#### SMS SPAM Classification

## 1)Import required library

```
In [ ]:
```

```
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

```
In [ ]:
```

```
! unzip "/content/drive/MyDrive/Colab Notebooks/spam.zip"
```

```
Archive: /content/drive/MyDrive/Colab Notebooks/spam.zip
inflating: spam.csv
```

```
In [ ]:
```

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

Out[]:

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

5572 rows × 5 columns

## 2) ii)Pre-processing

```
In [ ]:
```

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

```
df # Drop the columns that are not requried for the neural network.
```

### Out[]:

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

### 5572 rows × 2 columns

#### In [ ]:

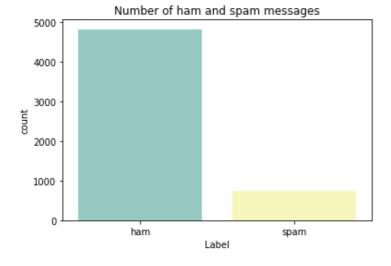
```
sns.countplot(df.v1,palette='Set3')
plt.xlabel('Label')
plt.title('Number of ham and spam messages')
```

/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

### Out[]:

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



# In [ ]:

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

# In [ ]:

```
# Split into training and test data.
```

```
X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size=0.15)
In [ ]:
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 g
et equal length for all words in a sentence
In [ ]:
sequences_matrix.shape
Out[]:
(4736, 150)
In [ ]:
sequences matrix.ndim
Out[]:
In [ ]:
sequences_matrix = np.reshape(sequences_matrix, (4736,150,1))
sequences matrix.ndim #3d shape verification to proceed to RNN LSTM
Out[]:
3
4) Create Model for RNN
In [ ]:
from keras.models import Sequential
from keras.layers import Dense
from keras.layers import LSTM
from keras.layers import Embedding
In [ ]:
model = Sequential()
5) Add Layers (LSTM, Dense-(Hidden Layers), Output)
In [ ]:
model.add(Embedding(max words, 50, input length=max len))
model.add(LSTM(units=64,input shape = (sequences matrix.shape[1],1),return sequences=Tru
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

```
In []:
model.summary()
model.compile(loss='binary_crossentropy',optimizer='adam',metrics=['accuracy'])
```

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
<pre>embedding_1 (Embedding)</pre>	(None, 1, 50)	50000
lstm_4 (LSTM)	(None, 1, 64)	29440
lstm_5 (LSTM)	(None, 1, 64)	33024
lstm_6 (LSTM)	(None, 1, 64)	33024
lstm_7 (LSTM)	(None, 64)	33024
dense_2 (Dense)	(None, 256)	16640
dense_3 (Dense)	(None, 1)	257

\_\_\_\_\_\_

Total params: 390,818 Trainable params: 390,818 Non-trainable params: 0

# 7)Fit the model on the training data.

```
In [ ]:
```

```
X = model.fit(sequences_matrix,Y_train,batch_size=128,epochs=5,validation_split=0.2)
Χ
val_loss: 0.2616 - val_accuracy: 0.8903
Epoch 2/5
val_loss: 0.0683 - val_accuracy: 0.9778
Epoch 3/5
val_loss: 0.0633 - val_accuracy: 0.9821
Epoch 4/5
30/30 [============= ] - 34s 1s/step - loss: 0.0369 - accuracy: 0.9894 -
val loss: 0.0773 - val accuracy: 0.9821
Epoch 5/5
val loss: 0.0833 - val accuracy: 0.9821
Out[]:
<keras.callbacks.History at 0x7f0e3ddf3c10>
```

## 8)Save the model

#### In [ ]:

```
model.save
```

 $print('Test set\n Loss: {:0.3f}\n Accuracy: {:0.3f}'.format(l,a))$ 

a = accr[1]

Test set

In [ ]:

Loss: 0.102 Accuracy: 0.970