Assignment - 4
LSTM for Text Classification

Assignment submission	4 November 2022
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Maximum Marks	2 Marks

1. Download the Dataset 2. Import required library import pandas as pd

import numpy as np import matplotlib.pyplot as plt import seaborn as sns from

sklearn.model_selection import train_test_split from sklearn.preprocessing

import LabelEncoder from keras.models import Model from keras.layers import

LSTM, Activation, Dense, Dropout, Input, Embedding from keras.optimizers

import RMSprop from keras.preprocessing.text import Tokenizer from

keras.utils import pad_sequences from keras.utils import to_categorical from

keras.callbacks import EarlyStopping

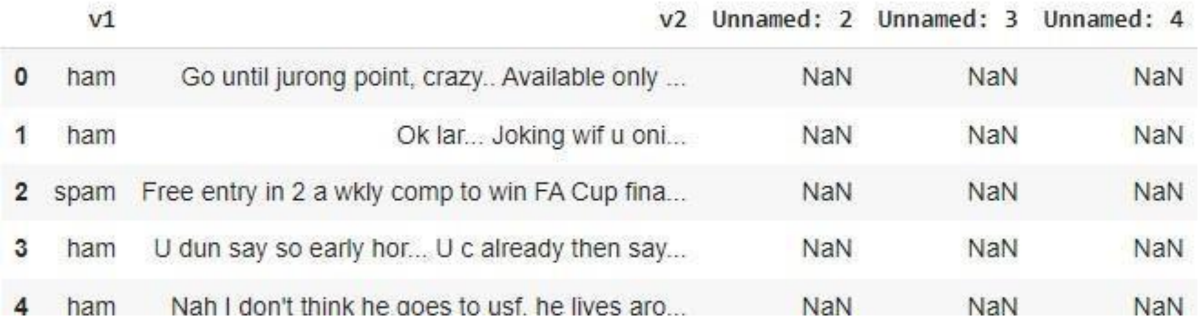
%matplotlib inline

3. Read dataset and do pre-processing Load the data into Pandas

dataframe df =

pd.read_csv('/content/spam.csv',delimiter=',',encoding='latin-1')

df.head()

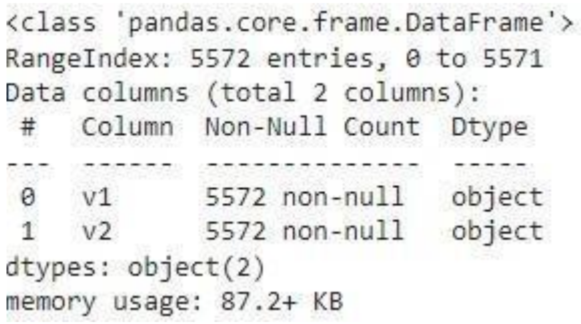


	v1	v2	Unnamed: 2	Unnamed: 3	Unnamed: 4
0	ham	Go until jurong point, crazy.. Available only ...	NaN	NaN	NaN
1	ham	Ok lar... Joking wif u oni...	NaN	NaN	NaN
2	spam	Free entry in 2 a wkly comp to win FA Cup fina...	NaN	NaN	NaN
3	ham	U dun say so early hor... U c already then say...	NaN	NaN	NaN
4	ham	Nah I don't think he goes to usf, he lives aro...	NaN	NaN	NaN

Drop the columns that are not required for the neural network.

df.drop(['Unnamed: 2', 'Unnamed: 3', 'Unnamed: 4'],axis=1,inplace=True)

df.info() pH

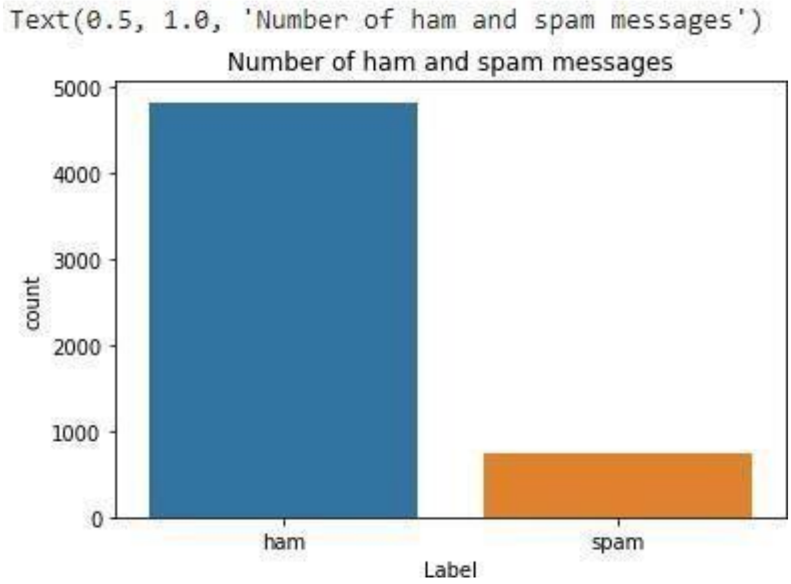


```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5572 entries, 0 to 5571
Data columns (total 2 columns):
 #   Column  Non-Null Count  Dtype 
---  ------  --------------  ----- 
 0   v1      5572 non-null   object
 1   v2      5572 non-null   object
dtypes: object(2)
memory usage: 87.2+ KB
```

Understand the distribution better.

sns.countplot(df.v1) plt.xlabel('Label')

plt.title('Number of ham and spam messages')



```
Text(0.5, 1.0, 'Number of ham and spam messages')
```

- Create input and output vectors.
- Process the labels.

X = df.v2 Y = df.v1 le = LabelEncoder()

Y = le.fit_transform(Y)

Y = Y.reshape(-1,1)

Split into training and test data.

X_train,X_test,Y_train,Y_test = train_test_split(X,Y,test_size=0.15) Process the data

- Tokenize the data and convert the text to sequences.
- Add padding to ensure that all the sequences have the same shape.
- There are many ways of taking the *max_len* and here an arbitrary length of 150 is chosen.

```
max_words = 1000 max_len = 150 tok =
 Tokenizer(num_words=max_words)

 tok.fit_on_texts(X_train)


 sequences = tok.texts_to_sequences(X_train)



 sequences_matrix =pad_sequences(sequences,maxlen=max_len)
```

5. Create Model

● Add Layers (LSTM, Dense-(Hidden Layers), Output)

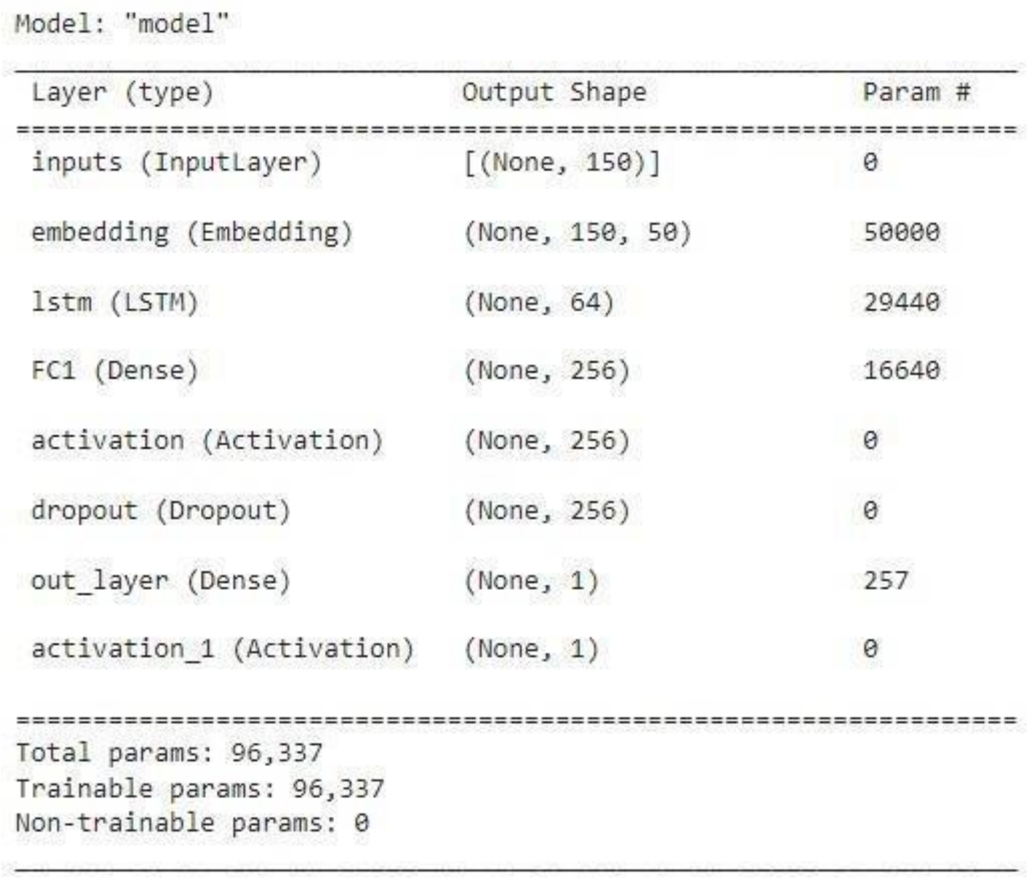
Define the RNN structure. def

```
RNN():

   inputs = Input(name='inputs',shape=[max_len])     layer =

Embedding(max_words,50,input_length=max_len)(inputs)     layer =

LSTM(64)(layer)     layer = Dense(256,name='FC1')(layer)     layer

= Activation('relu')(layer)     layer = Dropout(0.5)(layer)     layer =

Dense(1,name='out_layer')(layer)     layer =

Activation('sigmoid')(layer)  model =

Model(inputs=inputs,outputs=layer)     return model
```

Call the function and compile the model.

model = RNN() model.summary() **6. Compile the Model**

```
model.compile(loss='binary_crossentropy',optimizer=RMSprop(),metrics=['accuracy'])
```

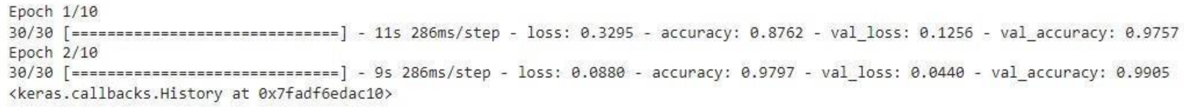


```
Model: "model"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 inputs (InputLayer)         [(None, 150)]             0

 embedding (Embedding)       (None, 150, 50)           50000

 lstm (LSTM)                 (None, 64)                29440

 FC1 (Dense)                 (None, 256)               16640

 activation (Activation)     (None, 256)               0

 dropout (Dropout)           (None, 256)               0

 out_layer (Dense)           (None, 1)                 257

 activation_1 (Activation)   (None, 1)                 0

=================================================================
Total params: 96,337
Trainable params: 96,337
Non-trainable params: 0
_________________________________________________________________
```

7. Fit the Model

model.fit(sequences_matrix,Y_train,batch_size=128,epochs=10,

validation_split=0.2,callbacks=[EarlyStopping(monitor='val_loss',min_delta=0.0001)])



```
Epoch 1/10
30/30 [==============================] - 11s 286ms/step - loss: 0.3295 - accuracy: 0.8762 - val_loss: 0.1256 - val_accuracy: 0.9757
Epoch 2/10
30/30 [==============================] - 9s 286ms/step - loss: 0.0880 - accuracy: 0.9797 - val_loss: 0.0440 - val_accuracy: 0.9905
<keras.callbacks.History at 0x7fadf6edac10>
```

The model performs well on the validation set and this configuration is chosen as the final model.

8. Save The Model lstm_model.save('text_model.h5')

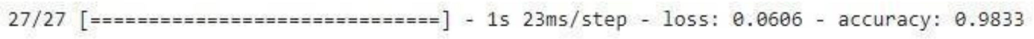
9. Test The Model test_sequences =

tok.texts_to_sequences(X_test) test_sequences_matrix

=pad_sequences(test_sequences,maxlen=max_len)

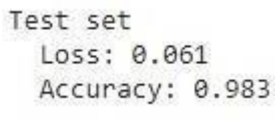
Evaluate the model on the test set.

```
accr = model.evaluate(test_sequences_matrix,Y_test)
```



```
27/27 [==============================] - 1s 23ms/step - loss: 0.0606 - accuracy: 0.9833
```

```
print('Test set\n Loss: {:0.3f}\n Accuracy: {:0.3f}'.format(accr[0],accr[1]))
```



```
Test set
  Loss: 0.061
  Accuracy: 0.983
```