Import the necessary 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
%matplotlib inline
```

```
Using TensorFlow backend.
```

Download Dataset and Load into Dataframe

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

Data Analysis

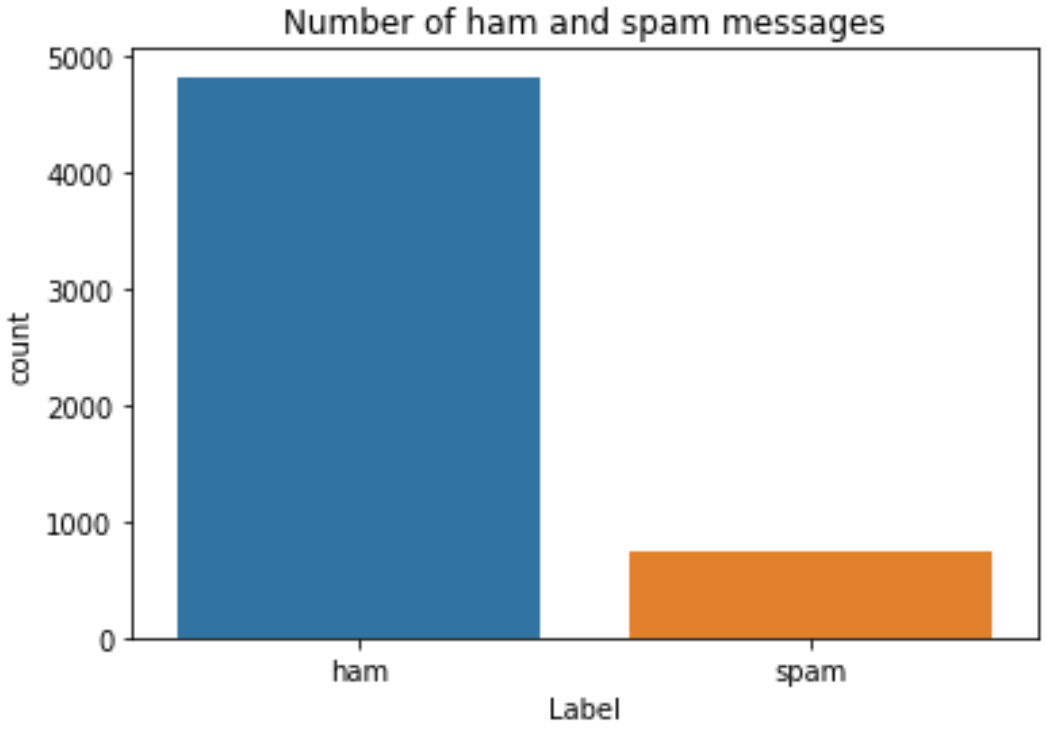
Drop the columns that are not required for the neural network. `df.drop(['Unnamed:`

```
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):
v1    5572 non-null object
v2    5572 non-null object
dtypes: object(2) memory
usage: 87.1+ KB
```

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

```
Text(0.5,1,'Number of ham and spam messages')
```




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

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

Pre-Processing

```
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 Model and add Layers

```
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'])
```

```
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
inputs (InputLayer)          (None, 150)               0
_________________________________________________________________
embedding_1 (Embedding)      (None, 150, 50)           50000
_________________________________________________________________
lstm_1 (LSTM)                (None, 64)                29440
_________________________________________________________________
FC1 (Dense)                  (None, 256)               16640
_________________________________________________________________
activation_1 (Activation)    (None, 256)               0
_________________________________________________________________
dropout_1 (Dropout)          (None, 256)               0
_________________________________________________________________
out_layer (Dense)            (None, 1)                 257
_________________________________________________________________
activation_2 (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_l
oss',min_d elta=0.0001)])
```

```
Train on 3788 samples, validate on 948 samples
```

```
Epoch 1/10
3788/3788 [==============================] - 8s 2ms/step - loss:
0.3312 - acc: 0.8746 - val_loss: 0.1460 - val_acc: 0.9504
Epoch 2/10
3788/3788 [==============================] - 8s 2ms/step - loss:
0.0860 - acc: 0.9789 - val_loss: 0.0666 - val_acc: 0.9768
Epoch 3/10
3788/3788 [==============================] - 8s 2ms/step - loss:
0.0447 - acc: 0.9873 - val_loss: 0.0465 - val_acc: 0.9895
Epoch 4/10
3788/3788 [==============================] - 9s 2ms/step - loss:
0.0353 - acc: 0.9892 - val_loss: 0.0459 - val_acc: 0.9863
Epoch 5/10
3788/3788 [==============================] - 8s 2ms/step - loss:
0.0258 - acc: 0.9918 - val_loss: 0.0437 - val_acc: 0.9884
Epoch 6/10
3788/3788 [==============================] - 8s 2ms/step - loss:
0.0196 - acc: 0.9947 - val_loss: 0.0468 - val_acc: 0.9905

<keras.callbacks.History at 0x7f780f71ad68>
```

Test the Model

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

accr = model.evaluate(test_sequences_matrix,Y_test)

836/836 [==============================] - 1s 821us/step

print('Test set\n  Loss: {:0.3f}\n  Accuracy:
{:0.3f}'.format(accr[0],accr[1]))

Test set
  Loss: 0.057
  Accuracy: 0.986
```