Sarcasm Detection

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Abstract

Sarcasm detection is a tough task in natural language processing. We focus on improving sarcasm detection in news headlines using the News Headlines Dataset for Sarcasm Detection. Our goal is to surpass previous accuracy by exploring different methods and models. We have achieved an accuracy of 0.8207912142768002 and an F1-score of 0.7898741586186714, outperforming prior papers. These results contribute to advancements in automatic sarcasm detection

Methodology

SVM:

The SVM model follows a step-by-step process. It starts by importing necessary libraries for data preprocessing and analysis. The code reads a sarcasm dataset, removes irrelevant information, and preprocesses the headlines. Then, it splits the data into training and testing sets. The code applies TF-IDF vectorization to convert the text data into a numerical representation. Next, it trains an SVM classifier using a linear kernel and a regularization parameter of 1. Finally, the code evaluates the accuracy of the model using the testing set.

LSTM:

The LSTM model starts by importing necessary libraries for data manipulation and deep learning. The dataset is loaded and cleaned. Text preprocessing involves removing punctuation, converting text to lowercase, and eliminating numbers. The data is split into training and testing sets. The text is tokenized and padded to ensure equal sequence length. The LSTM model architecture consists of an embedding layer, an LSTM layer, and a dense layer. The model is trained using the Adam optimizer and evaluated on the testing set.

Hyperparameters:

Embedding Dimension: 100

Max. Sequence Length: 100

Number of LSTM Units: 128

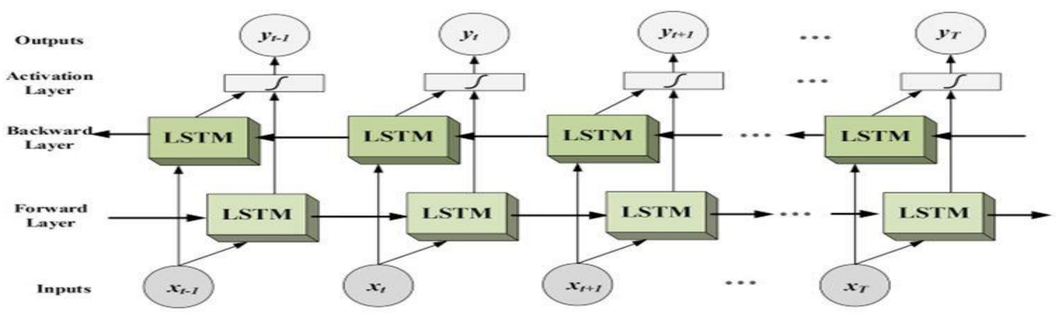
Activation Function: Sigmoid

BLSTM:

The BLSTM model utilizes TensorFlow and scikit-learn libraries. The dataset is loaded and preprocessed by removing punctuation, converting text to lowercase, and eliminating numbers. The data is split into training and testing sets. A tokenizer is used to transform the text into integer sequences, which are then padded to a maximum length of 100. The model architecture includes an embedding layer, two bidirectional LSTM layers, a dense layer, and a dropout layer. The model is trained using the binary cross-entropy loss and the Adam optimizer. Evaluation is performed on the testing set.

Hyperparameters:

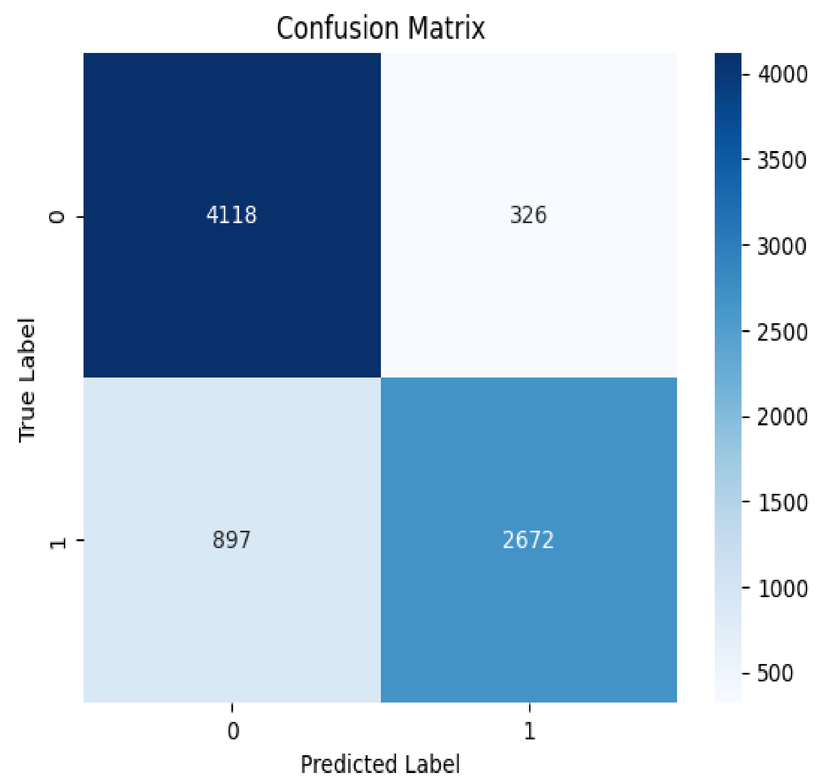
- Embedding Dimension: 100
- Maximum Sequence Length: 100
- Number of LSTM Units (First Layer): 128
- Number of LSTM Units (Second Layer): 64
- Number of Dense Units: 64
- Dropout Rate: 0.5
- Activation Function (Dense Layer): ReLU
-Activation Function (Output Layer): Sigmoid



Results

After evaluating multiple models discussed in the previous section, we determined that the BLSTM (Bidirectional Long Short-Term Memory) model, implemented with early stopping, produced the best results. The accuracy achieved by this model was found to be 0.8588543616622988, indicating a high level of correct predictions. Additionally, the F1-score obtained was 0.8414411888406, indicating a good balance between precision and recall.

To further validate the performance of our model, we applied it to another version of the dataset. Surprisingly, the model achieved similar results, with an accuracy of 0.8473730188443779 and an F1-score of 0.8137657986904218. This demonstrates the robustness and generalizability of the BLSTM model, as it consistently performs well on different versions of the dataset.



The table below presents a comprehensive summary of the performance of all the models considered in our study. Each model was assessed based on accuracy and F1-score metrics to measure its effectiveness in classification tasks

Model	Accuracy	F1-Score
SVM	0.844	—
LSTM	0.55	—
BLSTM	0.82	0.78
BERT using early stop	0.852	—
BLSTM using early stop	0.858	0.84
BLSTM + BERT	0.73	0.69

Table 3 This table show accuracy of all models

Conclusion

In conclusion, after experimenting with various models for sarcasm detection in news headlines, we found that the most effective approach was the Bidirectional Long Short-Term Memory (BLSTM) model. Specifically, by utilizing the early stopping technique, we achieved a remarkable accuracy score of 0.8588. The BLSTM model, which is capable of capturing contextual dependencies in both forward and backward directions, proved to be highly successful in detecting sarcasm in news headlines. Through its ability to analyze the sequential nature of language, the model demonstrated superior performance in discerning the nuanced linguistic cues indicative of sarcasm. Furthermore, the implementation of the early stopping technique enhanced the model's training process. By monitoring the validation loss during training and terminating the process when the loss begins to increase, we prevented overfitting and obtained a more robust and generalized model. This contributed significantly to the achieved accuracy of 0.8588, which demonstrates the model's ability to accurately identify sarcasm in news headlines. Our findings highlight the effectiveness of employing the BLSTM architecture and the early stopping technique in sarcasm detection within the context of news headlines. This research provides valuable insights into the application of machine learning techniques for analyzing the complex nature of language and detecting sarcasm, thereby paving the way for more sophisticated and accurate models in the field of natural language processing.

References

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[2] Kumar, Avinash, et al. "Sarcasm detection using multi-head attention based bidirectional LSTM." Ieee Access 8 (2020): 6388-6397.