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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

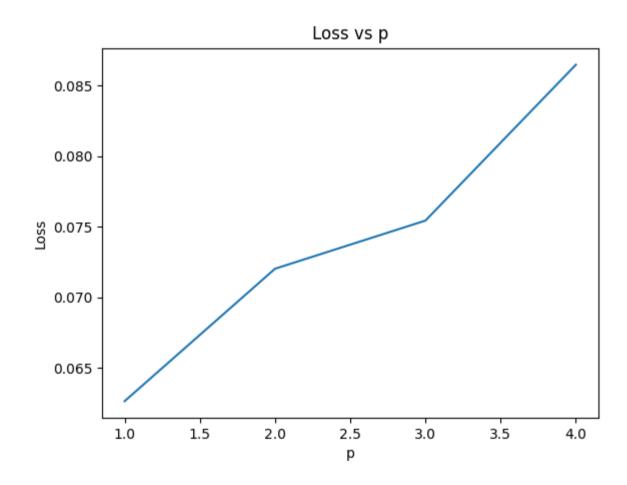
• Hidden Dimension: 64

• Learning Rate: 0.001

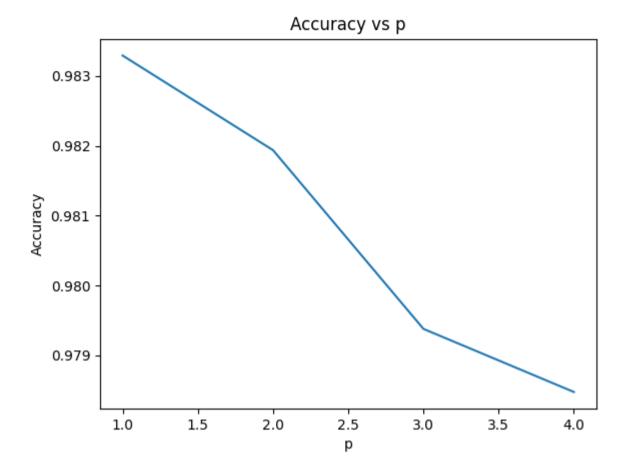
• Number of Hidden Layers: 1

P-S Graph:

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



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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:

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_	ADV	AÚX	NUM	PROPN	unk	ADJ	CCONJ	PART	VERB	ınˈtj	ADP	DET	NOUN	PRON		- 0
PRON -	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	2.000000	0.000000	411.000000		
NOON -	0.000000	0.000000	0.000000	11.000000	0.000000	1.000000	0.000000	0.000000	2.000000	0.000000	1.000000	0.000000	1128.000000	0.000000		- 200
DET -	0.000000	0.000000	1.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	17.000000	540.000000	0.000000	9.000000		
ADP -	0.000000	0.000000	0.000000	1.000000	0.000000	1.000000	0.000000	6.000000	0.000000	0.000000	1405.000000	0.000000	0.000000	2.000000		- 400
Į.	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	35.000000	0.000000	0.000000	0.000000	0.000000		
VERB -	0.000000	1.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	647.000000	0.000000	0.000000	0.000000	4.000000	0.000000		- 600
PART -	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	72.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000		
CCON	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	107.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		- 800
ADJ -	3.000000	0.000000	1.000000	3.000000	0.000000	206.000000	0.000000	0.000000	0.000000	0.000000	2.000000	0.000000	12.000000	0.000000		
- NK	0.000000	0.000000	0.000000	2.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		- 1000
PROPN -	1.000000	0.000000	0.000000	1542.000000	0.000000	1.000000	0.000000	0.000000	2.000000	0.000000	0.000000	0.000000	5.000000	0.000000		- 1200
NOM -	0.000000	0.000000	129.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000		
AUX -	0.000000	255.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	11.000000	0.000000	0.000000	0.000000	0.000000	0.000000		- 1400
ADV -	49.000000	0.000000	1.000000	0.000000	0.000000	6.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	2.000000	0.000000		

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:

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<u>a</u>	ADV	AÚX	NUM	PROPN	unk	ADJ	CCONJ	PART	VERB	ınTj	ADP	DET	NOUN	PRON		- 0
PRON	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	1.000000	0.000000	389.000000		
NOON	1.000000	0.000000	1.000000	9.000000	0.000000	1.000000	0.000000	0.000000	3.000000	0.000000	1.000000	0.000000	150.00000	0.000000		- 200
DET	0.000000	0.000000	0.000000	1.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	1.000000	503.000000	0.000000	6.000000		
ADP	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	1426.000000	0.000000	1.000000	5.000000		- 400
Į.	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	36.000000	0.000000	0.000000	0.000000	0.000000		
VERB	0.000000	1.000000	1.000000	4.000000	0.000000	1.000000	0.000000	0.000000	617.000000	0.000000	3.000000	0.000000	2.000000	0.000000		- 600
PART	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	55.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000		
CCON	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	109.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		- 800
ADJ -	3.000000	0.000000	1.000000	4.000000	0.000000	209.000000	0.000000	0.000000	1.000000	0.000000	1.000000	0.000000	1.000000	0.000000		1000
NN -	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	0.000000		- 1000
PROPN	0.000000	0.000000	4.000000	1559.000000	0.000000	1.000000	0.000000	0.000000	3.000000	0.000000	0.000000	0.000000	0.000000	0.000000		- 1200
MUM -	0.000000	1.000000	120.000000	2.000000	0.000000	2.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	2.000000	0.000000		
AUX -	0.000000	254.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	2.000000	0.000000	0.000000	0.000000	0.000000	0.000000		- 1400
ADV	52.000000	0.000000	0.000000	5.000000	0.000000	18.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000		

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

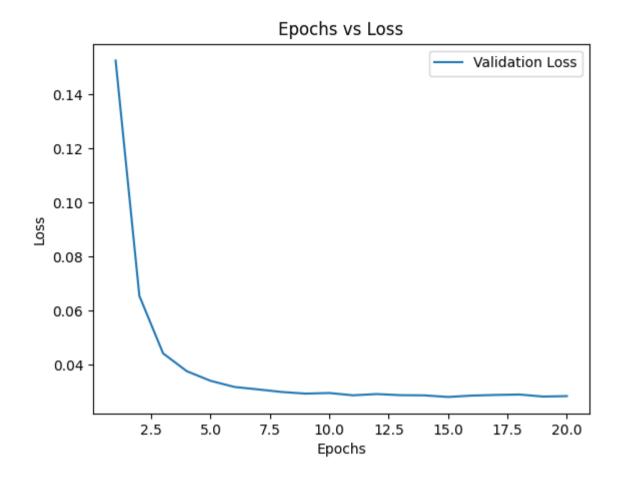
• Learning Rate: 0.001

• Number of LSTM Layers: 1

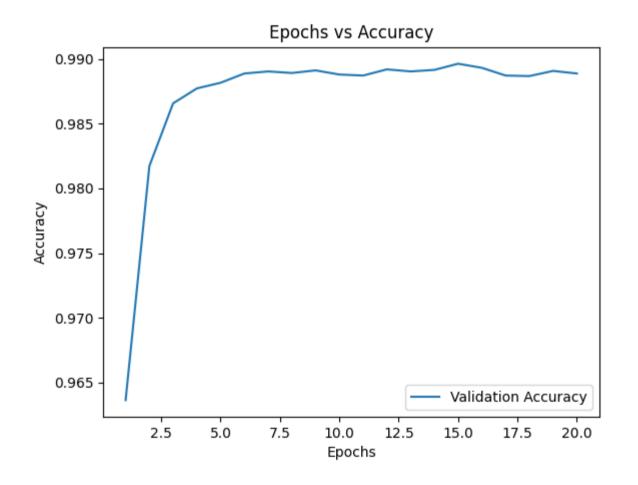
• bidirectionality: True

Epoch vs validation loss graph:

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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

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Confusion matrix:

	VERB	ADV	UNK	ADP	DET	AÚX	ADJ	NÚM	PRON	NOUN	PROPN	PART	INTJ	CCONJ	_	0
CCON	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	107.000000		
Į.	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	34.000000	0.000000		2500
PART	0.000000	0.000000	0.000000	71.000000	0.000000	2.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		2500
PROPN	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	18.000000	0.000000	5.000000	1528.000000	0.000000	0.000000	0.000000	-	5000
NOON	15.000000	0.000000	0.000000	0.000000	0.000000	4.000000	0.000000	12.000000	0.000000	1087.000000	25.000000	0.000000	0.000000	0.000000		
PRON -	0.000000	0.000000	0.000000	0.000000	1.000000	1.000000	0.000000	1.000000	411.000000	0.000000	0.000000	0.000000	0.000000	0.000000	-	7500
MUM -	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	130.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000		
ADJ -	0.000000	8.000000	0.000000	0.000000	0.000000	0.000000	199.000000	5.000000	0.000000	12.000000	3.000000	0.000000	0.000000	0.000000	-	10000
AUX -	0.000000	0.000000	0.000000	0.000000	0.000000	265.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000		
DET -	0.000000	0.000000	0.000000	12.000000	493.000000	0.000000	0.000000	1.000000	62.000000	0.000000	0.000000	0.000000	0.000000	0.000000	-	12500
ADP -	0.000000	0.000000	0.000000	1414.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000		
NA -	0.000000	0.000000	8524.00000	0.000000	0.000000	0.000000	0.000000	2.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	-	15000
ADV -	0.000000	46.000000	0.000000	0.000000	0.000000	0.000000	5.000000	7.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000		
VERB	628.000000	0.000000	0.000000	0.000000	0.000000	11.000000	0.000000	9.000000	0.000000	5.000000	0.000000	0.000000	0.000000	0.000000	-	17500

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:

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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
NOON	- 16.000000	0.000000	0.000000	0.000000	0.000000	4.000000	0.000000	10.000000	0.000000	1112.00000	0 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
INT)	- 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
CCON	- 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	AÚX	ADJ	NUM	PRON	NOUN	PROPN	PART	INTJ	CCONJ

- 12000

- 10000

- 8000

- 6000

- 4000

- 2000

- 0

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