

**Assignment - 4**  
**Python Programming**

Assignment Date	18-10-2022
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Maximum Marks	2 Marks

**Question 1:**

**Import the necessary libraries** Solution:

```
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.preprocessing import sequence
from keras.utils import pad_sequences
from keras.utils import to_categorical
from keras.callbacks import EarlyStopping
```

**Question 2:**

**Download the Dataset** Solution:

Dataset Downloaded and uploaded to drive <https://www.kaggle.com/code/kredy10/simple-lstm-for-textclassification/data>

**Question 3:**

**Read dataset and do pre-processing** Solution:

Read dataset

```
In [21]: df = pd.read_csv('/content/drive/MyDrive/spam.csv', delimiter=',', encoding='latin-1')
df.head()
```

```
Out[21]:
```

	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

## Pre-processing the Dataset

```
In [22]: df.drop(['Unnamed: 2', 'Unnamed: 3', 'Unnamed: 4'],axis=1,inplace=True)
df.info()
```

```
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 [23]: X = df.v2
Y = df.v1
le = LabelEncoder()
Y = le.fit_transform(Y)
Y = Y.reshape(-1,1)
```

```
In [24]: X_train,X_test,Y_train,Y_test = train_test_split(X,Y,test_size=0.15)
```

```
In [25]: 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)
```

```
In [26]: 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)

model.summary()
```

Model: "model\_1"

Layer (type)	Output Shape	Param #
inputs (InputLayer)	[(None, 150)]	0
embedding_1 (Embedding)	(None, 150, 50)	50000
lstm_1 (LSTM)	(None, 64)	29440
FC1 (Dense)	(None, 256)	16640
activation_2 (Activation)	(None, 256)	0
dropout_1 (Dropout)	(None, 256)	0
out_layer (Dense)	(None, 1)	257
activation_3 (Activation)	(None, 1)	0

=====  
Total params: 96,337

Trainable params: 96,337

Non-trainable params: 0

```
In [27]: model.compile(loss='binary_crossentropy',optimizer=RMSprop(),metrics=['accuracy'])
```

#### Train and Fit the Model

```
In [28]: model.fit(sequences_matrix,Y_train,batch_size=128,epochs=10,  
                validation_split=0.2)
```

```
Epoch 1/10  
30/30 [=====] - 10s 264ms/step - loss: 0.3182 - accuracy: 0.8788 - val_loss: 0.1571 - val_accuracy: 0.9715  
Epoch 2/10  
30/30 [=====] - 7s 247ms/step - loss: 0.0805 - accuracy: 0.9786 - val_loss: 0.0742 - val_accuracy: 0.9778  
Epoch 3/10  
30/30 [=====] - 7s 237ms/step - loss: 0.0403 - accuracy: 0.9881 - val_loss: 0.0670 - val_accuracy: 0.9821  
Epoch 4/10  
30/30 [=====] - 7s 245ms/step - loss: 0.0272 - accuracy: 0.9929 - val_loss: 0.0806 - val_accuracy: 0.9778  
Epoch 5/10  
30/30 [=====] - 7s 242ms/step - loss: 0.0220 - accuracy: 0.9937 - val_loss: 0.0820 - val_accuracy: 0.9800  
Epoch 6/10  
30/30 [=====] - 7s 240ms/step - loss: 0.0178 - accuracy: 0.9955 - val_loss: 0.0787 - val_accuracy: 0.9789  
Epoch 7/10  
30/30 [=====] - 7s 243ms/step - loss: 0.0150 - accuracy: 0.9958 - val_loss: 0.0969 - val_accuracy: 0.9800  
Epoch 8/10  
30/30 [=====] - 7s 241ms/step - loss: 0.0162 - accuracy: 0.9958 - val_loss: 0.0901 - val_accuracy: 0.9768  
Epoch 9/10  
30/30 [=====] - 7s 246ms/step - loss: 0.0099 - accuracy: 0.9968 - val_loss: 0.1284 - val_accuracy: 0.9789  
Epoch 10/10  
30/30 [=====] - 7s 247ms/step - loss: 0.0355 - accuracy: 0.9905 - val_loss: 0.1264 - val_accuracy: 0.9726
```

Out[28]:

### Save The Model

```
In [29]: model.save('sms_classifier.h5')
```

### Preprocessing the Test Dataset

```
In [30]: test_sequences = tok.texts_to_sequences(X_test)
test_sequences_matrix = pad_sequences(test_sequences,maxlen=max_len)
```

### Testing the Model

```
In [31]: accr = model.evaluate(test_sequences_matrix,Y_test)
```

27/27 [=====] - 1s 20ms/step - loss: 0.0886 - accuracy: 0.9821

```
In [32]: print('Test set\n Loss: {:.3f}\n Accuracy: {:.3f}'.format(accr[0],accr[1]))
```

Test set  
Loss: 0.089  
Accuracy: 0.982