Importing Required Libraries

```
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
from keras.utils import pad_sequences
%matplotlib inline
```

Read Dataset and Preprocessing

```
df = pd.read_csv('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
```

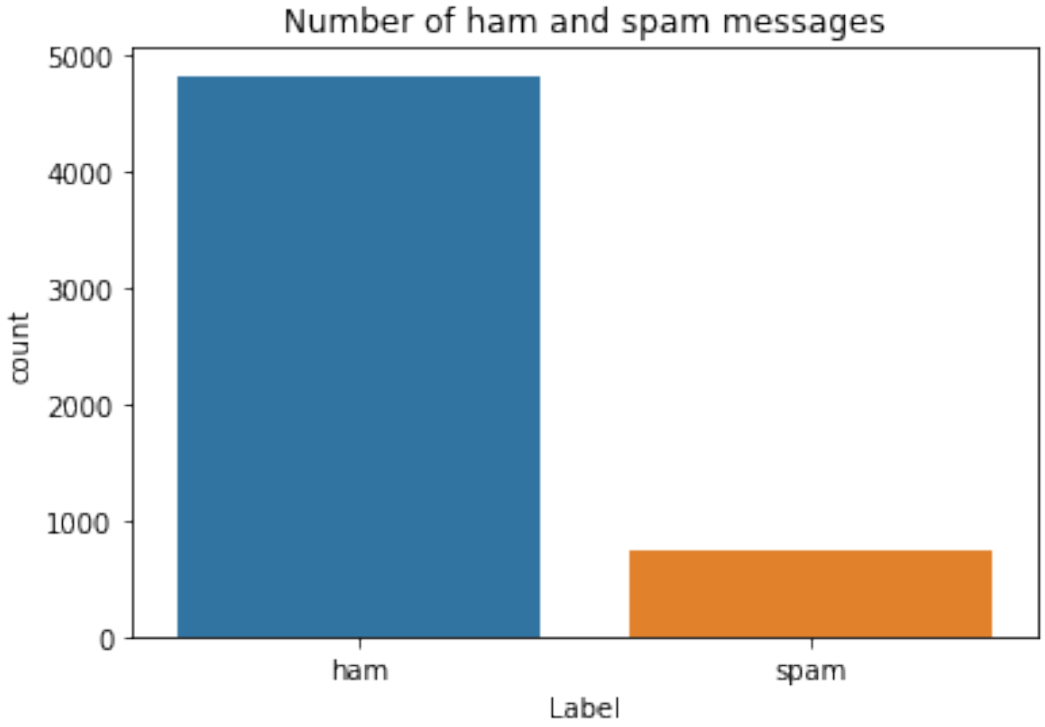
```
df.drop(['Unnamed: 2', 'Unnamed: 3', 'Unnamed:
4'],axis=1,inplace=True)
df.info()
```

```
<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
 1   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')
X = df.v2
Y = df.v1
le = LabelEncoder()
Y = le.fit_transform(Y)
Y = Y.reshape(-1,1)
```

```
/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
```




```
X_train,X_test,Y_train,Y_test = train_test_split(X,Y,test_size=0.15)
```

```
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)
```

Create Model

```
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
```

Adding LSTM Layers

```
model = RNN()
model.summary()
```

```
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
_________________________________________________________________
```

Compile The Model

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

Fit The Model

```
model.fit(sequences_matrix,Y_train,batch_size=128,epochs=10,

validation_split=0.2,callbacks=[EarlyStopping(monitor='val_loss',min_d
elta=0.0001)])
```

```
Epoch 1/10
30/30 [==============================] - 13s 281ms/step - loss: 0.3342
- accuracy: 0.8633 - val_loss: 0.1301 - val_accuracy: 0.9810
Epoch 2/10
30/30 [==============================] - 8s 264ms/step - loss: 0.0833
- accuracy: 0.9791 - val_loss: 0.0476 - val_accuracy: 0.9884

<keras.callbacks.History at 0x7f7f57c210d0>
```

Save The Model

```
model.save('Spam.h5')
```

Test The Model

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

```
array([[  0,   0,   0, ...,  18,   5, 136],
       [  0,   0,   0, ...,  84,  33,  89],
       [  0,   0,   0, ..., 475,   2, 306],
       ...,
       [  0,   0,   0, ..., 625,  54, 171],
       [  0,   0,   0, ...,  56,  42,  41],
       [  0,   0,   0, ..., 185, 108, 236]], dtype=int32)
```

Accuracy Of The Model

```
accr = model.evaluate(test_sequences_matrix,Y_test)
print('Accuracy:',accr[1])
print('Loss:',accr[0])
```

```
27/27 [==============================] - 1s 39ms/step - loss: 0.0614 -
accuracy: 0.9821
Accuracy: 0.9820573925971985
Loss: 0.061391204595565796
```