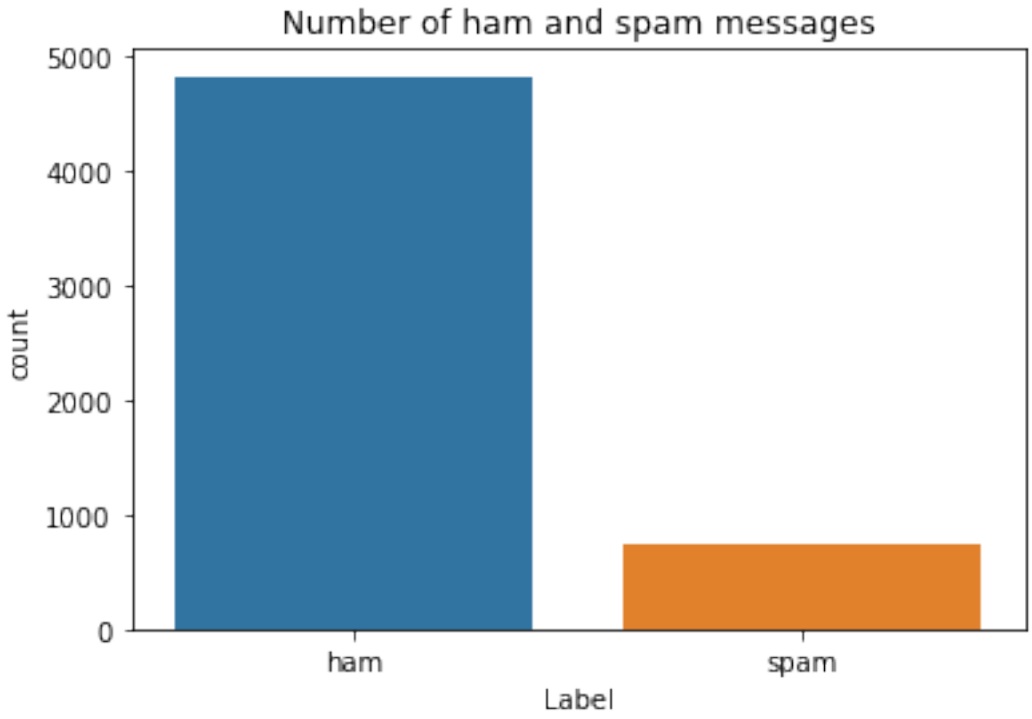
```
import pandas as pd

spam=
pd.read_csv('C:/Users/Admin/Desktop/Nalaiyathiran/assign/spam.csv',del
imiter=',',encoding='latin-1')

spam.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

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

import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.preprocessing import LabelEncoder

sns.countplot(spam.v1)
plt.xlabel('Label')
plt.title('Number of ham and spam messages')
X = spam.v2
```

```
Y = spam.v1
le = LabelEncoder()
Y = le.fit_transform(Y)
Y = Y.reshape(-1,1)
```

```
C:\Users\Admin\anaconda3\lib\site-packages\seaborn\_decorators.py:36:
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.
  warnings.warn(
```




```
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.preprocessing.text import Tokenizer
from keras.preprocessing import sequence
from keras.callbacks import EarlyStopping
%matplotlib inline
```

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

```
from keras.preprocessing.sequence import pad_sequences
```

```
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)
```

```
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
```

```
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
_________________________________________________________________
```

```
from tensorflow.keras.optimizers import RMSprop

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

```
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 [==============================] - 6s 144ms/step - loss: 0.3212
- accuracy: 0.8743 - val_loss: 0.1448 - val_accuracy: 0.9473
Epoch 2/10
30/30 [==============================] - 4s 129ms/step - loss: 0.0865
- accuracy: 0.9810 - val_loss: 0.0528 - val_accuracy: 0.9873

<keras.callbacks.History at 0x207c54e3a90>
```

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

```
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, ..., 386, 696, 100],
       [  0,   0,   0, ...,  82, 259,   2],
       [  0,   0,   0, ..., 296,  27, 338],
       ...,
       [  0,   0,   0, ..., 621, 377, 190],
       [  0,   0,   0, ...,  93, 143,  11],
       [  0,   0,   0, ..., 408, 744, 480]])
```

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

```
27/27 [==============================] - 0s 13ms/step - loss: 0.0951 -
accuracy: 0.9749
Accuracy: 0.9748803973197937
Loss: 0.09510093927383423
```