# ****Spam Message Classification using LSTM****

## 1.Import the Necessary Libraries

```
import numpy as np
import pandas as pd
import os
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
for dirname, _, filenames in os.walk('/kaggle/input'):
    for filename in filenames:
        print(os.path.join(dirname, filename))
```

```
/kaggle/input/sms-spam-collection-dataset/spam.csv
```

****2. Reading the .csv dataset****

```
data=pd.read_csv("../input/sms-spam-collection-dataset/
spam.csv",encoding="latin")
data.head()
```

```
     v1                                                 v2 Unnamed: 2
\
0   ham  Go until jurong point, crazy.. Available only ...        NaN

1   ham                      Ok lar... Joking wif u oni...        NaN

2  spam  Free entry in 2 a wkly comp to win FA Cup fina...        NaN

3   ham  U dun say so early hor... U c already then say...        NaN

4   ham  Nah I don't think he goes to usf, he lives aro...        NaN


  Unnamed: 3 Unnamed: 4
0        NaN        NaN
1        NaN        NaN
2        NaN        NaN
3        NaN        NaN
4        NaN        NaN
```

```
data.columns
```

```
Index(['v1', 'v2', 'Unnamed: 2', 'Unnamed: 3', 'Unnamed: 4'],
dtype='object')
```

****3. Drop the unnamed Columns****

```
data=data.drop(columns=["Unnamed: 2","Unnamed: 3","Unnamed: 4"])
```

****4. Renaming Column names sensible****

```
data=data.rename(
{
    "v1":"Category",
    "v2":"Message"
},
    axis=1
)
```

```
data.head()
```

```
  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...
```

****5. Check for null values in dataset****

```
data.isnull().sum()
```

```
Category    0
Message     0
dtype: int64
```

```
data.info()
```

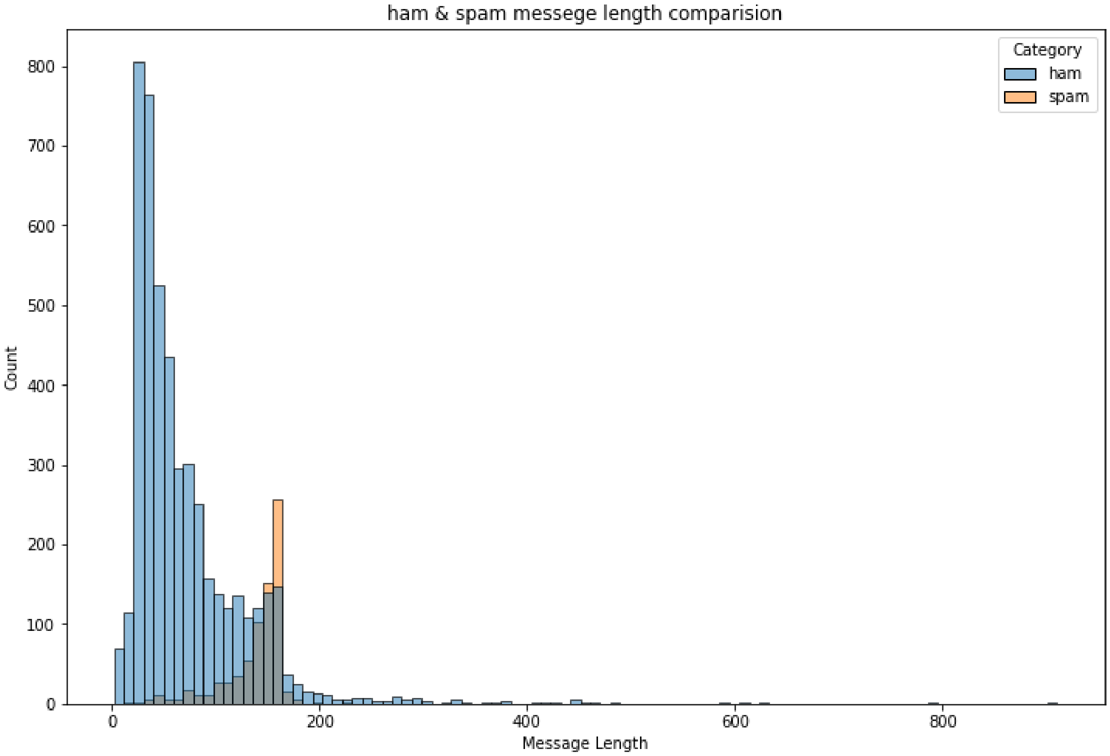
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5572 entries, 0 to 5571
Data columns (total 2 columns):
 #   Column    Non-Null Count  Dtype 
---  ------    --------------  ----- 
 0   Category  5572 non-null   object
 1   Message   5572 non-null   object
dtypes: object(2)
memory usage: 87.2+ KB
```

****6.Creating a new Field to store the Message Lengths****

```
data["Message Length"]=data["Message"].apply(len)
```

****7. Histogram Inference of Message Lengths of Spam and Non-spam messages****

```
fig=plt.figure(figsize=(12,8))
sns.histplot(
    x=data["Message Length"],
    hue=data["Category"]
)
plt.title("ham & spam messege length comparision")
plt.show()
```



```
ham_desc=data[data["Category"]=="ham"]["Message Length"].describe()
spam_desc=data[data["Category"]=="spam"]["Message Length"].describe()

print("Ham Messege Length Description:\n",ham_desc)
print("************************************")
print("Spam Message Length Description:\n",spam_desc)

Ham Messege Length Description:
 count    4825.000000
mean       71.023627
std        58.016023
min         2.000000
25%        33.000000
50%        52.000000
75%        92.000000
max       910.000000
Name: Message Length, dtype: float64
************************************
Spam Message Length Description:
 count    747.000000
mean     138.866131
std       29.183082
min       13.000000
25%      132.500000
50%      149.000000
75%      157.000000
```

```
max      224.000000
Name: Message Length, dtype: float64
```

```
data.describe(include="all")
```

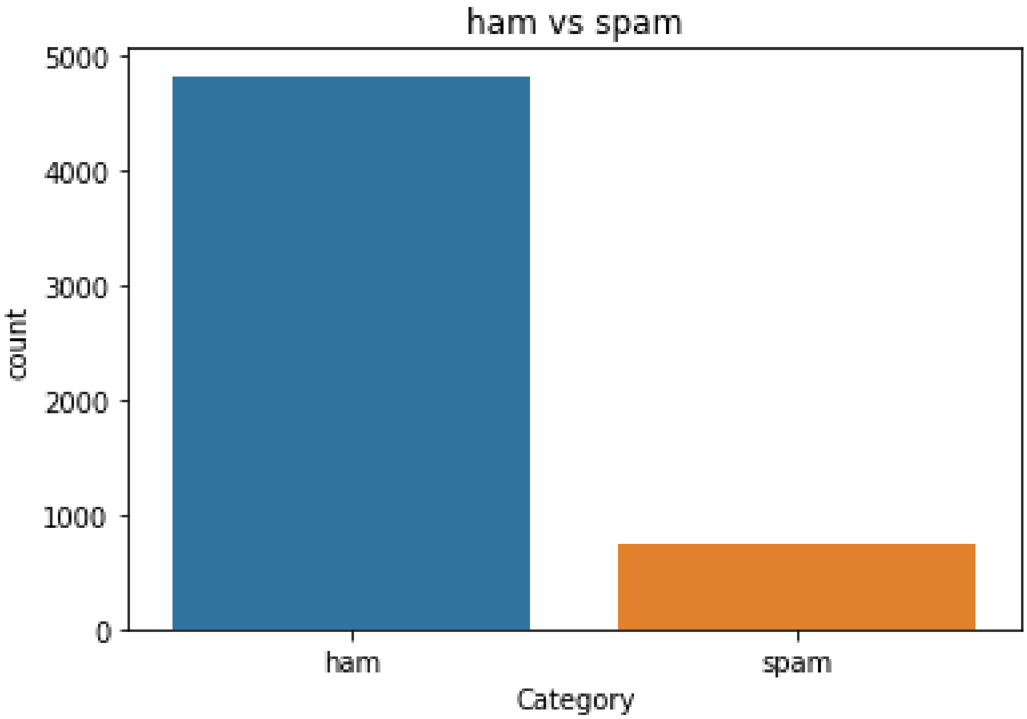
```
       Category                Message  Message Length
count      5572                   5572     5572.000000
unique        2                   5169             NaN
top         ham  Sorry, I'll call later            NaN
freq       4825                     30             NaN
mean        NaN                    NaN       80.118808
std         NaN                    NaN       59.690841
min         NaN                    NaN        2.000000
25%         NaN                    NaN       36.000000
50%         NaN                    NaN       61.000000
75%         NaN                    NaN      121.000000
max         NaN                    NaN      910.000000
```

****8. Visualizing count of messages of Spam and Non Spam****

```
data["Category"].value_counts()
```

```
ham     4825
spam     747
Name: Category, dtype: int64
```

```
sns.countplot(
    data=data,
    x="Category"
)
plt.title("ham vs spam")
plt.show()
```



```
ham_count=data["Category"].value_counts()[0]
spam_count=data["Category"].value_counts()[1]

total_count=data.shape[0]

print("Ham contains:{:.2f}% of total
data.".format(ham_count/total_count*100))
print("Spam contains:{:.2f}% of total
data.".format(spam_count/total_count*100))
```

```
Ham contains:86.59% of total data.
Spam contains:13.41% of total data.
```

****9. Undersampling to Genralize Model and Balance Spam and Ham quantities in dataset****

```
minority_len=len(data[data["Category"]=="spam"])
majority_len=len(data[data["Category"]=="ham"])
minority_indices=data[data["Category"]=="spam"].index
majority_indices=data[data["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=data.loc[undersampled_indices]
df=df.sample(frac=1)
df=df.reset_index()
df=df.drop(
    columns=["index"],
)
```

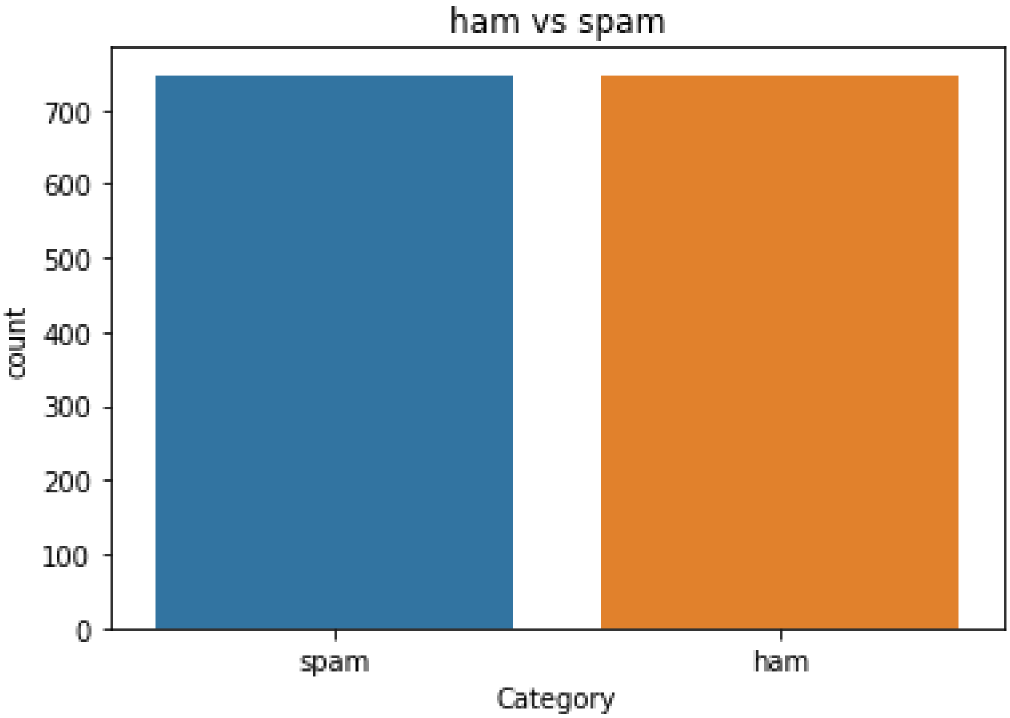
```
df.shape
```

```
(1494, 3)
```

```
df["Category"].value_counts()
```

```
ham     747
spam    747
Name: Category, dtype: int64
```

```
sns.countplot(
    data=df,
    x="Category"
)
plt.title("ham vs spam")
plt.show()
```



Display the head of new **df**

```
df.head()
```

```
  Category                                            Message  Message 
Length
0     spam  FREE>Ringtone! Reply REAL or POLY eg REAL1 1. ...
158
1     spam  URGENT! We are trying to contact U Todays draw...
157
2      ham      Ok ill send you with in  &lt;DECIMAL&gt;  ok.
45
3      ham                     Oh just getting even with u.... u?
34
4     spam  A link to your picture has been sent. You can ...
96
```

****10. Binary Encoding of Spam and Ham Categories****

```
df["Label"]=df["Category"].map(
    {
        "ham":0,
        "spam":1
    }
)
```

```
df.head()
```

```
  Category                                            Message  Message 
Length  \
0     spam  FREE>Ringtone! Reply REAL or POLY eg REAL1 1. ...
158
1     spam  URGENT! We are trying to contact U Todays draw...
157
2      ham      Ok ill send you with in  &lt;DECIMAL&gt;  ok.
45
3      ham                     Oh just getting even with u.... u?
34
4     spam  A link to your picture has been sent. You can ...
96

   Label
0      1
1      1
2      0
3      0
4      1
```

****11. Import Necessary Libraries to perform Word Tokenization****

```
import re
import nltk
from nltk.corpus import stopwords
from nltk.stem import PorterStemmer
```

```
stemmer=PorterStemmer()

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)
```

****12. Perform One Hot on Corpus****

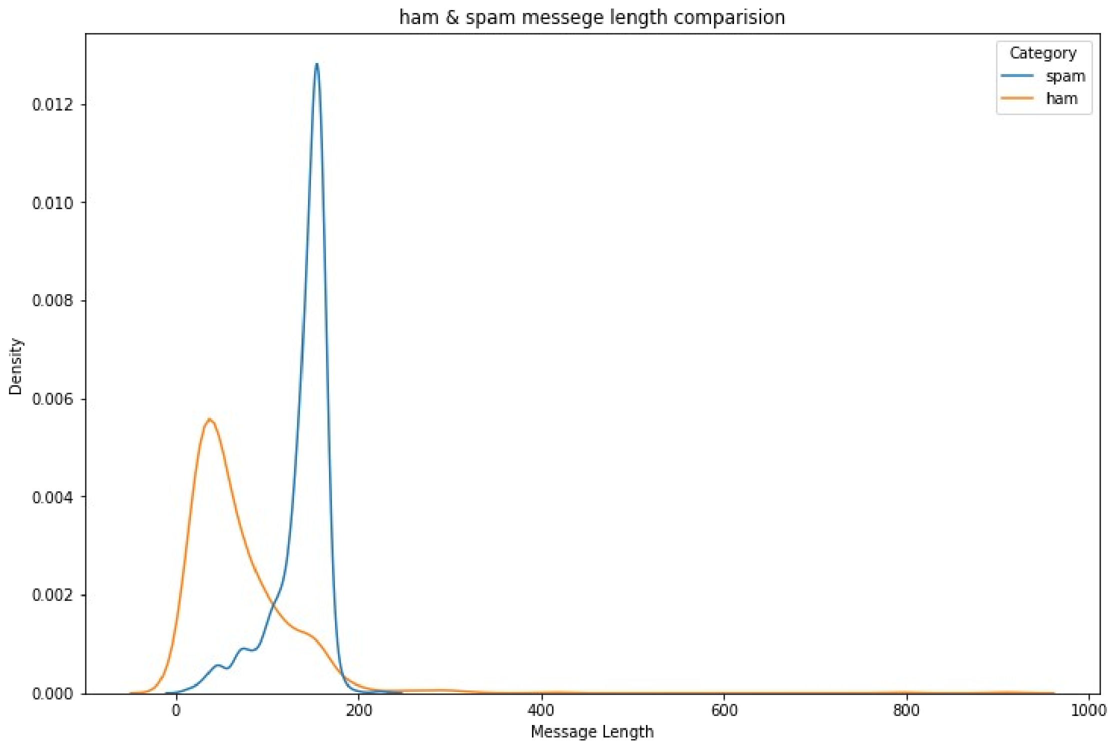
```
from tensorflow.keras.preprocessing.text import one_hot
vocab_size=10000


oneHot_doc=[one_hot(words,n=vocab_size)
           for words in corpus
           ]
```

```
df["Message Length"].describe()
```

```
count    1494.000000
mean      104.491299
std        60.362332
min         2.000000
25%        49.000000
50%       114.000000
75%       153.000000
max       910.000000
Name: Message Length, dtype: float64
```

```
fig=plt.figure(figsize=(12,8))
sns.kdeplot(
    x=df["Message Length"],
    hue=df["Category"]
)
plt.title("ham & spam messege length comparision")
plt.show()
```



```
from tensorflow.keras.preprocessing.sequence import pad_sequences
sentence_len=200
embedded_doc=pad_sequences(
    oneHot_doc,
    maxlen=sentence_len,
    padding="pre"
)

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

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

df_final.head()
```

```
   0  1  2  3  4  5  6  7  8  9  ...   191   192   193   194   195
196  \
0  0  0  0  0  0  0  0  0  0  0  ...  8116  8983  7883  1884  5957
5877
1  0  0  0  0  0  0  0  0  0  0  ...  9989  7682  5710  5519  2447
1240
2  0  0  0  0  0  0  0  0  0  0  ...     0     0  3310  6099  7761
9276
3  0  0  0  0  0  0  0  0  0  0  ...     0     0     0     0  8194
7945
4  0  0  0  0  0  0  0  0  0  0  ...  5677  7440  8481  9975  2366
```

```
4841

    197   198   199  Label
0   266  1527  5846      1
1  3994  6950  3655      1
2  4679  2205  3310      0
3  3841   266   266      0
4  4320  4320  4672      1

[5 rows x 201 columns]
```

### 13. Splitting Dependent and Independent Variables

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

****14. Train, test and Validation Split****

```
from sklearn.model_selection import train_test_split

X_trainval,X_test,y_trainval,y_test=train_test_split(
    X,
    y,
    random_state=42,
    test_size=0.15
)

X_train,X_val,y_train,y_val=train_test_split(
    X_trainval,
    y_trainval,
    random_state=42,
    test_size=0.15
)
```

****15.Building a Sequential Model****

```
from tensorflow.keras.layers import LSTM
from tensorflow.keras.layers import Dense
from tensorflow.keras.layers import Embedding
from tensorflow.keras.models import Sequential

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"
_________________________________________________________________
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
_________________________________________________________________
```

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

****16. Model Fitting****

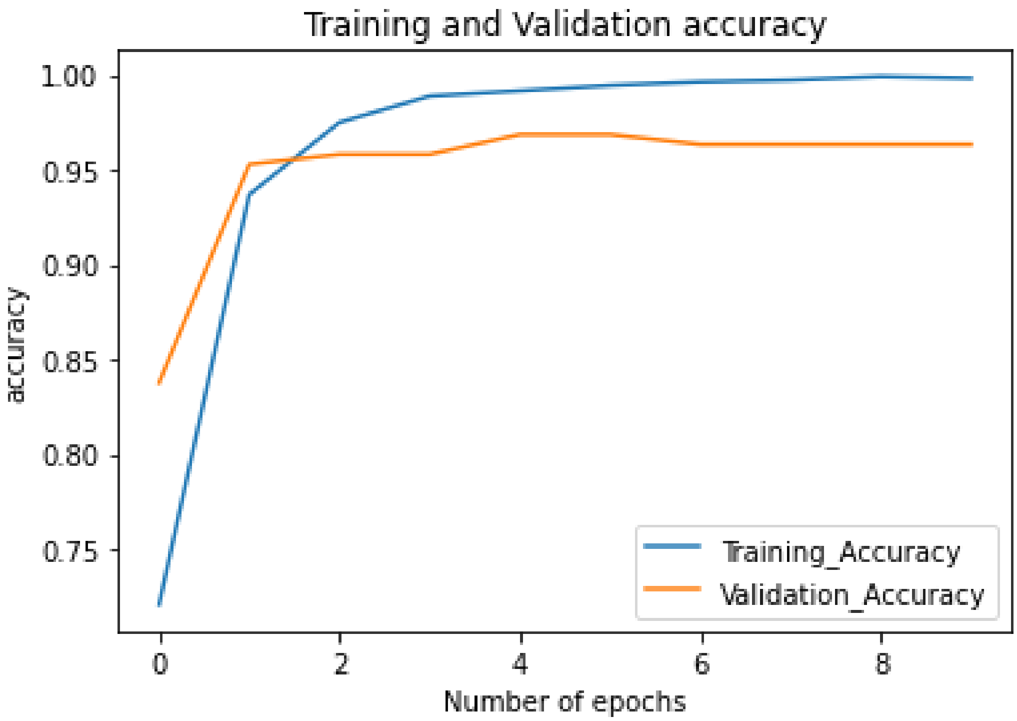
```
history=model.fit(
    X_train,
    y_train,
    validation_data=(
        X_val,
        y_val
    ),
    epochs=10
)
```

```
Epoch 1/10
34/34 [==============================] - 24s 633ms/step - loss: 0.6324
```

```
- accuracy: 0.6331 - val_loss: 0.4218 - val_accuracy: 0.8377
Epoch 2/10
34/34 [==============================] - 21s 608ms/step - loss: 0.3045
- accuracy: 0.9257 - val_loss: 0.1631 - val_accuracy: 0.9529
Epoch 3/10
34/34 [==============================] - 21s 609ms/step - loss: 0.1046
- accuracy: 0.9689 - val_loss: 0.1231 - val_accuracy: 0.9581
Epoch 4/10
34/34 [==============================] - 21s 621ms/step - loss: 0.0465
- accuracy: 0.9880 - val_loss: 0.1293 - val_accuracy: 0.9581
Epoch 5/10
34/34 [==============================] - 21s 613ms/step - loss: 0.0342
- accuracy: 0.9895 - val_loss: 0.1252 - val_accuracy: 0.9686
Epoch 6/10
34/34 [==============================] - 21s 615ms/step - loss: 0.0179
- accuracy: 0.9951 - val_loss: 0.1366 - val_accuracy: 0.9686
Epoch 7/10
34/34 [==============================] - 21s 614ms/step - loss: 0.0121
- accuracy: 0.9968 - val_loss: 0.1314 - val_accuracy: 0.9634
Epoch 8/10
34/34 [==============================] - 21s 619ms/step - loss: 0.0222
- accuracy: 0.9944 - val_loss: 0.1479 - val_accuracy: 0.9634
Epoch 9/10
34/34 [==============================] - 21s 614ms/step - loss: 0.0077
- accuracy: 0.9989 - val_loss: 0.1624 - val_accuracy: 0.9634
Epoch 10/10
34/34 [==============================] - 21s 614ms/step - loss: 0.0077
- accuracy: 0.9976 - val_loss: 0.1751 - val_accuracy: 0.9634
```

```
metrics = pd.DataFrame(history.history)
metrics.rename(columns = {'loss': 'Training_Loss', 'accuracy':
'Training_Accuracy', 'val_loss': 'Validation_Loss', 'val_accuracy':
'Validation_Accuracy'}, inplace = True)
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])

plot_graph_acc('Training_Accuracy', 'Validation_Accuracy', 'accuracy')
```



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

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

### 17. Evaluating the Model

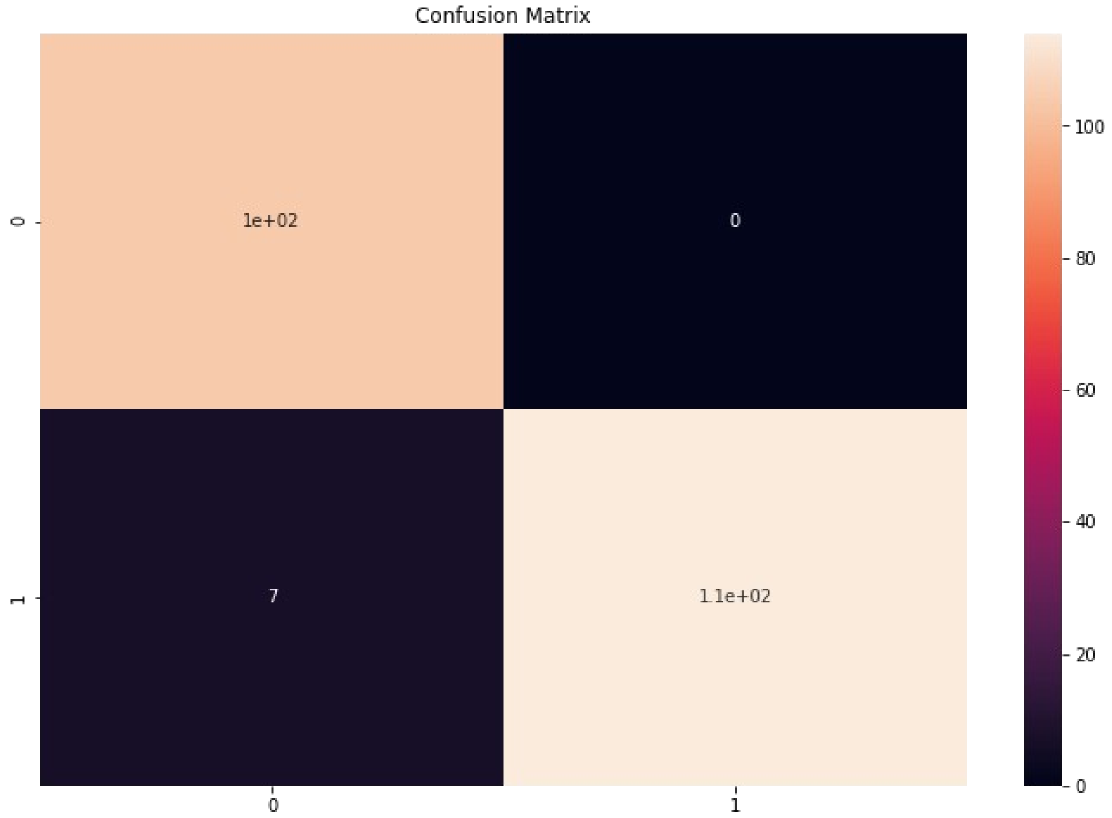
```
from sklearn.metrics import accuracy_score,confusion_matrix
```

```
score=accuracy_score(y_test,y_pred)
print("Test Score:{:.2f}%".format(score*100))
```

```
Test Score:96.89%
```

```
cm=confusion_matrix(y_test,y_pred)
fig=plt.figure(figsize=(12,8))
sns.heatmap(
    cm,
    annot=True,
)
plt.title("Confusion Matrix")
cm
```

```
array([[104,   0],
       [  7, 114]])
```



### 18. Function to Test the Model on a Random message

```
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])


message1="I am having my Tests right now. Will call back as soon as
possible! Till then be safe wherever you are. Be Alert of any hazard"
message2="Your Rs.8850 welcome bonus is ready to be credited. Download
Junglee Rummy now. Claim Bonus on your first deposit prize pool"
```

```
classify_message(model,message1)
```

```
It is not a spam
predict score:  0.037389785
```

```
classify_message(model,message2)
```

```
It is a spam
predict score:  0.9936712
```