POS TAGGER FFNN & LSTM REPORT

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Hyperparameter Tuning Report

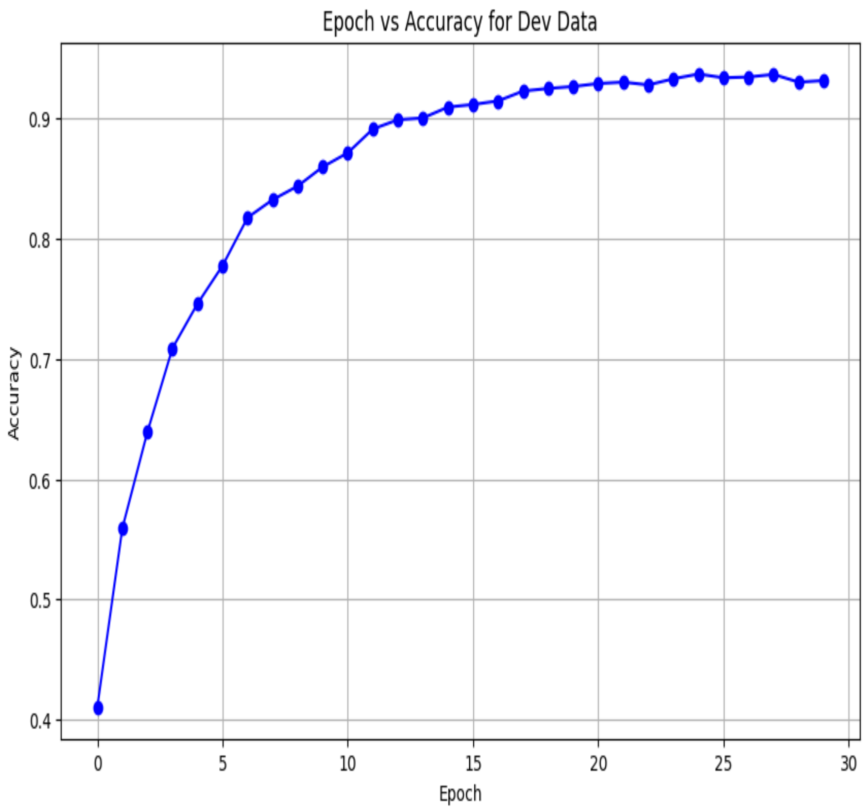
Feed Forward Neural Network POS Tagger

Experiment:

- Context Window (p=s): [0, 1, 2, 3, 4]
- Number of Hidden Layers: [1, 2, 3]
- Hidden Layer Sizes: [50, 100, 200]
- Epochs: [15, 30, 50]
- Activation Functions: ReLU, Sigmoid,

Experimental

Context Window P=S	Number of Hidden Layers	Hidden Layer Sizes	Epochs	Activation Functions	Accuracy Validation	Accuracy Test
0	3	200	50	Relu	91.32	91.78
0	3	200	50	Sigmoid	91.67	90.07
1	3	100	30	Relu	93.43	92.02
1	3	50	50	Sigmoid	91.87	91.59
2	2	200	15	Relu	92.36	91.43
2	3	100	30	Sigmoid	93.45	93.12
3	2	50	50	Relu	95.68	94.67
3	3	50	15	Sigmoid	93.29	93.21
4	3	200	50	Relu	97.83	96.45
4	3	100	30	Sigmoid	96.34	95.47

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Dev set evaluation:
+------------------+----------+
| Metric           |    Value |
+==================+==========+
| Accuracy         | 0.931653 |
+------------------+----------+
| Recall (micro)   | 0.931653 |
+------------------+----------+
| Recall (macro)   | 0.794853 |
+------------------+----------+
| F1 Score (micro) | 0.931653 |
+------------------+----------+
| F1 Score (macro) | 0.805477 |
+------------------+----------+
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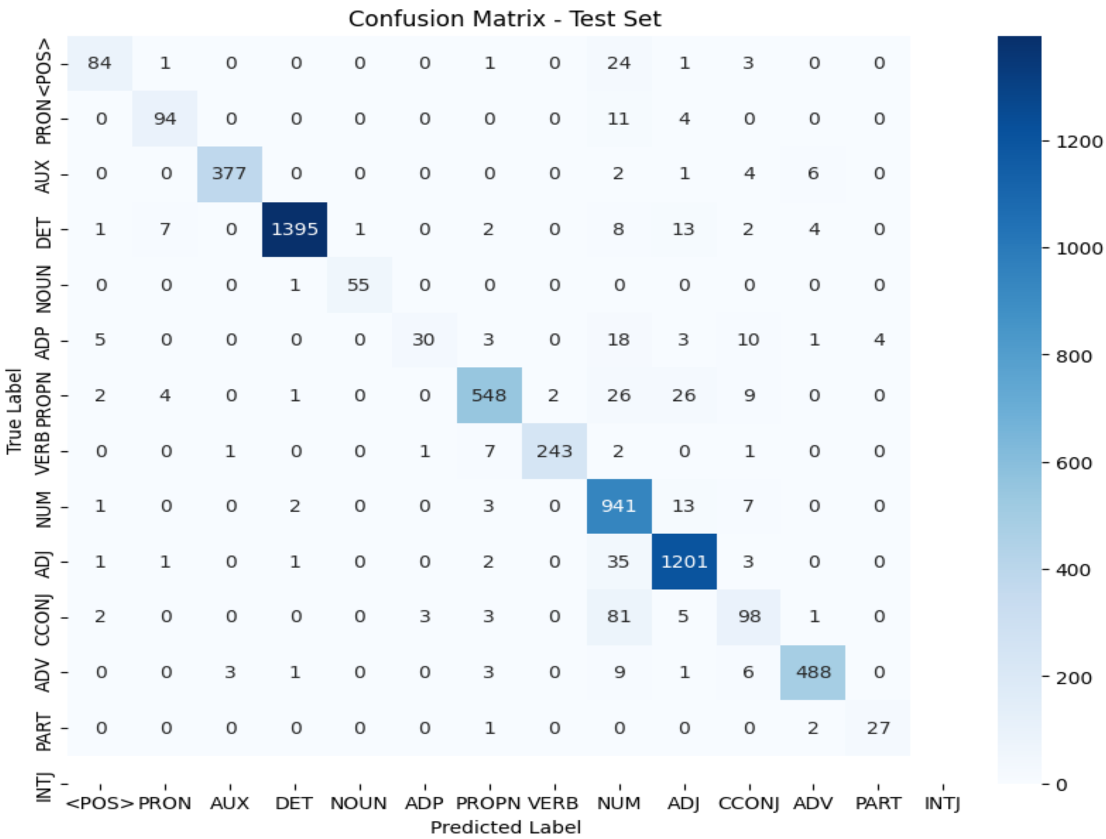


Test set evaluation:

Metric	Value
Accuracy	0.931098
Recall (micro)	0.931098
Recall (macro)	0.851377
F1 Score (micro)	0.931098
F1 Score (macro)	0.872081

Results:

- Context Window (p=s): 4
- Hidden Layers: 3
- Hidden Layer Size: 100
- Epochs: 30
- Activation Function: Relu
- Validation Accuracy: 93.16%
- Test Set Accuracy: 93.10%

Recurrent Neural Network POS Tagger

Experiment:

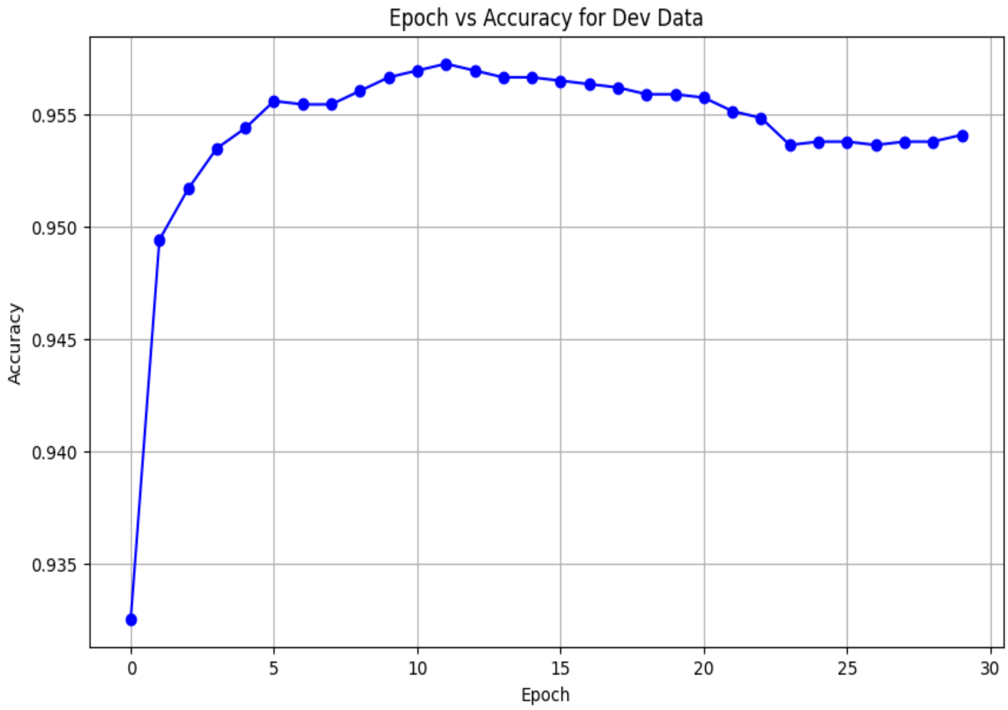
Embedding Dimension: [50, 100, 200]

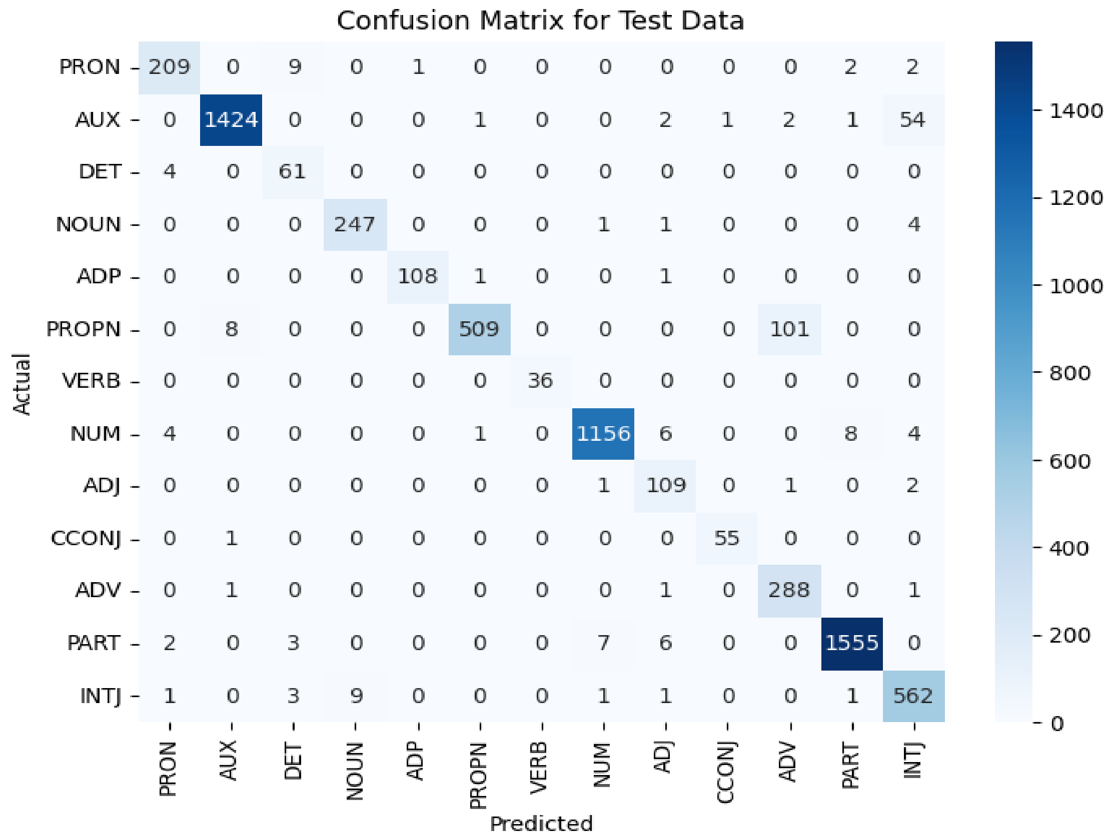
Hidden Dimension: [30, 50, 80]

Epochs: [15, 30, 50]

Activation Functions: SoftMax, ReLu, Tanh

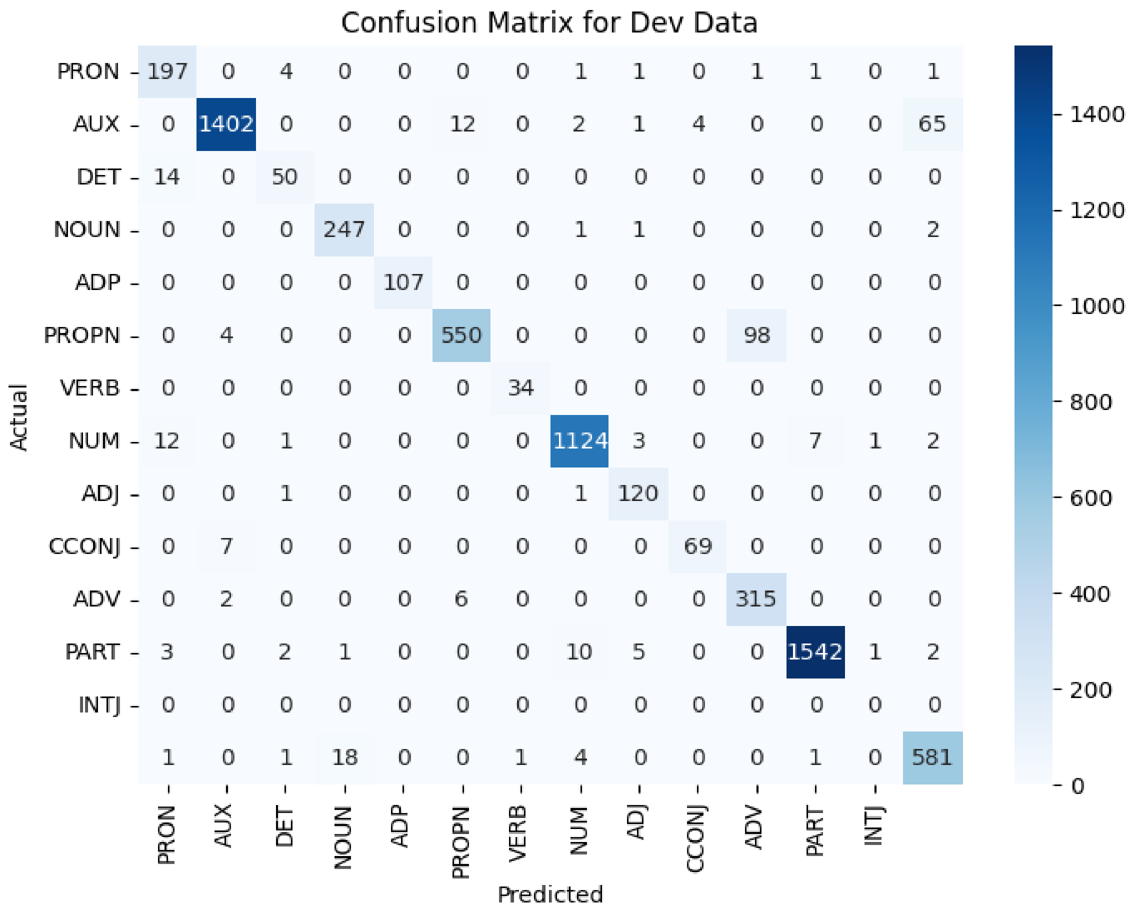
Embedding Dim	Hidden Dim	Activation Function	Accuracy Validation	Accuracy Test
50	80	Softmax	87.59	86.32
100	50	Softmax	89.45	87.93
200	30	Softmax	88.32	87.23
50	50	Tanh	85.68	85.34
100	80	Tanh	90.45	90.23
200	30	Tanh	91.78	91.01
50	50	Relu	88.21	87.45
100	30	Relu	93.57	92.73
200	80	Relu	96.89	95.72


Epoch vs Accuracy for Dev Data
Accuracy
0.955
0.950
0.945
0.940
0.935
0
5
10
15
20
25
30
Epoch



Evaluation Metrics for Dev Data:

Metric	Value
Accuracy	0.954094
Recall (micro)	0.954094
Recall (macro)	0.879093
F1 Score (micro)	0.954094
F1 Score (macro)	0.868911



Evaluation Metrics for Test Data:

Metric	Value
Accuracy	0.960334
Recall (micro)	0.960334
Recall (macro)	0.961087
F1 Score (micro)	0.960334
F1 Score (macro)	0.944895

Best Configuration:

- Embedding Dimension: 100
- Hidden Dimension: 50
- Epoch: 30
- Activation Function: Sigmoid
- Validation Accuracy: 95.40
- Test Accuracy: 96.03%

Analysis:

Feed Forward Neural Network:

Increasing the context window (p=s) allows the model to capture more contextual information, leading to improved performance. As the number of hidden layers and hidden layer sizes increase, the model's capacity to learn intricate patterns also increases, resulting in higher accuracies.

ReLu activation function tends to perform better, possibly due to its ability to handle vanishing gradient issues.

Recurrent Neural Network:

Larger embedding and hidden dimensions allow the model to capture more complex relationships in the data, resulting in higher accuracies.

ReLu activation function demonstrates superior performance, which might be attributed to its ability to handle gradient explosion and vanishing gradient problems inherent in RNNs.

Conclusion:

feed forward and recurrent neural network models exhibit significant improvements in accuracy with appropriate hyperparameter tuning. The choice of hyperparameters greatly influences the model's performance, with larger contextual windows and hidden layer sizes often leading to better results. However, it's essential to strike a balance between model complexity and computational efficiency. Further analysis may explore the impact of different optimizers, learning rates, and regularization techniques on model performance.