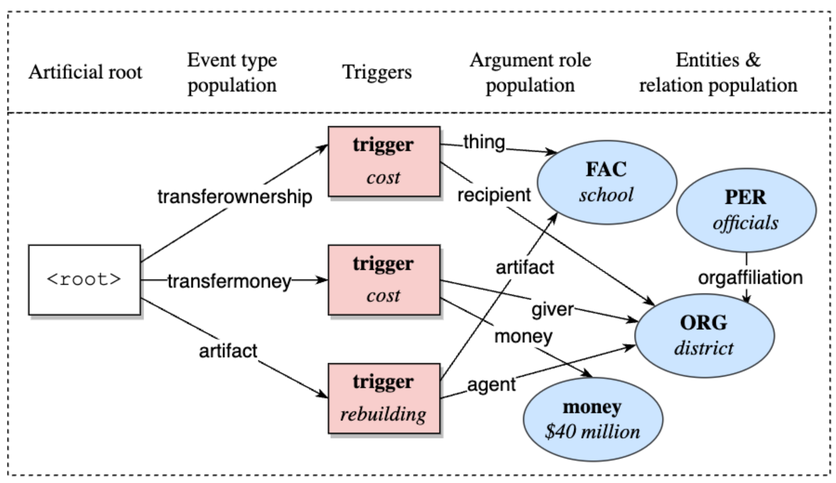

Figure 2: Example of graph representation for entities, relations, and events from the sentence "School district officials have estimated the cost of rebuilding an intermediate school at $40 million."

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