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

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

	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 ...	NaN	NaN	NaN
4	ham	Nah I don't think he goes to usf, he lives ...	NaN	NaN	NaN

2) ii)Pre-processing

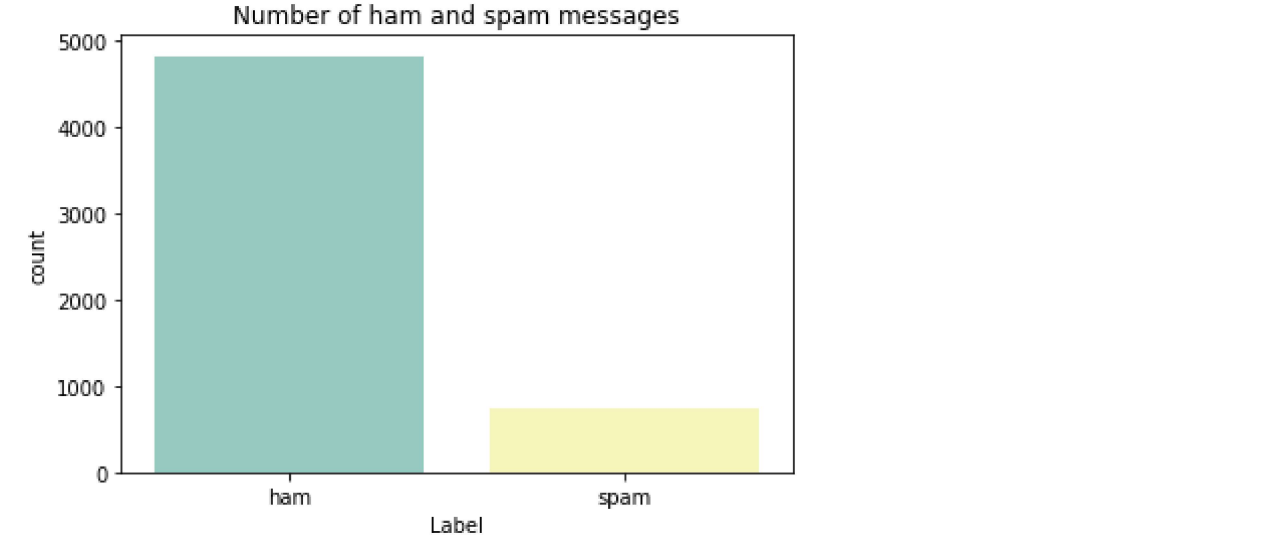
```
df.drop(['Unnamed: 2', 'Unnamed: 3', 'Unnamed: 4'],axis=1,inplace=True)
df # Drop the columns that are not requried for the neural network.
```

	v1	v2
0	ham	Go until jurong point, crazy.. Available only ...

Double-click (or enter) to edit

```
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: P
  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 ge
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'))
```

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6)Compile the Model

```
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

=================================================================
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 [==============================] - 71s 2s/step - loss: 0.4387 - accuracy: 0.8432 - val_loss: 0.2452 - val_accuracy: 0.906
Epoch 2/5
30/30 [==============================] - 95s 3s/step - loss: 0.1523 - accuracy: 0.9578 - val_loss: 0.0831 - val_accuracy: 0.974
Epoch 3/5
30/30 [==============================] - 71s 2s/step - loss: 0.0610 - accuracy: 0.9831 - val_loss: 0.0742 - val_accuracy: 0.982
Epoch 4/5
30/30 [==============================] - 37s 1s/step - loss: 0.0426 - accuracy: 0.9881 - val_loss: 0.0828 - val_accuracy: 0.982
Epoch 5/5
30/30 [==============================] - 42s 1s/step - loss: 0.0268 - accuracy: 0.9934 - val_loss: 0.0995 - val_accuracy: 0.978
<keras.callbacks.History at 0x7f5dcb7afdd0>
```

8)Save the model

```
model.save
```

```
<bound method Model.save of <keras.engine.sequential.Sequential object at 0x7f5dcfdbb350>>
```

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 [==============================] - 10s 144ms/step - loss: 0.0561 - accuracy: 0.9844
```

```
l = accr[0]
a =accr[1]
```

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

```
Test set
 Loss: 0.056
 Accuracy: 0.984
```