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ITAI 2376: Deep Learning
March 29, 2024

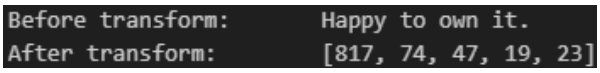
Application of Recurrent Neural Networks to Text Data: Reflective Journal

Introduction

In this Lab, I share my hands-on experience with performing text transformations, utilizing pre-trained GloVe (Global Vectors) word embeddings, and setting up a Recurrent Neural Network for training, “a type of artificial neural network which uses sequential data or time series data" (IBM). I will also test the RNN model, focusing on evaluating its performance with real-world text data. The goal is to underscore the essential practical skills and theoretical knowledge required for applying deep learning methodologies to natural language processing (NLP) tasks.

Experience Description

With the libraries installed, I imported the data, which consisted of a small sample of Amazon product reviews, to understand the associations between the words through recurrent networks. Eventually, it learned to classify the text with a certain accuracy level. It was done by exploring the number of positive and negative reviews, filling in the missing values, splitting the dataset into training and validation, creating a tokenized vocabulary, and mapping the text data so computers could understand it. Finally, I passed the transformed and the padded data (data with standard length) to the dataset to create data loaders.



Following the Lab, I used *GloVe 6B* with 300 dimensions to get the word vectors before setting the training parameters. The RNN model consisted of an embedding layer, a stacked RNN layer, and a linear layer, performing poorly before starting the training process. After training the RNN with different sets of parameters, I achieved different and interesting results, although always increasing the model’s accuracy.

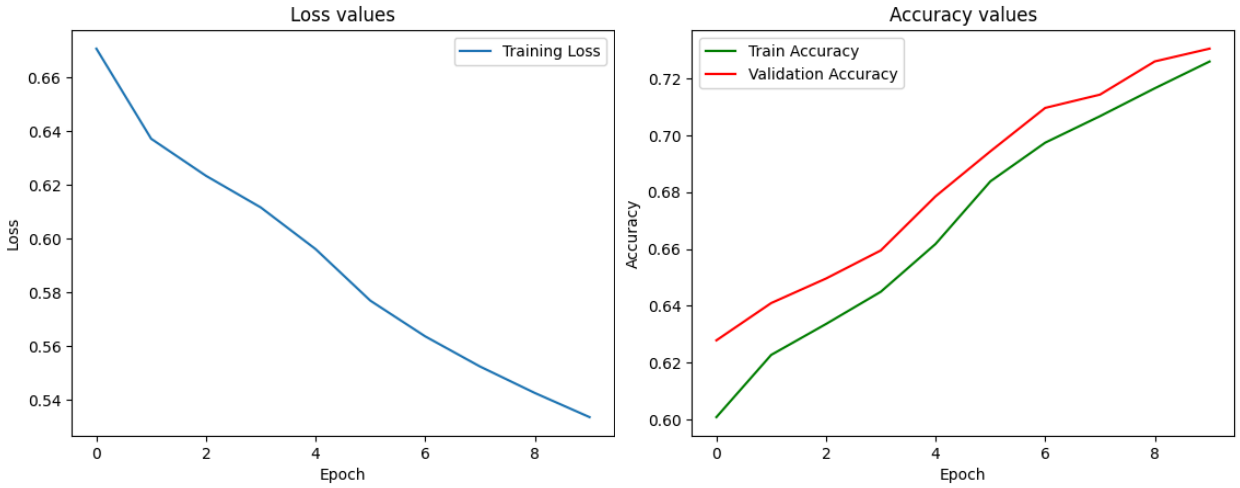
Personal Reflection

Performing this Lab provided a great understanding of RNNs. I learned that some applications of this advanced type of neural network that greatly rely on “sequential data include: Time series analysis such as stock price forecasting, machine translation, speech recognition, image captioning, and sentiment analysis” (Dilmegani). Moreover, Stanford University describes the main advantages and drawbacks of recurrent neural networks in the following table.

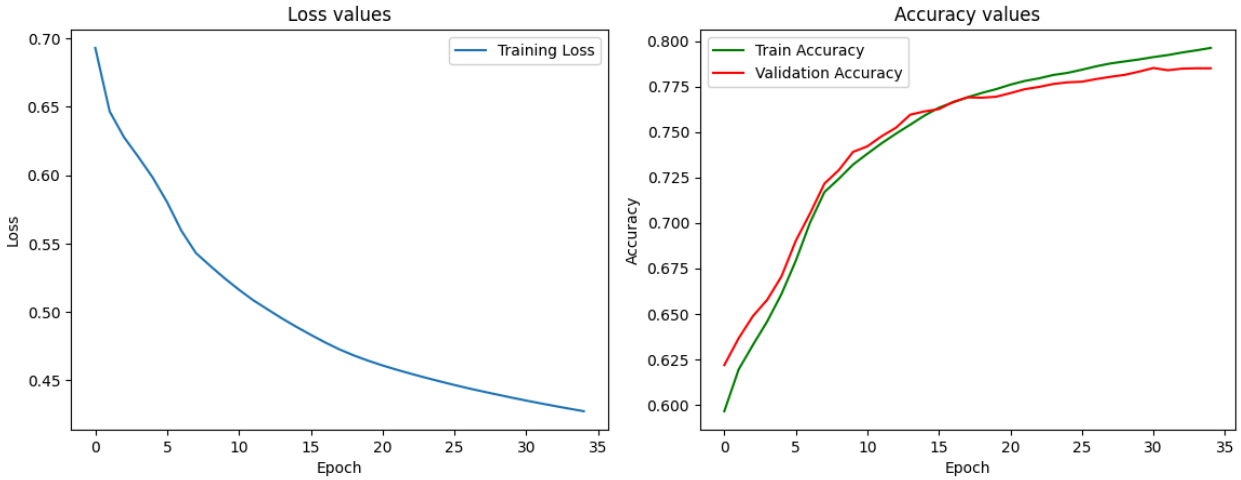
Advantages	Drawbacks
• Possibility of processing input of any length • Model size not increasing with size of input • Computation takes into account historical information • Weights are shared across time	• Computation being slow • Difficulty of accessing information from a long time ago • Cannot consider any future input for the current state

Improvements and Learning

When testing different hyperparameters for training the RNN, I realized that the more epochs the model would run, the less the loss values, thus the higher the accuracy score. For example, the two images below picture the loss and accuracy values after training in 10 epochs.



Now, comparing 35 epochs:



This simple adjustment in the number of epochs increased by 5.5% accuracy, ultimately leading to 78.5%. Testing different learning rate values could also have impacted the final model's performance.

Conclusion

In conclusion, this reflective journal on the application of Recurrent Neural Networks to text data has illuminated the intricate process of transforming, understanding, and leveraging textual information through deep learning techniques. From the initial steps of preprocessing text and employing pre-trained GloVe embeddings to the complexities of setting up, training, and fine-tuning an RNN model, this journey has been both challenging and rewarding. It underscored the significance of hyperparameter tuning, such as adjusting epochs and learning rates, in improving model performance, affirming the transformative potential of RNNs in extracting meaningful insights from text data.

Works Cited

Amidi, Afshine, and Shervine Amidi. “CS 230 - Recurrent Neural Networks Cheatsheet.” *Stanford.edu*, Updated in 2024, https://stanford.edu/~shervine/teaching/cs-230/cheatsheet-recurrent-neural-networks. Accessed 29 March 2024.

Dilmegani, Cem. “In-Depth Guide to Recurrent Neural Networks (RNNs) in 2024.” *Research AIMultiple*, 14 February 2024, https://research.aimultiple.com/rnn/. Accessed 29 March 2024.

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