In [1]:
```
import pandas as pd
import numpy as np
import pickle
import re
import nltk
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline

from sklearn.metrics import accuracy_score,fbeta_score,classification_report
from wordcloud import WordCloud
from nltk.tokenize import word_tokenize

from nltk.corpus import stopwords
nltk.download('stopwords')
stop=stopwords.words("english")

from nltk.stem.porter import PorterStemmer
from nltk.stem import SnowballStemmer
ss = SnowballStemmer("english")
ps = PorterStemmer()

msg_df = pd.read_csv('spam.csv', sep='\t', names=["label", "message"])
msg_df.shape
```

```
[nltk_data] Downloading package stopwords to
[nltk_data]     C:\Users\Aman\AppData\Roaming\nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
```

Out[1]:
```
(5572, 2)
```

In [2]:
```
stop
```

Out[2]:
```
['i',
 'me',
 'my',
 'myself',
 'we',
 'our',
 'ours',
 'ourselves',
 'you',
 "you're",
 "you've",
 "you'll",
 "you'd",
 'your',
 'yours',
 'yourself',
 'yourselves',
 'he',
 'him',
```

In [3]:
```
msg_df = pd.read_csv('spam.csv', sep='\t', names=["label", "message"])
msg_df.shape
msg_df.head(5)
```

Out[3]:

	label	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 [4]:
```
msg_df.describe()
```

Out[4]:

	label	message
count	5572	5572
unique	2	5169
top	ham	Sorry, I'll call later
freq	4825	30

In [5]:
```
msg_df.groupby('label').describe().T
```

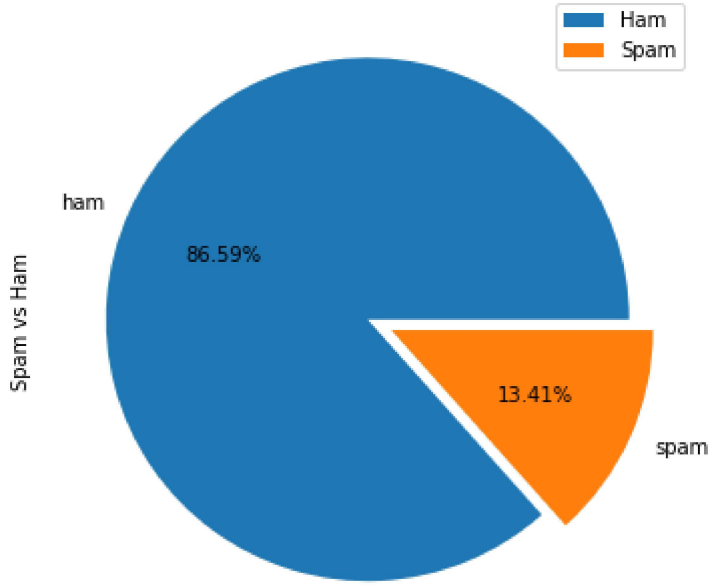
Out[5]:

	label	ham	spam
message	**count**	4825	747
	unique	4516	653
	top	Sorry, I'll call later	Please call our customer service representativ...
	freq	30	4

In [6]:
```
msg_df["label"].value_counts()
```

Out[6]:
```
ham     4825
spam     747
Name: label, dtype: int64
```

In [7]:
```
msg_df["label"].value_counts().plot(kind = 'pie', explode = [0, 0.1], figsize = (6, 6),
plt.ylabel("Spam vs Ham")
plt.legend(["Ham", "Spam"])
plt.show()
```



In [8]:
```
msg_df.groupby("message")["label"].agg([len, np.max]).sort_values(by = "len", ascending
```

Out[8]:

I cant pick the phone right now. P

7 wonders in My WORLD 7th You 6th Ur style 5th Ur smile 4th Ur Personality 3rd Ur Nature 2nd Ur SMS Friendship"... g

Wen ur lovable bcums angry wid u, dnt take it seriously.. Coz being angry is d most childish n true way of show care n luv!.. kettoda manda..

Your opinion about me? 1. Over 2. Jada 3. Kusruthi 4. Lovable 5. Silent 6. Spl character 7. Not matured 8. Stylish 9

Please call our customer service representative on FREEPHONE 0808 145 4742 between 9am-11pm as you have £1000 c

In [9]:
```
msg_df['length']=msg_df['message'].apply(len)
msg_df.head()
```

Out[9]:

	label	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 [10]:
```
msg_df.length.describe()
```

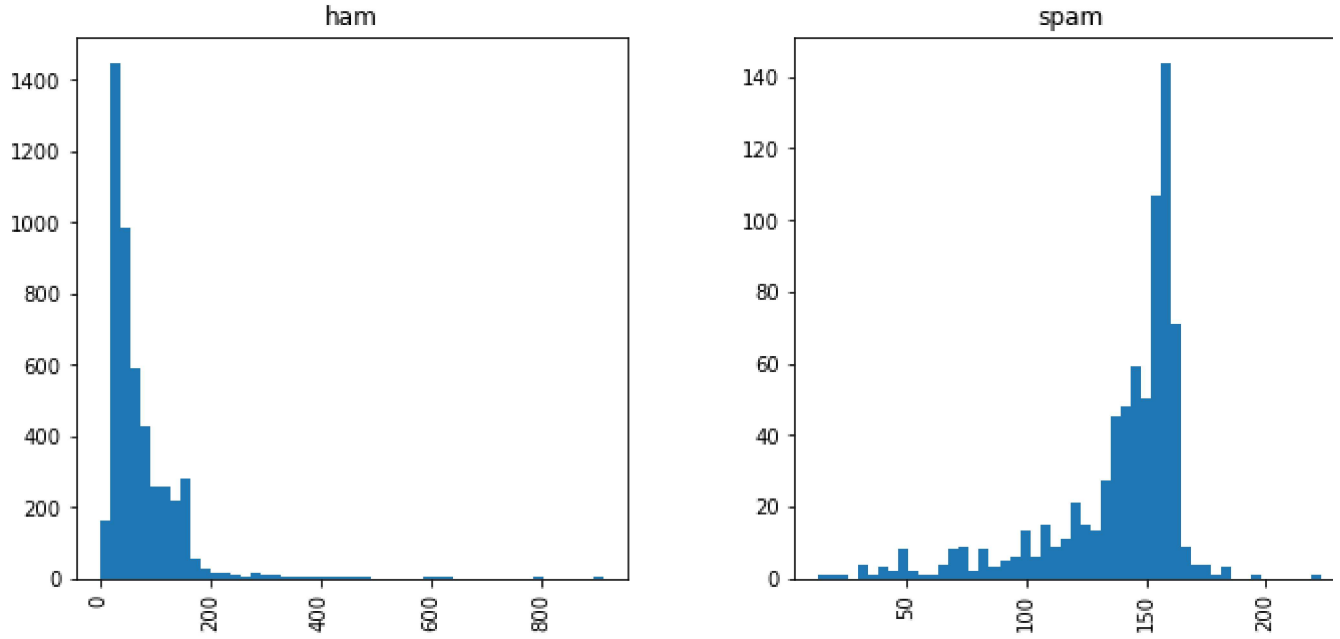
Out[10]:
```
count    5572.000000
mean       80.489950
std        59.942907
min         2.000000
25%        36.000000
50%        62.000000
75%       122.000000
max       910.000000
Name: length, dtype: float64
```

In [11]:
```
msg_df[msg_df['length']==910]['message'].iloc[0]
```

Out[11]:
```
"For me the love should start with attraction.i should feel that I need her every time
the first thing which comes in my thoughts.I would start the day and end it with her.sh
time I dream.love will be then when my every breath has her name.my life should happen
be named to her.I would cry for her.will give all my happiness and take all her sorrows
ht with anyone for her.I will be in love when I will be doing the craziest things for h
don't have to proove anyone that my girl is the most beautiful lady on the whole planet
ng praises for her.love will be when I start up making chicken curry and end up makiing
e most beautiful then.will get every morning and thank god for the day because she is w
say a lot..will tell later.."
```

In [12]:
```
msg_df.hist(column='length', by='label', bins=50,figsize=(11,5))
```

Out[12]:
```
array([<AxesSubplot:title={'center':'ham'}>,
       <AxesSubplot:title={'center':'spam'}>], dtype=object)
```



Looks like the lengthy is the message, more likely it is a spam. Let's not forget this

Text Transformation

Data Cleaning (Removing unimportant data/ Stopwords/ Stemming)

In [13]:
```
msg_df.head(4)
```

Out[13]:

	label	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

In [14]:
```
import string
def cleanText(message):
    #message = message.translate(str.maketrans('ranjan', 'ranjan', string.punctuation))
    message = re.sub('[^a-zA-Z]', ' ', message)
    message = message.lower()
    message = message.split()
    words = [ss.stem(word) for word in message if word not in stop]
    return " ".join(words)

msg_df["message"] = msg_df["message"].apply(cleanText)
msg_df.head(n = 10)
```

Out[14]:

	label	message	length
0	ham	go jurong point crazi avail bugi n great world...	111
1	ham	ok lar joke wif u oni	29
2	spam	free entri wkli comp win fa cup final tkts st ...	155
3	ham	u dun say earli hor u c alreadi say	49
4	ham	nah think goe usf live around though	61
5	spam	freemsg hey darl week word back like fun still...	147
6	ham	even brother like speak treat like aid patent	77
7	ham	per request mell mell oru minnaminungint nurun...	160
8	spam	winner valu network custom select receivea pri...	157
9	spam	mobil month u r entitl updat latest colour mob...	154

In [15]:
```
spam_messages = msg_df[msg_df["label"] == "spam"]["message"]
ham_messages = msg_df[msg_df["label"] == "ham"]["message"]
```

In [16]:
```
spam_messages
```

Out[16]:
```
2       free entri wkli comp win fa cup final tkts st ...
5       freemsg hey darl week word back like fun still...
8       winner valu network custom select receivea pri...
9       mobil month u r entitl updat latest colour mob...
11      six chanc win cash pound txt csh send cost p d...
                              ...
5537    want explicit sex sec ring cost p min gsex pob...
5540    ask mobil chatlin inclu free min india cust se...
5547    contract mobil mnths latest motorola nokia etc...
5566    remind get pound free call credit detail great...
5567    nd time tri contact u u pound prize claim easi...
Name: message, Length: 747, dtype: object
```

In [17]:
```
nltk.download('punkt')
```

```
[nltk_data] Downloading package punkt to
[nltk_data]     C:\Users\Aman\AppData\Roaming\nltk_data...
[nltk_data]   Package punkt is already up-to-date!
```

Out[17]:
```
True
```

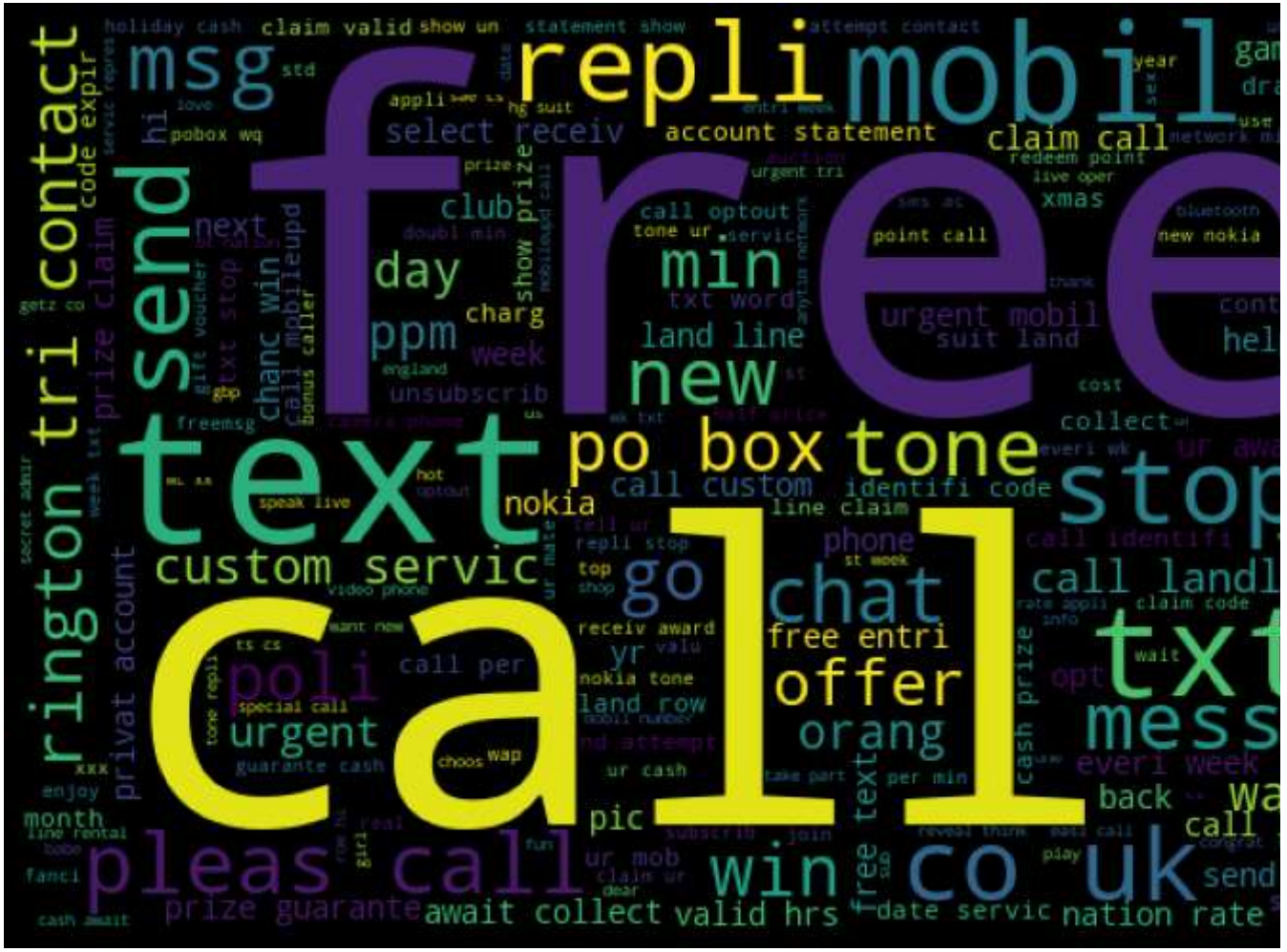
In [18]:
```
spam_words = []
ham_words = []

def extractSpamWords(spamMessages):
    global spam_words
    words = [word for word in word_tokenize(spamMessages)]
    spam_words = spam_words + words

def extractHamWords(hamMessages):
    global ham_words
    words = [word for word in word_tokenize(hamMessages) ]
    ham_words = ham_words + words

spam_messages.apply(extractSpamWords)
ham_messages.apply(extractHamWords)
```

Out[18]:
```
0       None
1       None
3       None
4       None
6       None
        ...
5565    None
5568    None
5569    None
5570    None
5571    None
Name: message, Length: 4825, dtype: object
```

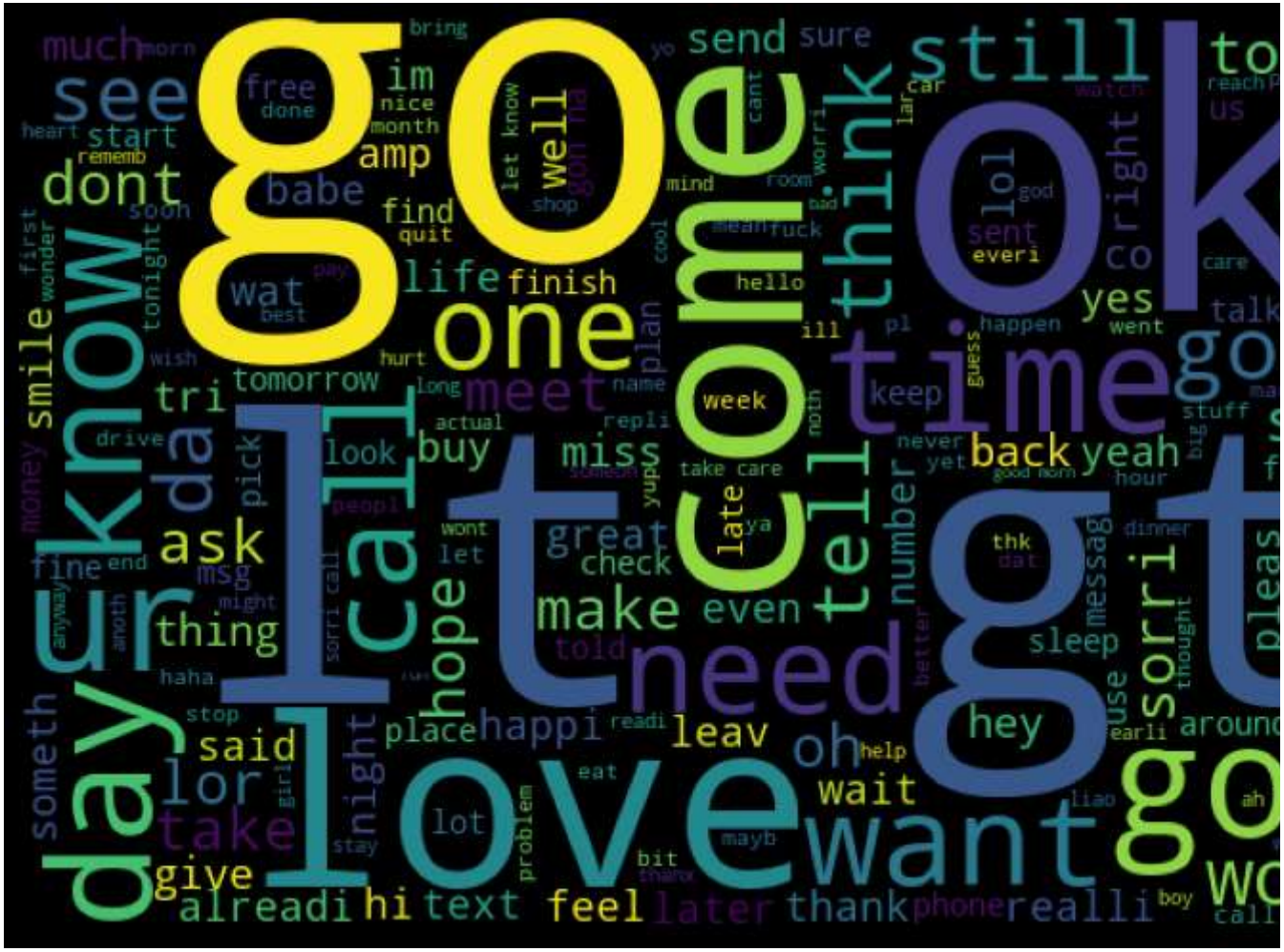
In [19]:
```
ham_words
```

Out[19]:
```
['go',
 'jurong',
 'point',
 'crazi',
 'avail',
 'bugi',
 'n',
 'great',
 'world',
 'la',
 'e',
 'buffet',
 'cine',
 'got',
 'amor',
 'wat',
 'ok',
 'lar',
 'joke',
```

In [20]:
```
spam_wordcloud = WordCloud(width=600, height=400).generate(" ".join(spam_words))
plt.figure( figsize=(10,8), facecolor='k')
plt.imshow(spam_wordcloud)
plt.axis("off")
plt.tight_layout(pad=0)
plt.show()
```



In [21]:
```
ham_wordcloud = WordCloud(width=600, height=400).generate(" ".join(ham_words))
plt.figure( figsize=(10,8), facecolor='k')
plt.imshow(ham_wordcloud)
plt.axis("off")
plt.tight_layout(pad=0)
plt.show()
```



In [22]:
```
msg_df
```

Out[22]:

	label	message	length
0	ham	go jurong point crazi avail bugi n great world...	111
1	ham	ok lar joke wif u oni	29
2	spam	free entri wkli comp win fa cup final tkts st ...	155
3	ham	u dun say earli hor u c alreadi say	49
4	ham	nah think goe usf live around though	61
...	...	...	...
5567	spam	nd time tri contact u u pound prize claim easi...	160
5568	ham	b go esplanad fr home	36
5569	ham	piti mood suggest	57
5570	ham	guy bitch act like interest buy someth els nex...	125
5571	ham	rofl true name	26

5572 rows × 3 columns

In [23]:
```
def encodeCategory(cat):
    if cat == "spam":
        return 1
    else:
        return 0

msg_df["label"] = msg_df["label"].apply(encodeCategory)
```

In [24]:
```
msg_df
```

Out[24]:

	label	message	length
0	0	go jurong point crazi avail bugi n great world...	111
1	0	ok lar joke wif u oni	29
2	1	free entri wkli comp win fa cup final tkts st ...	155
3	0	u dun say earli hor u c alreadi say	49
4	0	nah think goe usf live around though	61
...	...	...	...
5567	1	nd time tri contact u u pound prize claim easi...	160
5568	0	b go esplanad fr home	36
5569	0	piti mood suggest	57
5570	0	guy bitch act like interest buy someth els nex...	125
5571	0	rofl true name	26

5572 rows × 3 columns

Lets convert our clean text into a representation that a machine learning model can understand. Bag of Wor
#Count Vectorizer

In [25]:
```
from sklearn.feature_extraction.text import TfidfVectorizer
vec = TfidfVectorizer(encoding = "latin-1", strip_accents = "unicode")
features = vec.fit_transform(msg_df["message"])
print(features.shape)
```

```
(5572, 6292)
```

In [26]:
```
from sklearn.feature_extraction.text import CountVectorizer
cv = CountVectorizer()
X=cv.fit_transform(msg_df["message"])
print (X.shape)
```

```
(5572, 6292)
```

In [27]:
```
cv = CountVectorizer()

X=cv.fit(msg_df["message"])
X.vocabulary_
X.get_feature_names()
```

Out[27]:
```
['aa',
 'aah',
 'aaniy',
 'aaooooright',
 'aathi',
 'ab',
 'abbey',
 'abdomen',
 'abeg',
 'abel',
 'aberdeen',
 'abi',
 'abil',
 'abiola',
 'abj',
 'abl',
 'abnorm',
 'abouta',
 'abroad',
```

In [28]:
```
X = cv.fit_transform(msg_df["message"]).toarray()
X
```

Out[28]:
```
array([[0, 0, 0, ..., 0, 0, 0],
       [0, 0, 0, ..., 0, 0, 0],
       [0, 0, 0, ..., 0, 0, 0],
       ...,
       [0, 0, 0, ..., 0, 0, 0],
       [0, 0, 0, ..., 0, 0, 0],
       [0, 0, 0, ..., 0, 0, 0]], dtype=int64)
```

In [29]:
```
df = pd.DataFrame(X,columns=cv.get_feature_names())
df
df['len']=msg_df['length']
df
```

Out[29]:

	aa	aah	aaniy	aaooooright	aathi	ab	abbey	abdomen	abeg	abel	...	zf	zhong	zindgi	zoe	z
0	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
1	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
2	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
3	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
4	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
5567	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
5568	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
5569	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
5570	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
5571	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	

5572 rows × 6293 columns

In [30]:
```
df
```

Out[30]:

	aa	aah	aaniy	aaooooright	aathi	ab	abbey	abdomen	abeg	abel	...	zf	zhong	zindgi	zoe	z
0	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
1	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
2	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
3	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
4	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
5567	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
5568	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
5569	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
5570	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
5571	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	

5572 rows × 6293 columns

In [31]:
```
print(X)
```

```
[[0 0 0 ... 0 0 0]
 [0 0 0 ... 0 0 0]
 [0 0 0 ... 0 0 0]
 ...
 [0 0 0 ... 0 0 0]
 [0 0 0 ... 0 0 0]
 [0 0 0 ... 0 0 0]]
```

In [32]:
```
df.head()
```

Out[32]:

	aa	aah	aaniy	aaooooright	aathi	ab	abbey	abdomen	abeg	abel	...	zf	zhong	zindgi	zoe	zogt
0	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
1	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
2	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
3	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
4	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	

5 rows × 6293 columns

In [33]:
```
y=msg_df['label']
```

In [ ]:
```

```

In [34]:
```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(df, y, test_size = 0.20, random_sta

# Training model using Naive bayes classifier

from sklearn.naive_bayes import MultinomialNB
spam_detect_model = MultinomialNB().fit(X_train, y_train)

y_pred=spam_detect_model.predict(X_test)
```

In [35]:
```
print(accuracy_score(y_test,y_pred))
print(fbeta_score(y_test,y_pred,beta =0.5))
```

```
0.9811659192825112
0.9390862944162438
```

In [36]:
```
y_pred
```

Out[36]:
```
array([0, 0, 0, ..., 0, 1, 0], dtype=int64)
```

In [37]:
```
print (classification_report(y_test,y_pred))
```

```
              precision    recall  f1-score   support

           0       0.99      0.99      0.99       955
           1       0.94      0.93      0.93       160

    accuracy                           0.98      1115
   macro avg       0.97      0.96      0.96      1115
weighted avg       0.98      0.98      0.98      1115
```

In [38]:
```
saved_model=pickle.dumps(spam_detect_model)
```

In [39]:
```
modelfrom_pickle = pickle.loads(saved_model)
```

In [40]:
```
y_pred=modelfrom_pickle.predict(X_test)
```

In [41]:
```
print(accuracy_score(y_test,y_pred))
```

```
0.9811659192825112
```

In [42]:
```
import joblib
```

In [43]:
```
joblib.dump(spam_detect_model,'pickle.pkl')
```

Out[43]:
```
['pickle.pkl']
```

In [44]:
```
joblib.dump(X,'transform.pkl')
```

Out[44]:
```
['transform.pkl']
```

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]: