ASSIGNMENT DATE	10 SEPTEMBER 2022
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MAXIMUM MARKS	2 MARKS

ASSIGNMENT 4 :

IMPORTING THE LIBRARIES

```
In [ ]: import numpy as np
        import pandas as pd
        import os
        import seaborn as sns
        import matplotlib.pyplot as plt
```

M

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

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

```
Out[ ]:      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
```

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

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

Out[ ]:

	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[ ]:

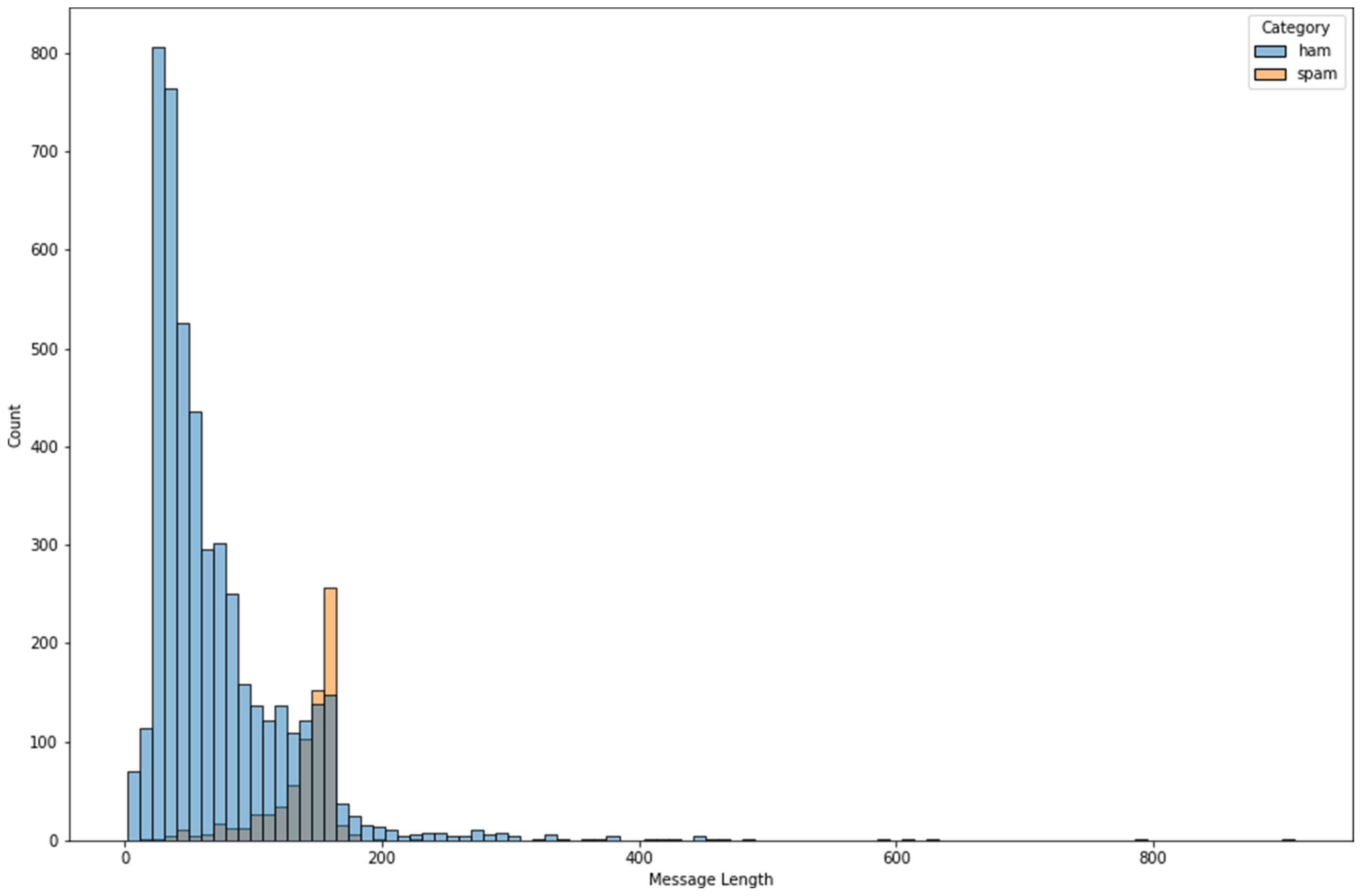
	Category	Message
0	ham	Go until jurong point, crazy.. Available only ...
1	ham	Ok lar... Joking wif u oni...
2	spam	Free entry in 2 a wkly comp to win FA Cup fina...
3	ham	U dun say so early hor... U c already then say...
4	ham	Nah I don't think he goes to usf, he lives aro...

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

Out[ ]: Category    0
        Message     0
        dtype: int64

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

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

Out[ ]:

	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

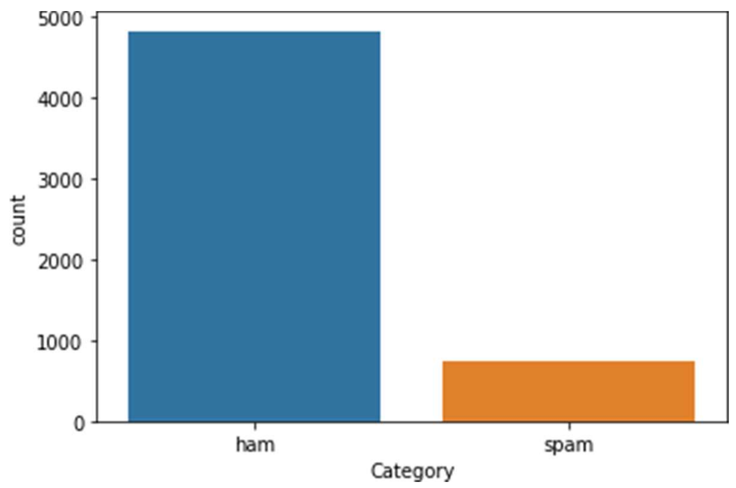
```
In [ ]: fig = plt.figure(figsize=(15,10))
        sns.histplot(data=dataset,x='Message Length', hue='Category')

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



PLOTTING THE DATA

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

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



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

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

```
In [ ]: print(ham_desc)
```

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

```
In [ ]: 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)
```

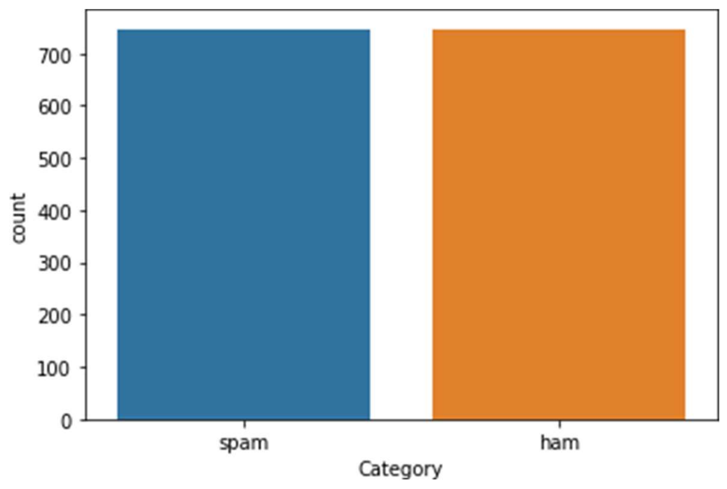
In [ ]:
```
minority_len=len(dataset[dataset["Category"]=="spam"])
majority_len=len(dataset[dataset["Category"]=="ham"])
minority_indices=dataset[dataset["Category"]=="spam"].index
majority_indices=dataset[dataset["Category"]=="ham"].index
random_majority_indices=np.random.choice(
    majority_indices,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

```
In [ ]: df.head(5)
```

Out[ ]:

	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 å£100 High Street prize if...	162	1
3	spam	INTERFLORA - åÒIt'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"]:
```

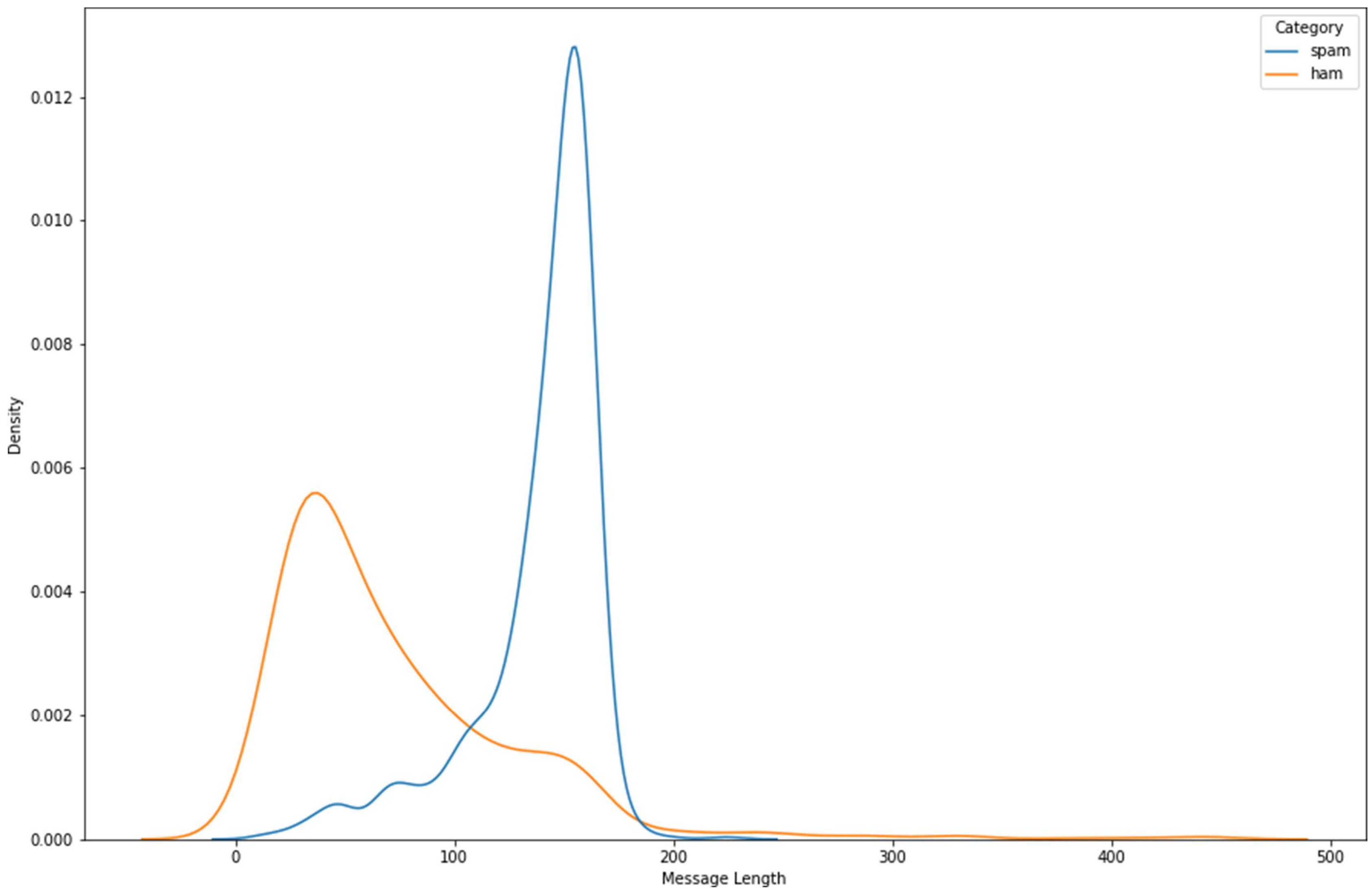
```
     message=re.sub("[^a-zA-Z]"," ",message)
    message=message.lower()
    message=message.split()
    message=[stemmer.stem(words)
             for words in message
              if words not in set(stopwords.words("english"))
             ]
     message=" ".join(message)
     corpus.append(message)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

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       444.000000
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 [ ]:
```
df_final=pd.concat([extract_features,target],axis=1)
```

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

Out[ ]:

	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	4477	6385	567	6627	4070	3385	6627	7684	1
1	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	...	1580	6091	6371	9693	2650	7602	2047	9283	5043	1
3	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	...	6627	290	3385	3101	7104	1171	3996	1952	5339	1

5 rows × 201 columns

CREATING A MODEL

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

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

In [ ]:
```
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
_________________________________________________________________
```

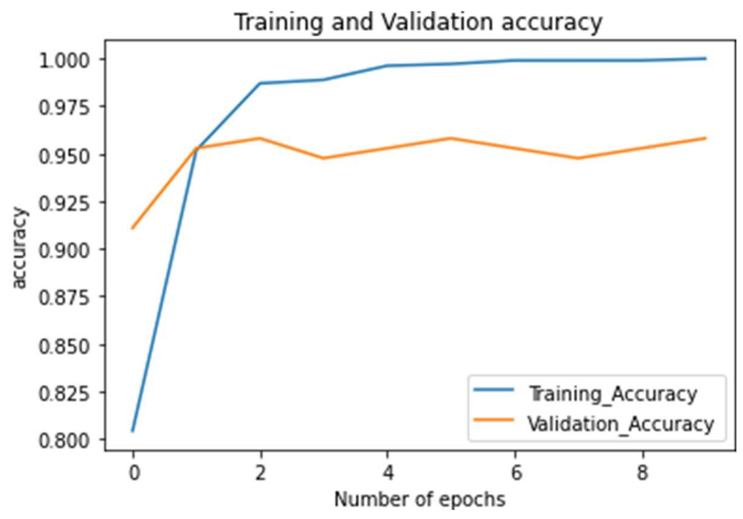
In [ ]:
```
from tensorflow.keras.optimizers import Adam
model.compile(
    optimizer=Adam(
    learning_rate=0.001
    ),
    loss="binary_crossentropy",
    metrics=["accuracy"]
)
```

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: 0.9
110
Epoch 2/10
34/34 [==============================]     - 9s 263ms/step - loss: 0.1598 - accuracy: 0.9518 - val_loss: 0.1667 - val_accuracy: 0.95
29
Epoch 3/10
34/34 [==============================]     - 9s 260ms/step - loss: 0.0450 - accuracy: 0.9870 - val_loss: 0.1750 - val_accuracy: 0.95
81
Epoch 4/10
34/34 [==============================]     - 9s 254ms/step - loss: 0.0365 - accuracy: 0.9889 - val_loss: 0.1723 - val_accuracy: 0.94
76
Epoch 5/10
34/34 [==============================]     - 9s 265ms/step - loss: 0.0346 - accuracy: 0.9963 - val_loss: 0.1603 - val_accuracy: 0.95
29
Epoch 6/10
34/34 [==============================]     - 9s 247ms/step - loss: 0.0114 - accuracy: 0.9972 - val_loss: 0.1931 - val_accuracy: 0.95
81
Epoch 7/10
34/34 [==============================]     - 9s 256ms/step - loss: 0.0066 - accuracy: 0.9991 - val_loss: 0.2008 - val_accuracy: 0.95
29
Epoch 8/10
34/34 [==============================]     - 9s 251ms/step - loss: 0.0042 - accuracy: 0.9991 - val_loss: 0.1951 - val_accuracy: 0.94
76
Epoch 9/10
34/34 [==============================]     - 9s 256ms/step - loss: 0.0031 - accuracy: 0.9991 - val_loss: 0.2113 - val_accuracy: 0.95
29
Epoch 10/10
34/34 [==============================]     - 9s 258ms/step - loss: 0.0022 - accuracy: 1.0000 - val_loss: 0.2267 - val_accuracy: 0.95
81
```

```
In [ ]: metrics = pd.DataFrame(history.history)
        metrics.rename(columns = {'loss': 'Training_Loss', 'accuracy': 'Training_Accuracy', 'val_loss': 'Validation_Loss', 'val_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 [ ]: model.save('Spam_OR_Ham_Classifier_SMS.h5')
```

```
In [ ]: y_pred=model.predict(x_test)
        y_pred=(y_pred>0.5)
```

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

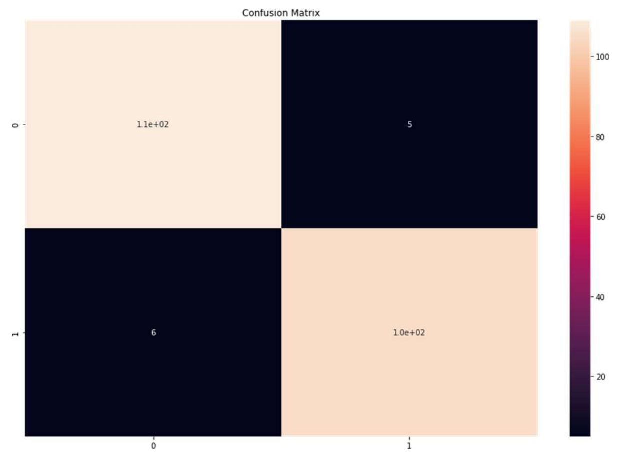
```
In [ ]: from sklearn.metrics import accuracy_score,confusion_matrix
```

```
In [ ]: 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 [ ]:
```

```
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 [ ]:
```