

# A Method for Classifying Temporal Relations Using Attention-based Neural Networks

## Attentionに基づくニューラルネットワークを利用した 時間関係の分類手法の提案

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Temporal relations classification is an important task in natural language processing field, and is still challenging due to two difficulties. The first is that temporal relations between time and events are complicated which makes existing deep learning based models fail to capture contextual information related to temporal relation. Secondly, most deep learning methods do not work well due to the lack of the task related information.

This study explored a new attention unit to calculate the attention score aiming at helping the model to decide which parts of the sentence should be paid more attention as well as give task-related information tips to the model by using the context of time-event entities.

It has been suggested that just two entities in a sentence can be viewed as forming a pseudo question when casting relation extraction as a question-answering problem, even if the question is not necessarily grammatical. Constructing such kind of pseudo questions from the context of the entities can not only provide mapping evidence for attention calculation but also give task related tips to the model. In this study, instead of using all the terms in the input sentence, we can calculate the attention score in a more natural way with the context of the entities by mapping a pseudo question and a set of key-value pairs to an output. In addition, the model can obtain task related information with the query vector created from the pseudo question.

Our experimental results on a publicly available Timebank-Dense corpus demonstrate that our approach outperforms existing state-of-the-arts. In addition, with the task-related information tips, our model can be trained on the expanded dataset which provides significantly improved performance.

The contribution of this research can be summarized as follows:

- (1) We explore a novel approach to calculate the attention score by using the context of time-event entities.
- (2) We conduct the experiments to investigate the effectiveness of our proposed attention mechanism by replacing the LSTM part with a simple multilayer perceptron and impose attention weights.
- (3) To alleviate the lack of training data problem, we expand some of the Timebank-Dense dataset by including the reversed relationships.

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