AHSANULLAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Course No: CSE 4238

Course Name: Soft Computing Lab

Section: C

Semester: Fall 2020

Submitted to:

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Completing Text Classfication Problem using Bidirectional LSTM:

Hyperparameters:

embed_dim = 128

lstm_out = 196

learning rate = 0.001

After Processing the Dataset:

	text	polarity
0	just had a real good moment i missssssssss him...	0
1	is reading manga httpplurkcompmzp1e	0
2	comeagainjen httptwitpiccom2y2lx httpwwwyoutu...	0
3	lapcat need to send em to my accountant tomorr...	0
4	add me on myspace myspacecomlookthunder	0
...	...	...
10309	no depression by g herbo is my mood from now o...	1
10310	what do you do when depression succumbs the br...	1
10311	ketamine nasal spray shows promise against dep...	1
10312	dont mistake a bad day with depression everyon...	1
10313	0	1

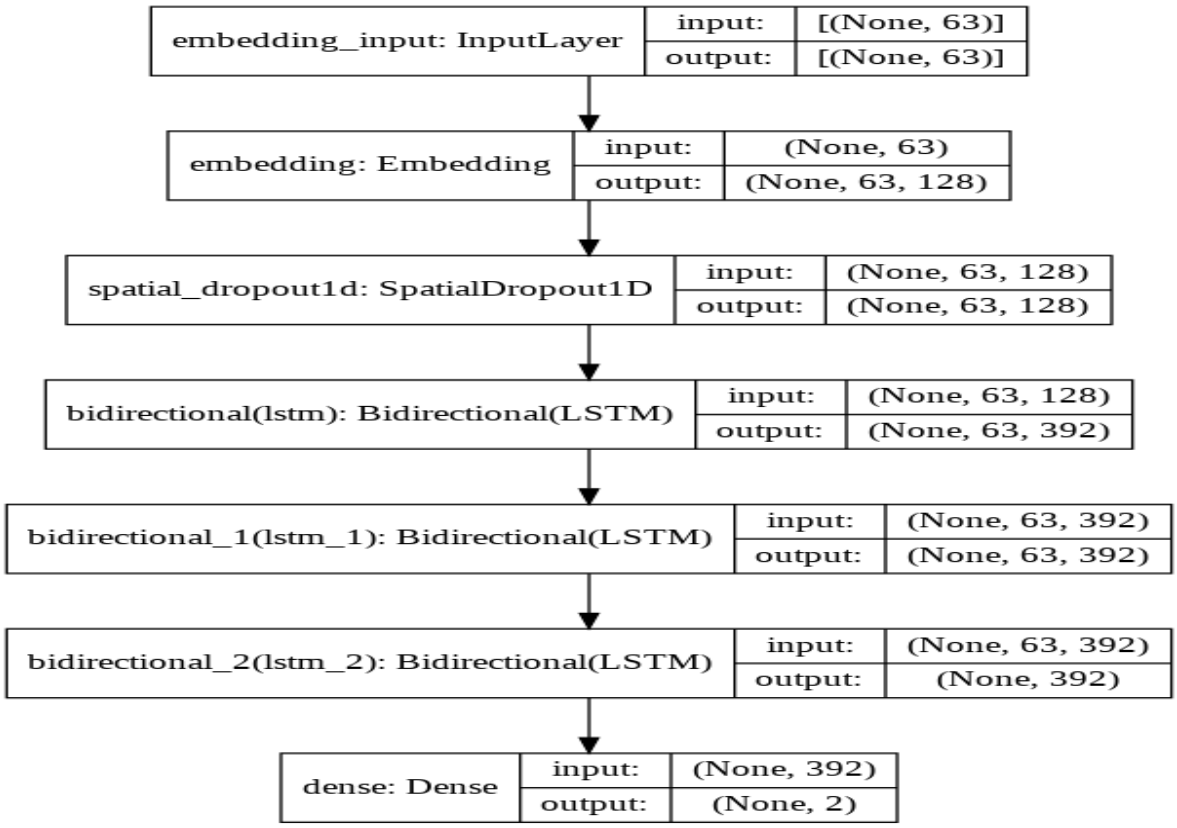
10314 rows × 2 columns

Table of the Sequential Model:

Layer (type)	Output Shape	Param #
embedding (Embedding)	(None, 63, 128)	256000
spatial_dropout1d (SpatialDr	(None, 63, 128)	0
bidirectional (Bidirectional	(None, 63, 392)	509600
bidirectional_1 (Bidirection	(None, 63, 392)	923552
bidirectional_2 (Bidirection	(None, 392)	923552
dense (Dense)	(None, 2)	786

Total params: 2,613,490
Trainable params: 2,613,490
Non-trainable params: 0

Neural Model Architecture:



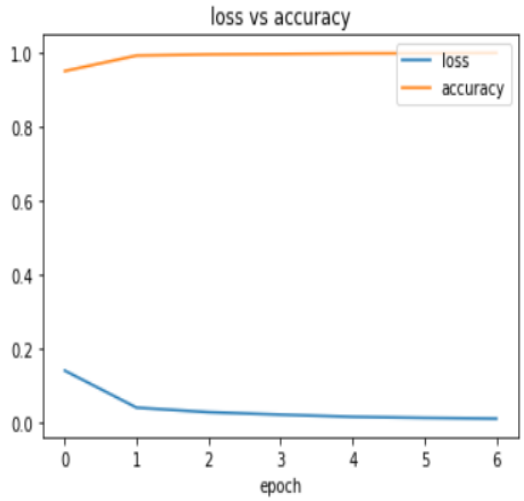
Training Dataset and Performance Evaluation:

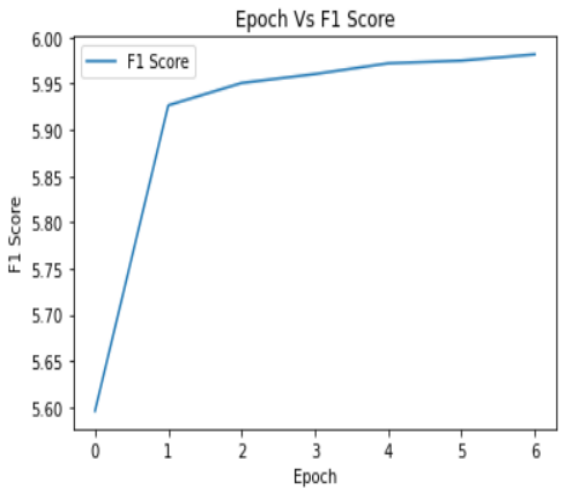
When we take batch_size=32, epochs=7.

Training Dataset:

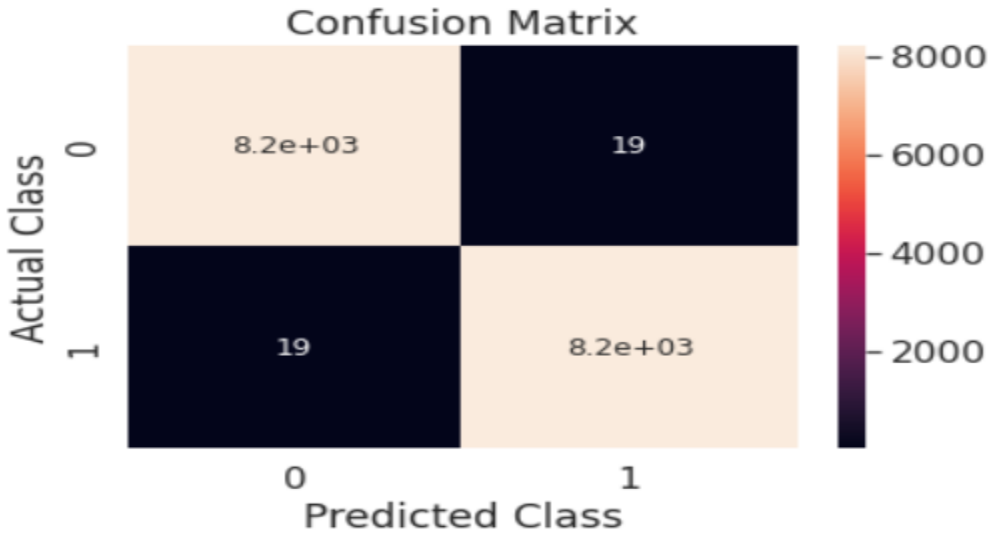
```
Epoch 1/7
258/258 [==============================] - 695s 3s/step - loss: 0.1416 - true_positives: 7829.0000 - true_negatives: 7829.0000 - false_po
sitives: 422.0000 - false_negatives: 422.0000 - accuracy: 0.9489 - precision: 0.9489 - recall: 0.9489
Epoch 2/7
258/258 [==============================] - 691s 3s/step - loss: 0.0416 - true_positives: 8175.0000 - true_negatives: 8175.0000 - false_po
sitives: 76.0000 - false_negatives: 76.0000 - accuracy: 0.9908 - precision: 0.9908 - recall: 0.9908
Epoch 3/7
258/258 [==============================] - 684s 3s/step - loss: 0.0294 - true_positives: 8200.0000 - true_negatives: 8200.0000 - false_po
sitives: 51.0000 - false_negatives: 51.0000 - accuracy: 0.9938 - precision: 0.9938 - recall: 0.9938
Epoch 4/7
258/258 [==============================] - 677s 3s/step - loss: 0.0227 - true_positives: 8210.0000 - true_negatives: 8210.0000 - false_po
sitives: 41.0000 - false_negatives: 41.0000 - accuracy: 0.9950 - precision: 0.9950 - recall: 0.9950
Epoch 5/7
258/258 [==============================] - 674s 3s/step - loss: 0.0169 - true_positives: 8222.0000 - true_negatives: 8222.0000 - false_po
sitives: 29.0000 - false_negatives: 29.0000 - accuracy: 0.9965 - precision: 0.9965 - recall: 0.9965
Epoch 6/7
258/258 [==============================] - 671s 3s/step - loss: 0.0140 - true_positives: 8225.0000 - true_negatives: 8225.0000 - false_po
sitives: 26.0000 - false_negatives: 26.0000 - accuracy: 0.9968 - precision: 0.9968 - recall: 0.9968
Epoch 7/7
258/258 [==============================] - 662s 3s/step - loss: 0.0122 - true_positives: 8232.0000 - true_negatives: 8232.0000 - false_po
sitives: 19.0000 - false_negatives: 19.0000 - accuracy: 0.9977 - precision: 0.9977 - recall: 0.9977
```

Performance Evaluation:





Confusion Matrix:



Test Data Accuracy:

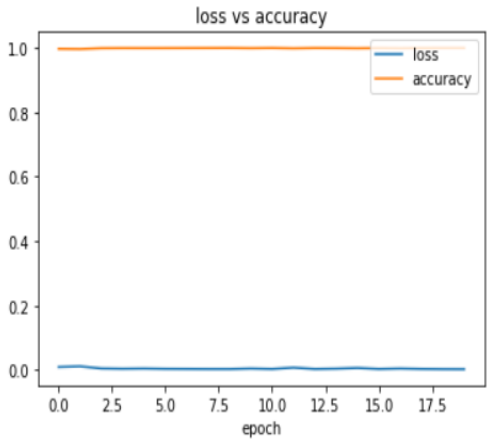
```
Epoch 1/7
65/65 [==============================] - 115s 2s/step - loss: 0.3484 - true_positives: 1771.0000 - true_negatives: 1771.0000 - false_posi
tives: 292.0000 - false_negatives: 292.0000 - accuracy: 0.8585 - precision: 0.8585 - recall: 0.8585
Epoch 2/7
65/65 [==============================] - 105s 2s/step - loss: 0.0424 - true_positives: 2044.0000 - true_negatives: 2044.0000 - false_posi
tives: 19.0000 - false_negatives: 19.0000 - accuracy: 0.9908 - precision: 0.9908 - recall: 0.9908
Epoch 3/7
65/65 [==============================] - 105s 2s/step - loss: 0.0338 - true_positives: 2048.0000 - true_negatives: 2048.0000 - false_posi
tives: 15.0000 - false_negatives: 15.0000 - accuracy: 0.9927 - precision: 0.9927 - recall: 0.9927
Epoch 4/7
65/65 [==============================] - 105s 2s/step - loss: 0.0199 - true_positives: 2056.0000 - true_negatives: 2056.0000 - false_posi
tives: 7.0000 - false_negatives: 7.0000 - accuracy: 0.9966 - precision: 0.9966 - recall: 0.9966
Epoch 5/7
65/65 [==============================] - 105s 2s/step - loss: 0.0199 - true_positives: 2053.0000 - true_negatives: 2053.0000 - false_posi
tives: 10.0000 - false_negatives: 10.0000 - accuracy: 0.9952 - precision: 0.9952 - recall: 0.9952
Epoch 6/7
65/65 [==============================] - 105s 2s/step - loss: 0.0178 - true_positives: 2055.0000 - true_negatives: 2055.0000 - false_posi
tives: 8.0000 - false_negatives: 8.0000 - accuracy: 0.9961 - precision: 0.9961 - recall: 0.9961
Epoch 7/7
65/65 [==============================] - 105s 2s/step - loss: 0.0112 - true_positives: 2057.0000 - true_negatives: 2057.0000 - false_posi
tives: 6.0000 - false_negatives: 6.0000 - accuracy: 0.9971 - precision: 0.9971 - recall: 0.9971
```

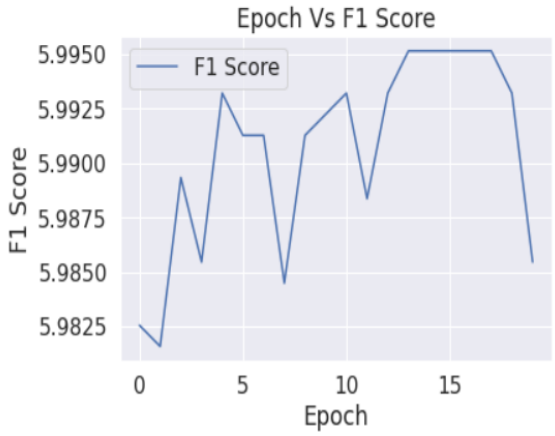
When we take batch_size=30, epochs=20.

Training Dataset:

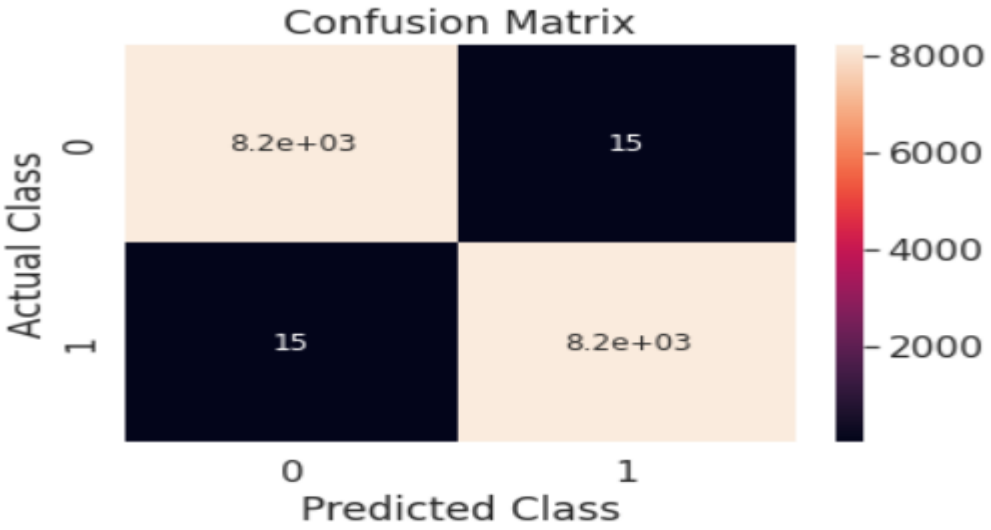
```
Epoch 11/20
276/276 [==============================] - 196s 709ms/step - loss: 0.0033 - true_positives: 8244.0000 - true_negatives: 8244.0000 - false
_positives: 7.0000 - false_negatives: 7.0000 - accuracy: 0.9992 - precision: 0.9992 - recall: 0.9992
Epoch 12/20
276/276 [==============================] - 196s 710ms/step - loss: 0.0038 - true_positives: 8239.0000 - true_negatives: 8239.0000 - false
_positives: 12.0000 - false_negatives: 12.0000 - accuracy: 0.9985 - precision: 0.9985 - recall: 0.9985
Epoch 13/20
276/276 [==============================] - 197s 716ms/step - loss: 0.0029 - true_positives: 8244.0000 - true_negatives: 8244.0000 - false
_positives: 7.0000 - false_negatives: 7.0000 - accuracy: 0.9992 - precision: 0.9992 - recall: 0.9992
Epoch 14/20
276/276 [==============================] - 196s 710ms/step - loss: 0.0028 - true_positives: 8246.0000 - true_negatives: 8246.0000 - false
_positives: 5.0000 - false_negatives: 5.0000 - accuracy: 0.9994 - precision: 0.9994 - recall: 0.9994
Epoch 15/20
276/276 [==============================] - 193s 701ms/step - loss: 0.0026 - true_positives: 8246.0000 - true_negatives: 8246.0000 - false
_positives: 5.0000 - false_negatives: 5.0000 - accuracy: 0.9994 - precision: 0.9994 - recall: 0.9994
Epoch 16/20
276/276 [==============================] - 188s 682ms/step - loss: 0.0023 - true_positives: 8246.0000 - true_negatives: 8246.0000 - false
_positives: 5.0000 - false_negatives: 5.0000 - accuracy: 0.9994 - precision: 0.9994 - recall: 0.9994
Epoch 17/20
276/276 [==============================] - 188s 682ms/step - loss: 0.0025 - true_positives: 8246.0000 - true_negatives: 8246.0000 - false
_positives: 5.0000 - false_negatives: 5.0000 - accuracy: 0.9994 - precision: 0.9994 - recall: 0.9994
Epoch 18/20
276/276 [==============================] - 186s 674ms/step - loss: 0.0025 - true_positives: 8246.0000 - true_negatives: 8246.0000 - false
_positives: 5.0000 - false_negatives: 5.0000 - accuracy: 0.9994 - precision: 0.9994 - recall: 0.9994
Epoch 19/20
276/276 [==============================] - 188s 682ms/step - loss: 0.0032 - true_positives: 8244.0000 - true_negatives: 8244.0000 - false
_positives: 7.0000 - false_negatives: 7.0000 - accuracy: 0.9992 - precision: 0.9992 - recall: 0.9992
Epoch 20/20
276/276 [==============================] - 188s 681ms/step - loss: 0.0082 - true_positives: 8236.0000 - true_negatives: 8236.0000 - false
_positives: 15.0000 - false_negatives: 15.0000 - accuracy: 0.9982 - precision: 0.9982 - recall: 0.9982
```

Performance Evaluation:





Confusion Matrix:



In above, I trained and tested my dataset on dataset 2 using Bidirectional LSTM. For Performance Evaluation, I showed **loss vs accuracy** graph, **Epoch vs F1 Score** graph and **Confusion matrix**. For Performance comparison and model accuracy comparison ,I used multiple epoch , batch-size and applied in the google colab.

Github code links:

Experimenting using dataset 2:

https://github.com/Rakesh6430/Softcom-Lab-Codes/blob/main/Assignment%203/170104130_Softcom_Assignment3.ipynb