

# ASSIGNMENT – 4

## PROBLEM STATEMENT :-SMS SPAM CLASSIFICATION

Assignment Date	9 November-2022
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Maximum Marks	2 Marks

### QUESTION -1:

### DOWNLOAD THE DATASET.

In [ ]:

```
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 to_categorical
from keras.callbacks import EarlyStopping
%matplotlib inline
```

Type your text

### QUESTION -2:

# IMPORT REQUIRED LIBRARY

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

```
Out[ ]:
```

	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

## QUESTION – 3:-

# READ DATASET & DO PRE-PROCESSING

```
In [ ]: df
```

```
Out[ ]:
```

	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 \_ 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

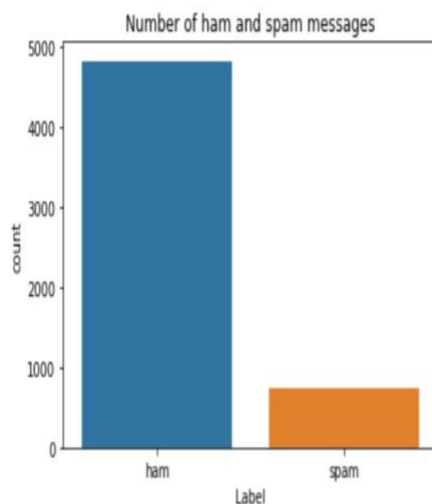
## QUESTION -4:- CREATE DATASET

```
In [ ]: 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

```
Out[ ]: Text(0.5, 1.0, 'Number of ham and spam messages')
```



## QUESTION -5:- ADD LAYERS (LSTM,DENSE-(HIDDEN LAYERS),OUTPUT)

```

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

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

In [ ]: import tensorflow as tf

In [ ]: 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 = tf.keras.preprocessing.sequence.pad_sequences(sequences,maxlen=max_len)

In [ ]: 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

```

**QUESTION – 6:-**

**COMPILE THE MODEL**

```
In [ ]: 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		

## QUESTION – 7:-

### FIT THE MODEL

```
In [ ]: model.fit(sequences_matrix,Y_train,batch_size=128,epochs=20,
validation_split=0.2,callbacks=[EarlyStopping(monitor='val_loss',min_delta=0.0001)])
```

Epoch 1/20

30/30 [=====] - 11s 380ms/step - loss: 0.0184 - accuracy: 0.9966 - val\_loss: 0.0756 - val\_accuracy: 0.9810

Epoch 2/20

30/30 [=====] - 9s 286ms/step - loss: 0.0165 - accuracy: 0.9947 - val\_loss: 0.0791 - val\_accuracy: 0.9842

Out[ ]: <keras.callbacks.History at 0x7f2b6ec39610>

## QUESTION -8:-

## SAVE THE MODEL

```
In [26]: model.save('Spam.h5')
```

```
In [28]: test_sequences = tok.texts_to_sequences(X_test)
test_sequences_matrix = tf.keras.preprocessing.sequence.pad_sequences(test_sequences,maxlen=max_len)
```

## QUESTION – 9:-

## TEST THE MODEL

```
In [29]: accr = model.evaluate(test_sequences_matrix,Y_test)
```

27/27 [=====] - 1s 23ms/step - loss: 0.0960 - accuracy: 0.9809

```
In [30]: print('Test set\n Loss: {:.3f}\n Accuracy: {:.3f}'.format(accr[0],accr[1]))
```

Test set  
Loss: 0.096  
Accuracy: 0.981