Modeling the Semantic Change Dynamic using Diachronic Word Embedding

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The semantic change dynamic includes all changes in the meanings of lexical items happening over time. It has been established that there are some systemic regularities that direct the semantic shifts of words' meanings. Not all words exhibit the same degree or speed of semantic change. Some words (categories of words) are more resistant than others to the semantic change phenomenon [1]. Various hypotheses have been proposed in the literature to explain such regularities in semantic change from a linguistic point of view [2].

The computational study of semantic change and regularity has become an active research topic recently, especially with the emergence of new and more effective vector word representations such as word2vec. Such word embedding techniques can be extended to work on a diachronic perspective too. Taking into account the temporal dimension and the diachronic nature of words as a research direction has been effectively demonstrated in several studies as well [3].

Following this line of thought, in this work we address the question of semantic change from a computational point of view. Our aim is to capture the systemic change in words' meanings in an empirical model that can be able predict such change as well. We propose a model that makes use of two techniques: 1. Diachronic word embedding to represent the meanings of words over time as the data component of the model 2. Recurrent neural network to handle the temporal dimension of these data

The idea is to train a LSTMs-based recurrent neural network on word embeddings coming from a certain time-period (measured in decades) and try to predict the word embeddings of the following decade. In order to illustrate the significance of such empirical model, we conduct an experimental evaluation using a large-scale diachronic corpus, namely the Google N-Gram corpus.

The results show that the model can be highly effective in capturing semantic change and can achieve high accuracies on predicting words distributional semantics. For example, the model was able to achieve a 71.4% Top-1 accuracy up to 92.5% Top-10 accuracy when trained and tested exclusively on embeddings coming from the 10000 most frequent words of the corpus. The model was also able to correctly predict word embeddings even for words that have known an important and attested semantic change in the last two centuries such as *awful*, *nice*, *call* and *record*. Moreover, a large portion of the false predictions corresponds to borderline cases of words that have not necessarily shifted significantly in meaning, but for which the model has a tendency to predict vectors that are closer to frequent words occurring in the same semantic context, such as predicting a vector closer to *sent* for the word *dispatched*, or *inhabited* for the word *peopled*.

References

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