Probing Syntax Information in Word Representations with Deep Metric Learning

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Abstract : In recent years, with the development of large-scale pre-trained lan-guage models, building vector representations of text through deep neural network models has become a standard practice for natural language processing tasks. From the performance on downstream tasks, we can know that the text representation constructed by these models contains linguistic information, but its encoding mode and extent are unclear. In this work, a structural probe is proposed to detect whether the vector representation produced by a deep neural network is embedded with a syntax tree. The probe is trained with the deep metric learning method, so that the distance between word vectors in the metric space it defines encodes the distance of words on the syntax tree, and the norm of word vectors encodes the depth of words on the syntax tree. The experiment results on ELMo and BERT show that the syntax tree is encoded in their parameters and the word representations they produce.

Keywords : deep metric learning, syntax tree probing, natural language processing, word representations

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