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**Weakly-supervised Deep Embedding for Product Review Sentiment Analysis**

**Abstract**

Product reviews are valuable for upcoming buyers in helping them make decisions. To this end, different opinion mining techniques have been proposed, where judging a review sentence's orientation (e.g., positive or negative) is one of their key challenges. Recently, deep learning has emerged as an effective means for solving sentiment classification problems. A neural network intrinsically learns a useful representation automatically without human efforts. However, the success of deep learning highly relies on the availability of large-scale training data. We propose a novel deep learning framework for product review sentiment classification which employs prevalently available ratings as weak supervision signals. The framework consists of two steps: (1) learning a high level representation (an embedding space) which captures the general sentiment distribution of sentences through rating information; and (2) adding a classification layer on top of the embedding layer and use labeled sentences for supervised fine-tuning. We explore two kinds of low level network structure for modeling review sentences, namely, convolutional feature extractors and long short-term memory. To evaluate the proposed framework, we construct a dataset containing 1.1M weakly labeled review sentences and 11,754 labeled review sentences from Amazon. Experimental results show the efficacy of the proposed framework and its superiority over baselines.