

## ASSINGMENT- 4

Assignment Date	20 October 2022
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Maximum marks	2 marks

# 1.Spam dataset downloaded

from:- <https://www.kaggle.com/datasets/uciml/sms-spam-collection-dataset?resource=download>

## 2.Required libraries are imported

In [17]:

```
import numpy as np
import pandas as pd
import keras

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
#from keras.preprocessing.sequence import pad_sequences
%matplotlib inline
```

## 3.Read dataset and pre processing

In [2]:

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

Out[2]:

	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

drop the unnecessary columns with Nan values

In [3]:

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

In [4]:

```
df.shape
```

Out[4]:

```
(5572, 2)
```

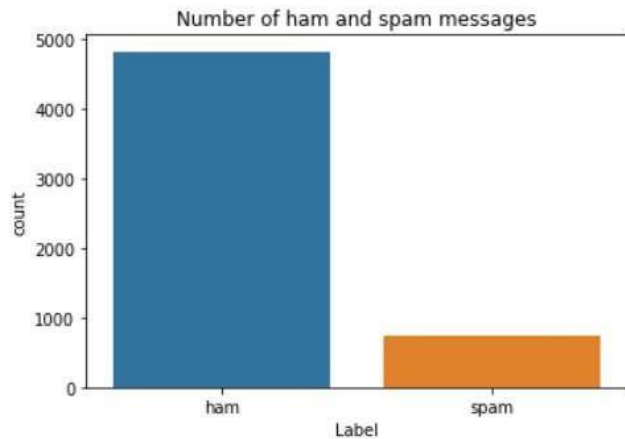
In [5]:

```
#plot the ham and spam messages to understand the distribution
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[5]:

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



```
In [6]: X = df.v2
Y = df.v1
#Label encoding for Y
le = LabelEncoder()
Y = le.fit_transform(Y)
Y = Y.reshape(-1,1)
```

### Train-test split

```
In [7]: #split into train and test sets
X_train,X_test,Y_train,Y_test = train_test_split(X,Y,test_size=0.20)
```

```
In [18]: 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 = keras.utils.pad_sequences(sequences,maxlen=max_len)
```

## 5.Add layers

```
In [19]: 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)
```

## 6.compile the model

```
In [20]: 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		

## 7.fit the model

```
In [21]: model.fit(sequences_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 [=====] - 9s 246ms/step - loss: 0.3549 - accuracy: 0.8626 - val\_loss: 0.1654 - val\_accuracy: 0.9742  
Epoch 2/10  
28/28 [=====] - 4s 153ms/step - loss: 0.0957 - accuracy: 0.9767 - val\_loss: 0.0468 - val\_accuracy: 0.9821  
Out[21]: <keras.callbacks.History at 0x7fec903e8390>

## 8. Save the model

```
In [25]: model.save('spam_lstm_model.h5')
```

## 9.test the model

```
In [26]: #processing test data
test_sequences = tok.texts_to_sequences(X_test)
test_sequences_matrix = keras.utils.pad_sequences(test_sequences,maxlen=max_len)
```

```
In [27]: #evaluation of our model
accr = model.evaluate(test_sequences_matrix,Y_test)
print('Test set\n Loss: {:.3f}\n Accuracy: {:.3f}'.format(accr[0],accr[1]))
```

```
35/35 [=====] - 0s 14ms/step - loss: 0.0816 - accuracy: 0.9776
```

```
Test set
```

```
Loss: 0.082
```

```
Accuracy: 0.978
```