SMS SPAM Classification

1) Import required library

```
import pandas as pd
import numpy as np
from keras import utils
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
%matplotlib inline
```

2) i) Read dataset

```
!unzip "/content/drive/MyDrive/archive.zip"
```

```
Archive:  /content/drive/MyDrive/archive.zip
replace spam.csv? [y]es, [n]o, [A]ll, [N]one, [r]ename:
```

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

```
        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
...    ...                                                ...        .
..
5567  spam  This is the 2nd time we have tried 2 contact u...
NaN
5568   ham              Will Ì_ b going to esplanade fr home?
NaN
5569   ham  Pity, * was in mood for that. So...any other s...
NaN
5570   ham  The guy did some bitching but I acted like i'd...
```

```
NaN
5571   ham                       Rofl. Its true to its name
NaN

     Unnamed: 3 Unnamed: 4
0           NaN        NaN
1           NaN        NaN
2           NaN        NaN
3           NaN        NaN
4           NaN        NaN
...         ...        ...
5567        NaN        NaN
5568        NaN        NaN
5569        NaN        NaN
5570        NaN        NaN
5571        NaN        NaN

[5572 rows x 5 columns]
```

2) ii) Pre-processing

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

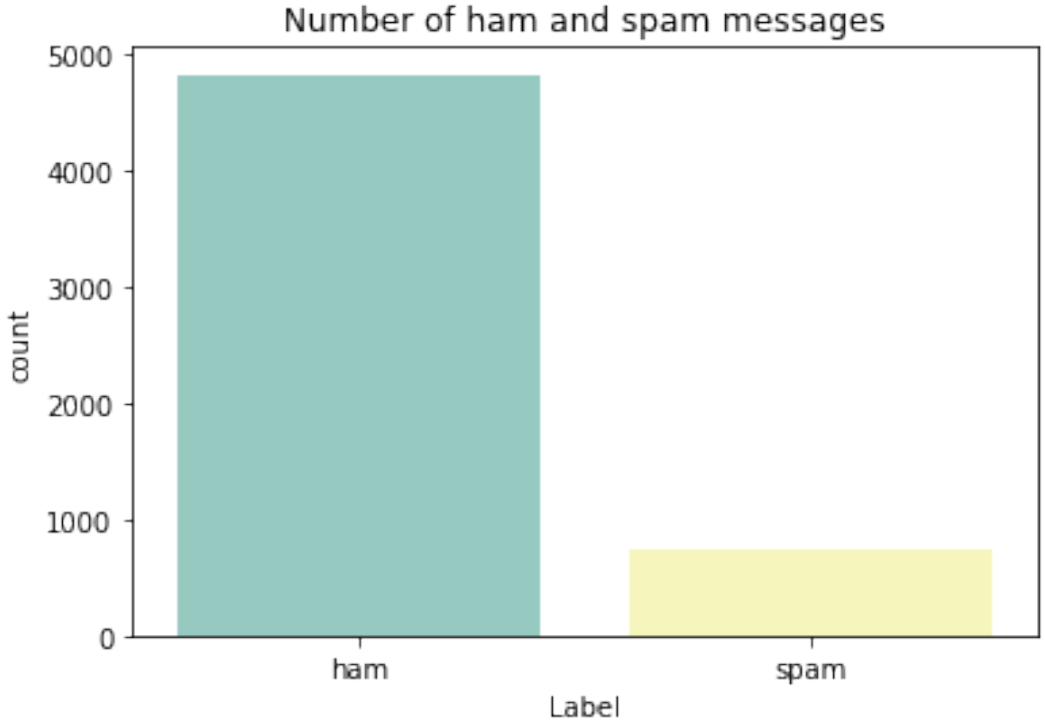
```
        v1                                                  v2
0      ham  Go until jurong point, crazy.. Available only ...
1      ham                      Ok lar... Joking wif u oni...
2     spam  Free entry in 2 a wkly comp to win FA Cup fina...
3      ham  U dun say so early hor... U c already then say...
4      ham  Nah I don't think he goes to usf, he lives aro...
...    ...                                                 ...
5567  spam  This is the 2nd time we have tried 2 contact u...
5568   ham              Will Ì_ b going to esplanade fr home?
5569   ham  Pity, * was in mood for that. So...any other s...
5570   ham  The guy did some bitching but I acted like i'd...
5571   ham                       Rofl. Its true to its name

[5572 rows x 2 columns]
```

```
sns.countplot(df.v1,palette='Set3')
plt.xlabel('Label')
plt.title('Number of ham and spam messages')
```

```
/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
```

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




```
X = df.v2
Y = df.v1
le = LabelEncoder()
Y = le.fit_transform(Y)
Y = Y.reshape(-1,1)
# Split into training and test data.
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 = utils.pad_sequences(sequences,maxlen=max_len) #
Padding the words to get equal length for all words in a sentence
sequences_matrix.shape
```

```
(4736, 150)
```

```
sequences_matrix.ndim
```

```
2
```

```
sequences_matrix = np.reshape(sequences_matrix,(4736,150,1))
sequences_matrix.ndim #3d shape verification to proceed to RNN LSTM
```

```
3
```

4) Create Model for RNN

```
from keras.models import Sequential
from keras.layers import Dense
from keras.layers import LSTM
from keras.layers import Embedding
model = Sequential()
```

5) Add Layers (LSTM, Dense-(Hidden Layers), Output)

```
model.add(Embedding(max_words,50,input_length=max_len))
model.add(LSTM(units=64,input_shape =
(sequences_matrix.shape[1],1),return_sequences=True))
model.add(LSTM(units=64,return_sequences=True))
model.add(LSTM(units=64,return_sequences=True))
model.add(LSTM(units=64))
model.add(Dense(units = 256,activation = 'relu'))
model.add(Dense(units = 1,activation = 'sigmoid'))
```

6)Compile the Model

```
model.summary()
model.compile(loss='binary_crossentropy',optimizer='adam',metrics=['ac
curacy'])
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 embedding (Embedding)       (None, 150, 50)           50000

 lstm (LSTM)                 (None, 150, 64)           29440

 lstm_1 (LSTM)               (None, 150, 64)           33024

 lstm_2 (LSTM)               (None, 150, 64)           33024

 lstm_3 (LSTM)               (None, 64)                33024

 dense (Dense)               (None, 256)               16640

 dense_1 (Dense)             (None, 1)                 257

=================================================================
Total params: 195,409
Trainable params: 195,409
Non-trainable params: 0
_________________________________________________________________
```

7) Fit the model on the training data

```
X =
model.fit(sequences_matrix,Y_train,batch_size=128,epochs=5,validation_
split=0.2)
X
```

```
Epoch 1/5
30/30 [==============================] - 50s 1s/step - loss: 0.4524 -
accuracy: 0.8400 - val_loss: 0.3312 - val_accuracy: 0.8713
Epoch 2/5
30/30 [==============================] - 36s 1s/step - loss: 0.1699 -
accuracy: 0.9414 - val_loss: 0.0951 - val_accuracy: 0.9768
Epoch 3/5
30/30 [==============================] - 41s 1s/step - loss: 0.0595 -
accuracy: 0.9828 - val_loss: 0.0743 - val_accuracy: 0.9789
Epoch 4/5
30/30 [==============================] - 31s 1s/step - loss: 0.0420 -
accuracy: 0.9894 - val_loss: 0.0805 - val_accuracy: 0.9800
Epoch 5/5
30/30 [==============================] - 31s 1s/step - loss: 0.0284 -
accuracy: 0.9929 - val_loss: 0.0838 - val_accuracy: 0.9768

<keras.callbacks.History at 0x7f4115654190>
```

8)Save the model

```
model.save
```

```
<bound method Model.save of <keras.engine.sequential.Sequential object
at 0x7f4119c87750>>
```

9)Evaluate the model on test set data

```
test_sequences = tok.texts_to_sequences(X_test)
test_sequences_matrix =
utils.pad_sequences(test_sequences,maxlen=max_len)
accr = model.evaluate(test_sequences_matrix,Y_test)
```

```
27/27 [==============================] - 4s 82ms/step - loss: 0.0462 -
accuracy: 0.9868
```

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

```
Test set
 Loss: 0.046
 Accuracy: 0.987
```