Import the necessary libraries

In [1]:

```
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

In [2]:

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

Out[2]:

```
V1
0  ham    Go until jurong point, crazy.. Available only …
1  ham    Ok lar... Joking wif u oni…
2  spam  Free entry in 2 a wkly comp to win FA Cup fina…
3  ham    U dun say so early hor... U c already then say…
4  ham    Nah I don't think he goes to usf, he lives aro…
V2
Unnamed: 2
0 NaN
1 NaN
2 NaN
3 NaN
4 NaN
Unnamed: 3
0 NaN
1 NaN
2 NaN
3 NaN
```

```
4 NaN
Unnamed: 4
0 NaN
1 NaN
2 NaN
3 NaN
4 NaN
```

Data Analysis

Drop the columns that are not required for the neural network.

In [3]:

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

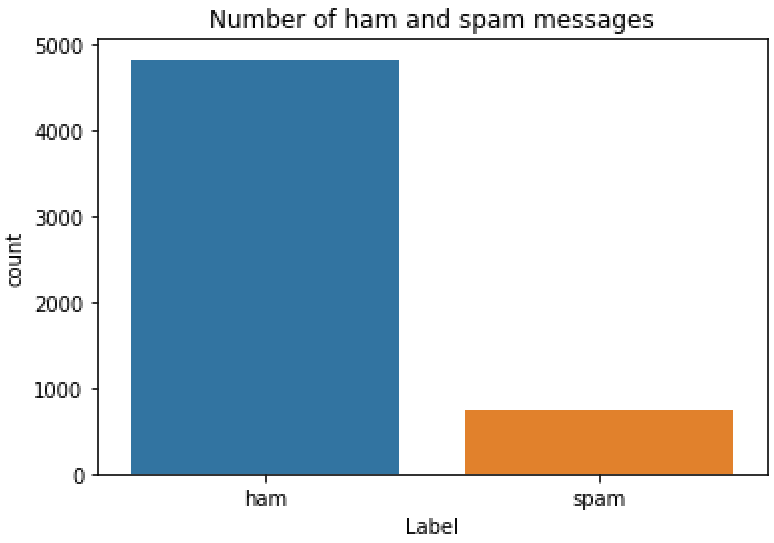
```
RangeIndex: 5572 entries, 0 to 5571
Data columns (total 2 columns):
v1    5572 non-null object
v2    5572 non-null object
dtypes: object(2)
memory usage: 87.1+ KB
```

In [4]:

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

Out[4]:

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



In [5]:

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

In [6]:

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

Pre-Processing

In [7]:

```
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

In [9]:

```
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

In [10]:

```
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

In [11]:

```
model.fit(sequences_matrix,Y_train,batch_size=128,epochs=10,
          validation_split=0.2,callbacks=[EarlyStopping(monitor='val_loss',min_delta=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
```

```
Epoch6/10
3788/3788 [==============================] - 8s 2ms/step - loss: 0.0196 - acc: 0.9947 -
val_loss: 0.0468 - val_acc: 0.9905
```

Out[11]:

Test the Model

In [12]:

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

In [13]:

```
accr = model.evaluate(test_sequences_matrix,Y_test)
```

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

In [14]:

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

```
Test set
  Loss: 0.057
  Accuracy: 0.986
```