INLP ASSIGNMENT - 2

Wandb report for hyperparameter tuning

FEED-FORWARD NEURAL NETWORK

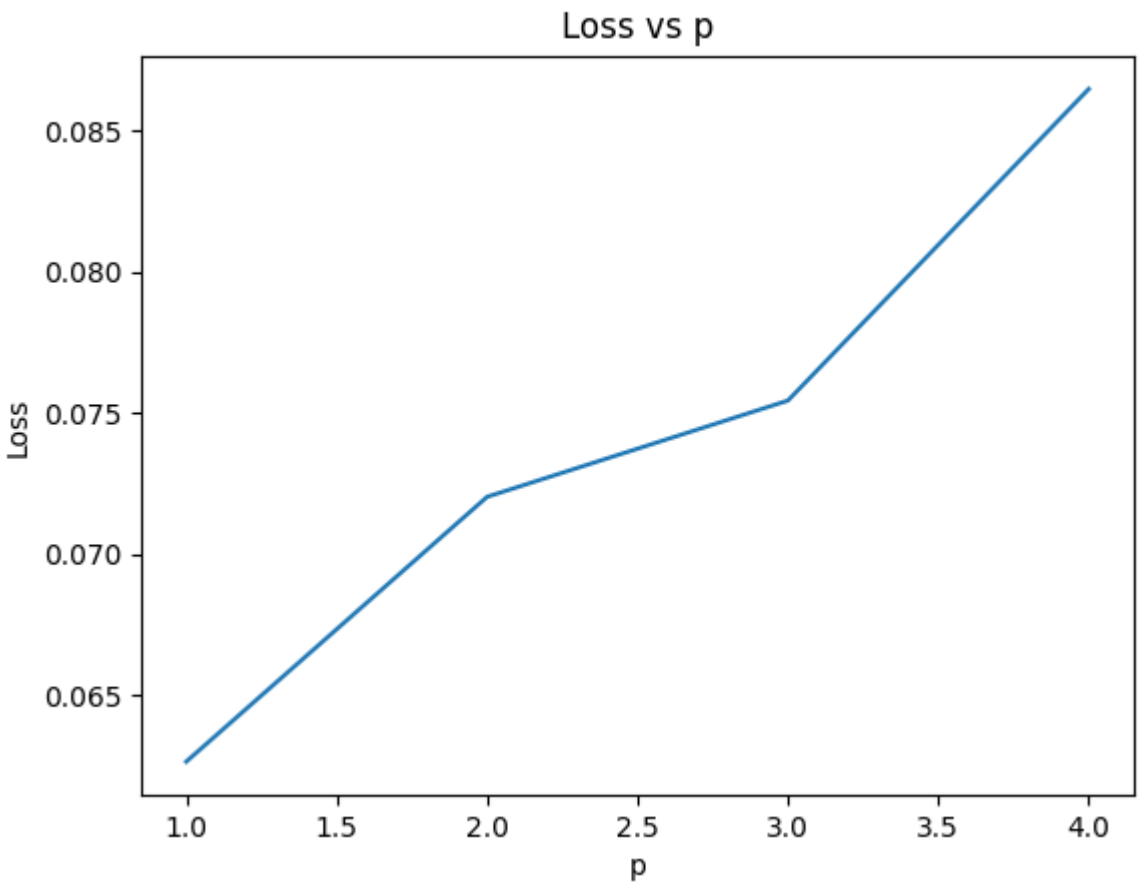
Hyperparameters:

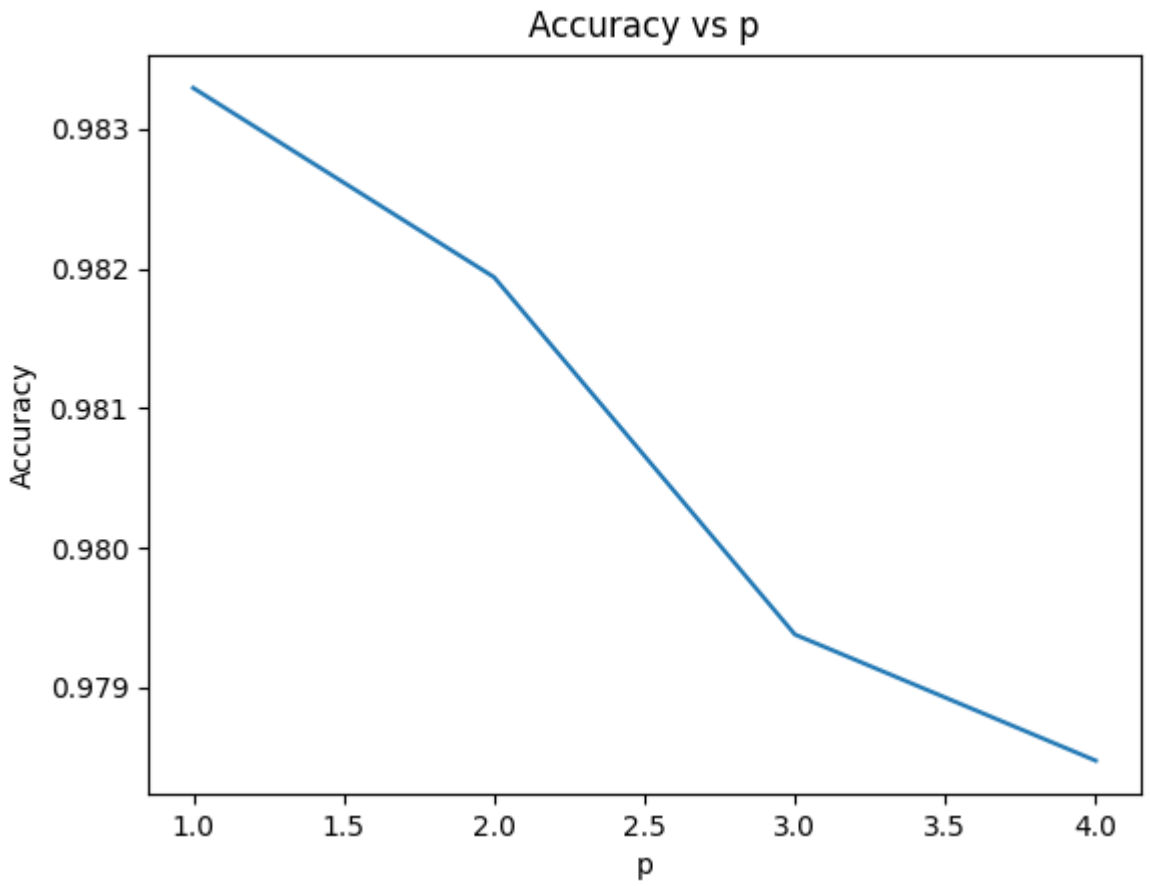
Keeping *p* and *s* constant, the model was trained using various hyperparameters and then tested on the dev set. The best performance on the dev set is achieved with the following hyperparameters:

- Activation Function: Tanh
- Embedding Dimension: 256
- Epochs: 5
- Hidden Dimension: 64
- Learning Rate: 0.001
- Number of Hidden Layers: 1

P-S Graph:

The graphs below illustrate how validation loss and accuracy vary with the context window size ($2p + 1$).





As the context window size increases with higher *p*, the model considers a wider range of words for prediction, leading to increased complexity. This can make it harder for the model to capture relevant patterns and dependencies within the data, resulting in decreased accuracy and increased loss on the validation set.

Evaluation metrics:

Therefore, the best hyperparameters are as follows:

- Activation Function: Tanh
- Embedding Dimension: 256
- Epochs: 5
- Hidden Dimension: 64
- Learning Rate: 0.001
- Number of Hidden Layers: 1
- p = 1
- s = 1

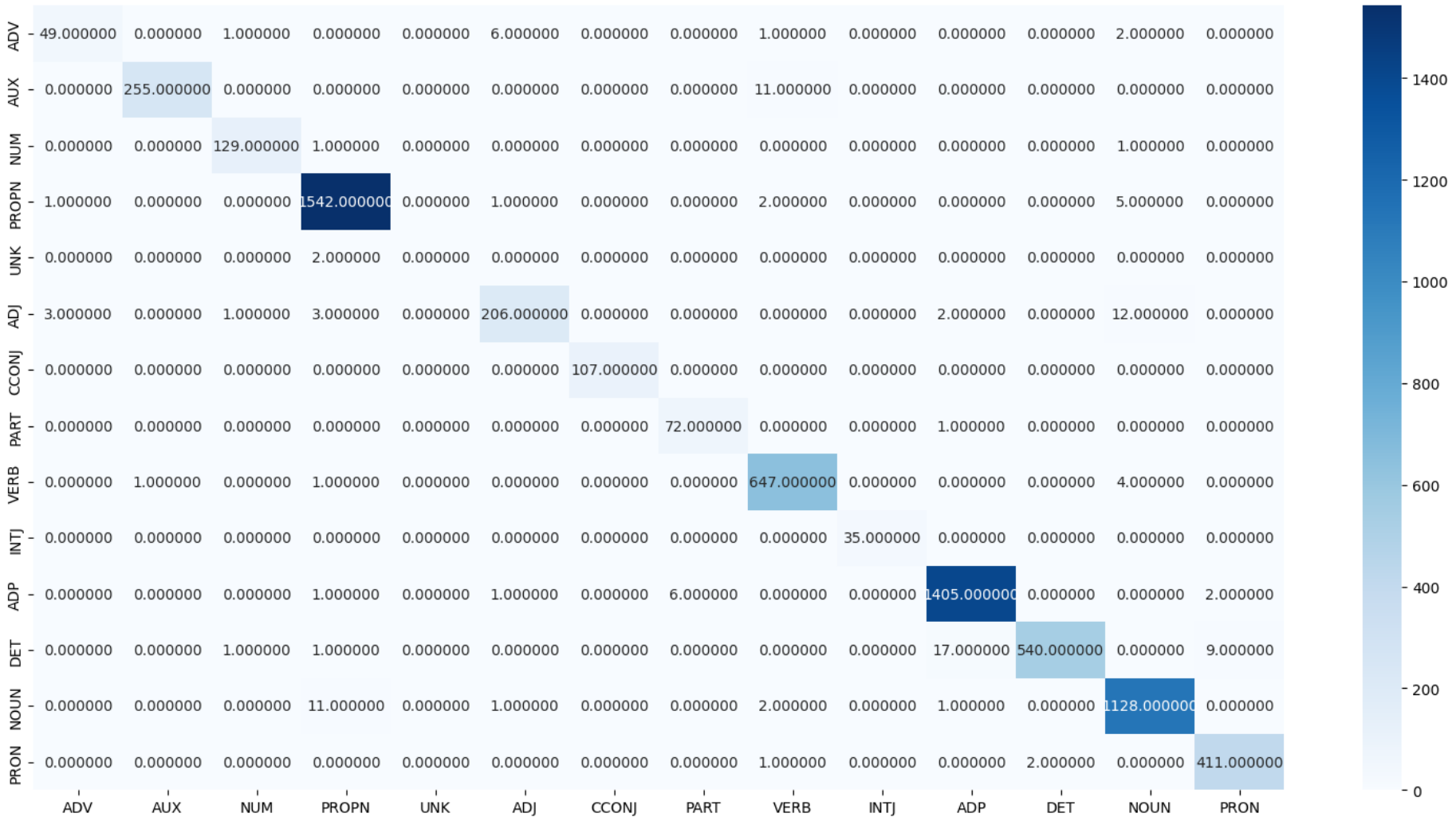
The model trained with these parameters is used for evaluation. Here are the results on the dev set and test set.

DEV SET

Metrics:

```
Loss:  0.06856416342527397
Accuracy:  0.9822396146899458
Precision Macro:  0.9750298847316909
Recall Macro:  0.9673811195387914
F1 Macro:  0.9707931468622644
Precision Micro:  0.9822396146899458
Recall Micro:  0.9822396146899458
F1 Micro:  0.9822396146899458
```

Confusion matrix:

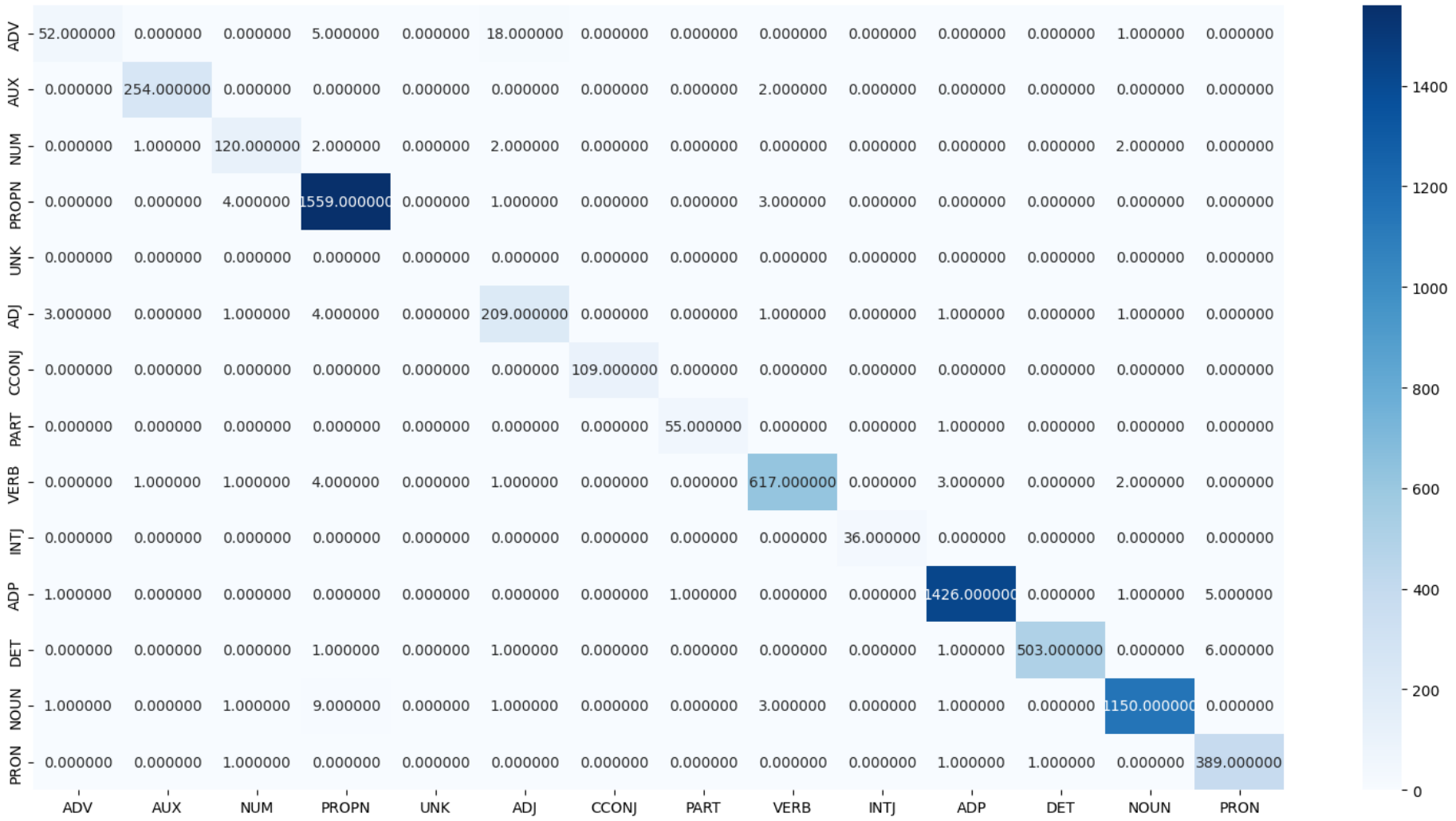


Test set

Metrics:

```
Loss:  0.053863800140203845
Accuracy:  0.9846504559270517
Precision Macro:  0.9730641449827822
Recall Macro:  0.9603621124103205
F1 Macro:  0.9653841546375171
Precision Micro:  0.9846504559270517
Recall Micro:  0.9846504559270517
F1 Micro:  0.9846504559270517
```

Confusion matrix:



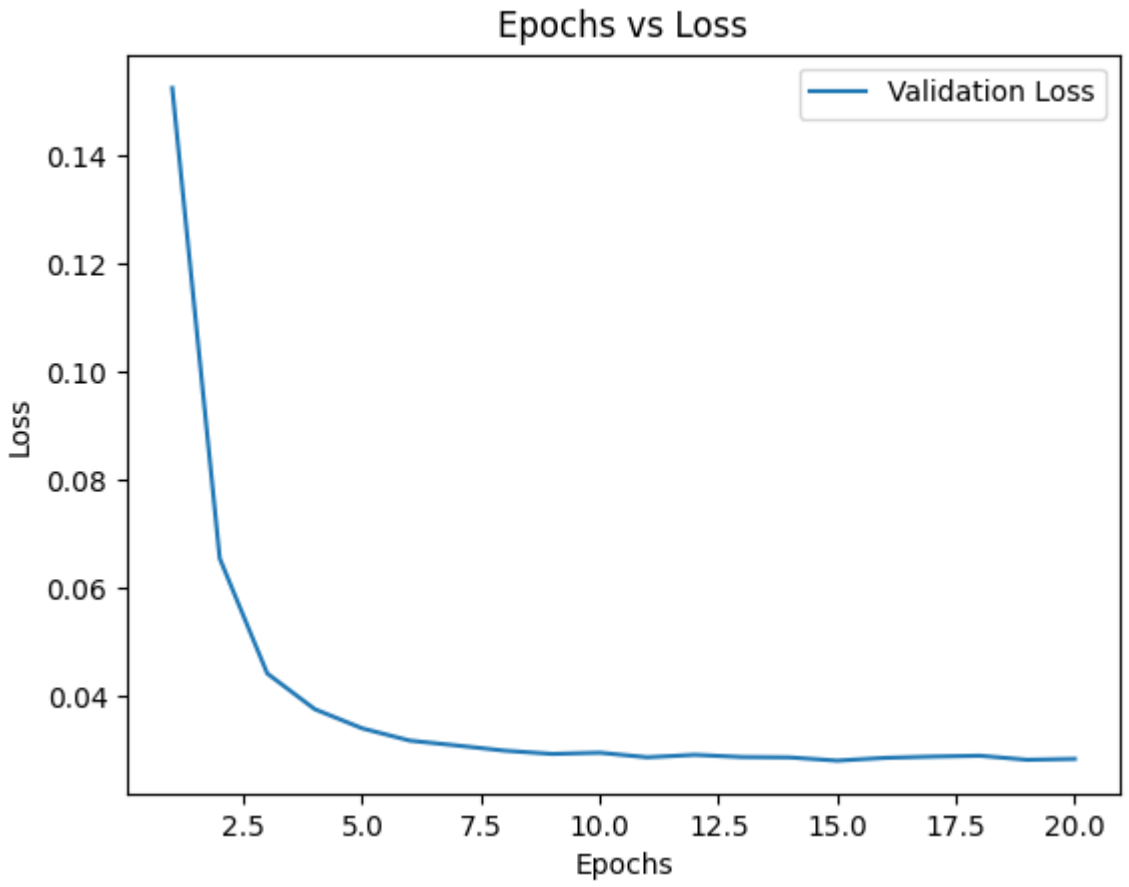
LSTM

Hyperparameters:

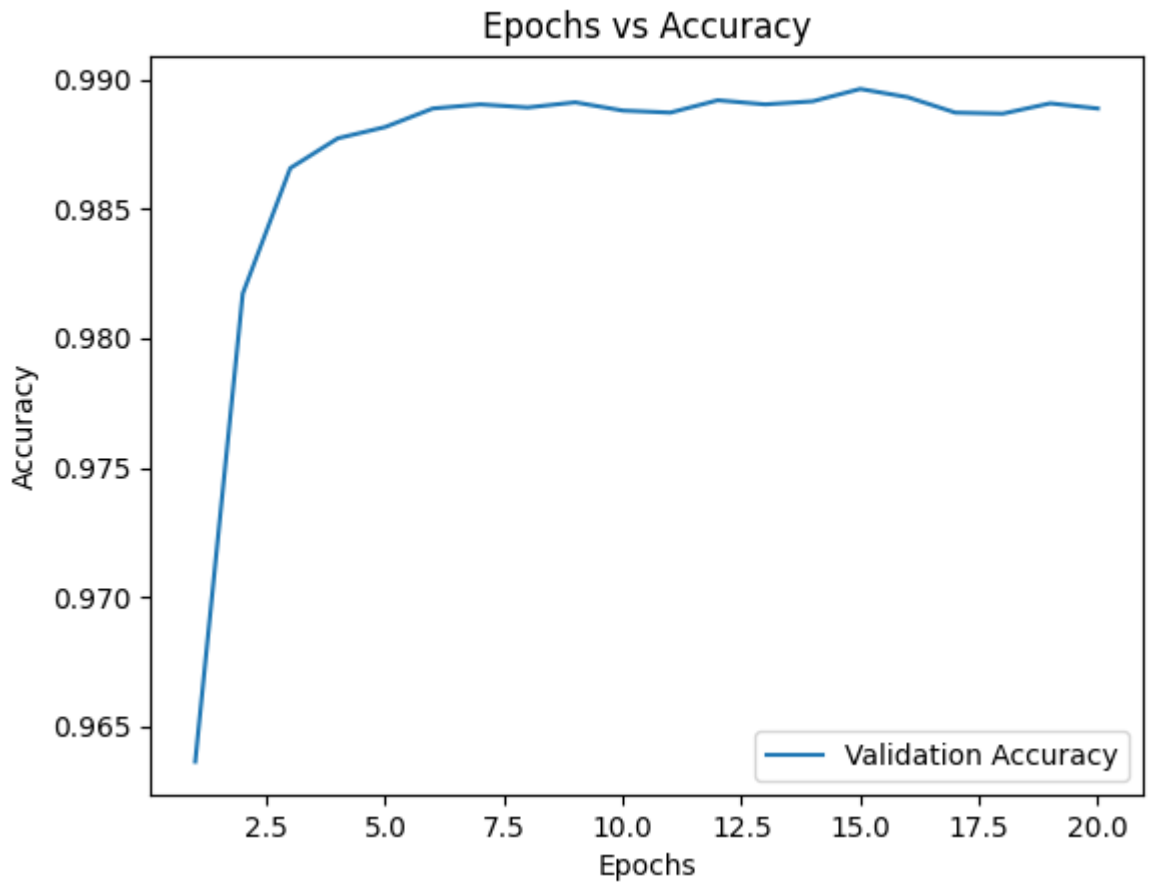
The model was trained using various hyperparameters and then tested on the dev set. The best performance on the dev set is achieved with the following hyperparameters:

- Activation Function: Relu
- Embedding Dimension: 128
- Epochs: 15
- Hidden Dimension: 128
- Learning Rate: 0.001
- Number of LSTM Layers: 1
- bidirectionality: True

Epoch vs validation loss graph:



Epoch vs validation accuracy graph:



Evaluation metrics:

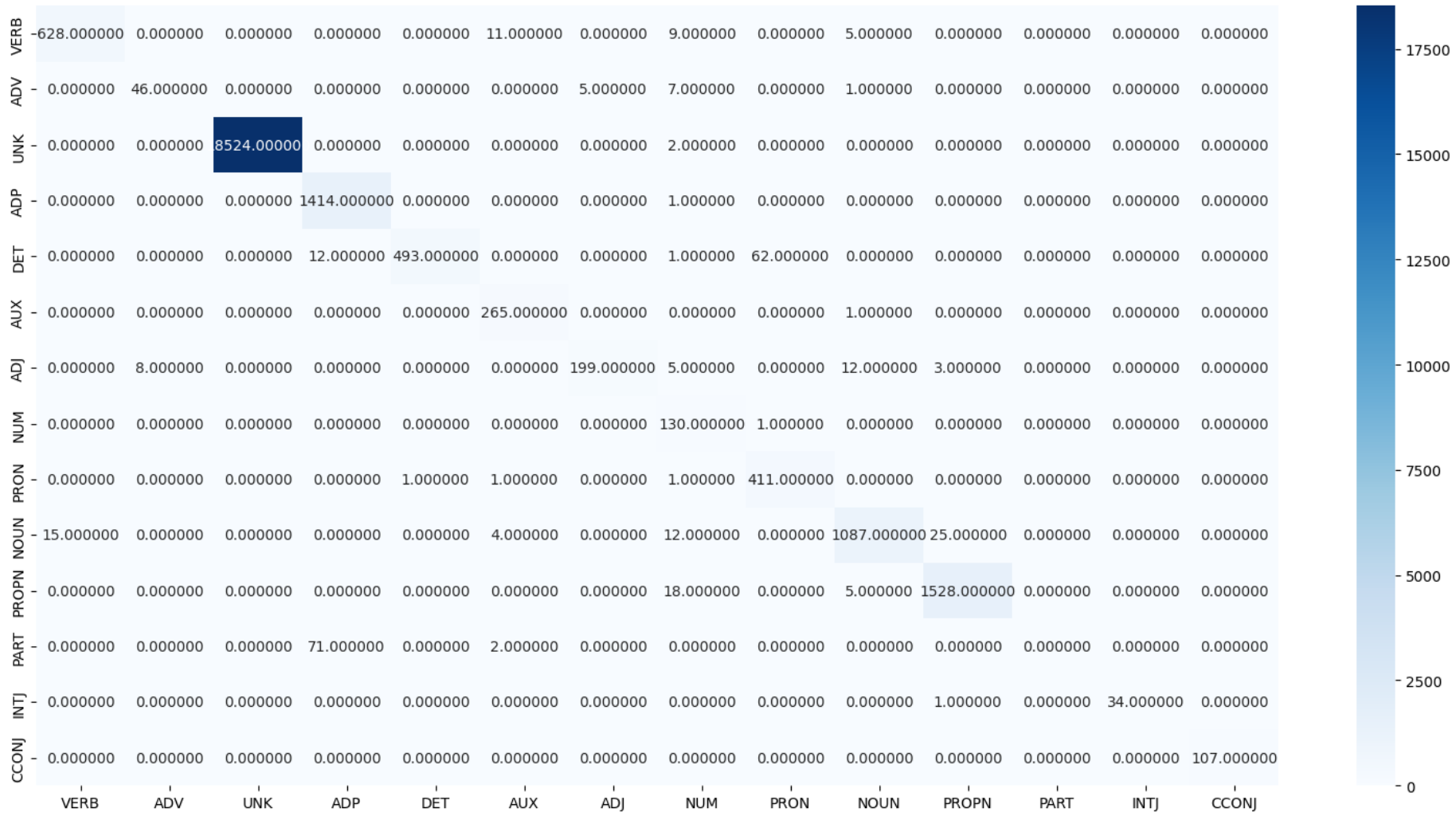
The model trained with the above parameters is used for evaluation. Here are the results on the dev set and test set.

DEV SET

Metrics:

```
Loss:  0.0438898950876026
Accuracy:  0.9880006357279084
Precision Macro:  0.9391328278197021
Recall Macro:  0.9518567251166844
F1 Macro:  0.9423696991381186
Precision Micro:  0.9880006357279084
Recall Micro:  0.9880006357279084
F1 Micro:  0.9880006357279084
```

Confusion matrix:

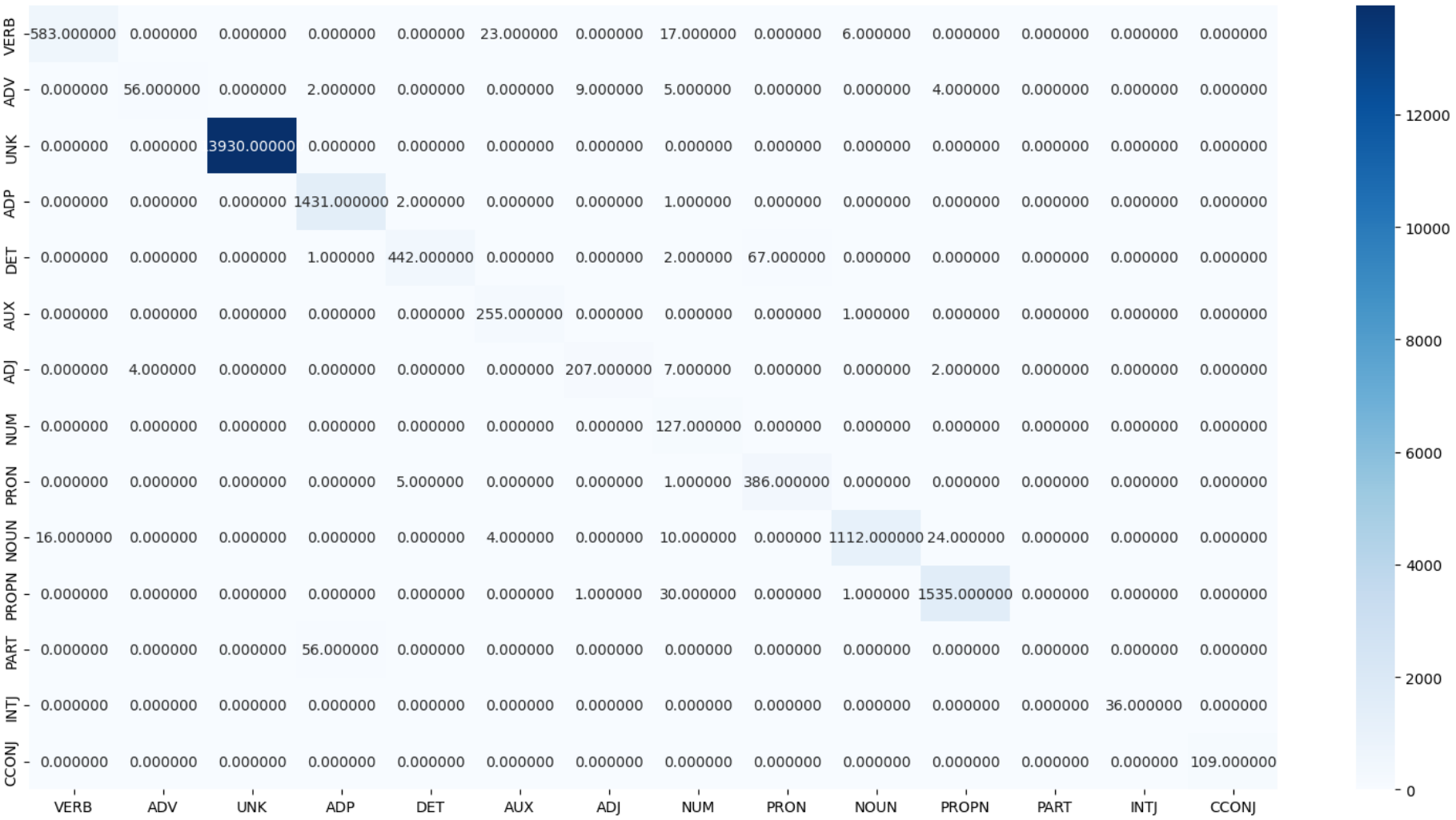


Test set

Metrics:

```
Loss:  0.05258695724928703
Accuracy:  0.9853242320819112
Precision Macro:  0.9361839958468827
Recall Macro:  0.9522971309738479
F1 Macro:  0.9392681948633034
Precision Micro:  0.9853242320819112
Recall Micro:  0.9853242320819112
F1 Micro:  0.9853242320819112
```

Confusion matrix:


VERB -583.000000 0.000000 0.000000 0.000000 0.000000 23.000000 0.000000 17.000000 0.000000 6.000000 0.000000 0.000000 0.000000 0.000000
ADV - 0.000000 56.000000 0.000000 2.000000 0.000000 0.000000 9.000000 5.000000 0.000000 0.000000 4.000000 0.000000 0.000000 0.000000
UNK - 0.000000 0.000000 3930.00000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
ADP - 0.000000 0.000000 0.000000 1431.000000 2.000000 0.000000 0.000000 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
DET - 0.000000 0.000000 0.000000 1.000000 442.000000 0.000000 0.000000 2.000000 67.000000 0.000000 0.000000 0.000000 0.000000 0.000000
AUX - 0.000000 0.000000 0.000000 0.000000 0.000000 255.000000 0.000000 0.000000 0.000000 1.000000 0.000000 0.000000 0.000000 0.000000
ADJ - 0.000000 4.000000 0.000000 0.000000 0.000000 0.000000 207.000000 7.000000 0.000000 0.000000 2.000000 0.000000 0.000000 0.000000
NUM - 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 127.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
PRON - 0.000000 0.000000 0.000000 0.000000 5.000000 0.000000 0.000000 1.000000 386.000000 0.000000 0.000000 0.000000 0.000000 0.000000
NOUN - 16.000000 0.000000 0.000000 0.000000 0.000000 4.000000 0.000000 10.000000 0.000000 1112.000000 24.000000 0.000000 0.000000 0.000000
PROPN - 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 1.000000 30.000000 0.000000 1.000000 1535.000000 0.000000 0.000000 0.000000
PART - 0.000000 0.000000 0.000000 56.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
INTJ - 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 36.000000 0.000000
CCONJ - 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 109.000000
VERB ADV UNK ADP DET AUX ADJ NUM PRON NOUN PROPN PART INTJ CCONJ
12000
10000
8000
6000
4000
2000
0