Assignment -4
LSTM for Text Classification

Assignment Date	08 November 2022
Student Name	K.Karthik
Student Roll Number	620619106011
Maximum Marks	2 Marks

#Import necessary libraries

```
import numpy as np

import pandas as pd

import matplotlib.pyplot as plt

import seaborn as sns

%matplotlib inline

from sklearn.model_selection import train_test_split

from keras.layers import Dense , LSTM , Embedding , Dropout , Activation , Flatten

from sklearn.preprocessing import LabelEncoder

from keras.preprocessing.text import Tokenizer

from keras.models import Sequential

from tensorflow.keras.preprocessing import sequence

from tensorflow.keras.utils import to_categorical

from keras.callbacks import EarlyStopping

from tensorflow.keras.optimizers import RMSprop

from keras_preprocessing.sequence import pad_sequences
```

```
[5]  import numpy as np
     import pandas as pd
     import matplotlib.pyplot as plt
     import seaborn as sns
     %matplotlib inline
```

```
[6]  from sklearn.model_selection import train_test_split
     from keras.layers import Dense , LSTM , Embedding , Dropout , Activation , Flatten
     from sklearn.preprocessing import LabelEncoder
     from keras.preprocessing.text import Tokenizer
     from keras.models import Sequential
     from tensorflow.keras.preprocessing import sequence
     from tensorflow.keras.utils import to_categorical
     from keras.callbacks import EarlyStopping
     from tensorflow.keras.optimizers import RMSprop
     from keras_preprocessing.sequence import pad_sequences
```

#Read dataset and do pre-processing

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

data

#Information about dataset

data.describe().T

data.shape

#Check if there is any missing values

data.isnull().sum()

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

#Visualize the dataset

sns.countplot(data.v1)

#Preprocess using Label Encoding

X = data.v2

Y = data.v1

le = LabelEncoder()

Y = le.fit_transform(Y)

Y = Y.reshape(-1,1)

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

	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
...	...	...	...	...	...
5567	spam	This is the 2nd time we have tried 2 contact u...	NaN	NaN	NaN
5568	ham	Will Ì_ b going to esplanade fr home?	NaN	NaN	NaN
5569	ham	Pity, * was in mood for that. So...any other s...	NaN	NaN	NaN
5570	ham	The guy did some bitching but I acted like i'd...	NaN	NaN	NaN
5571	ham	Rofl. Its true to its name	NaN	NaN	NaN

5572 rows × 5 columns

```
data.describe().T
```

	count	unique	top	freq
v1	5572	2	ham	4825
v2	5572	5169	Sorry, I'll call later	30
Unnamed: 2	50	43	bt not his girlfrnd... G o o d n i g h t . . .@"	3
Unnamed: 3	12	10	MK17 92H. 450Ppw 16"	2
Unnamed: 4	6	5	GNT:-)"	2

```
[9] data.shape
```

```
(5572, 5)
```

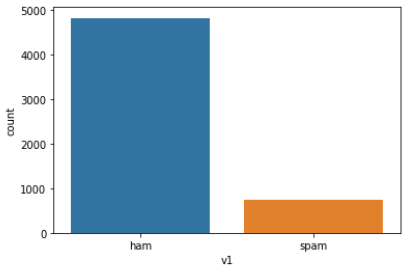
```
[10] data.isnull().sum()
```

```
v1              0
v2              0
Unnamed: 2    5522
Unnamed: 3    5560
Unnamed: 4    5566
dtype: int64
```

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

```
[12] sns.countplot(data.v1)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, the only vali
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7fa9779e2510>
```




```
X = data.v2
Y = data.v1
le = LabelEncoder()
Y = le.fit_transform(Y)
Y = Y.reshape(-1,1)
```

#Create Model and Add Layers (LSTM, Dense-(Hidden Layers), Output)

#Splitting into training and testing data

X_train,X_test,Y_train,Y_test = train_test_split(X,Y,test_size = 0.2)

max_word = 1000

max_len = 250

token = Tokenizer(num_words = max_word)

token.fit_on_texts(X_train)

sequences = token.texts_to_sequences(X_train)

seq_matrix = sequence.pad_sequences(sequences , maxlen = max_len)

#Creating the model

model = Sequential()

model.add(Embedding(max_word , 32 , input_length = max_len))

model.add(LSTM(64))

model.add(Flatten())

model.add(Dense(250, activation='relu'))

model.add(Dropout(0.5))

model.add(Dense(120, activation='relu'))

model.add(Dense(1, activation='sigmoid'))

```
[14] X_train,X_test,Y_train,Y_test = train_test_split(X,Y,test_size = 0.2)
```

```
[15] max_word = 1000
     max_len = 250
     token = Tokenizer(num_words = max_word)
     token.fit_on_texts(X_train)
     sequences = token.texts_to_sequences(X_train)
     seq_matrix = sequence.pad_sequences(sequences , maxlen = max_len)
```

```
model = Sequential()
model.add(Embedding(max_word , 32 , input_length = max_len))
model.add(LSTM(64))
model.add(Flatten())
model.add(Dense(250, activation='relu'))
model.add(Dropout(0.5))
model.add(Dense(120, activation='relu'))
model.add(Dense(1, activation='sigmoid'))
```

#compile the model

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

model.summary()

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

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 embedding (Embedding)       (None, 250, 32)           32000

 lstm (LSTM)                 (None, 64)                24832

 flatten (Flatten)           (None, 64)                0

 dense (Dense)               (None, 250)               16250

 dropout (Dropout)           (None, 250)               0

 dense_1 (Dense)             (None, 120)               30120

 dense_2 (Dense)             (None, 1)                 121

=================================================================
Total params: 103,323
Trainable params: 103,323
Non-trainable params: 0
_________________________________________________________________
```

#Fit the model

model.fit(seq_matrix,Y_train,batch_size=128,epochs=10,validation_split=0.2,callbacks=[EarlyStopping(monitor='val_loss',min_delta=0.0001)])

test_seq = token.texts_to_sequences(X_test)

test_seq_matrix = sequence.pad_sequences(test_seq,maxlen=max_len)

```
model.fit(seq_matrix,Y_train,batch_size=128,epochs=10,validation_split=0.2,callbacks=[EarlyStopping(monitor='val_loss',min_delta=0.0001)])
```

```
Epoch 1/10
28/28 [==============================] - 17s 617ms/step - loss: 0.0421 - accuracy: 0.9868 - val_loss: 0.0453 - val_accuracy: 0.9843
Epoch 2/10
28/28 [==============================] - 12s 428ms/step - loss: 0.0301 - accuracy: 0.9916 - val_loss: 0.0674 - val_accuracy: 0.9843
<keras.callbacks.History at 0x7fa972dac190>
```

```
[25] test_seq = token.texts_to_sequences(X_test)
     test_seq_matrix = sequence.pad_sequences(test_seq,maxlen=max_len)
```

#Save the model

model.save(r'lstm_model.h5')

```
[26] model.save(r'lstm_model.h5')
```

#Test the model:

from tensorflow.keras.models import load_model

new_model=load_model(r'lstm_model.h5')

new_model.evaluate(test_seq_matrix,Y_test)

scores = model.evaluate(test_seq_matrix, Y_test, verbose=0)

scores

print("Accuracy: %.2f%%" % (scores[1]*100))

```
[27] from tensorflow.keras.models import load_model
     new_model=load_model(r'lstm_model.h5')
```

```
[28] new_model.evaluate(test_seq_matrix,Y_test)

     35/35 [==============================] - 2s 34ms/step - loss: 0.0852 - accuracy: 0.9830
     [0.0852075144648552, 0.9829596281051636]
```

```
[29] scores = model.evaluate(test_seq_matrix, Y_test, verbose=0)
     scores

     [0.0852075144648552, 0.9829596281051636]
```

```
[30] print("Accuracy: %.2f%%" % (scores[1]*100))

     Accuracy: 98.30%
```