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Representation learning for natural language

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Abstract

Artificial neural networks have obtained astonishing results in a diverse number of tasks. One of the reasons for the success is their ability to learn the whole task at once (end-to-end learning), including the representations for data.

In this thesis, we propose a novel summarization approach that represents sentences using neural word embeddings, and a strategy for aggregating multiple sentence similarity scores to compute summaries that take multiple aspects into account. The approach obtains state-of-the-art results on standard benchmark datasets.

The rest of the thesis studies models trained end-to-end for some specific tasks, and investigates how to train the models to perform well, and to learn internal representations of data that explain the factors of variation in the data.

We devise a novel character-based recurrent neural network (RNN) model that recognize medical terms in health record data. The model is trained on openly available data, and evaluated using standard metrics on sensitive medical health record data in Swedish. We conclude that the model learns to solve the task and is able to generalize from the training data domain to the test domain.

We then present a novel recurrent neural model that transforms a query word into the morphological form demonstrated by another word. The model is trained and evaluated using word analogies and takes as input the raw character-sequence of the words with no explicit features needed. We conclude that character-based RNNs can successfully learn good representations internally and that the proposed model performs well on the analogy task, beating the baseline with a large margin. As the model learns to transform words, it learns internal representations that disentangles morphological relations using only cues from the training objective, which is to perform well on the word transformation task.

Such cues may not always be available at training time, and we therefore present a regularizer that improves disentanglement in the learned representations by penalizing the correlation between activations in a layer.

Keywords: Representation learning, Artificial neural networks, Deep learning, Machine learning, Multi-Document summarization, Natural language processing, Neural word embeddings