**Assignment -4**
**SMS SPAM Classification**

| | |
|---|---|
| Assignment Date | 29 October 2022 |
| Team ID | PNT2022TMID38853 |
| Project Name | VIRTUALEYE – LIFE GUARD FOR SWIMMING POOLS TO DETECT ACTIVE DROWNING |
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| Maximum Marks | 2 Marks |

**Question-1.** Import required library

**Solution:**

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
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 Adam
from keras.preprocessing.text import Tokenizer
from keras.preprocessing import sequence
from keras.utils import pad_sequences
from keras.utils import to_categorical
from keras.callbacks import EarlyStopping
```

**Question-2.** Read the Dataset

**Solution:**

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

| | 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 |

**Question-3.** Pre processing the Dataset

**Solution:**

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

from wordcloud import WordCloud, STOPWORDS, ImageColorGenerator

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

X_train,X_test,Y_train,Y_test = train_test_split(X,Y,test_size=0.25)

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 = pad_sequences(sequences,maxlen=max_len)
```

**Question-4.** Create Model

**Solution:**

```
inputs = Input(shape=[max_len])

layer = Embedding(max_words,50,input_length=max_len)(inputs)

layer = LSTM(128)(layer)

layer = Dense(128)(layer)
```

**layer = Activation('relu')(layer)**

**layer = Dropout(0.5)(layer)**

**layer = Dense(1)(layer)**

**layer = Activation('sigmoid')(layer)**

**model = Model(inputs=inputs,outputs=layer)**

**Question-5.** Add Layers (LSTM, Dense-(Hidden Layers), Output)

**Solution:**

**model.summary()**

```
Model: "model_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 input_2 (InputLayer)        [(None, 150)]             0

 embedding_1 (Embedding)     (None, 150, 50)           50000

 lstm_1 (LSTM)               (None, 128)               91648

 dense_2 (Dense)             (None, 128)               16512

 activation_2 (Activation)   (None, 128)               0

 dropout_1 (Dropout)         (None, 128)               0

 dense_3 (Dense)             (None, 1)                 129

 activation_3 (Activation)   (None, 1)                 0

=================================================================
Total params: 158,289
Trainable params: 158,289
Non-trainable params: 0
_________________________________________________________________
```

**Question-6.** Compile the Model

**Solution:**

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

**Question-7.** Fit the Model

**Solution:**

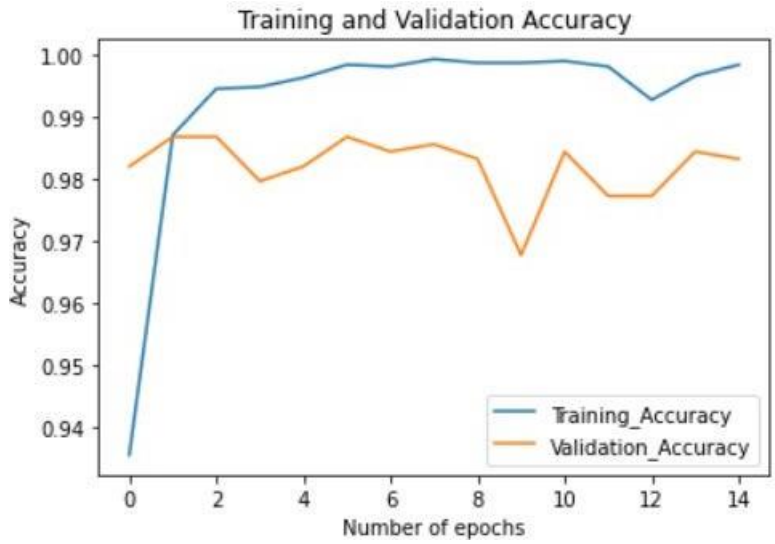
```
history = model.fit(sequences_matrix,Y_train,batch_size=20,epochs=15,
        validation_split=0.2)
```

```
Epoch 1/15
168/168 [==============================] - 34s 190ms/step - loss: 0.1980 - accuracy: 0.9354 - val_loss: 0.0649 - val_accuracy: 0.9821
Epoch 2/15
168/168 [==============================] - 31s 185ms/step - loss: 0.0416 - accuracy: 0.9871 - val_loss: 0.0513 - val_accuracy: 0.9868
Epoch 3/15
168/168 [==============================] - 31s 186ms/step - loss: 0.0217 - accuracy: 0.9946 - val_loss: 0.0613 - val_accuracy: 0.9868
Epoch 4/15
168/168 [==============================] - 33s 198ms/step - loss: 0.0155 - accuracy: 0.9949 - val_loss: 0.0779 - val_accuracy: 0.9797
Epoch 5/15
168/168 [==============================] - 32s 188ms/step - loss: 0.0132 - accuracy: 0.9964 - val_loss: 0.0661 - val_accuracy: 0.9821
Epoch 6/15
168/168 [==============================] - 32s 190ms/step - loss: 0.0065 - accuracy: 0.9985 - val_loss: 0.0772 - val_accuracy: 0.9868
Epoch 7/15
168/168 [==============================] - 32s 192ms/step - loss: 0.0057 - accuracy: 0.9982 - val_loss: 0.0811 - val_accuracy: 0.9844
Epoch 8/15
168/168 [==============================] - 32s 191ms/step - loss: 0.0045 - accuracy: 0.9994 - val_loss: 0.0877 - val_accuracy: 0.9856
Epoch 9/15
168/168 [==============================] - 32s 189ms/step - loss: 0.0046 - accuracy: 0.9988 - val_loss: 0.1282 - val_accuracy: 0.9833
Epoch 10/15
168/168 [==============================] - 32s 188ms/step - loss: 0.0066 - accuracy: 0.9988 - val_loss: 0.1191 - val_accuracy: 0.9677
Epoch 11/15
168/168 [==============================] - 33s 194ms/step - loss: 0.0036 - accuracy: 0.9991 - val_loss: 0.1149 - val_accuracy: 0.9844
Epoch 12/15
168/168 [==============================] - 31s 186ms/step - loss: 0.0131 - accuracy: 0.9982 - val_loss: 0.1019 - val_accuracy: 0.9773
Epoch 13/15
168/168 [==============================] - 31s 187ms/step - loss: 0.0251 - accuracy: 0.9928 - val_loss: 0.1015 - val_accuracy: 0.9773
Epoch 14/15
168/168 [==============================] - 31s 187ms/step - loss: 0.0081 - accuracy: 0.9967 - val_loss: 0.1005 - val_accuracy: 0.9844
Epoch 15/15
168/168 [==============================] - 32s 188ms/step - loss: 0.0048 - accuracy: 0.9985 - val_loss: 0.0985 - val_accuracy: 0.9833
```

```
metrics = pd.DataFrame(history.history)
metrics.rename(columns = {'loss': 'Training_Loss', 'accuracy': 'Training_Accuracy', 'val_loss': 'Valida
tion_Loss', 'val_accuracy': 'Validation_Accuracy'}, inplace = True)
def plot_graphs1(var1, var2, string):
   metrics[[var1, var2]].plot()
```

```
plt.title('Training and Validation ' + string)
plt.xlabel ('Number of epochs')
plt.ylabel(string)
plt.legend([var1, var2])
```

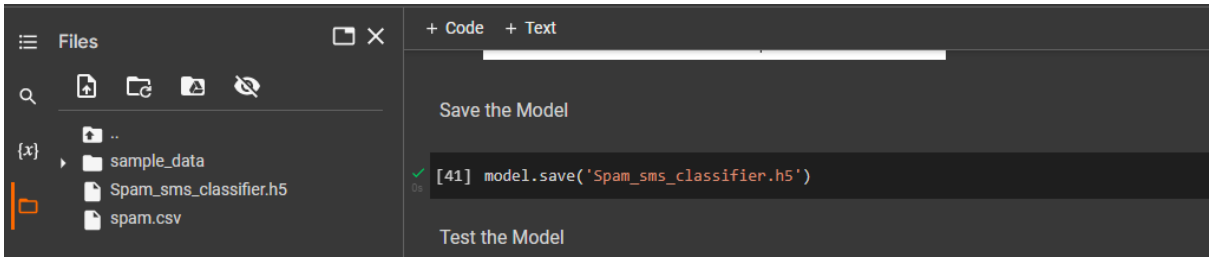
```
plot_graphs1('Training_Accuracy', 'Validation_Accuracy', 'Accuracy')
```




**Question-8.** Save The Model

**Solution:**

```
model.save('Spam_sms_classifier.h5')
```




**Question-9.** Test The Model

**Solution:**

```
test_sequences = tok.texts_to_sequences(X_test)
```

**test_sequences_matrix = pad_sequences(test_sequences,maxlen=max_len)**

**accuracy1 = model.evaluate(test_sequences_matrix,Y_test)**

```
44/44 [==============================] - 4s 82ms/step - loss: 0.1061 - accuracy: 0.9828
```

**print(' loss: {:0.4f}'.format(accuracy1[0]))**

**print(' Accuracy: {:0.4f}'.format(accuracy1[1]))**

```
loss: 0.1061
Accuracy: 0.9828
```