## 1.Spam dataset downloaded

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

## 2.Required libararies are imported

In [ ]:

```
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 [ ]:

```
df = pd.read_csv('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 |

drop the unnecessary columns with Nan values

In [ ]:

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

In [ ]:

```
df.shape
```

Out[ ]:

```
(5572, 2)
```

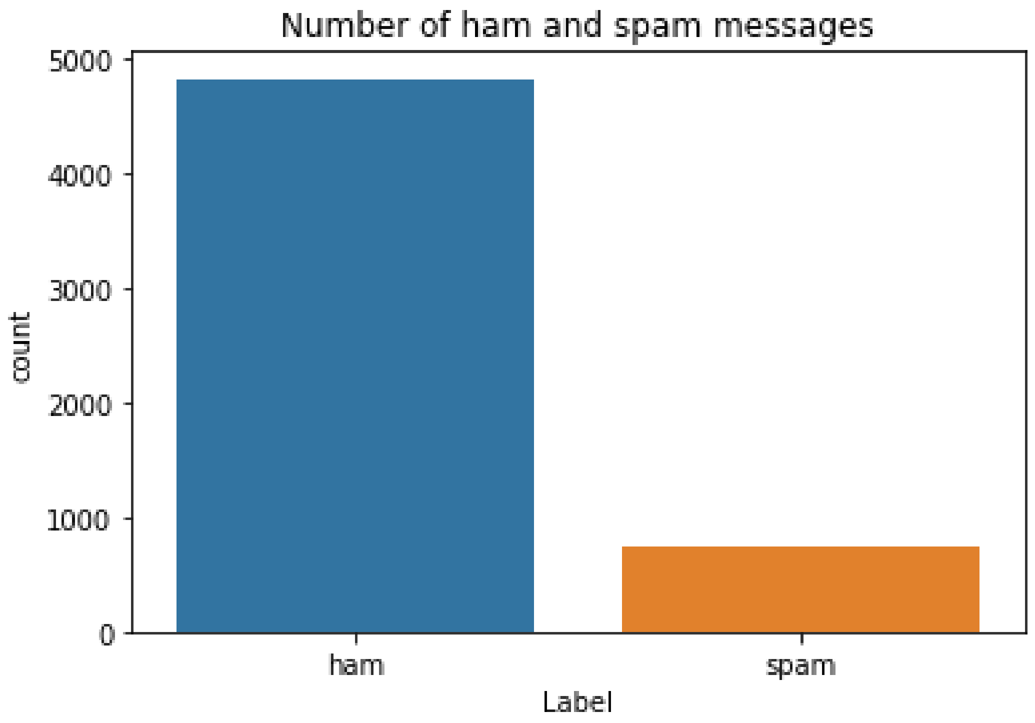
In [ ]:

```
#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: FutureWar
ning: Pass the following variable as a keyword arg: x. From version 0.12, t
he only valid positional argument will be `data`, and passing other argumen
ts without an explicit keyword will result in an error or misinterpretation
.
  FutureWarning
```

Out[ ]:

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



In [ ]:

```
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 [ ]:

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

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 = keras.utils.pad_sequences(sequences,maxlen=max_len)
```

## 4.Create LSTM model, 5.Add layers

In [ ]:

```
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 [ ]:

```
model.summary()
model.compile(loss='binary_crossentropy',optimizer=RMSprop(),metrics=['accu
racy'])
```

```
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 [ ]: 
```
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 - acc
uracy: 0.8626 - val_loss: 0.1654 - val_accuracy: 0.9742
Epoch 2/10
28/28 [==============================] - 4s 153ms/step - loss: 0.0957 - acc
uracy: 0.9767 - val_loss: 0.0468 - val_accuracy: 0.9821
```

Out[ ]:

## 8. Save the model

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

## 9.test the model

In [ ]:

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

In [ ]:

```
#evaluation     of     our     model     accr     =
model.evaluate(test_sequences_matrix,Y_test)
print('Test  set\n    Loss:  {:0.3f}\n    Accuracy:
{:0.3f}'.format(accr[0],accr[1]))
```

```
35/35 [==============================] - 0s 14ms/step - loss: 0.0816 - accu
racy: 0.9776 Test set
  Loss: 0.082
  Accuracy: 0.978
```