

ASSIGNMENT DATE	10 SEPTEMBER 2022
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STUDENT REGISTER NUMBER	2019504554
MAXIMUM MARKS	2 MARKS

## ASSIGNMENT 4 :

```
import numpy as np
import pandas as pd
import os
import seaborn as sns
import matplotlib.pyplot as plt
```

### IMPORTING THE LIBRARIES

In [ ]:

IM

In [ ]:

```
dataset = pd.read_csv(r'C:\Users\spdpr\Downloads\spam.csv',encoding='latin')
```

Out[ ]:

```
dataset.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

<b>3</b>	ham	U dun say so early hor... U c already then say...	NaN	NaN	NaN
<b>4</b>	ham	Nah I don't think he goes to usf, he lives aro...	NaN	NaN	NaN

```
In [ ]: dataset.drop(columns=['Unnamed: 2','Unnamed: 3','Unnamed: 4'], inplace=True)
In [ ]:
```

Out[ ]:

```
dataset.head()
```

**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...

```
In [ ]: dataset.rename(columns={'v1': 'Category', 'v2': 'Message'}, inplace=True)
```

```
In [ ]: dataset.head()
```

```
Out[ ]:      Category      Message
```

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...

```
In [ ]: dataset.isnull().sum()
```

```
Out[ ]: Category      0
      Message      0
      dtype: int64
```

```
In [ ]:
```

```
In [ ]: dataset['Message Length'] = dataset['Message'].apply(len)
```

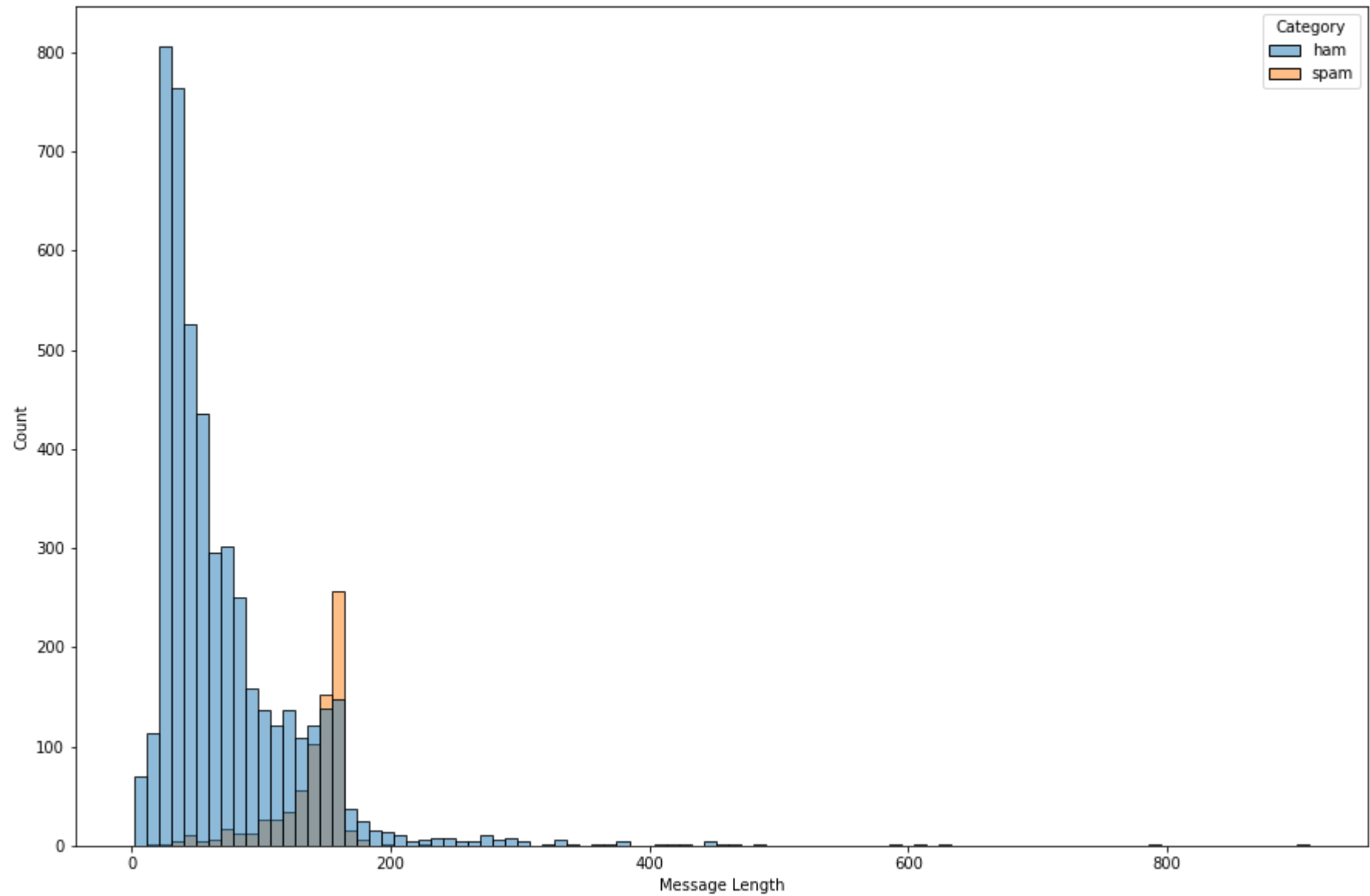
```
Out[ ]:
```

```
dataset.head()
```

	Category	Message	Message Length
0	ham	Go until jurong point, crazy.. Available only ...	111
1	ham	Ok lar... Joking wif u oni...	29
2	spam	Free entry in 2 a wkly comp to win FA Cup fina...	155
3	ham	U dun say so early hor... U c already then say...	49
4	ham	Nah I don't think he goes to usf, he lives aro...	61

```
In [ ]: fig = plt.figure(figsize=(15,10))
sns.histplot(data=dataset,x='Message Length', hue='Category')
```

```
Out[ ]: <AxesSubplot:xlabel='Message Length', ylabel='Count'>
```

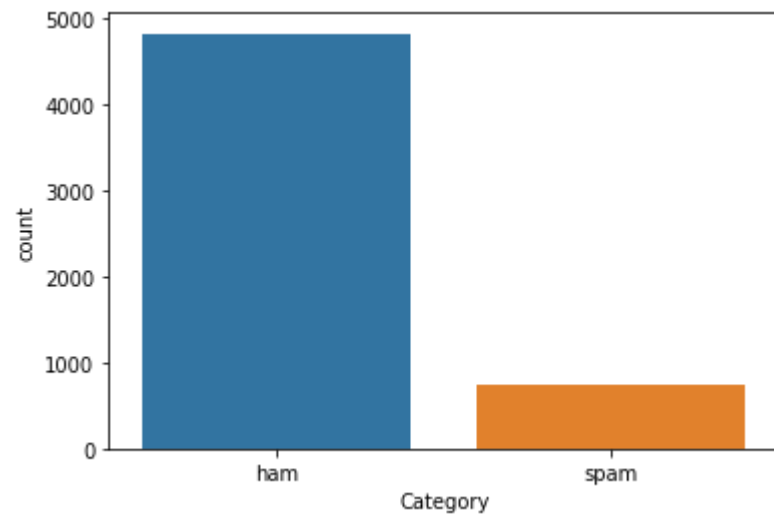


PLOTTING THE DATA

```
sns.countplot(data=dataset,x='Category')
```

```
In [ ]:
```

```
Out[ ]: <AxesSubplot:xlabel='Category', ylabel='count'>
```



```
In [ ]:
```

```
In [ ]: ham_desc = dataset[dataset['Category']=='ham'].describe()
```

```
In [ ]:
```

```
spam_desc = dataset[dataset['Category']=='spam'].describe()
```

```
print(ham_desc)
```

```
In [ ]: count    Message Length
        mean      4825.000000
        std       71.023627 58.016023
        min       2.000000
        25%       33.000000 52.000000
        50%       92.000000
        75%      910.000000
        max
```

```
print(spam_desc)
```

```
        Message Length
count      747.000000
mean      138.866131 std
        29.183082
```

```
min      13.000000
25%     132.500000
50%     149.000000
75%     157.000000
max     224.000000
```

```
In [ ]: dataset.index
```

```
Out[ ]: RangeIndex(start=0, stop=5572, step=1) In
```

```
[ ]:
```

```
minority_len=len(dataset[dataset["Category"]=="spam"])
majority_len=len(dataset[dataset["Category"]=="ham"])
minority_indices=dataset[dataset["Category"]=="spam"].index
majority_indices=dataset[dataset["Category"]=="ham"].index
random_majority_indices=np.random.choice( majority_indices,
size=minority_len, replace=False
)

undersampled_indices=np.concatenate([minority_indices,random_majority_indices])
df=dataset.loc[undersampled_indices] df=df.sample(frac=1) df=df.reset_index()
df=df.drop( columns=["index"],
)

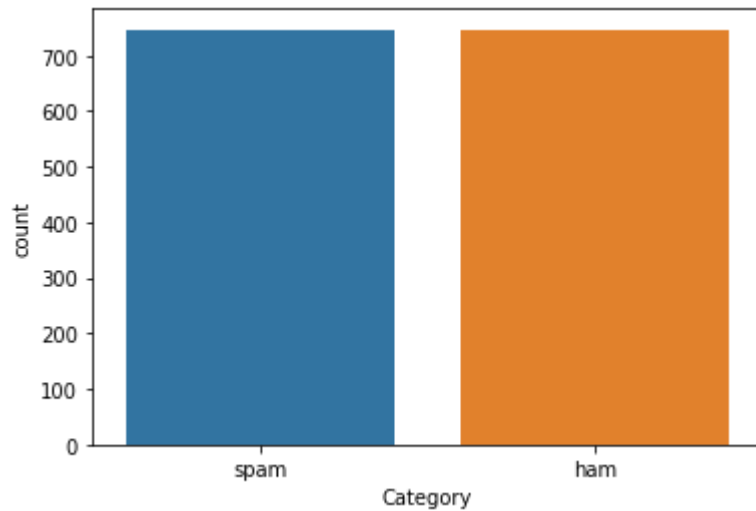
```

```
In [ ]: df.shape
```

```
Out[ ]:
(1494,
3)
```

```
In [ ]: sns.countplot(data=df,x='Category')
```

```
Out[ ]: <AxesSubplot:xlabel='Category', ylabel='count'>
```



In [ ]:

```
df['Label'] = df['Category'].apply(lambda x: 1 if x=='spam' else 0)
```

Out[ ]:

```
df.head(5)
```

	Category	Message	Message Length	Label
0	spam	Congratulations YOU'VE Won. You're a Winner in...	115	1
1	spam	Fantasy Football is back on your TV. Go to Sky...	162	1
2	spam	Moby Pub Quiz.Win a £100 High Street prize if...	162	1
3	spam	INTERFLORA - ðIt's not too late to order Inte...	137	1
4	spam	URGENT! We are trying to contact U. Todays dra...	158	1

In [ ]:

```
import re
import nltk
from nltk.corpus import stopwords
from nltk.stem import PorterStemmer
stemmer=PorterStemmer()
```

```
In [ ]: corpus=[] for message in
df["Message"]:

    message=re.sub("[^a-zA-Z]", " ",message)
    message=message.lower() message=message.split()
    message=[stemmer.stem(words)
              for words in message
              if words not in set(stopwords.words("english"))
            ]
    message=" ".join(message) corpus.append(message)
```

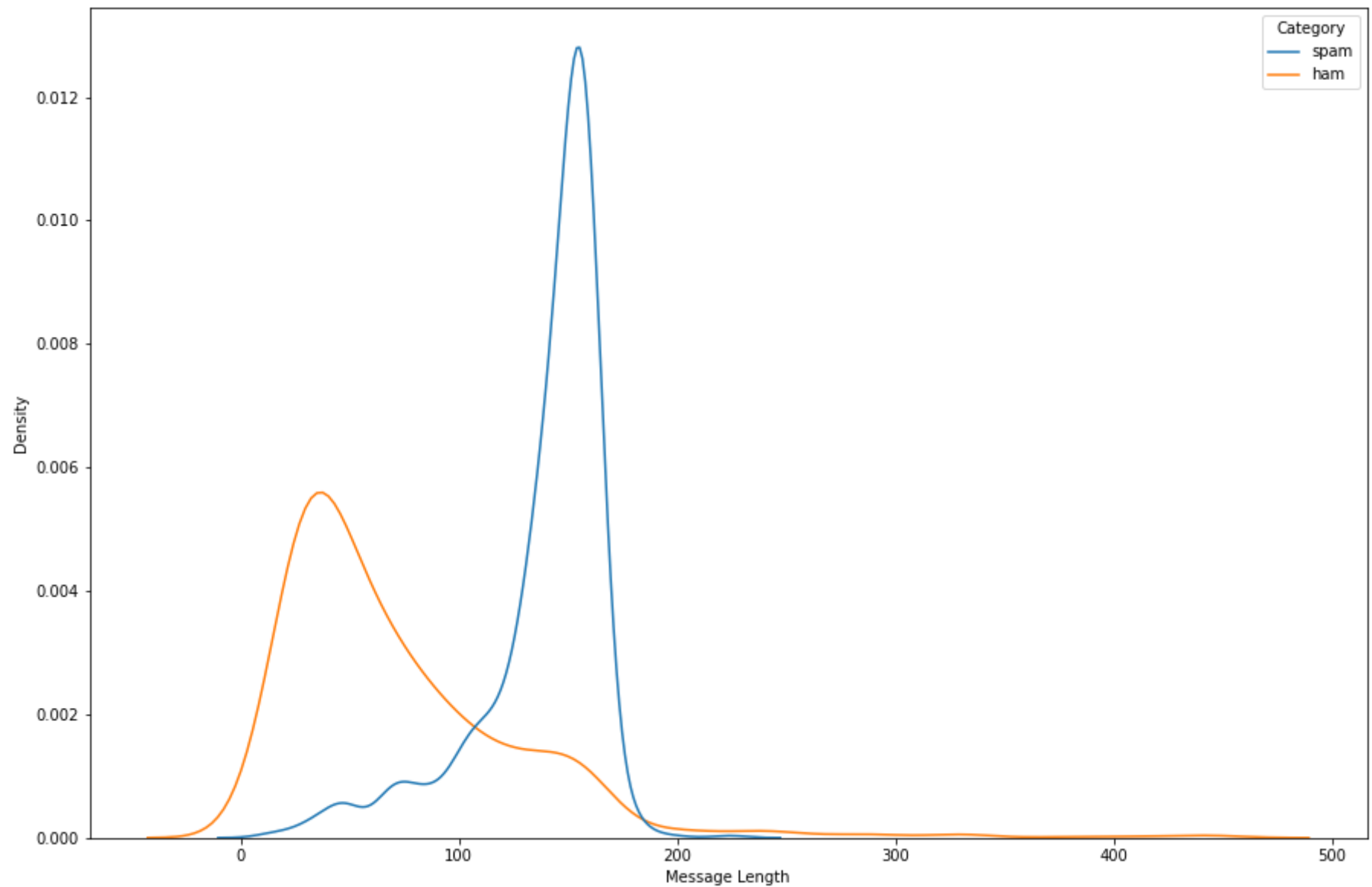
```
In [ ]: from tensorflow.keras.preprocessing.text import one_hot vocab_size=10000
oneHot_doc=[one_hot(words,n=vocab_size)
            for words in corpus
            ]
```

```
In [ ]: df['Message Length'].describe()
```

```
Out[ ]:
count          1494.000000
mean           105.848728
std             56.052314
min              3.000000
25%             51.000000
50%            120.000000
75%            153.000000
max
Name: Message Length, dtype: float64
```

```
In [ ]: fig=plt.figure(figsize=(15,10))
sns.kdeplot( x=df["Message
Length"], hue=df["Category"]
) plt.show()
```





```
In [ ]: from tensorflow.keras.preprocessing.sequence import pad_sequences
sentence_len=200 embedded_doc=pad_sequences( oneHot_doc,
maxlen=sentence_len,
```

```
padding="pre"
)
```

```
In [ ]: extract_features=pd.DataFrame( data=embedded_doc
)
target=df["Label"]
```

```
In [ ]:
```

```
In [ ]: df_final=pd.concat([extract_features,target],axis=1)
```

```
Out[ ]: df_final.head()
```

```
0 1 2 3
4 5 6 7
8 9 ...
```

```
191      192  193  194  195  196  197  198 199 Label
```

0	0	0	0	0	0	0	0	0	0	0	0	...	0	4477	6385	567	6627	4070	3385	6627	7684	1
1	0	0	0	0	0	0	0	0	0	0	0	...	1098	2883	3053	564	1334	769	9085	9996	9293	1
2	0	0	0	0	0	0	0	0	0	0	0	...	1580	6091	6371	9693	2650	7602	2047	9283	5043	1
3	0	0	0	0	0	0	0	0	0	0	0	...	4991	555	3715	7835	3385	2258	4991	1007	6700	1
4	0	0	0	0	0	0	0	0	0	0	0	...	6627	290	3385	3101	7104	1171	3996	1952	5339	1

5 rows × 201 columns

## CREATING A MODEL

```
x=df_final.drop("Label",axis=1)
y=df_final["Label"]
```

```
from sklearn.model_selection import train_test_split
```

```
In [ ]: x_train, x_test, y_train, y_test = train_test_split(x,y,random_state=20,test_size=0.15) x_train,  
x_val, y_train, y_val = train_test_split(x_train,y_train,random_state=20,test_size=0.15)
```

```
In [ ]:
```

```
In [ ]:
```

```
In [ ]: from tensorflow.keras.layers import LSTM from  
tensorflow.keras.layers import Dense from  
tensorflow.keras.layers import Embedding from  
tensorflow.keras.models import Sequential
```

```
In [ ]:
```

```
In [ ]: model=Sequential()
```

```
feature_num=100 model.add(  
    Embedding(  
input_dim=vocab_size,  
output_dim=feature_num,  
input_length=sentence_len ) )  
model.add( LSTM( units=128  
    )  
)
```

```
model.add(  
    Dense( units=1,  
        activation="sigmoid"  
    ) )  
model.summary()
```

Model: "sequential\_1"

---

Layer (type)	Output Shape	Param #
--------------	--------------	---------

===== embedding

(Embedding) (None, 200, 100) 1000000

lstm (LSTM) (None, 128) 117248 dense (Dense) (None, 1) 129

=====

Total params: 1,117,377

Trainable params: 1,117,377

Non-trainable params: 0

---

```
In [ ]: from tensorflow.keras.optimizers import Adam
model.compile( optimizer=Adam(
```

```
    learning_rate=0.001
    ), loss="binary_crossentropy",
    metrics=["accuracy"]
)
```

```
In [ ]: history=model.fit(
    x_train, y_train,
    validation_data=(x_val,y_val), epochs=10
)
```

```

Epoch 1/10
34/34 [=====] - 15s 301ms/step - loss: 0.4961 - accuracy: 0.8043 - val_loss: 0.2683 - val_accuracy: 0.9110
Epoch 2/10
34/34 [=====] - 9s 263ms/step - loss: 0.1598 - accuracy: 0.9518 - val_loss: 0.1667 - val_accuracy: 0.9529
Epoch 3/10
34/34 [=====] - 9s 260ms/step - loss: 0.0450 - accuracy: 0.9870 - val_loss: 0.1750 - val_accuracy: 0.9581
Epoch 4/10
34/34 [=====] - 9s 254ms/step - loss: 0.0365 - accuracy: 0.9889 - val_loss: 0.1723 - val_accuracy: 0.9476
Epoch 5/10
34/34 [=====] - 9s 265ms/step - loss: 0.0346 - accuracy: 0.9963 - val_loss: 0.1603 - val_accuracy: 0.9529
Epoch 6/10
34/34 [=====] - 9s 247ms/step - loss: 0.0114 - accuracy: 0.9972 - val_loss: 0.1931 - val_accuracy: 0.9581
Epoch 7/10
34/34 [=====] - 9s 256ms/step - loss: 0.0066 - accuracy: 0.9991 - val_loss: 0.2008 - val_accuracy: 0.9529
Epoch 8/10
34/34 [=====] - 9s 251ms/step - loss: 0.0042 - accuracy: 0.9991 - val_loss: 0.1951 - val_accuracy: 0.9476
Epoch 9/10
34/34 [=====] - 9s 256ms/step - loss: 0.0031 - accuracy: 0.9991 - val_loss: 0.2113 - val_accuracy: 0.9529
Epoch 10/10
34/34 [=====] - 9s 258ms/step - loss: 0.0022 - accuracy: 1.0000 - val_loss: 0.2267 - val_accuracy: 0.9581

```

```

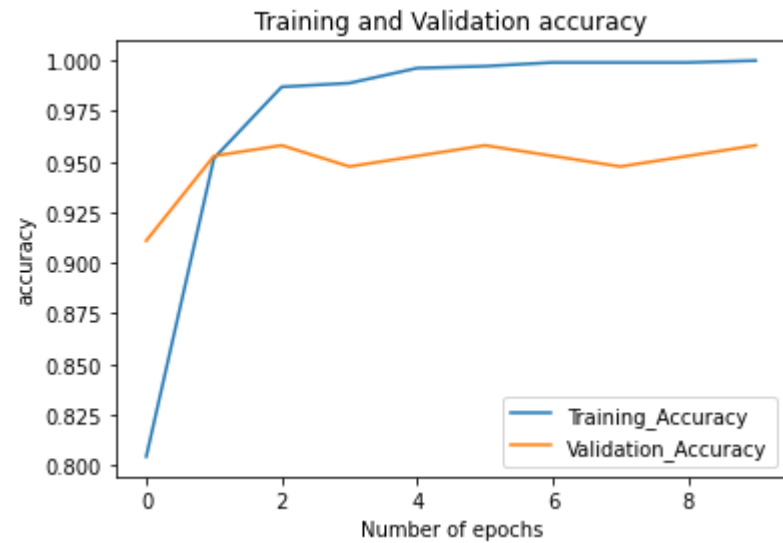
In [ ]: metrics = pd.DataFrame(history.history)
metrics.rename(columns = {'loss': 'Training_Loss', 'accuracy': 'Training_Accuracy', 'val_loss': 'Validation_Loss', 'val_accuracy': 'Validation_Accuracy'})
def plot_graph_acc(var1, var2, string):
    metrics[[var1, var2]].plot()
    plt.title('Training and Validation ' + string)
    plt.xlabel('Number of epochs')
    plt.ylabel(string)
    plt.legend([var1, var2])

```

```

In [ ]: plot_graph_acc('Training_Accuracy', 'Validation_Accuracy', 'accuracy')

```



In [ ]:

```
In [ ]: model.save('Spam_OR_Ham_Classifier_SMS.h5')
```

```
y_pred=model.predict(x_test) y_pred=(y_pred>0.5)
```

8/8 [=====] - 2s 100ms/step

In [ ]:

```
In [ ]: from sklearn.metrics import accuracy_score, confusion_matrix
```

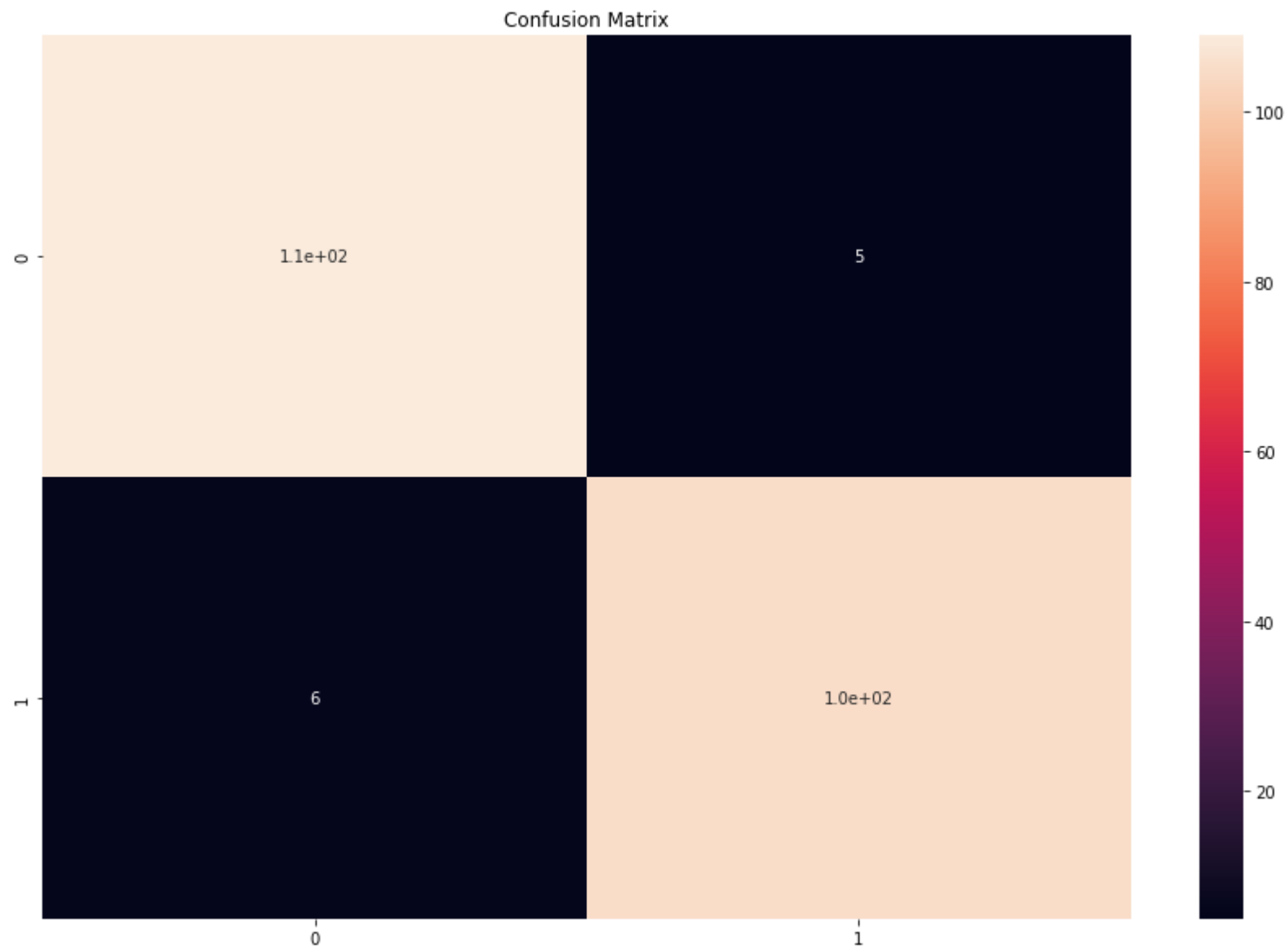
```
print(accuracy_score(y_test,y_pred))
```

0.9511111111111111

In [ ]:

```
cm=confusion_matrix(y_test,y_pred)
fig=plt.figure(figsize=(15,10))
sns.heatmap( cm,
    annot=True,
) plt.title("Confusion
Matrix") cm
```

Out[ ]: array([[109, 5],  
[ 6, 105]], dtype=int64)



**To test a Random SMS**

```
In [ ]: def classify_message(model,message):
        for sentences in message:

            sentences=nltk.sent_tokenize(message) for
            sentence in sentences:
                words=re.sub("[^a-zA-Z]", " ",sentence) if words
                not in set(stopwords.words('english')):
                    word=nltk.word_tokenize(words) word="
                    ".join(word)
            oneHot=[one_hot(word,n=vocab_size)]
            text=pad_sequences(oneHot,maxlen=sentence_len,padding="pre")
            predict=model.predict(text) if predict>0.5:
                print("It is a spam") print("predict
                score: ", predict[0][0])
            else:
                print("It is not a spam") print("predict
                score: ", predict[0][0])
```

```
In [ ]: message1="Hello Mom. I'm fine. I'm busy right now. Can I call u later?"
        message2="PRIVATE! Your 2004 Account Statement for 07742676969 shows 786 unredeemed Bonus Points. To claim call 08719180248 Iden
```

```
In [ ]: classify_message(model,message1)
```

```
1/1 [=====] - 0s 70ms/step It
is not a spam
predict score: 0.008738322
```

```
In [ ]: classify_message(model,message2)
```

```
1/1 [=====] - 0s 59ms/step It
is a spam
predict score: 0.9998115
```

```
In [ ]:
```