
**CSE440 Project Report**

**Team 11**

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**Project Title: Text Classification of IMDB Movie reviews using RNN**

## Abstract

This report presents the development and evaluation of a shallow recurrent neural network (RNN) model specifically designed for the classification of movie reviews from the Internet Movie Database (IMDB). The primary objective of this project is to accurately categorize these reviews into binary sentiment classes: positive or negative. The model employs a single hidden layer architecture, leveraging the temporal dynamic capabilities of RNNs to process the sequential data inherent in textual content. The dataset comprises a substantial collection of IMDB reviews, providing a rich, varied corpus for training and testing the model. This study not only demonstrates the efficacy of shallow RNNs in natural language processing tasks but also provides insights into the trade-offs between model complexity and performance in sentiment analysis. Through rigorous experimentation, including hyperparameter tuning and cross-validation, the research underscores the potential of shallow neural networks in handling large-scale text classification, offering a valuable tool for sentiment analysis in the entertainment industry. The outcomes of this project are expected to contribute to the broader understanding of applying machine learning techniques to real-world natural language processing challenges.

## Introduction

This report delves into the development and evaluation of a shallow recurrent neural network (RNN) for sentiment analysis of IMDB movie reviews. The aim is to classify these reviews into positive or negative sentiments using a neural network with a single hidden layer. The choice of a shallow RNN is motivated by the need to assess the effectiveness of simpler, computationally efficient models in processing sequential text data. The IMDB review dataset, known for its voluminous and diverse user-generated content, serves as the basis for training and testing our model. This study primarily focuses on the model's architecture, training process, performance metrics, and the practical implications of using shallow neural networks in natural language processing, specifically for sentiment analysis. Through this investigation, we aim to provide insights into the balance between model simplicity and analytical performance in text classification tasks.

## Methodology

The methods used to carry out this task included transforming words to word vectors and their corresponding output to binary values. The data presented to us was converted to a dataframe using Pandas Library and later using Label Encoding we were able to convert output(sentiment) to binary values. Later we developed a function to convert the reviews to word vector representation. We used the GloVe model in order to transform the words to their respective vectors. After creating the embedding matrix for the RNN we finally split the data into 80% training samples and 20% testing samples. The model was constructed using a sequential model from Keras library. Sequential provides clean and precise ways to develop a simple RNN system, moreover given the task at hand which is to categorize review as either positive or negative; this model will provide an effective way. We also chose to run the model with 20 epochs with a batch size of 256. Additionally Adam optimiser and binary cross entropy was used in the model to produce effective  results.

## Results

After training and testing the model we found an accuracy of 82.7% on test data for the shallow model. However, we figured that by using an LSTM layer we can increase the accuracy by a huge factor; which we did. We created two models one with Unidirectional LSTM and another with a BIdirectional LSTM. Later we achieved an accuracy of 93.77% and 88.9% on the Unidirectional LSTM and Bidirectional LSTM. We have hoped for better results in the Bidirectional LSTM, but however the Bidirectional LSTM model didn't live up to our expextations. But, we can conclude that by adding an LSTM layer we are able to improve the models performance by a significant amount.

## Conclusion

I believe the results could have been further improved by increasing the epochs size. While experimenting with the model as it trained the model seemed to improve as we progressed through the training phase. Suggesting an increase of accuracy even further. We can further fine tune the model if we include a validation set of values thus, allowing the model to give the optimum result suited for our task completion. In conclusion, the project showcased the efficacy of incorporating LSTM layers in RNN architectures for sentiment analysis on IMDb movie reviews. It emphasized the trade-offs between model complexity and performance, highlighting the substantial

performance gains achieved by moving from shallow to deeper architectures. The study's findings contribute valuable insights into the application of neural network structures for natural language processing tasks, particularly in sentiment analysis within the entertainment domain.