Assignment-4

LSTM for Text Classification

Student Name	S.Ragavi
Student Roll Number	510119104016
Assignment Date	03 November 2022
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
```

In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

In [2]:
```
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/sapm.csv',delimiter=',',encoding='latin-1')

data

#Infromation 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)

```
In [3]: data = pd.read_csv('/content/spam.csv',delimiter=',',encoding='latin-1')
```

```
In [4]: data
```

Out[4]:

	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 İ_ 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

```
[31] 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

```
[32] data.shape
```

```
(5572, 5)
```

```
data.isnull().sum()
```

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

```
[31] 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

```
[32] data.shape
```

```
(5572, 5)
```

```
data.isnull().sum()
```

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

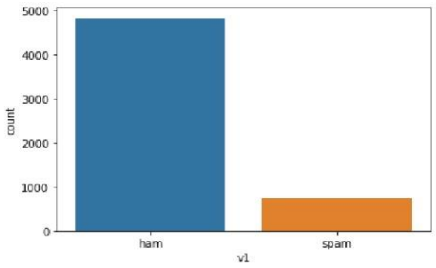
```
[34] data.drop(['Unnamed: 2', 'Unnamed: 3', 'Unnamed: 4'],axis=1,inplace=True)
     data.info()
```

```
<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
```

```
In [9]: 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 valid positional argument will be `data`, and passing other arguments without an explicit keywor
d will result in an error or misinterpretation.
  FutureWarning
```

```
Out[9]: <matplotlib.axes._subplots.AxesSubplot at 0x7f1735223150>
```




```
In [10]: X = data.v2
         Y = data.v1
         le = LabelEncoder()
         Y = le.fit_transform(Y)
```

```
In [11]: 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'))

```
In [12]: X_train,X_test,Y_train,Y_test = train_test_split(X,Y,test_size = 0.2)
```

```
In [13]: 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)
```

```
In [28]: 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()

```
In [15]: 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=’vals_loss’,min_delta=0.0001)])

test_seq= token.texts_to_sequences(X_test)

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

```
In [18]: model.fit(seq_matrix,Y_train,batch_size=128,epochs=10,validation_split=0.2,callbacks=[EarlyStopping(monitor='val_loss',min_delta
         Epoch 1/10
         28/28 [==============================] - 14s 489ms/step - loss: 0.0256 - accuracy: 0.9910 - val_loss: 0.0566 - val_accuracy: 0.
         9843
         Epoch 2/10
         28/28 [==============================] - 11s 385ms/step - loss: 0.0180 - accuracy: 0.9952 - val_loss: 0.0582 - val_accuracy: 0.
         9843

Out[18]: <keras.callbacks.History at 0x7f172ca32b90>

In [19]: 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’)

model.save(r'lstm_model.h5')

```
In [24]: 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))

```
In [25]: from tensorflow.keras.models import load_model
         new_model=load_model(r'lstm_model.h5')

In [27]: new_model.evaluate(test_seq_matrix,Y_test)
         35/35 [==============================] - 2s 36ms/step - loss: 0.0655 - accuracy: 0.9821
Out[27]: [0.06549865007400513, 0.9820627570152283]
```

```
In [20]: scores = model.evaluate(test_seq_matrix, Y_test, verbose=0)
         scores
Out[20]: [0.06549865007400513, 0.9820627570152283]

In [21]: print("Accuracy: %.2f%%" % (scores[1]*100))
         Accuracy: 98.21%
```