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CSI 5340 Intro to Deep Learning and Reinforcement Learning

Homework Exercise 3

Oct 18, 2021

Part I: Introduction

The IMDB Movie Review Dataset is used as the experience dataset, which is a standard dataset for text classification or sentiment analysis. And all text data is labeled either by a positive label or by a negative label. Number of training examples is 25000 and number of testing examples is also 25000. There are only two labels of the text dataset, which are positive and negative, and both have 12500 text data.

Part II: Models

The assignment is based on PyTorch and it compares different state dimensions of two models, which are Vanilla RNN and LSTM. The parameters are set as follows and the ten figures of different state dimensions are shown below.

Parameters Settings

Glove with 50 dimensions for each word

Optimizer: Adam

Epoch = 5

Batch Size = 50

Learning rate = 0.001

Output dimension = 1

Embedded dimension = 50

Layers = 2

Dropout = 0.5

State dimension = {20, 50, 100, 200, 500}

Model 1: LSTM

1. Plots Show

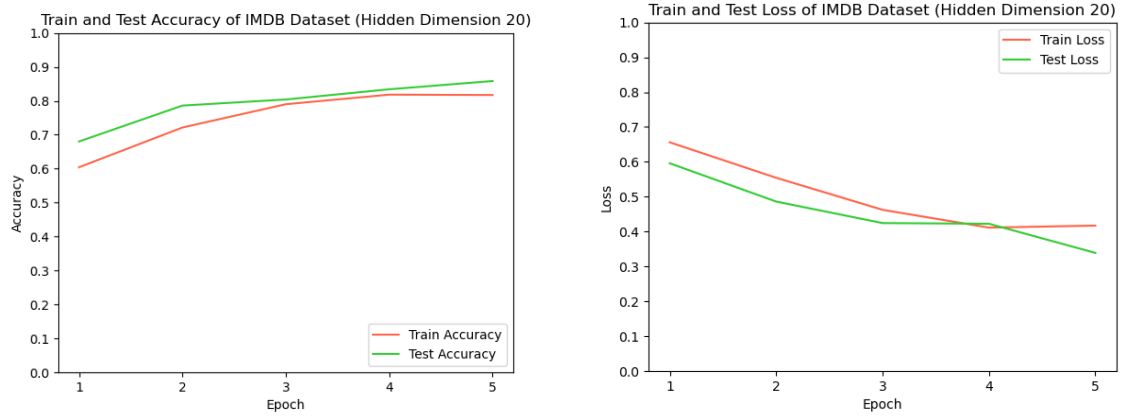


Figure 1: Train & Test Accuracy and Loss when Hidden Dimension is 20 (LSTM)

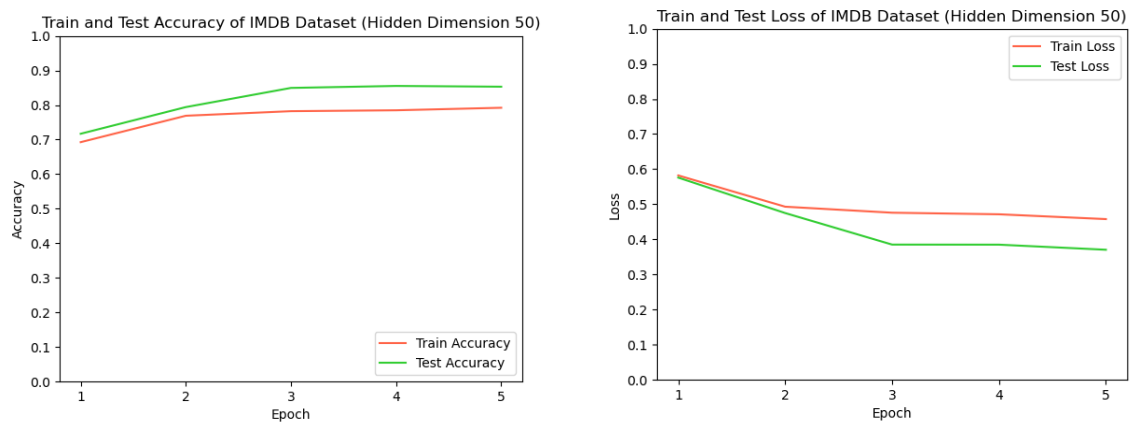


Figure 2: Train & Test Accuracy and Loss when Hidden Dimension is 50 (LSTM)

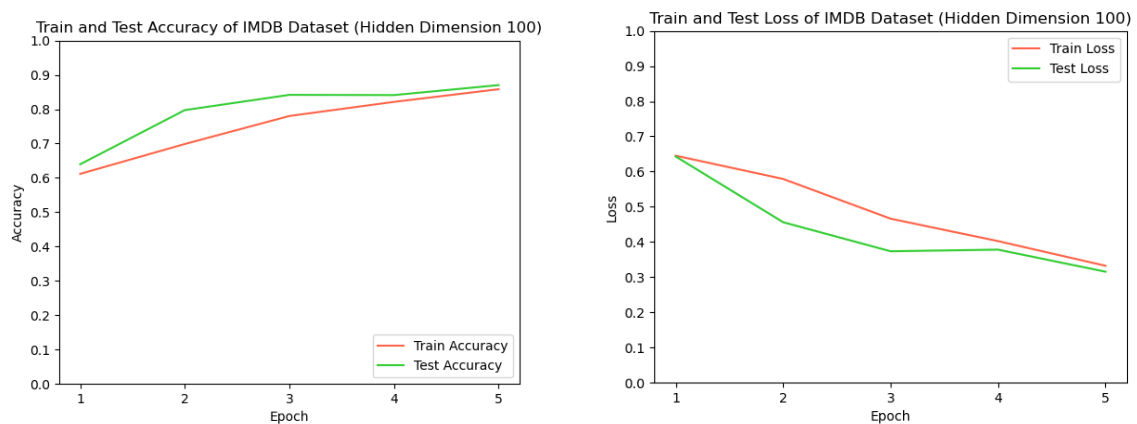


Figure 3: Train & Test Accuracy and Loss when Hidden Dimension is 100 (LSTM)

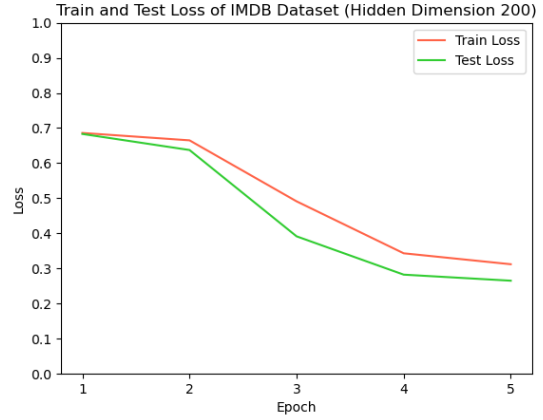
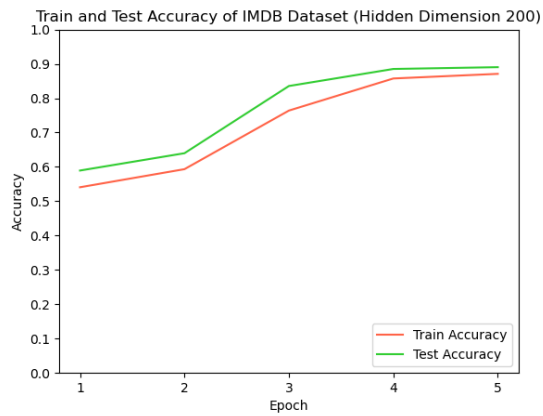


Figure 4: Train & Test Accuracy and Loss when Hidden Dimension is 200 (LSTM)

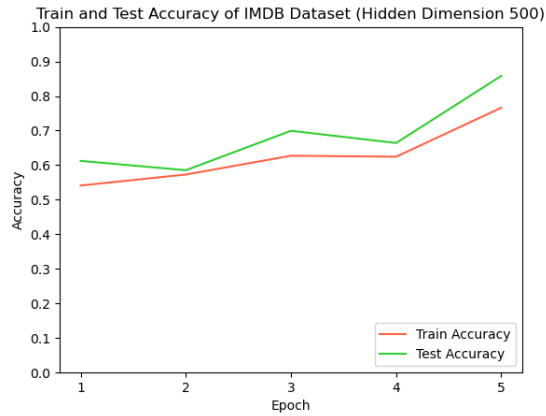


Figure 5: Train & Test Accuracy and Loss when Hidden Dimension is 500 (LSTM)

2. Results and Conclusion

Table 1: Train & Test Accuracy and Loss of LSTM with different State Dimension

State Dimension	Train Accuracy	Test Accuracy	Train Loss	Test Loss
20	0.8172	0.8583	0.4116	0.3392
50	0.8795	0.8871	0.2967	0.2863
100	0.8582	0.8702	0.3324	0.3156
200	0.8709	0.8904	0.3121	0.2653
500	0.7662	0.8582	0.4878	0.3405

The test accuracy is always higher than the train accuracy from the five plots shown above. Also, the test loss is always lower than the train loss. From Table 1 shown above, when state dimension is 50, the train accuracy is the best which is 87.95% and the best test accuracy is 89.04% when state dimension = 200.

Model 2: Vanilla RNN

1. Plots Show

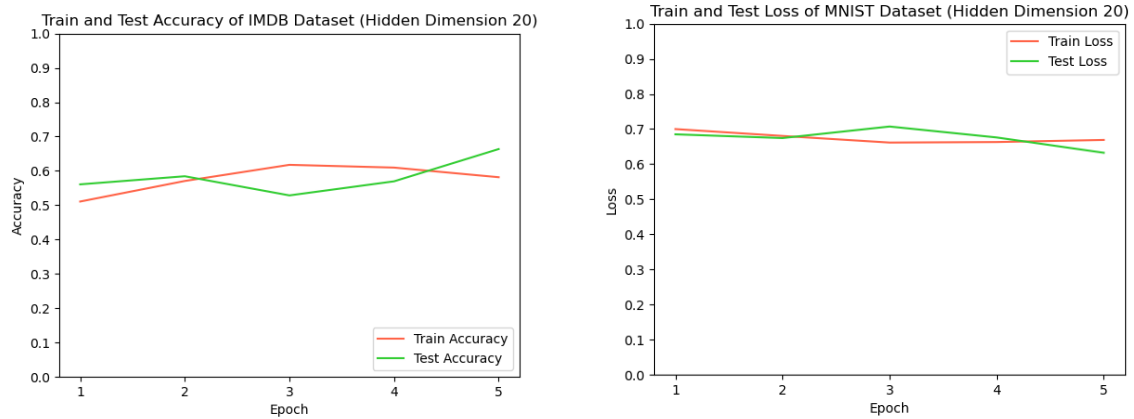


Figure 6: Train & Test Accuracy and Loss when Hidden Dimension is 20 (Vanilla RNN)

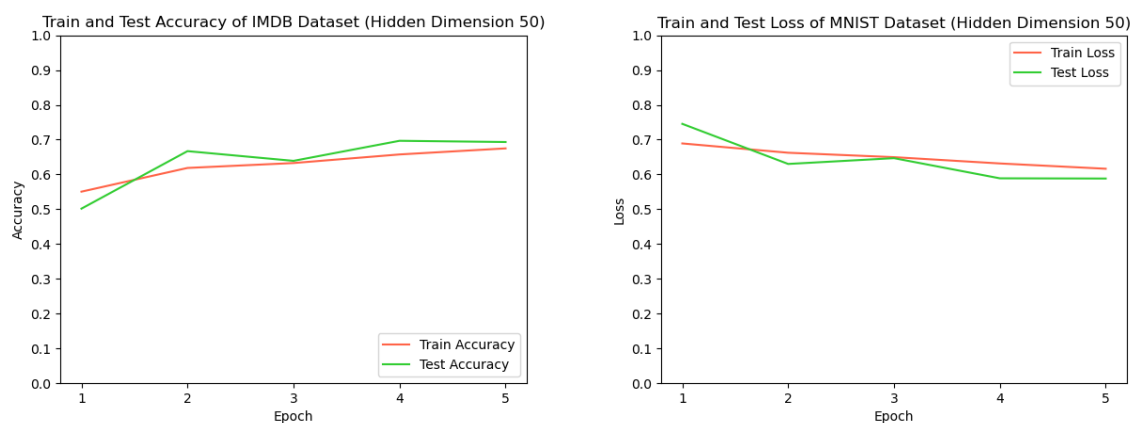


Figure 7: Train & Test Accuracy and Loss when Hidden Dimension is 50 (Vanilla RNN)

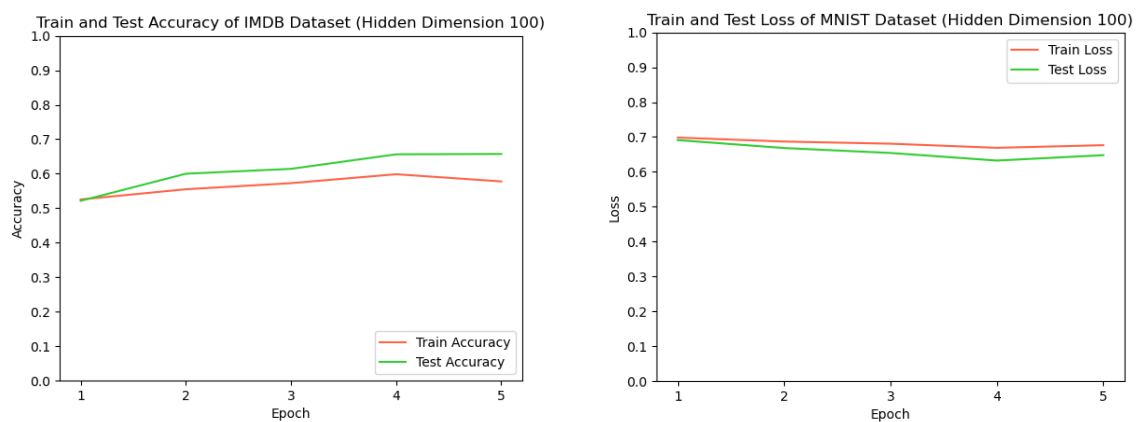


Figure 8: Train & Test Accuracy and Loss when Hidden Dimension is 100 (Vanilla RNN)

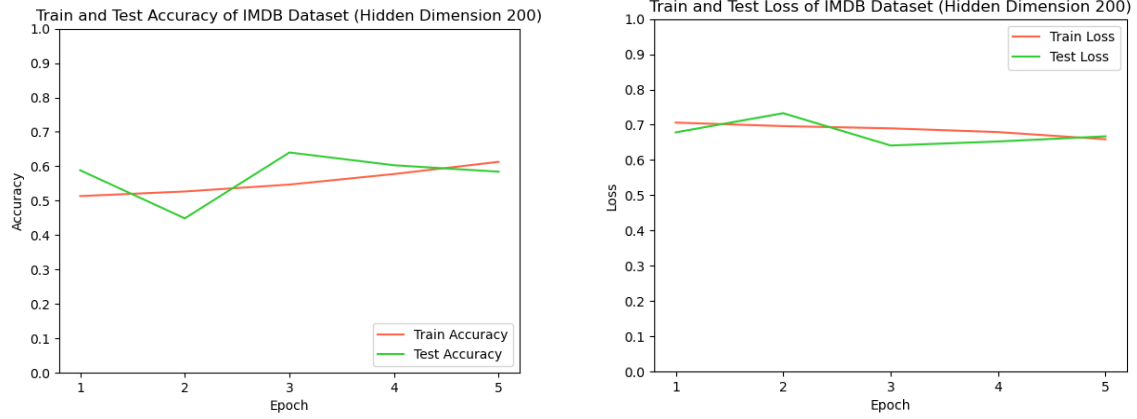


Figure 9: Train & Test Accuracy and Loss when Hidden Dimension is 200 (Vanilla RNN)

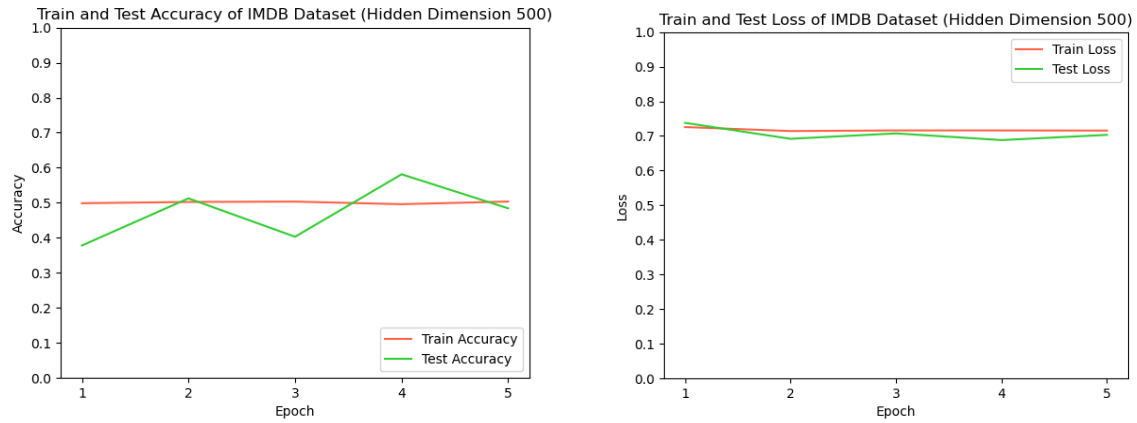


Figure 10: Train & Test Accuracy and Loss when Hidden Dimension is 500 (Vanilla RNN)

2. Results and Conclusion

Table 2: Train & Test Accuracy and Loss of Vanilla RNN with different State Dimension

State Dimension	Train Accuracy	Test Accuracy	Train Loss	Test Loss
20	0.6176	0.6636	0.6615	0.6324
50	0.6749	0.6967	0.6164	0.5883
100	0.5986	0.6573	0.6690	0.6324
200	0.5994	0.6400	0.6683	0.6429
500	0.5035	0.5813	0.7141	0.6880

From Table 2 shown above, the best train accuracy of Vanilla RNN model is when state dimension is equal to 50, the train accuracy is 67.49%. Also, at the state dimension = 50, the best test accuracy is 69.67%. For the loss value, when state dimension is 50, the train loss and test loss are at the lowest. At this point, for the Vanilla RNN model, state dimension = 50 is the best model.

Compare with LSTM model, it is obvious to conclude that the accuracy of model LSTM is the way better than model Vanilla RNN. It has higher train and test accuracy and lower train and test loss value. The five figures of each model also show that, for LSTM, the curve of train accuracy is a little bit higher than the curve test accuracy, the train loss line is lower than test loss line in most cases. It is barely to see the train curve and the test curve are constantly interlaced. However, in Vanilla RNN model, the train and the test curve often interest, so it is not as stable as LSTM model.