In [1]:

```python
#text analytics assignment
import re
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import string
import nltk
import warnings
warnings.filterwarnings("ignore", category=DeprecationWarning)

%matplotlib inline
```

In [2]:

```python
# Print many statements at same time using the below command
from IPython.core.interactiveshell import InteractiveShell
InteractiveShell.ast_node_interactivity='all'
```

In [3]:

```python
#load data
df= pd.read_csv("SMS-Messages2.csv")
df.head()
df.info()
```

Out[3]:

	Message	Class_Label
0	'Go until jurong point	ham
1	'Ok lar... Joking wif u oni...'	ham
2	'Free entry in 2 a wkly comp to win FA Cup fin...	spam
3	'U dun say so early hor... U c already then sa...	ham
4	'Nah I don\'t think he goes to usf	ham

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 2 columns):
 Message        200 non-null object
Class_Label    200 non-null object
dtypes: object(2)
memory usage: 3.2+ KB
```

In [4]:

```
#group ham and spam
df.groupby('Class_Label').count()
```

Out[4]:

	Message
Class_Label	
ham	167
spam	33

In [5]:

```
#R getting rid of the short words upto three words
df[' Message'] = df[' Message'].apply(lambda x: ' '.join([w for w in x.split() if len(w)>3]))
```

In [6]:

```
#Converting all letters into lower case NORMLIZATION
df[' Message'] = df[' Message'].astype(str).str.lower()
```

In [7]:

```
df.head()
```

Out[7]:

	Message	Class_Label
0	until jurong point	ham
1	lar... joking oni...'	ham
2	'free entry wkly comp final tkts 21st 2005. te...	spam
3	early hor... already then say...'	ham
4	'nah don\'t think goes	ham

In [8]:

```
df.tail()
```

Out[8]:

	Message	Class_Label
195	'how doing? hope you\'ve settled school year. ...	ham
196	'gud mrng dear nice day'	ham
197	'did that persons story'	ham
198	your hamster dead? meet orchard mrt?	ham
199	kate your evening? hope tomorrow have bloody b...	ham

In [173]:

```
#df1 =  df[["Message","Class_Label"]]
```

In [9]:

```
#Dumming Coding
df['Class_Label']= df['Class_Label'].map({'ham':0,'spam':1}).astype(int)
```

In [10]:

```
#Shuffling rows of the dataframe
df1 = df.reindex(np.random.permutation(df.index))
```

In [120]:

```
# split data in train and test
train=df1.sample(frac=0.75,random_state=3)
test=df1.drop(train.index)
```

In [172]:

```
train.shape
test.shape
```

Out[172]:

(150, 2)

Out[172]:

(50, 2)

In [121]:

```
train_list = train.values.tolist()
train_list[0:4]
```

Out[121]:

```
[["your request \\'melle melle (oru minnaminunginte nurungu vettam)
\\' been your callertune callers. press copy your friends callertun
e'",
  0],
 ["'haha awesome", 0],
 ["'i\\'m gonna home soon don\\'t want talk about this stuff anymore
tonight",
  0],
 ["see. when finish have loads loans pay'", 0]]
```

In [122]:

```
test_list = test.values.tolist()
test_list[0:4]
```

Out[122]:

```
[["'good stuff", 0],
 ["'07732584351 rodger burns tried call your reply free nokia mobile
free camcorder. please call 08000930705 delivery tomorrow'",
  1],
 ["'winner!! valued network customer have been selected receivea £90
0 prize reward! claim call 09061701461. claim code kl341. valid hour
s only.'",
  1],
 ["'you everywhere dirt", 0]]
```

In [123]:

```
#carrying tokenization on train data
tokenized_train = train[' Message'].apply(lambda x: x.split())
tokenized_train.head()
```

Out[123]:

```
103     [your, request, \'melle, melle, (oru, minnamin...
187                                    ['haha, awesome]
10      ['i\'m, gonna, home, soon, don\'t, want, talk,...
97          [see., when, finish, have, loads, loans, pay']
57                                              ['sorry]
Name:  Message, dtype: object
```

In [124]:

```
#Tokenization on test data
tokenized_test = test[' Message'].apply(lambda x: x.split())
tokenized_test.head()
```

Out[124]:

```
126                                    ['good, stuff]
42     ['07732584351, rodger, burns, tried, call, you...
8      ['winner!!, valued, network, customer, have, b...
155                          ['you, everywhere, dirt]
58                            ['tell, where, reached']
Name:  Message, dtype: object
```

In [126]:

```
tokenized_message_train = tokenized_train.tolist()
tokenized_message_train[0:4]
```

Out[126]:

```
[['your',
  'request',
  "\\'melle",
  'melle',
  '(oru',
  'minnaminunginte',
  'nurungu',
  "vettam)\\'",
  'been',
  'your',
  'callertune',
  'callers.',
  'press',
  'copy',
  'your',
  'friends',
  "callertune'"],
 ["'haha", 'awesome'],
 ["'i\\'m",
  'gonna',
  'home',
  'soon',
  "don\\'t",
  'want',
  'talk',
  'about',
  'this',
  'stuff',
  'anymore',
  'tonight'],
 ['see.', 'when', 'finish', 'have', 'loads', 'loans', "pay'"]]
```

In [127]:

```
tokenized_message_test = tokenized_test.tolist()
tokenized_message_test[0:4]
```

Out[127]:

```
[["'good", 'stuff'],
 ["'07732584351",
  'rodger',
  'burns',
  'tried',
  'call',
  'your',
  'reply',
  'free',
  'nokia',
  'mobile',
  'free',
  'camcorder.',
  'please',
  'call',
  '08000930705',
  'delivery',
  "tomorrow'"],
 ["'winner!!",
  'valued',
  'network',
  'customer',
  'have',
  'been',
  'selected',
  'receivea',
  '£900',
  'prize',
  'reward!',
  'claim',
  'call',
  '09061701461.',
  'claim',
  'code',
  'kl341.',
  'valid',
  'hours',
  "only.'"],
 ["'you", 'everywhere', 'dirt']]
```

In [137]:

```python
from sklearn.feature_extraction.text import TfidfVectorizer
tfidf_vectorizer = TfidfVectorizer(max_df=0.90, min_df=2, max_features=33, stop_
words='english')
# TF-IDF feature matrix
tfidf_train = tfidf_vectorizer.fit_transform(train[' Message'])
```

In [139]:

```python
tfidf_test = tfidf_vectorizer.fit_transform(test[' Message'])
```

In [140]:

```
train_x = tfidf_train
train_y = train['Class_Label']
```

In [141]:

```
test_x = tfidf_test
test_y = test['Class_Label']
```

In [142]:

```
train_x .shape
train_y.shape
test_x.shape
test_y.shape
```

Out[142]:

(150, 33)

Out[142]:

(150,)

Out[142]:

(50, 33)

Out[142]:

(50,)

In [143]:

```
train.groupby('Class_Label').count()
```

Out[143]:

	Message
Class_Label	
0	125
1	25

In [144]:

```
test.groupby('Class_Label').count()
```

Out[144]:

	Message
Class_Label	
0	42
1	8

In [145]:

```python
from sklearn.naive_bayes import MultinomialNB, GaussianNB, BernoulliNB
# Fitting the model
model = MultinomialNB()
model.fit(train_x,train_y)
```

Out[145]:

```
MultinomialNB(alpha=1.0, class_prior=None, fit_prior=True)
```

In [146]:

```python
classes = model.predict(test_x)
```

In [147]:

```python
from sklearn import metrics
from sklearn.metrics import roc_curve,auc,recall_score,precision_score,accuracy_
score,f1_score
from sklearn.metrics import confusion_matrix,average_precision_score,recall_scor
e
```

In [148]:

```python
#Precision and Recall
print("Accuracy Score")
print(metrics.accuracy_score(test_y,classes))
print("Precision/Recall Metrics")
print(metrics.classification_report(test_y,classes))
print("AUC")
auc=metrics.roc_auc_score(test_y,classes)
auc
```

```
Accuracy Score
0.86
Precision/Recall Metrics
             precision    recall  f1-score   support

          0       0.87      0.98      0.92        42
          1       0.67      0.25      0.36         8

avg / total       0.84      0.86      0.83        50

AUC
```
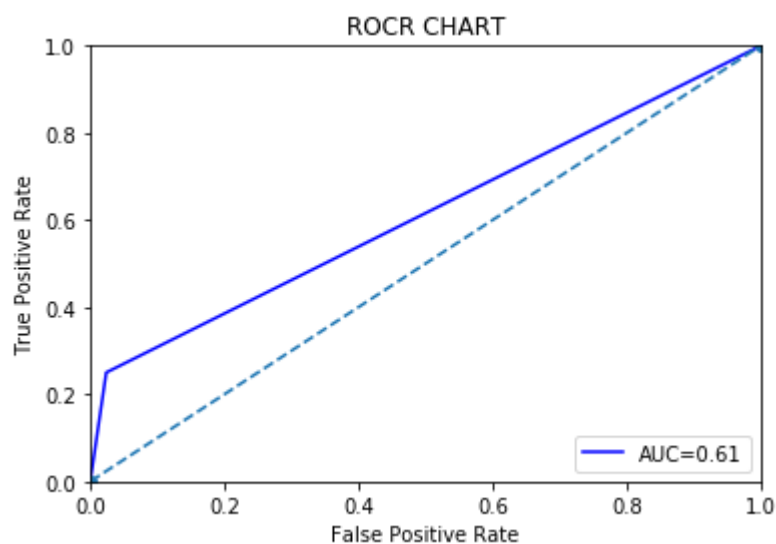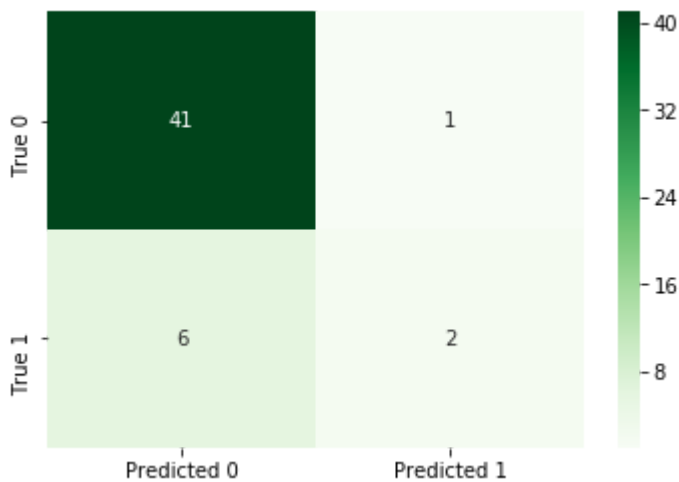
Out[148]:

```
0.61309523809523803
```

In [149]:

```python
#ROC Chart
fpr,tpr,th=roc_curve(test_y,classes)
roc_auc=metrics.auc(fpr,tpr)
import matplotlib.pyplot as plt
plt.title('ROCR CHART')
plt.plot(fpr,tpr,'b',label='AUC=%0.2f'% roc_auc)
plt.legend(loc="lower right")
plt.plot([0,1],[0,1],'o--')
plt.xlim([0,1])
plt.ylim([0,1])
plt.ylabel('True Positive Rate')
plt.xlabel('False Positive Rate')
plt.show();
```

In [150]:

```python
#Confusion Matrix
print("Confusion Matrix")
cf=metrics.confusion_matrix(test_y,classes)
lbl1=["Predicted 0","Predicted 1"]
lbl2=["True 0","True 1"]
sns.heatmap(cf,annot=True,cmap="Greens",fmt="d",xticklabels=lbl1,yticklabels=lbl
2)
plt.show();
```

Confusion Matrix

In [151]:

```python
lex_file = pd.read_csv("AFINN-111.csv", sep=',', engine='python')
```

In [152]:

```python
lex_file.head()
```

Out[152]:

	words	score
0	abandon	-2
1	abandoned	-2
2	abandons	-2
3	abducted	-2
4	abduction	-2

In [153]:

```python
type(lex_file)
```

Out[153]:

pandas.core.frame.DataFrame

In [154]:

```python
#Converting dataframe into dictionary
lexicons = dict(zip(lex_file.words,lex_file.score))
```

In [155]:

```
print(lexicons)
```

```
{'abandon': -2, 'abandoned': -2, 'abandons': -2, 'abducted': -2, 'ab
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```

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'zealot': -2, 'zealots': -2, 'zealous': 2}
```

In [156]:

```
lexicons["abandon"]
```

Out[156]:

-2

In [157]:

```
#lexicons = {}
#records = lex_file.readlines()
#for record in lex_file:
    #print(record) # line contains newline charecter
    #print(record.rstrip('\n').split(",")) # to remove new line charecter
    #lexicons[record.rstrip('\n').split(",")[0]] = int(record.rstrip('\n').split
(",")[1])
#print(lexicons)
#lexicons["abandon"]
```

In [158]:

```python
#For each tweet
#For each word in tweet
#Get the word score (score is a number if the word is in Lexicon, 0 if not)
#Add all the scores and find the ploarity
strength = []
prediction = []
    for tweet in tokenized_message_test:
    score = 0
    for word in tweet:
        if word in lexicons:
            score = score + lexicons[word]
    strength.append(score)
    if (score >= 0 ):
        prediction.append('ham')
    else:
        prediction.append('spam')
print(strength)
print(prediction)
```

```
[0, 3, 0, -2, 0, 4, 2, 0, 0, 0, -2, 0, 0, 0, -5, -2, 0, 0, 0, -1, 0,
0, 0, 1, 0, 1, -2, 0, 1, 0, -5, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 9, 1, 0, 2, 0, -3]
['ham', 'ham', 'ham', 'spam', 'ham', 'ham', 'ham', 'ham', 'ham', 'ha
m', 'spam', 'ham', 'ham', 'ham', 'spam', 'spam', 'ham', 'ham', 'ha
m', 'spam', 'ham', 'ham', 'ham', 'ham', 'ham', 'ham', 'spam', 'ham',
'ham', 'ham', 'spam', 'ham', 'ham', 'ham', 'ham', 'ham', 'ham', 'ha
m', 'ham', 'ham', 'ham', 'ham', 'ham', 'ham', 'ham', 'ham', 'ham',
'ham', 'ham', 'spam']
```

In [159]:

```python
#Get the columns of data
class_label= []
corpus = []
for record in test_list :
    corpus.append(record[0])
    class_label.append(record[1])
print(corpus)
print(class_label)
```

["'good stuff", "'07732584351 rodger burns tried call your reply fre
e nokia mobile free camcorder. please call 08000930705 delivery tomo
rrow'", "'winner!! valued network customer have been selected receiv
ea £900 prize reward! claim call 09061701461. claim code kl341. vali
d hours only.'", "'you everywhere dirt", "'tell where reached'", "kn
ow! grumpy people. like better lying. then again always play joke
s...'", "'i\\'m like things. scared like mah. said loud.'", "early h
or... already then say...'", "'its part checking", '', "'yes started
send requests make pain came back i\\'m back bed. double coins facto
ry too. gotta cash nitros.'", "calls..messages..missed calls'", 'cal
l just', "'watching telugu movie..wat", "'your gonna have pick burge
r yourself your home. can\\'t even move. pain killing me.'", "'sorry
pain. meet another night? spent late afternoon casualty that means h
aven\\'t done stuff42moro that includes time sheets that. sorry.",
'\'hi. been hols now! run. forgot that have hairdressers appointment
four need home shower beforehand. does that cause prob u?"'', 'going
today. will done only', "'whats staff name taking class us?'", "will
stop itself. however suggest stays with someone that will able give
every stool.'", "'i\\'m going months only joking'", 'entered cabin s
aid', "'wow. you\\'re right! didn\\'t mean that. guess once gave bos
ton changed search location", 'thought: "nver tired doing little thi
ngs lovable persons.." coz..somtimes those little things occupy bigg
est part their hearts.. ni8\'', "'sindu birla soft", "'lol trust m
e.'", "'keep yourself safe because need miss already envy everyone t
hat see\\'s real life'", '\'did hear about "divorce barbie"? comes w
ith ken\\\'s stuff!\'', "'hello! how\\'s saturday just texting you
\\'d decided anything tomo. that i\\'m trying invite myself anythin
g!'", 'valued customer', "don\\'t know stubborn didn\\'t even want h
ospital. kept telling mark i\\'m weak sucker. hospitals weak sucker
s.'", "'aft finish lunch then down lor. smth lor. finish lunch alrea
dy?'", "'urgent awarded complimentary trip eurodisinc trav", "plane
give this month end.'", "'okay name price long legal! pick them",
"k...i\\'m watching here:)'", "'anything lor... decide...'", "'pleas
e call customer service representative 0800 6031 between 10am-9pm ha
ve guaranteed £1000 cash £5000 prize!'", "'ok... typical reply...'",
"'oops", "'yes..gauti sehwag series.'", "'finished class where yo
u.'", "there. call meet him'", "'going nothing great.bye'", "'i\\'m
sorry. i\\'ve joined league people that dont keep touch. mean great
deal have been friend times even great personal cost. have great wee
k.|'", '\'your free ringtone waiting collected. simply text password
"mix" 85069 verify. usher britney.', "'hmmm.. sure time ard...", "'w
ant laid tonight? want real dogging locations sent direct mob? join
uk\\'s largest dogging network txting gravel 69888! ec2a. 31p.msg@15
0p'", "only msn. it\\'s yijue@hotmail.com'", "'just forced myself sl
ice. i\\'m really hungry tho. this sucks. mark getting worried. know
s i\\'m sick when turn down pizza. lol'"]
[0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0,
1, 0, 1, 0, 0]

In [160]:

```
corpus_list = {'data':corpus}
labels = {'label':class_label}
senti_strength = {'senti_strength':strength}
```

In [161]:

```
#Create an Analysis Base Table (ABT)
senti_matrix = pd.DataFrame(corpus_list, strength)
senti_matrix['Label'] = class_label
senti_matrix['prediction']=prediction
```

In [162]:

```
senti_matrix.columns
```

Out[162]:

```
Index(['data', 'Label', 'prediction'], dtype='object')
```

In [163]:

```
senti_matrix[0:5]
```

Out[163]:

	data	Label	prediction
0	'good stuff	0	ham
3	'07732584351 rodger burns tried call your repl...	1	ham
0	'winner!! valued network customer have been se...	1	ham
-2	'you everywhere dirt	0	spam
0	'tell where reached'	0	ham

In [164]:

```
Matrix_Table = pd.pivot_table(senti_matrix,index=['prediction','Label'], aggfunc
= 'count')
Matrix_Table
```

Out[164]:

		data
prediction	**Label**	
ham	**0**	34
	1	8
spam	**0**	8

TextBlob Naive Bayes Classifier

In [165]:

```
test_list = list(map(tuple,test.values))
test_list[0:4]
```

Out[165]:

```
[("'good stuff", 0),
 ("'07732584351 rodger burns tried call your reply free nokia mobile
free camcorder. please call 08000930705 delivery tomorrow'",
  1),
 ("'winner!! valued network customer have been selected receivea £90
0 prize reward! claim call 09061701461. claim code kl341. valid hour
s only.'",
  1),
 ("'you everywhere dirt", 0)]
```

In [166]:

```
train_list = list(map(tuple,train.values))
train_list[0:4]
```

Out[166]:

```
[("your request \\'melle melle (oru minnaminunginte nurungu vettam)
\\' been your callertune callers. press copy your friends callertun
e'",
  0),
 ("'haha awesome", 0),
 ("'i\\'m gonna home soon don\\'t want talk about this stuff anymore
tonight",
  0),
 ("see. when finish have loads loans pay'", 0)]
```

In [167]:

```
from textblob.classifiers import NaiveBayesClassifier
```

In [168]:

```
cl = NaiveBayesClassifier(train_list)
```

In [169]:

```
cl.accuracy(train_list)
```

Out[169]:

```
0.9666666666666667
```

In [170]:

```
cl.accuracy(test_list)
```

Out[170]:

```
0.88
```

In [171]:

```
cl.show_informative_features(40)
```

```
Most Informative Features
        contains(please) = True              1 : 0      =      14.5
: 1.0
       contains(contact) = True              1 : 0      =      11.3
: 1.0
          contains(free) = True              1 : 0      =       8.7
: 1.0
          contains(from) = True              1 : 0      =       8.7
: 1.0
          contains(more) = True              1 : 0      =       8.1
: 1.0
          contains(send) = True              1 : 0      =       8.1
: 1.0
          contains(call) = True              1 : 0      =       7.1
: 1.0
          contains(text) = True              1 : 0      =       6.8
: 1.0
         contains(reply) = True              1 : 0      =       6.8
: 1.0
         contains(speak) = True              1 : 0      =       4.8
: 1.0
         contains(which) = True              1 : 0      =       4.8
: 1.0
          contains(dont) = True              1 : 0      =       4.8
: 1.0
          contains(year) = True              1 : 0      =       4.8
: 1.0
        contains(thanks) = True              1 : 0      =       4.8
: 1.0
      contains(question) = True              1 : 0      =       4.8
: 1.0
           contains(her) = True              1 : 0      =       4.8
: 1.0
          contains(frnd) = True              1 : 0      =       4.8
: 1.0
          contains(find) = True              1 : 0      =       4.8
: 1.0
          contains(must) = True              1 : 0      =       4.8
: 1.0
       contains(waiting) = True              1 : 0      =       4.8
: 1.0
        contains(points) = True              1 : 0      =       4.8
: 1.0
          contains(stop) = True              1 : 0      =       4.8
: 1.0
            contains(it) = True              1 : 0      =       4.8
: 1.0
          contains(miss) = True              1 : 0      =       4.8
: 1.0
       contains(nothing) = True              1 : 0      =       4.8
: 1.0
             contains(c) = True              1 : 0      =       4.8
: 1.0
        contains(enough) = True              1 : 0      =       4.8
: 1.0
          contains(been) = True              1 : 0      =       3.8
: 1.0
          contains(only) = True              1 : 0      =       3.5
: 1.0
           contains(you) = True              1 : 0      =       3.3
: 1.0
```

```
          contains(again) = True              1 : 0        =        2.9
  : 1.0
            contains(are) = True              1 : 0        =        2.9
  : 1.0
           contains(have) = True              1 : 0        =        2.7
  : 1.0
           contains(your) = True              1 : 0        =        2.3
  : 1.0
            contains(now) = True              1 : 0        =        2.1
  : 1.0
           contains(this) = True              1 : 0        =        2.1
  : 1.0
          contains(there) = True              1 : 0        =        2.1
  : 1.0
           contains(will) = True              0 : 1        =        1.6
  : 1.0
           contains(call) = False             0 : 1        =        1.5
  : 1.0
          contains(claim) = False             0 : 1        =        1.3
  : 1.0
```