

## 딥러닝 융합에 의한 텍스트 분류

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## Text Classification by Deep Learning Fusion

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### ● 요약 ●

This paper proposes a fusion model based on Long-Short Term Memory networks (LSTM) and CNN deep learning methods, and applied to multi-category news datasets, and achieved good results. Experiments show that the fusion model based on deep learning has greatly improved the precision and accuracy of text sentiment classification

**키워드:** Long-Short Term Memory networks (LSTM), CNN deep learning methods

### I. Introduction

In recent years, natural language processing has been in a rapid development stage. Data resources such as various vocabularies, semantic grammar dictionaries, and corpora are becoming more and more abundant. The technology of word segmentation, part-of-speech tagging, and syntactic analysis has developed rapidly. The emergence of various new theories, new methods, and new models has promoted the rapid development of natural language processing research [1].

### II. Proposed Method

In the study of natural language processing, most of the problems are related to the analysis of grammar, sentences, and semantics. Therefore, the analysis of sentences is inseparable from the analysis of the connection of contextual content. CNN has the characteristics of feature extraction. LSTM has the characteristics of memory context in time series. Therefore, combining the advantages of LSTM and CNN for text sentiment classification in natural language processing will produce better results.

The model we proposed consists of an initial LSTM layer that receives the word embedding for each token in the experimental data after data preprocessing. The token it outputs not only stores the information of the initial token, but also stores any previous tokens. In other words, the LSTM layer is generating a new encoding for the original input. The output of the LSTM layer then inputs to the desired local feature convolution layer, and the output of the final convolution layer will be aggregated into a smaller dimension, ultimately outputting the classification label of the text sentiment. In the past experiments, the LSTM-CNN model was mostly used for the binary category problem of the text. In this experiment, we mainly solved the multi-classification problem of the text. The structure of the LSTM-CNN model is shown in Fig. 1.

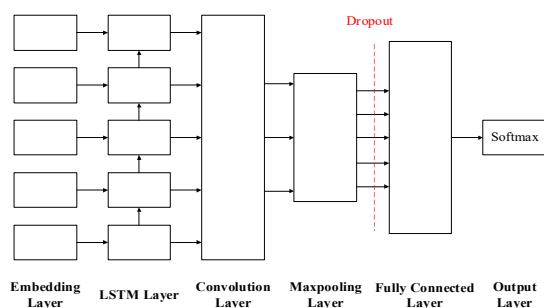


Fig. 1. LSTM-CNN model structure.

### III. Experiments

In order to verify the classification effect of the LSTM-CNN model, we randomly selected 10 categories of news from Sina News RSS subscription channel and applied to the model to predict and verify. The results of the verification show that among the 10 categories, there is only one class miss in the CNN and the LSTM model, and two miss in the RNN models, while the classifications predicted by the LSTM-CNN model are all correct.

Figs. 4 and 5 are graphs of the accuracy and loss rate statistics in the tensor board during training



Fig. 2. Training accuracy curve of the LSTM-CNN model.

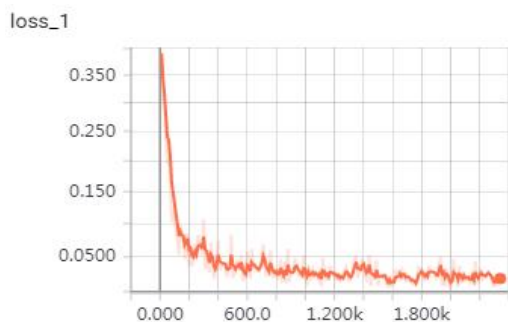


Fig. 3. Training loss rate graph of the LSTM-CNN model.

### IV. Conclusions

This paper proposed a text sentiment classification method based on deep learning method model fusion. The method is compared with CNN, RNN, LSTM and two traditional text classification methods.

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