NEURAL NETWORKS AND DEPP LEARNING ICP-6

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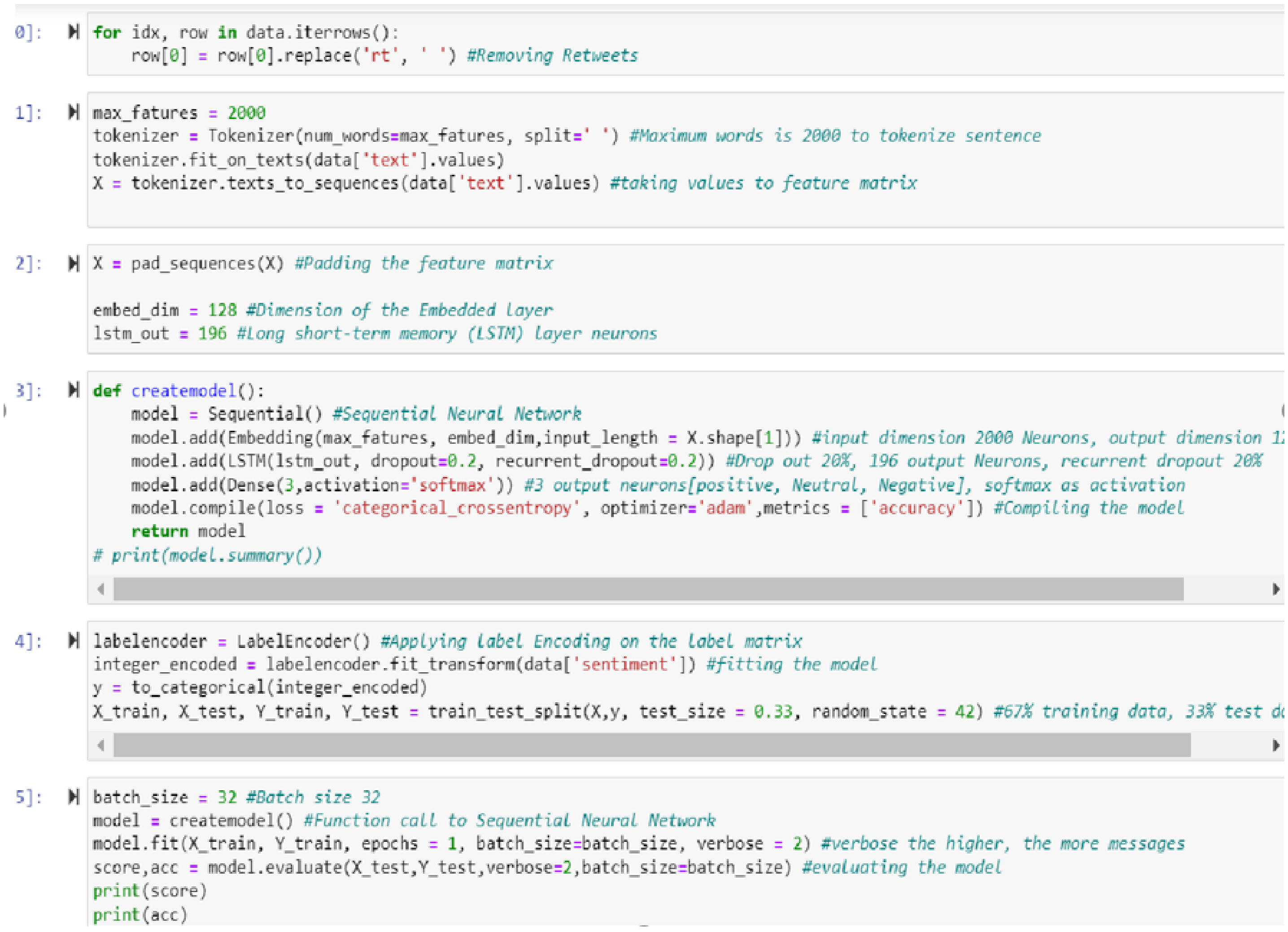
GitHub link: https://github.com/Manesh1712/ICP6

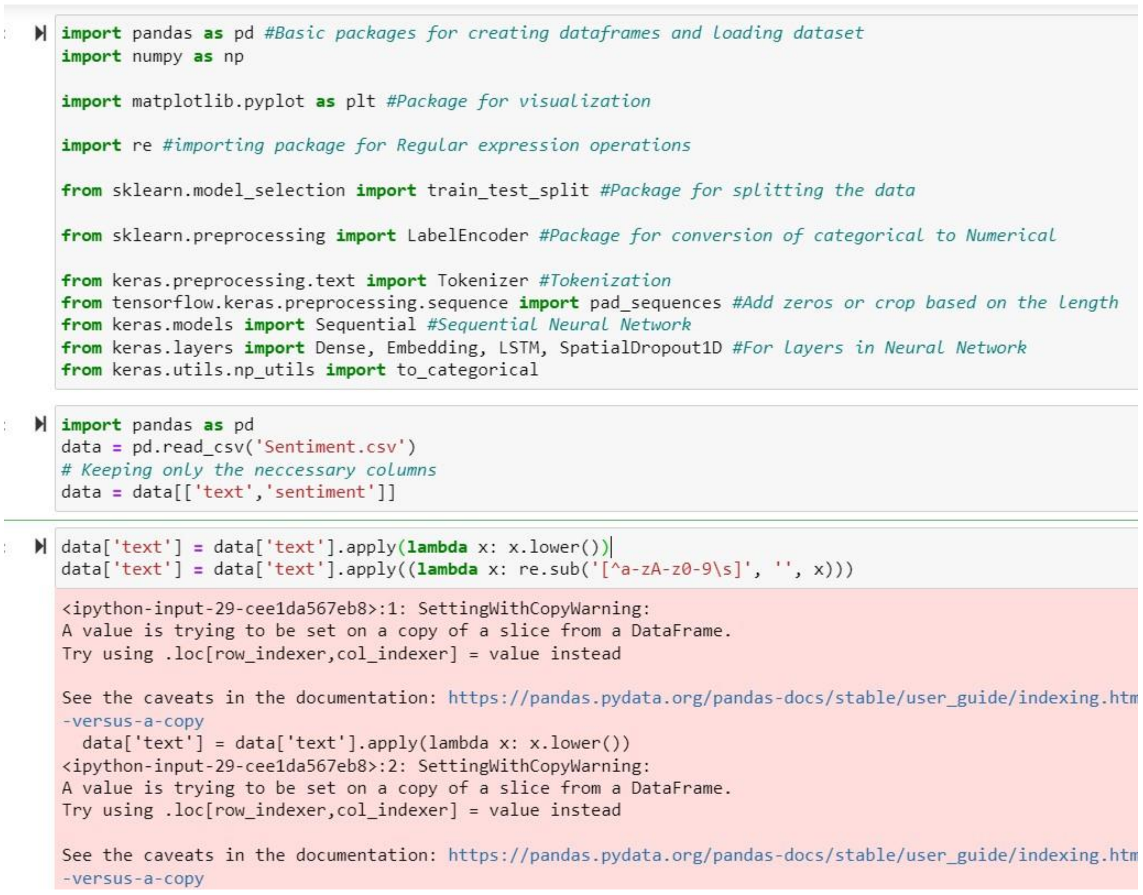
Video Link:
https://drive.google.com/file/d/1Bk_MlFiJE7rYK5qJO6vcBdNfLrLBxtx2/view?usp=sharing

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")



```
0]:  for idx, row in data.iterrows():
         row[0] = row[0].replace('rt', ' ') #Removing Retweets

1]:  max_fatures = 2000
     tokenizer = Tokenizer(num_words=max_fatures, split=' ') #Maximum words is 2000 to tokenize sentence
     tokenizer.fit_on_texts(data['text'].values)
     X = tokenizer.texts_to_sequences(data['text'].values) #taking values to feature matrix

2]:  X = pad_sequences(X) #Padding the feature matrix

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

3]:  def createmodel():
         model = Sequential() #Sequential Neural Network
         model.add(Embedding(max_fatures, embed_dim,input_length = X.shape[1])) #input dimension 2000 Neurons, output dimension 12
         model.add(LSTM(lstm_out, dropout=0.2, recurrent_dropout=0.2)) #Drop out 20%, 196 output Neurons, recurrent dropout 20%
         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())

4]:  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) #67% training data, 33% test da

5]:  batch_size = 32 #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) #verbose the higher, the more messages
     score,acc = model.evaluate(X_test,Y_test,verbose=2,batch_size=batch_size) #evaluating the model
     print(score)
     print(acc)
```

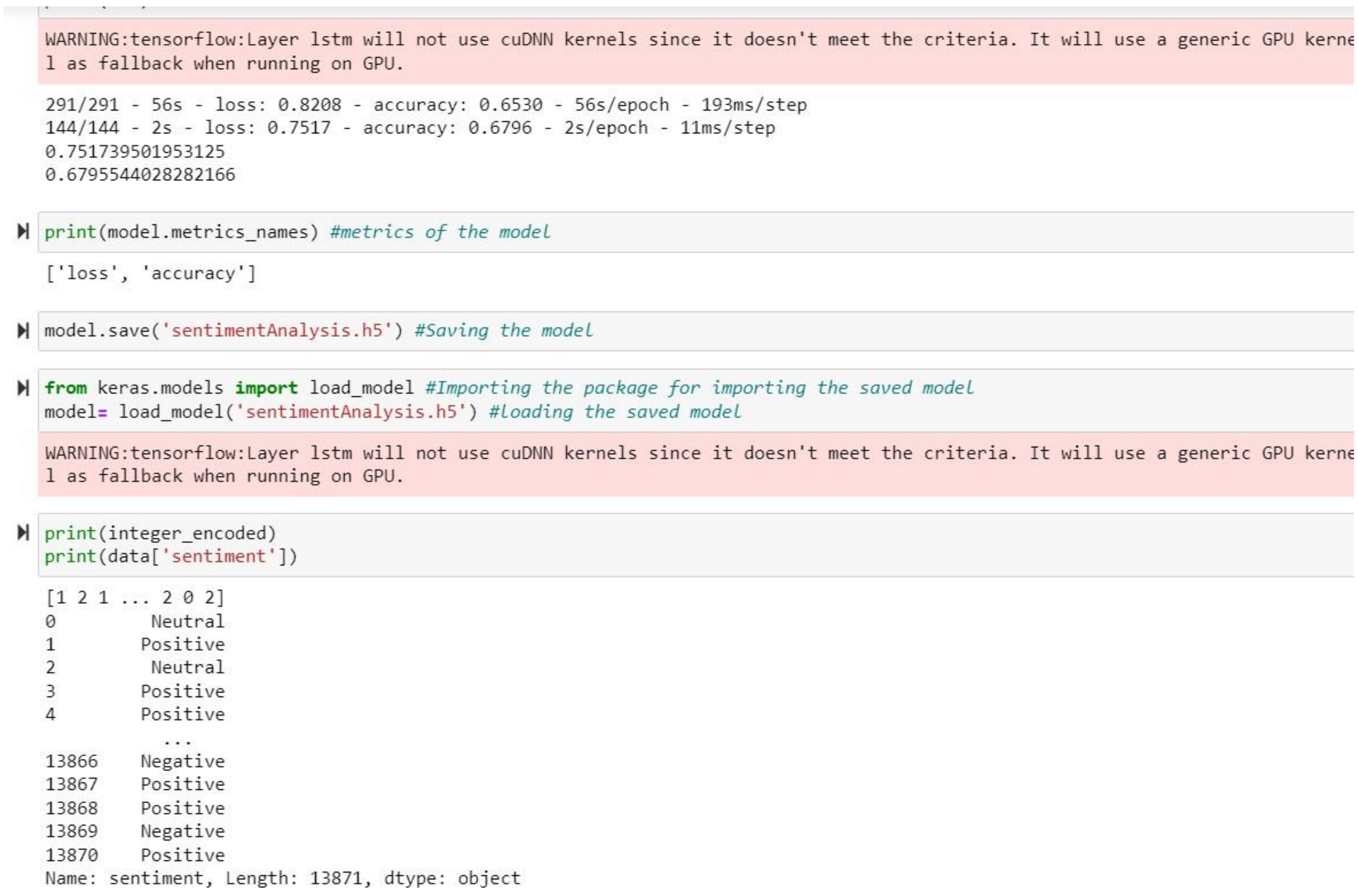


```python
import pandas as pd #Basic packages for creating dataframes and loading dataset
import numpy as np

import matplotlib.pyplot as plt #Package for visualization

import re #importing package for Regular expression operations

from sklearn.model_selection import train_test_split #Package for splitting the data

from sklearn.preprocessing import LabelEncoder #Package for conversion of categorical to Numerical

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 keras.utils.np_utils import to_categorical
```

```python
import pandas as pd
data = pd.read_csv('Sentiment.csv')
# Keeping only the neccessary columns
data = data[['text','sentiment']]
```

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

```
<ipython-input-29-cee1da567eb8>:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.htm
-versus-a-copy
  data['text'] = data['text'].apply(lambda x: x.lower())
<ipython-input-29-cee1da567eb8>:2: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.htm
-versus-a-copy
```



```
WARNING:tensorflow:Layer lstm will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU kerne
l as fallback when running on GPU.
```

```
291/291 - 56s - loss: 0.8208 - accuracy: 0.6530 - 56s/epoch - 193ms/step
144/144 - 2s - loss: 0.7517 - accuracy: 0.6796 - 2s/epoch - 11ms/step
0.751739501953125
0.6795544028282166
```

```python
print(model.metrics_names) #metrics of the model
```

```
['loss', 'accuracy']
```

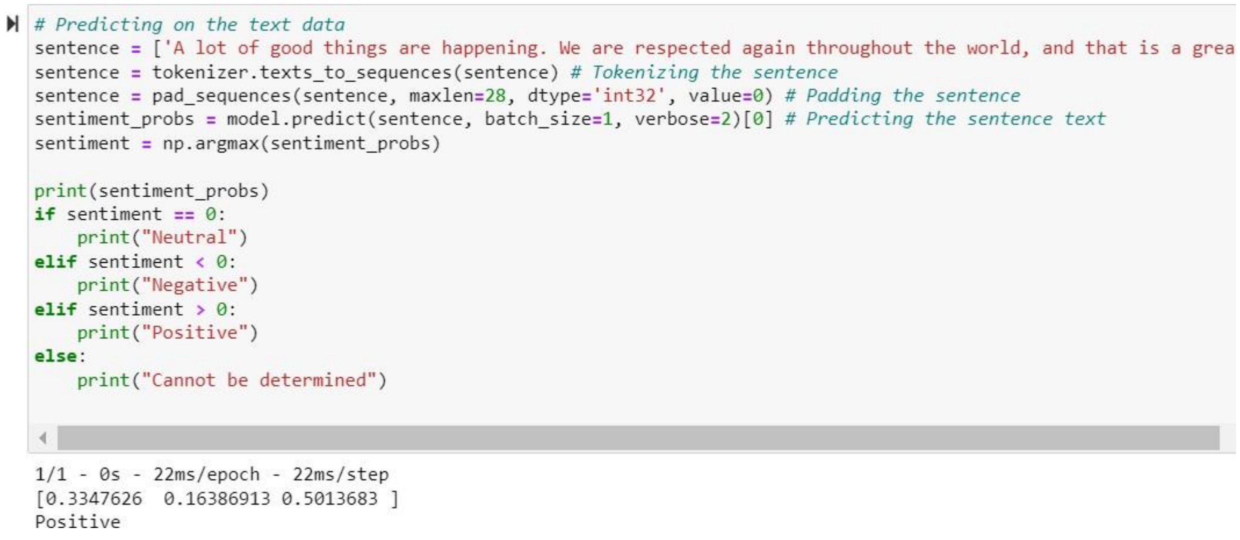
```python
model.save('sentimentAnalysis.h5') #Saving the model
```

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

```
WARNING:tensorflow:Layer lstm will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU kerne
l as fallback when running on GPU.
```

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

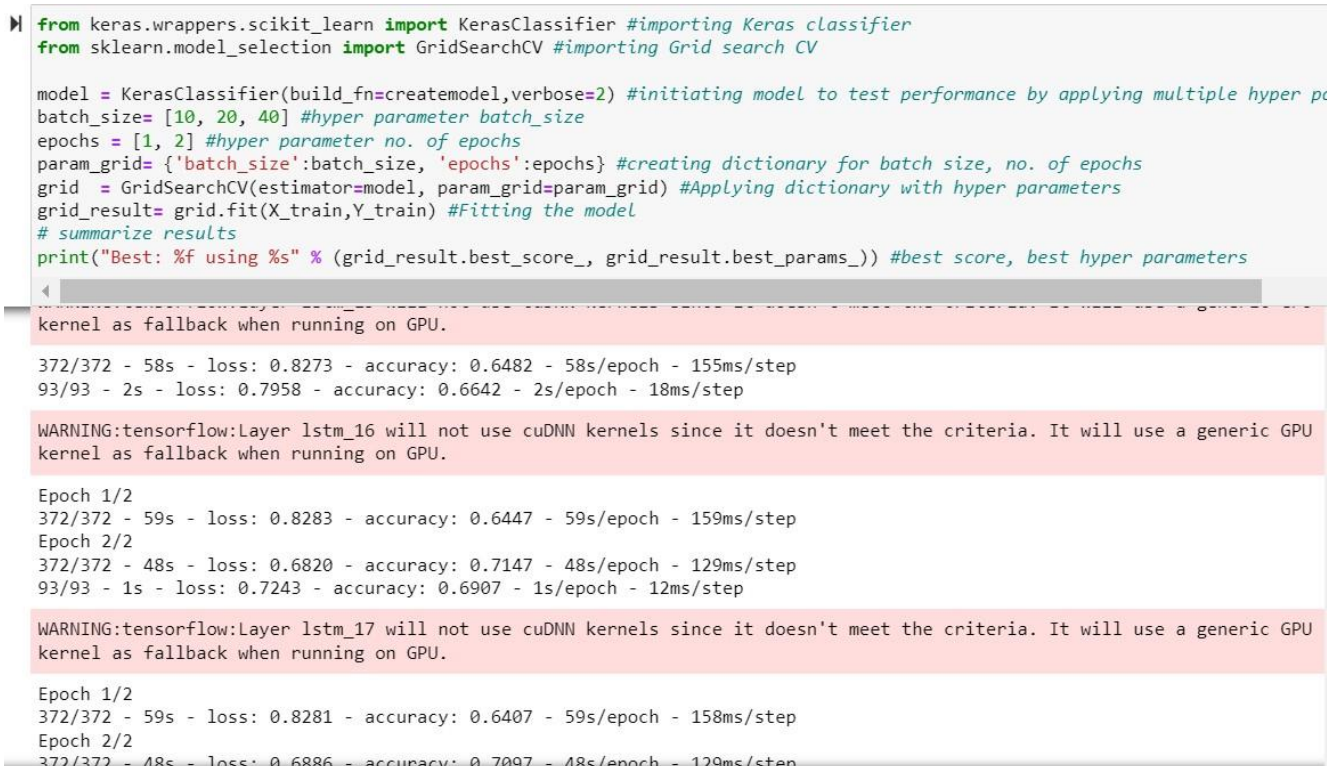
```
[1 2 1 ... 2 0 2]
0         Neutral
1        Positive
2         Neutral
3        Positive
4        Positive
           ...
13866    Negative
13867    Positive
13868    Positive
13869    Negative
13870    Positive
Name: sentiment, Length: 13871, dtype: object
```



```python
# Predicting on the text data
sentence = ['A lot of good things are happening. We are respected again throughout the world, and that is a grea
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")
```

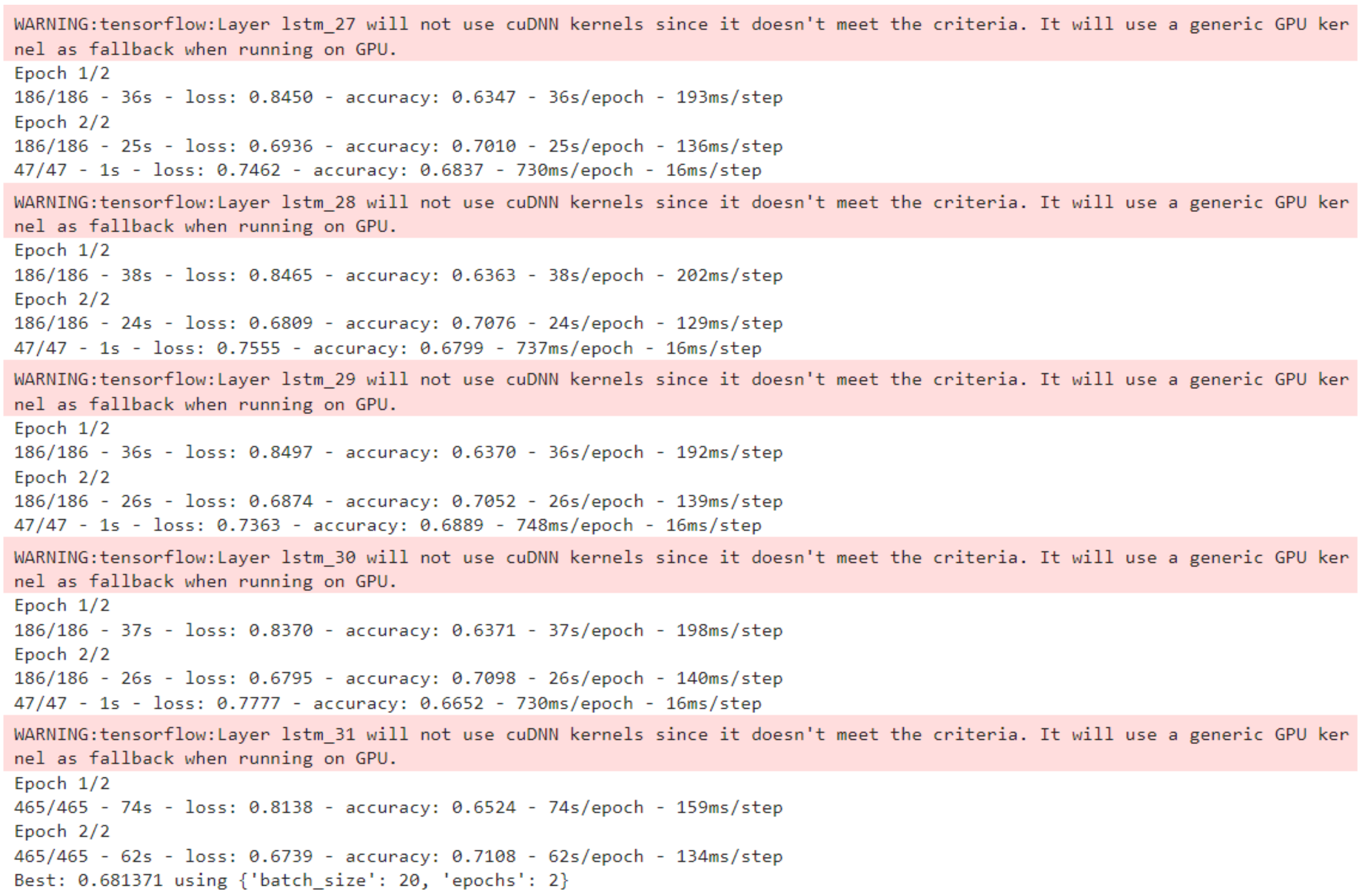
```
1/1 - 0s - 22ms/epoch - 22ms/step
[0.3347626  0.16386913 0.5013683 ]
Positive
```

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 p
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
```

```
kernel as fallback when running on GPU.

372/372 - 58s - loss: 0.8273 - accuracy: 0.6482 - 58s/epoch - 155ms/step
93/93 - 2s - loss: 0.7958 - accuracy: 0.6642 - 2s/epoch - 18ms/step

WARNING:tensorflow:Layer lstm_16 will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU
kernel as fallback when running on GPU.

Epoch 1/2
372/372 - 59s - loss: 0.8283 - accuracy: 0.6447 - 59s/epoch - 159ms/step
Epoch 2/2
372/372 - 48s - loss: 0.6820 - accuracy: 0.7147 - 48s/epoch - 129ms/step
93/93 - 1s - loss: 0.7243 - accuracy: 0.6907 - 1s/epoch - 12ms/step

WARNING:tensorflow:Layer lstm_17 will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU
kernel as fallback when running on GPU.

Epoch 1/2
372/372 - 59s - loss: 0.8281 - accuracy: 0.6407 - 59s/epoch - 158ms/step
Epoch 2/2
372/372 - 48s - loss: 0.6886 - accuracy: 0.7097 - 48s/epoch - 129ms/step
```



```
WARNING:tensorflow:Layer lstm_27 will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU ker
nel as fallback when running on GPU.
Epoch 1/2
186/186 - 36s - loss: 0.8450 - accuracy: 0.6347 - 36s/epoch - 193ms/step
Epoch 2/2
186/186 - 25s - loss: 0.6936 - accuracy: 0.7010 - 25s/epoch - 136ms/step
47/47 - 1s - loss: 0.7462 - accuracy: 0.6837 - 730ms/epoch - 16ms/step
WARNING:tensorflow:Layer lstm_28 will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU ker
nel as fallback when running on GPU.
Epoch 1/2
186/186 - 38s - loss: 0.8465 - accuracy: 0.6363 - 38s/epoch - 202ms/step
Epoch 2/2
186/186 - 24s - loss: 0.6809 - accuracy: 0.7076 - 24s/epoch - 129ms/step
47/47 - 1s - loss: 0.7555 - accuracy: 0.6799 - 737ms/epoch - 16ms/step
WARNING:tensorflow:Layer lstm_29 will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU ker
nel as fallback when running on GPU.
Epoch 1/2
186/186 - 36s - loss: 0.8497 - accuracy: 0.6370 - 36s/epoch - 192ms/step
Epoch 2/2
186/186 - 26s - loss: 0.6874 - accuracy: 0.7052 - 26s/epoch - 139ms/step
47/47 - 1s - loss: 0.7363 - accuracy: 0.6889 - 748ms/epoch - 16ms/step
WARNING:tensorflow:Layer lstm_30 will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU ker
nel as fallback when running on GPU.
Epoch 1/2
186/186 - 37s - loss: 0.8370 - accuracy: 0.6371 - 37s/epoch - 198ms/step
Epoch 2/2
186/186 - 26s - loss: 0.6795 - accuracy: 0.7098 - 26s/epoch - 140ms/step
47/47 - 1s - loss: 0.7777 - accuracy: 0.6652 - 730ms/epoch - 16ms/step
WARNING:tensorflow:Layer lstm_31 will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU ker
nel as fallback when running on GPU.
Epoch 1/2
465/465 - 74s - loss: 0.8138 - accuracy: 0.6524 - 74s/epoch - 159ms/step
Epoch 2/2
465/465 - 62s - loss: 0.6739 - accuracy: 0.7108 - 62s/epoch - 134ms/step
Best: 0.681371 using {'batch_size': 20, 'epochs': 2}
```