## Assignment 4

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*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
```

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### 2) i) Read Dataset

```
df = pd.read_csv('/content/drive/MyDrive/IBMPROJECT/spam.csv',delimiter=',',encoding='lati
df
```

| | v1 | v2 | Unnamed: 2 | Unnamed: 3 | Unnamed: 4 |
|---|---|---|---|---|---|
| **0** | ham | Go until jurong point, crazy.. Available only ... | NaN | NaN | NaN |

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| | | | | | |
|---|---|---|---|---|---|
| **2** | spam | fina | NaN | NaN | NaN |

## 2) ii)Pre-processing

say...

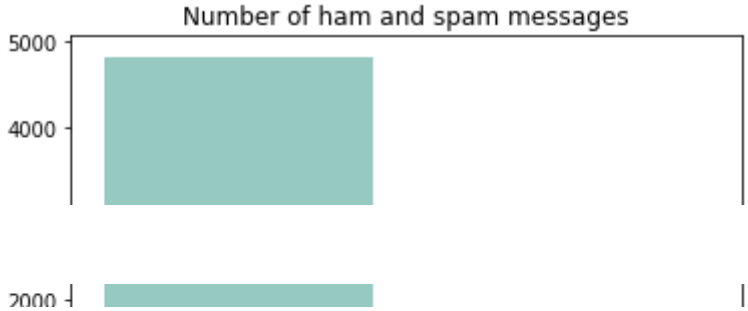
```
df.drop(['Unnamed: 2', 'Unnamed: 3', 'Unnamed: 4'],axis=1,inplace=True)
df  # Drop the columns that are not requried for the neural network.
```

| | v1 | v2 |
|---|---|---|
| **0** | ham | Go until jurong point, crazy.. Available only ... |
| **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 × 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
  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 = np.reshape(sequences_matrix,(4736,150,1))
sequences_matrix.ndim #3d shape verification to proceed to RNN LSTM
```

```
3
```

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### 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()
```

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### 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
_________________________________________________________________
```

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**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 [==============================] - 52s 1s/step - loss: 0.4381 - accuracy: 0.840
Epoch 2/5
30/30 [==============================] - 34s 1s/step - loss: 0.1480 - accuracy: 0.957
Epoch 3/5
30/30 [==============================] - 37s 1s/step - loss: 0.0674 - accuracy: 0.982
Epoch 4/5
30/30 [==============================] - 36s 1s/step - loss: 0.0463 - accuracy: 0.987
Epoch 5/5
30/30 [==============================] - 37s 1s/step - loss: 0.0305 - accuracy: 0.992
<keras.callbacks.History at 0x7fd136022c10>
```

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**8)Save the model**

```
model.save
```

```
<bound method Model.save of <keras.engine.sequential.Sequential object at
0x7fd13a3c31d0>>
```

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**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 [==============================] - 9s 179ms/step - loss: 0.0649 - accuracy: 0.9
```

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

```
Test set
  Loss: 0.065
  Accuracy: 0.981
```

✓ 0s completed at 11:47 AM