

CONTRASTIVE LEARNING FOR SENTENCE-LEVEL RELATION SEMANTICS

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Abstract

Understanding semantic relations expressed at the sentence level is a fundamental challenge in natural language processing (NLP), with applications in information extraction, knowledge graph construction, question answering, and semantic search. Traditional relation extraction methods primarily rely on supervised classification models that require extensive labeled datasets and often struggle to generalize across diverse sentence structures. To address these limitations, this study proposes a novel framework for sentence-level relation semantics learning via contrastive sentences, which leverages contrastive learning to enhance relational representation quality and semantic separability. The proposed approach focuses on learning robust sentence embeddings that capture underlying relational semantics rather than surface-level lexical patterns. Synthetic and template-driven datasets are generated to represent multiple semantic relations such as causality, contrast, temporal sequence, and entailment. A lightweight sentence encoder composed of embedding layers, mean pooling, and a projection head is trained using a supervised contrastive learning objective. In this framework, sentences expressing the same semantic relation are treated as positive pairs, while sentences representing different relations are treated as negative pairs. This contrastive mechanism encourages the embedding space to cluster semantically similar relations while maximizing inter-relation separation.