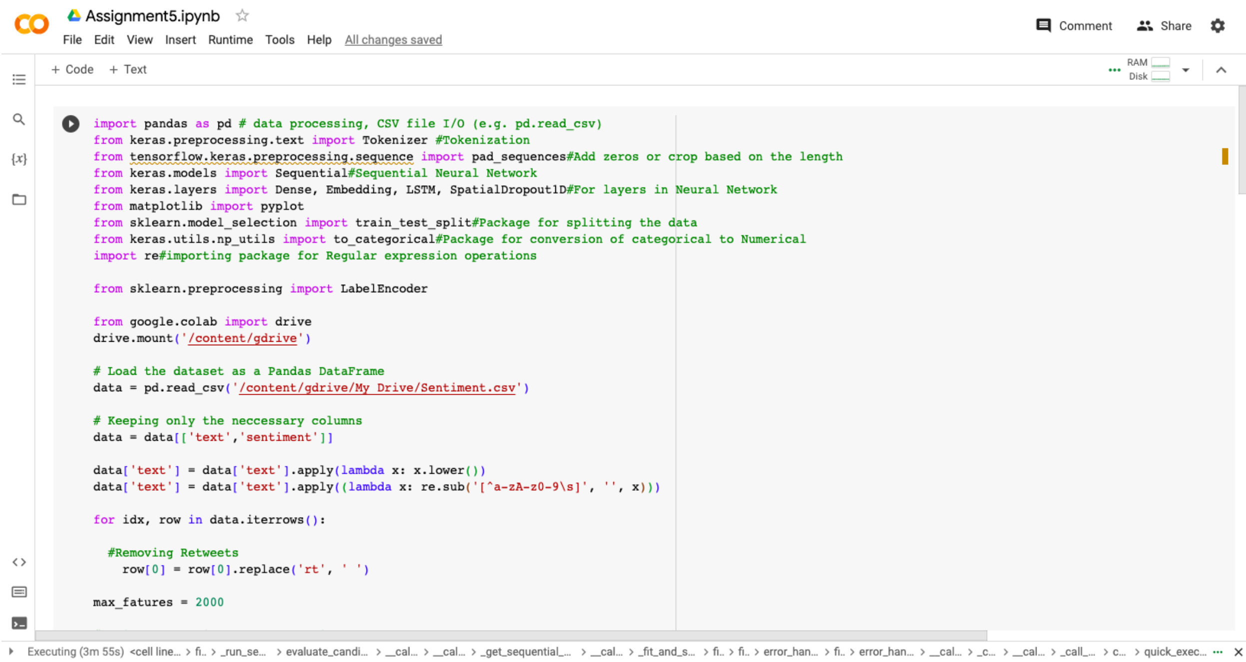
NN&DeepLearning_ICP10: LSTM

In class programming:

1. Save the model and use the saved model to predict on new text data (ex, “A lot of good things are happening. We are respected again throughout the world, and that's a great thing.@realDonaldTrump”)

Ans:

Running the provided code SentimentAnalysis.py and the output is :



```
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)
from keras.preprocessing.text import Tokenizer #Tokenization
from tensorflow.keras.preprocessing.sequence import pad_sequences#Add zeros or crop based on the length
from keras.models import Sequential#Sequential Neural Network
from keras.layers import Dense, Embedding, LSTM, SpatialDropout1D#For layers in Neural Network
from matplotlib import pyplot
from sklearn.model_selection import train_test_split#Package for splitting the data
from keras.utils.np_utils import to_categorical#Package for conversion of categorical to Numerical
import re#importing package for Regular expression operations

from sklearn.preprocessing import LabelEncoder

from google.colab import drive
drive.mount('/content/gdrive')

# Load the dataset as a Pandas DataFrame
data = pd.read_csv('/content/gdrive/My Drive/Sentiment.csv')

# Keeping only the neccessary columns
data = data[['text','sentiment']]

data['text'] = data['text'].apply(lambda x: x.lower())
data['text'] = data['text'].apply((lambda x: re.sub('[^a-zA-z0-9\s]', '', x)))

for idx, row in data.iterrows():

  #Removing Retweets
    row[0] = row[0].replace('rt', ' ')

max_fatures = 2000
```

```python
max_fatures = 2000

#Maximum words is 2000 to tokenize sentence
tokenizer = Tokenizer(num_words=max_fatures, split=' ')
tokenizer.fit_on_texts(data['text'].values)

#taking values to feature matrix
X = tokenizer.texts_to_sequences(data['text'].values)

#Padding the feature matrix
X = pad_sequences(X)

embed_dim = 128#Dimension of the Embedded layer
lstm_out = 196#Long short-term memory (LSTM) layer neurons

def createmodel():
    model = Sequential()#Sequential Neural Network
    model.add(Embedding(max_fatures, embed_dim,input_length = X.shape[1]))#input dimension 2000 Neurons, output
    model.add(LSTM(lstm_out, dropout=0.2, recurrent_dropout=0.2))#Drop out 20%, 196 output Neurons, recurrent dropout
    model.add(Dense(3,activation='softmax'))#3 output neurons[positive, Neutral, Negative], softmax as activation
    model.compile(loss = 'categorical_crossentropy', optimizer='adam',metrics = ['accuracy'])#Compiling the model
    return model
# print(model.summary())

labelencoder = LabelEncoder()#Applying label Encoding on the label matrix
integer_encoded = labelencoder.fit_transform(data['sentiment'])#fitting the model
y = to_categorical(integer_encoded)
X_train, X_test, Y_train, Y_test = train_test_split(X,y, test_size = 0.33, random_state = 42)

batch_size = 32
model = createmodel()#Function call to Sequential Neural Network
model.fit(X_train, Y_train, epochs = 1, batch_size=batch_size, verbose = 2)
score,acc = model.evaluate(X_test,Y_test,verbose=2,batch_size=batch_size) #evaluating the model
```

Executing (4m 25s) <cell line: 12> > fit() > _run_search() > evaluate_candidates() > __call__() > __call__() > _get_sequential_output() > __call__() > _fit_and_score() > fit() > fit() > error_handler()

```python
batch_size = 32
model = createmodel()#Function call to Sequential Neural Network
model.fit(X_train, Y_train, epochs = 1, batch_size=batch_size, verbose = 2)
score,acc = model.evaluate(X_test,Y_test,verbose=2,batch_size=batch_size) #evaluating the model
print(score)
print(acc)
print(model.metrics_names)#metrics of the model
```

```
Drive already mounted at /content/gdrive; to attempt to forcibly remount, call drive.mount("/content/gdrive", force_remount=True).
291/291 - 52s - loss: 0.8245 - accuracy: 0.6449 - 52s/epoch - 179ms/step
144/144 - 3s - loss: 0.7550 - accuracy: 0.6765 - 3s/epoch - 21ms/step
0.7550472021102905
0.6764962673187256
['loss', 'accuracy']
```

#1. Saving the model and using it to predict on new text data (ex, “A lot of good things are happening. We are respected again throughout the world, and that's a great thing.@realDonaldTrump”) and the output is:

```python
#1. Save the model and use the saved model to predict on new text data (ex, “A lot of good things are happening. We are respected again throughout the world

model.save('sentimentAnalysis.h5') #Saving the model
from keras.models import load_model #Importing the package for importing the saved model
model= load_model('sentimentAnalysis.h5') #loading the saved model

print(integer_encoded)
print(data['sentiment'])
```

```
[1 2 1 ... 2 0 2]
0         Neutral
1        Positive
2         Neutral
3        Positive
4        Positive
           ...
13866    Negative
13867    Positive
13868    Positive
13869    Negative
13870    Positive
Name: sentiment, Length: 13871, dtype: object
```

Predicting on the test data

```python
# Predicting on the text data

import numpy as np
sentence = ['A lot of good things are happening. We are respected again throughout the world, and that is a great thing.@realDonaldTrump']
sentence = tokenizer.texts_to_sequences(sentence) # Tokenizing the sentence
sentence = pad_sequences(sentence, maxlen=28, dtype='int32', value=0) # Padding the sentence
sentiment_probs = model.predict(sentence, batch_size=1, verbose=2)[0] # Predicting the sentence text
sentiment = np.argmax(sentiment_probs)

print(sentiment_probs)
if sentiment == 0:
    print("Neutral")
elif sentiment < 0:
    print("Negative")
elif sentiment > 0:
    print("Positive")
else:
    print("Cannot be determined")
```

```
1/1 - 0s - 107ms/epoch - 107ms/step
[0.6263405  0.16177209 0.2118874 ]
Neutral
```

2. Apply GridSearchCV on the source code provided in the class

Ans:

```python
#2. Apply GridSearchCV on the source code provided in the class

from keras.wrappers.scikit_learn import KerasClassifier #importing Keras classifier
from sklearn.model_selection import GridSearchCV #importing Grid search CV

model = KerasClassifier(build_fn=createmodel,verbose=2) #initiating model to test performance by applying multiple hyper parameters
batch_size= [10, 20, 40] #hyper parameter batch_size
epochs = [1, 2] #hyper parameter no. of epochs
param_grid= {'batch_size':batch_size, 'epochs':epochs} #creating dictionary for batch size, no. of epochs
grid  = GridSearchCV(estimator=model, param_grid=param_grid) #Applying dictionary with hyper parameters

grid_result= grid.fit(X_train,Y_train) #Fitting the model

# summarize results
print("Best: %f using %s" % (grid_result.best_score_, grid_result.best_params_)) #best score, best hyper parameters
```

Output:

Assignment5.ipynb

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```
<ipython-input-10-7e316dc5024d>:6: DeprecationWarning: KerasClassifier is deprecated, use Sci-Keras (https://github.com/adriangb/scikeras) instead. See https
  model = KerasClassifier(build_fn=createmodel,verbose=2) #initiating model to test performance by applying multiple hyper parameters
744/744 - 106s - loss: 0.8242 - accuracy: 0.6503 - 106s/epoch - 142ms/step
186/186 - 3s - loss: 0.7687 - accuracy: 0.6654 - 3s/epoch - 18ms/step
744/744 - 103s - loss: 0.8196 - accuracy: 0.6476 - 103s/epoch - 139ms/step
186/186 - 3s - loss: 0.7717 - accuracy: 0.6767 - 3s/epoch - 17ms/step
744/744 - 102s - loss: 0.8247 - accuracy: 0.6458 - 102s/epoch - 137ms/step
186/186 - 3s - loss: 0.7555 - accuracy: 0.6789 - 3s/epoch - 15ms/step
744/744 - 104s - loss: 0.8249 - accuracy: 0.6445 - 104s/epoch - 140ms/step
186/186 - 3s - loss: 0.7552 - accuracy: 0.6765 - 3s/epoch - 15ms/step
744/744 - 104s - loss: 0.8185 - accuracy: 0.6464 - 104s/epoch - 140ms/step
186/186 - 3s - loss: 0.7675 - accuracy: 0.6712 - 3s/epoch - 15ms/step
Epoch 1/2
744/744 - 103s - loss: 0.8267 - accuracy: 0.6504 - 103s/epoch - 139ms/step
Epoch 2/2
744/744 - 101s - loss: 0.6804 - accuracy: 0.7139 - 101s/epoch - 136ms/step
186/186 - 3s - loss: 0.7677 - accuracy: 0.6885 - 3s/epoch - 15ms/step
Epoch 1/2
744/744 - 103s - loss: 0.8183 - accuracy: 0.6427 - 103s/epoch - 139ms/step
Epoch 2/2
744/744 - 99s - loss: 0.6746 - accuracy: 0.7101 - 99s/epoch - 133ms/step
186/186 - 3s - loss: 0.7454 - accuracy: 0.6724 - 3s/epoch - 14ms/step
Epoch 1/2
744/744 - 104s - loss: 0.8223 - accuracy: 0.6473 - 104s/epoch - 140ms/step
Epoch 2/2
744/744 - 99s - loss: 0.6802 - accuracy: 0.7139 - 99s/epoch - 133ms/step
186/186 - 4s - loss: 0.7583 - accuracy: 0.6783 - 4s/epoch - 24ms/step
Epoch 1/2
744/744 - 102s - loss: 0.8254 - accuracy: 0.6437 - 102s/epoch - 137ms/step
Epoch 2/2
744/744 - 99s - loss: 0.6748 - accuracy: 0.7139 - 99s/epoch - 132ms/step
186/186 - 3s - loss: 0.7467 - accuracy: 0.6830 - 3s/epoch - 15ms/step
Epoch 1/2
744/744 - 102s - loss: 0.8176 - accuracy: 0.6436 - 102s/epoch - 137ms/step
Epoch 2/2
744/744 - 98s - loss: 0.6675 - accuracy: 0.7186 - 98s/epoch - 132ms/step
```

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Assignment5.ipynb

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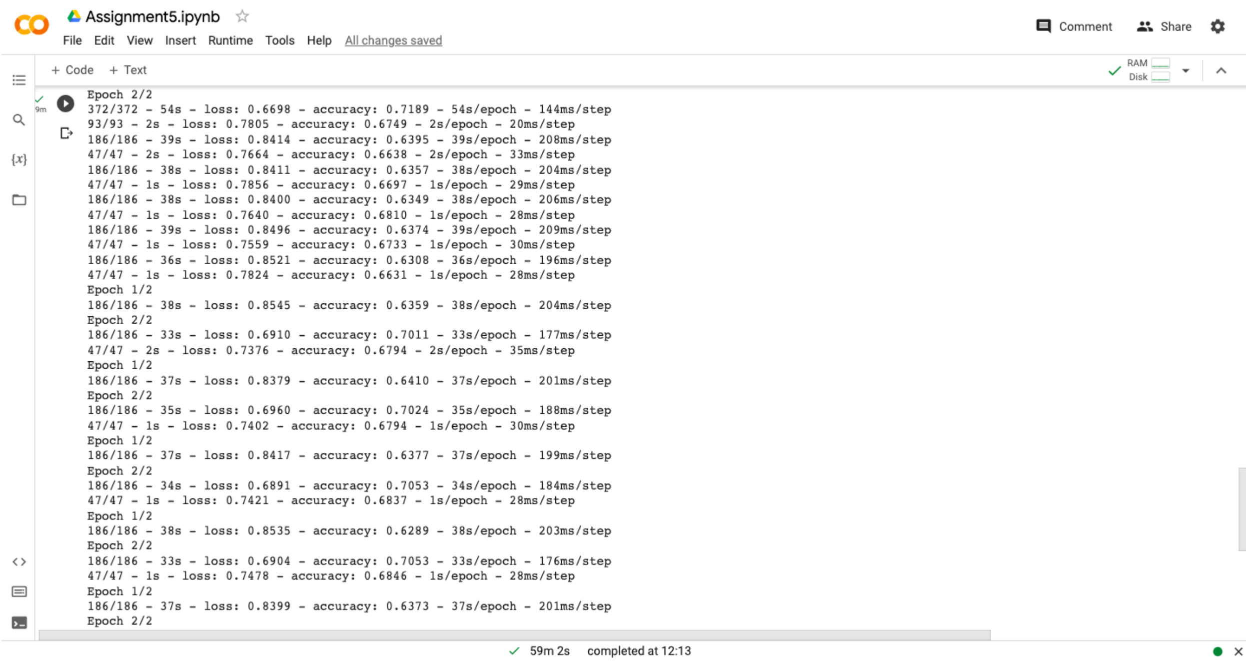
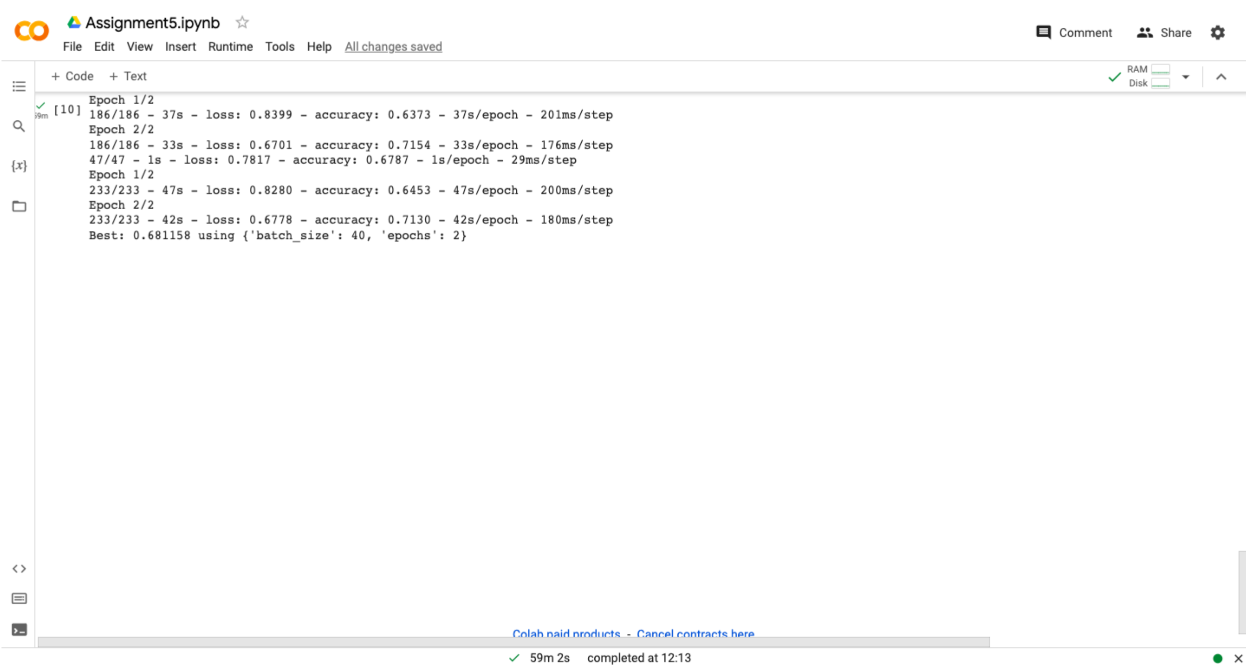
```
Epoch 2/2
744/744 - 98s - loss: 0.6675 - accuracy: 0.7186 - 98s/epoch - 132ms/step
186/186 - 3s - loss: 0.7822 - accuracy: 0.6679 - 3s/epoch - 14ms/step
372/372 - 58s - loss: 0.8363 - accuracy: 0.6457 - 58s/epoch - 156ms/step
93/93 - 2s - loss: 0.7821 - accuracy: 0.6751 - 2s/epoch - 20ms/step
372/372 - 60s - loss: 0.8313 - accuracy: 0.6451 - 60s/epoch - 162ms/step
93/93 - 2s - loss: 0.7537 - accuracy: 0.6740 - 2s/epoch - 24ms/step
372/372 - 62s - loss: 0.8323 - accuracy: 0.6407 - 62s/epoch - 166ms/step
93/93 - 2s - loss: 0.7546 - accuracy: 0.6902 - 2s/epoch - 21ms/step
372/372 - 60s - loss: 0.8351 - accuracy: 0.6399 - 60s/epoch - 162ms/step
93/93 - 2s - loss: 0.7620 - accuracy: 0.6679 - 2s/epoch - 21ms/step
372/372 - 59s - loss: 0.8299 - accuracy: 0.6447 - 59s/epoch - 160ms/step
93/93 - 2s - loss: 0.7785 - accuracy: 0.6604 - 2s/epoch - 20ms/step
Epoch 1/2
372/372 - 59s - loss: 0.8354 - accuracy: 0.6414 - 59s/epoch - 159ms/step
Epoch 2/2
372/372 - 55s - loss: 0.6815 - accuracy: 0.7104 - 55s/epoch - 147ms/step
93/93 - 2s - loss: 0.7310 - accuracy: 0.6740 - 2s/epoch - 19ms/step
Epoch 1/2
372/372 - 58s - loss: 0.8307 - accuracy: 0.6384 - 58s/epoch - 156ms/step
Epoch 2/2
372/372 - 55s - loss: 0.6830 - accuracy: 0.7140 - 55s/epoch - 149ms/step
93/93 - 2s - loss: 0.7280 - accuracy: 0.6923 - 2s/epoch - 19ms/step
Epoch 1/2
372/372 - 59s - loss: 0.8267 - accuracy: 0.6476 - 59s/epoch - 158ms/step
Epoch 2/2
372/372 - 55s - loss: 0.6776 - accuracy: 0.7125 - 55s/epoch - 148ms/step
93/93 - 3s - loss: 0.7528 - accuracy: 0.6842 - 3s/epoch - 33ms/step
Epoch 1/2
372/372 - 58s - loss: 0.8360 - accuracy: 0.6432 - 58s/epoch - 157ms/step
Epoch 2/2
372/372 - 55s - loss: 0.6799 - accuracy: 0.7119 - 55s/epoch - 147ms/step
93/93 - 2s - loss: 0.7390 - accuracy: 0.6787 - 2s/epoch - 20ms/step
Epoch 1/2
372/372 - 59s - loss: 0.8336 - accuracy: 0.6410 - 59s/epoch - 159ms/step
Epoch 2/2
```

✓ 59m 2s completed at 12:13





Github link:

https://github.com/LahariKollipara/NNDL_Assignment5