

Assignment 4

SMS SPAM Classification

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▼ 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('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

2) ii)Pre-processing

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

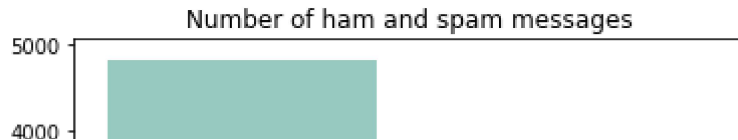
	v1	v2
0	ham	Go until jurong point, crazy.. Available only ...
1	ham	Ok lar... Joking wif u oni...
2	spam	Free entry in 2 a wkly comp to win FA Cup fina...
3	ham	U dun say so early hor... U c already then say...
4	ham	Nah I don't think he goes to usf, he lives aro...
...
5567	spam	This is the 2nd time we have tried 2 contact u...
5568	ham	Will i_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: 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)
```

```
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)
```

```
Label
```

```
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'))
```

▼ 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

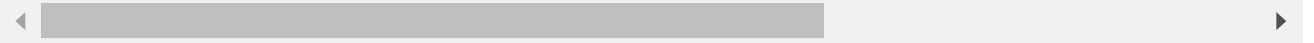
```
=====
Total params: 195,409
Trainable params: 195,409
Non-trainable params: 0
=====
```

▼ 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 [=====] - 26s 685ms/step - loss: 0.4328 - accuracy: 0
Epoch 2/5
30/30 [=====] - 19s 636ms/step - loss: 0.1765 - accuracy: 0
```

```
Epoch 3/5
30/30 [=====] - 19s 641ms/step - loss: 0.0588 - accuracy: 0
Epoch 4/5
30/30 [=====] - 19s 637ms/step - loss: 0.0336 - accuracy: 0
Epoch 5/5
30/30 [=====] - 19s 634ms/step - loss: 0.0195 - accuracy: 0
<keras.callbacks.History at 0x7f1497f02990>
```



▼ 8) Save the model

```
model.save
```

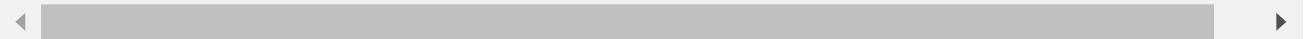
```
<bound method Model.save of <keras.engine.sequential.Sequential object at
0x7f149cf20a50>>
```

▼ 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 [=====] - 3s 54ms/step - loss: 0.1357 - accuracy: 0.9
```



```
l = accr[0]
a =accr[1]
print('Test set\n Loss: {:.3f}\n Accuracy: {:.3f}'.format(l,a))
```

```
Test set
Loss: 0.136
Accuracy: 0.976
```

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