

Improving Twitter based Disaster Response using Deep Learning

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Abstract

In Bag-of-Words (BoW) model, the increment in the vocabulary size leads to sparsity in the tweet representation, which is computationally expensive, in terms of both time and space complexity. Also, the BoW model does not preserve the context in which each word is being written in a tweet. To address this, four Deep learning models are trained using word embeddings to classify disaster-related tweets. Each Deep learning model comprises of three components viz. embedding layer, deep network and output layer. The choices considered for the embedding layer are word embedding training, using the embedding layer, or a pre-trained embedding model. The two variants of RNN viz. LSTM and GRU, are considered as choices for the deep network. The experimental results show that the GRU network learns faster than the LSTM network, when the word embeddings are trained using the embedding layer. In the case of pre-trained word embeddings, the learning significantly improves within a few epochs of training, since the embedding layer does not require to learn the word embeddings thereby requiring lesser number of parameters to be trained. Therefore, it can be inferred that the pre-trained word embeddings produce significant improvements in text classification tasks. Further, the Deep learning models using their own word embeddings were overfitting the training data compared to models using pre-trained word embeddings. Among the Deep learning models, the GRU deep network with pre-trained embeddings performed the best amongst all the other Deep learning models. Furthermore, the Deep learning models are shown to perform better than the traditional machine learning models. The proposed Twitter based disaster response system would enable timely dissemination of information to various stakeholders, so that prompt response and proactive measures can be taken in order to reduce the severe consequences of disasters.

Keywords

Disaster Response, Social Media, Twitter, Artificial Intelligence,
Deep Learning, Classification