

**ASSIGNMENT-4**  
**PYTHON PROGRAMMING**

<b>Assignment Date</b>	<b>30 October 2022</b>
<b>Student Name</b>	<b>Ajay</b>
<b>Student Roll No</b>	<b>61072011901</b>
<b>Maximum Marks</b>	<b>2 Marks</b>

**#Download the Dataset**

**#Import the 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 tensorflow.keras.preprocessing.sequence import pad_sequences
from sklearn.preprocessing import LabelEncoder
from tensorflow.keras.models import Model
from tensorflow.keras.layers import LSTM, Activation, Dense, Dropout, Input, Embedding
from tensorflow.keras.optimizers import RMSprop
from tensorflow.keras.preprocessing.text import Tokenizer
from tensorflow.keras.preprocessing import sequence
from tensorflow.keras.utils import to_categorical
from tensorflow.keras.callbacks import EarlyStopping
%matplotlib inline
```

**#Read Dataset and Preprocessing**

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

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

	Unnamed: 3	Unnamed: 4			
0	NaN	NaN			
1	NaN	NaN			
2	NaN	NaN			
3	NaN	NaN	4	NaN	NaN

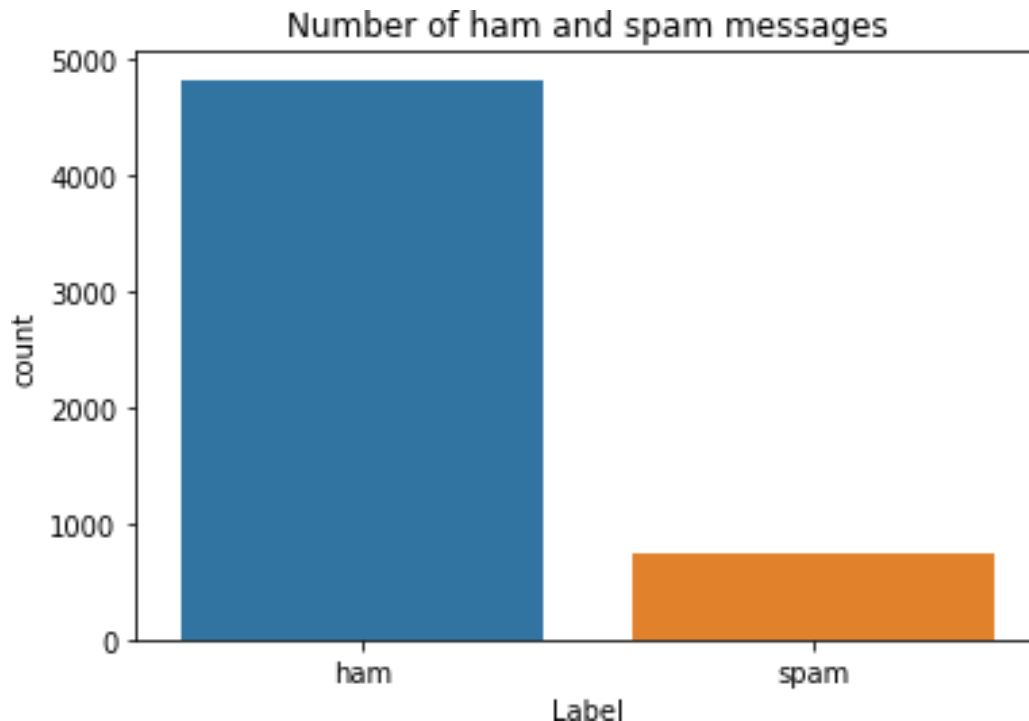
```
df.drop(['Unnamed: 2', 'Unnamed: 3', 'Unnamed: 4'],axis=1,inplace=True)
df.info()
```

```
<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
v2      5572 non-null    object dtypes:
object(2) memory usage:
87.2+ KB
```

```
sns.countplot(df.v1) plt.xlabel('Label')
plt.title('Number of ham and spam messages')
```

```
/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 keyword will result in an error or
misinterpretation. FutureWarning
```

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



### #Creating input and output vectors.

```
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)
```

### #Processing the data from tensorflow.keras.preprocessing.sequence

```
import pad_sequences

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

### #Create the model, Add Layers (LSTM, Dense)

```
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 #Compile the model
model = RNN() model.summary()
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		

## #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=0.001)])
Epoch 1/10
30/30 [=====] - 12s 295ms/step - loss: 0.3310 -
accuracy: 0.8759 - val_loss: 0.1603 - val_accuracy: 0.9346 Epoch 2/10
30/30 [=====] - 8s 273ms/step - loss: 0.0854 -
accuracy: 0.9778 - val_loss: 0.0571 - val_accuracy: 0.9831
<keras.callbacks.History at 0x7fbf58e3fbd0>
```

## #Process the data

```
test_sequences = tok.texts_to_sequences(X_test) test_sequences_matrix =
sequence.pad_sequences(test_sequences,maxlen=max_len)
```

**#Save the model** model.save('spam.h5') **#Testing the**

**model**

accr

=

model.evaluate(test\_sequences\_matrix,Y\_test)

27/27 [=====] - 1s 34ms/step - loss: 0.0363 -  
accuracy: 0.9904

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

Test set

Loss: 0.036

Accuracy: 0.990