Amala Ruban S

```
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
```

```
from google.colab import drive
drive.mount('/content/drive')
```

```
     Mounted at /content/drive
```

```
ls
```

```
     drive/  sample_data/
```

## READ DATASET

```
df = pd.read_csv('/content/drive/MyDrive/IBM_PROJECTS/spam.csv',delimiter=',',encoding='la
df.head()
```

Saved successfully!

| | v1 | v2 | Unnamed: 2 | Unnamed: 3 | Unnamed: |
|---|---|---|---|---|---|
| | | crazy.. Available only ... | NaN | NaN | Na |
| **1** | ham | Ok lar... Joking wif u oni... | NaN | NaN | Na |
| **2** | spam | Free entry in 2 a wkly comp to win FA Cup fina... | NaN | NaN | Na |
| **3** | ham | U dun say so early hor... U c already then say... | NaN | NaN | Na |
| **4** | ham | Nah I don't think he goes to usf, he lives aro... | NaN | NaN | Na |

## PREPROCESSING

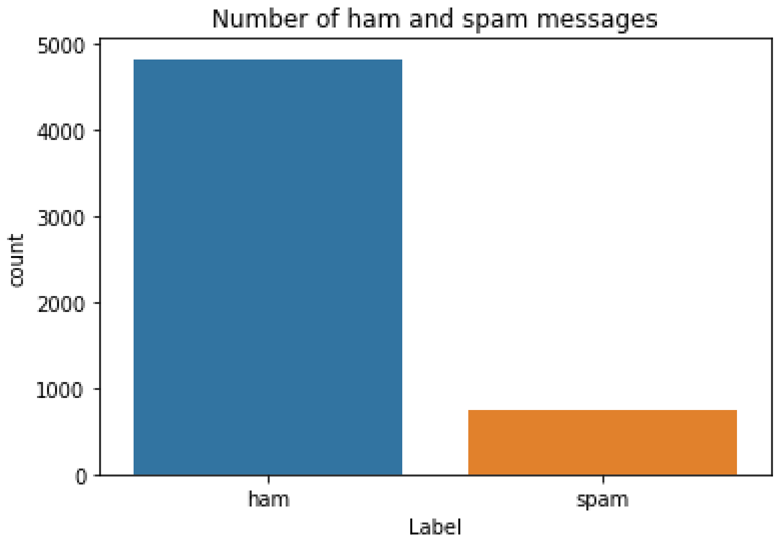
```
df.drop(['Unnamed: 2', 'Unnamed: 3', 'Unnamed: 4'],axis=1,inplace=True)
df.info()
```

```
     <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
```

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

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pas
  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)
```

Saved successfully!

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

```
max_words = 1000
max_len = 100
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)
```

```
sequences_matrix.shape
```

```
(4736, 100)
```

```
sequences_matrix.ndim

     2

sequences_matrix = np.reshape(sequences_matrix,(4736,100,1))

sequences_matrix.ndim #3d shape verification to proceed to RNN LSTM

     3

from keras.models import Sequential
from keras.layers import Dense
from keras.layers import LSTM
from keras.layers import Embedding

model = Sequential()
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'))

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

```
     Model: "sequential"
     _________________________________________________________________
      Layer (type)                Output Shape              Param #
     =================================================================
      embedding (Embedding)       (None, 100, 50)           50000

                                  None, 100, 64)            29440

                                  None, 100, 64)            33024

      lstm_2 (LSTM)               (None, 100, 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
     _________________________________________________________________
```

Saved successfully!

## FIT THE MODEL

```
M = model.fit(sequences_matrix,Y_train,batch_size=128,epochs=7,validation_split=0.2)
```

```
Epoch 1/7
30/30 [==============================] - 33s 816ms/step - loss: 0.3221 - accuracy: 0
Epoch 2/7
30/30 [==============================] - 22s 740ms/step - loss: 0.0905 - accuracy: 0
Epoch 3/7
30/30 [==============================] - 22s 738ms/step - loss: 0.0625 - accuracy: 0
Epoch 4/7
30/30 [==============================] - 22s 740ms/step - loss: 0.0518 - accuracy: 0
Epoch 5/7
30/30 [==============================] - 22s 742ms/step - loss: 0.0381 - accuracy: 0
Epoch 6/7
30/30 [==============================] - 24s 819ms/step - loss: 0.0278 - accuracy: 0
Epoch 7/7
30/30 [==============================] - 22s 733ms/step - loss: 0.0226 - accuracy: 0
```

## SAVE THE MODEL

```
model.save
```

```
<bound method Model.save of <keras.engine.sequential.Sequential object at
0x7f8604b54290>>
```

## TEST THE MODEL

```
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 67ms/step - loss: 0.0370 - accuracy: 0.9
```

Saved successfully!

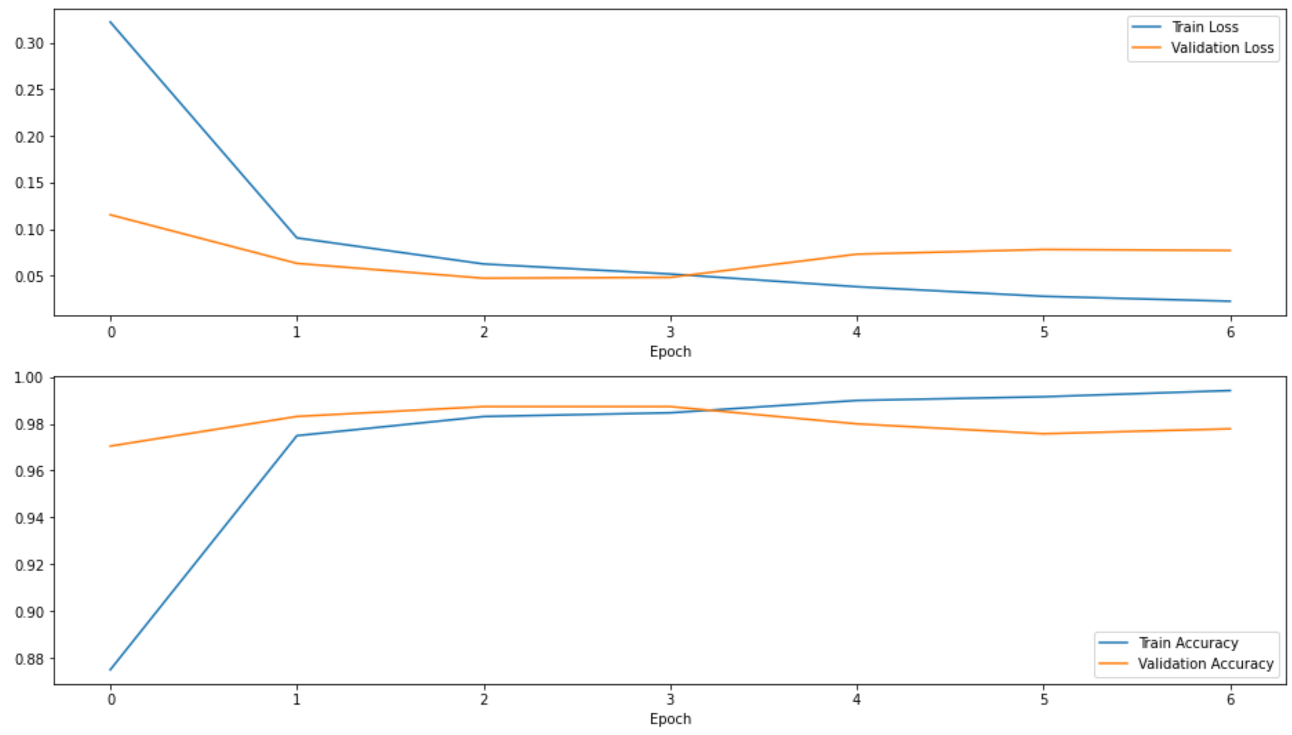
```
l = accr[0]
a =accr[1]
print('Test set\n  Loss: {:0.3f}\n  Accuracy: {:0.3f}'.format(l,a))
```

```
Test set
  Loss: 0.037
  Accuracy: 0.984
```

## ACCURACY AND LOSS GRAPH

```
results = pd.DataFrame({"Train Loss": M.history['loss'], "Validation Loss": M.history['val
fig, ax = plt.subplots(nrows=2, figsize=(16, 9))
results[["Train Loss", "Validation Loss"]].plot(ax=ax[0])
results[["Train Accuracy", "Validation Accuracy"]].plot(ax=ax[1])
```

```
results[["Train Accuracy", "Validation Accuracy"]].plot(ax=ax[1])
ax[0].set_xlabel("Epoch")
ax[1].set_xlabel("Epoch")
plt.show()
```



Saved successfully!

Colab paid products - Cancel contracts here

✓ 0s completed at 09:39 ● ✕

Saved successfully! ✕