Assignment 3

Text Classification Using Scikit-Learn

Introduction to Machine Learning

FA15-BCS

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Section A

In [ ]:

```
```

Phase 1 & 2

step 1 : Import Libraries

In [675]:
```
import re
import string
import scipy
import pickle
import pandas as pd
import numpy as np
from sklearn.feature_extraction.text import *
from sklearn.preprocessing import LabelEncoder
from sklearn.svm import LinearSVC
from sklearn.ensemble import RandomForestClassifier
from sklearn.naive_bayes import BernoulliNB
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score
from prettytable import PrettyTable
from astropy.table import Table,Column
import seaborn as sns
```

Step 2: Read, Understand and Pre-process Train/Test Data

Read, Understand and Pre-process Train/Test Data

Step 2.1: Read Data

In [676]:
```
train_data = pd.read_csv('train.csv')
train_data
```

Out[676]:

	comment_text	gender
0	r u cmng or u not cmng	male
1	r you cmng	female
2	I am fine, r u fine	male
3	m fn and you	female
4	my frnd is gr8, wll dn.	male
5	my best friend is great	female

In [677]:
```
test_data = pd.read_csv('test.csv')
test_data
```

Out[677]:

	comment_text	gender
0	plz go out, plz out with with frnd	male
1	r u going to walk, r u?	female
2	r you find	male
3	are you find	female

Step 2.2: Understand Data

In [678]:
```
print('Train Dataset Columns: ')
train_data.columns
```

```
Train Dataset Columns:
```

Out[678]:
```
Index(['comment_text', 'gender'], dtype='object')
```

In [679]:
```
print('Number of instaces in Train Dataset:')
print("Train Instances: ",len(train_data))
```

```
Number of instaces in Train Dataset:
Train Instances:  6
```

In [680]:
```
train_data.columns
```

Out[680]:
```
Index(['comment_text', 'gender'], dtype='object')
```

In [681]:
```
print('Number of instaces in Test Dataset:')
print("Test Instances: ",len(test_data))
```

```
Number of instaces in Test Dataset:
Test Instances:  4
```

In [682]:
```
print('Number of instance of Male / Female in Train data:')
train_data.gender.value_counts()
```

```
Number of instance of Male / Female in Train data:
```

Out[682]:
```
female    3
male      3
Name: gender, dtype: int64
```

In [683]:
```
print('Number of instance of Male / Female in Test data:')
test_data.gender.value_counts()
```

```
Number of instance of Male / Female in Test data:
```

Out[683]:
```
female    2
male      2
Name: gender, dtype: int64
```

In [684]:
```
print('Comments by \'Male\' in Train Dataset:')
train_data[train_data.gender == 'male']
```

```
Comments by 'Male' in Train Dataset:
```

Out[684]:

	comment_text	gender
0	r u cmng or u not cmng	male
2	I am fine, r u fine	male
4	my frnd is gr8, wll dn.	male

In [685]:
```
print('Comments by \'Female\' in Train Dataset:')
train_data[train_data.gender == 'female']
```

```
Comments by 'Female' in Train Dataset:
```

Out[685]:

	comment_text	gender
1	r you cmng	female
3	m fn and you	female
5	my best friend is great	female

In [686]:
```
print('Comments by \'Male\' in Test Dataset:')
test_data[test_data.gender == 'male']
```

```
Comments by 'Male' in Test Dataset:
```

Out[686]:

	comment_text	gender
0	plz go out, plz out with with frnd	male
2	r you find	male

In [687]:
```
print('Comments by \'Female\' in Train Dataset:')
test_data[test_data.gender == 'female']
```

```
Comments by 'Female' in Train Dataset:
```

Out[687]:

	comment_text	gender
1	r u going to walk, r u?	female
3	are you find	female

Frequency Counter of Words in Male train data

In [688]:
```
print('Comments Frequency of males in Train data:')

words_count_male_train_data = train_data[
    train_data.gender=='male'].comment_text.str.split(
    expand=True).stack().value_counts()
words_count_male_train_data
```

```
Comments Frequency of males in Train data:
```

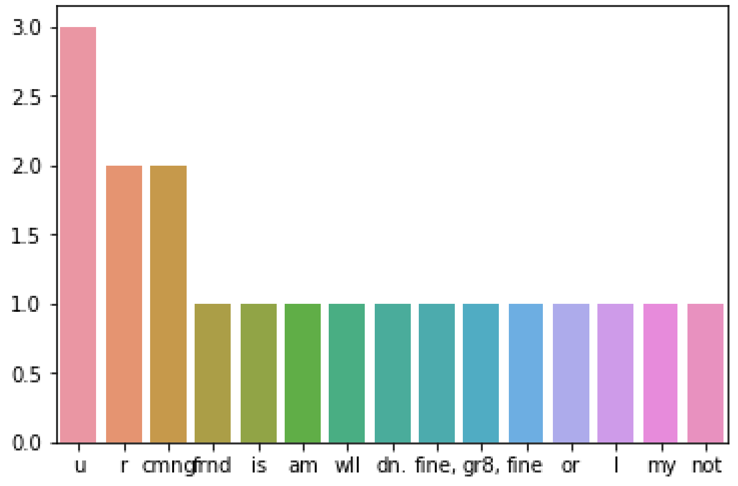
Out[688]:
```
u        3
r        2
cmng     2
frnd     1
is       1
am       1
wll      1
dn.      1
fine,    1
gr8,     1
fine     1
or       1
I        1
my       1
not      1
dtype: int64
```

Understanding data via graphs

In [689]:
```
print('Bar graph of Words used by a male in Train Data')
sns.barplot(x = words_count_male_train_data.keys(),
            y =words_count_male_train_data.values)
```

```
Bar graph of Words used by a male in Train Data
```

Out[689]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fa1ad1e09e8>
```



Frequency Counter of Words in Female train data

In [690]:
```
print('Comments Frequency of Females in Train data:')

words_count_female_train_data = train_data[
    train_data.gender=='female'].comment_text.str.split(
    expand=True).stack().value_counts()
words_count_female_train_data
```

```
   Comments Frequency of Females in Train data:
```

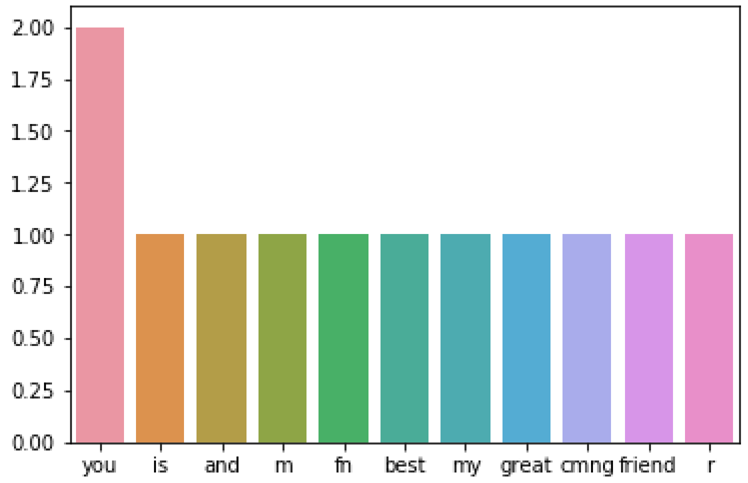
Out[690]:
```
you       2
is        1
and       1
m         1
fn        1
best      1
my        1
great     1
cmng      1
friend    1
r         1
dtype: int64
```

Understanding data via graphs

```
In [691]: print('Bar graph of Words used by a female in Train Data')
          sns.barplot(x = words_count_female_train_data.keys(),
                      y =words_count_female_train_data.values)
```

```
Bar graph of Words used by a female in Train Data
```

```
Out[691]: <matplotlib.axes._subplots.AxesSubplot at 0x7fa1ad234b38>
```



Frequency Counter of Words in Male test data

In [692]:
```
print('Comments Frequency of males in Test data:')

words_count_male_test_data = test_data[
    test_data.gender=='male'].comment_text.str.split(
    expand=True).stack().value_counts()
words_count_male_test_data
```

```
   Comments Frequency of males in Test data:
```

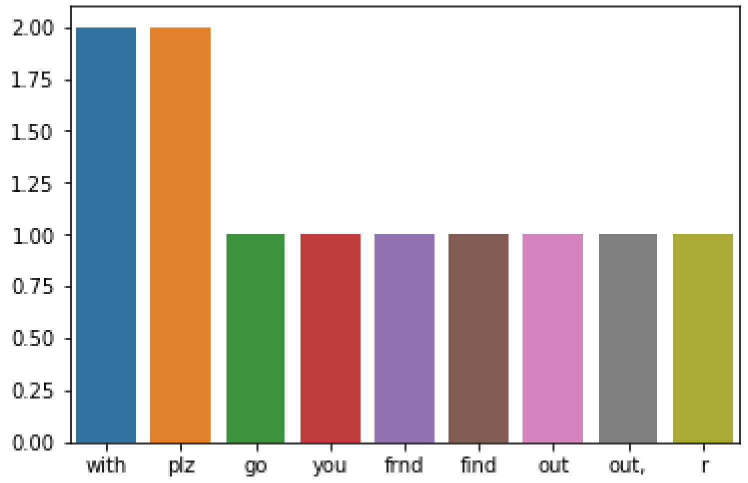
Out[692]:
```
with    2
plz     2
go      1
you     1
frnd    1
find    1
out     1
out,    1
r       1
dtype: int64
```

Understanding data via graphs

```
In [693]: print('Bar graph of Words used by a male in Test Data')
          sns.barplot(x = words_count_male_test_data.keys(),
                      y =words_count_male_test_data.values)
```

```
   Bar graph of Words used by a male in Test Data
```

```
Out[693]: <matplotlib.axes._subplots.AxesSubplot at 0x7fa1ad0b0048>
```



Frequency Counter of Words in Female test data

In [694]:
```
print('Comments Frequency of Females in Test data:')

words_count_female_test_data = test_data[
    test_data.gender=='female'].comment_text.str.split(
    expand=True).stack().value_counts()
words_count_female_test_data
```

```
Comments Frequency of Females in Test data:
```

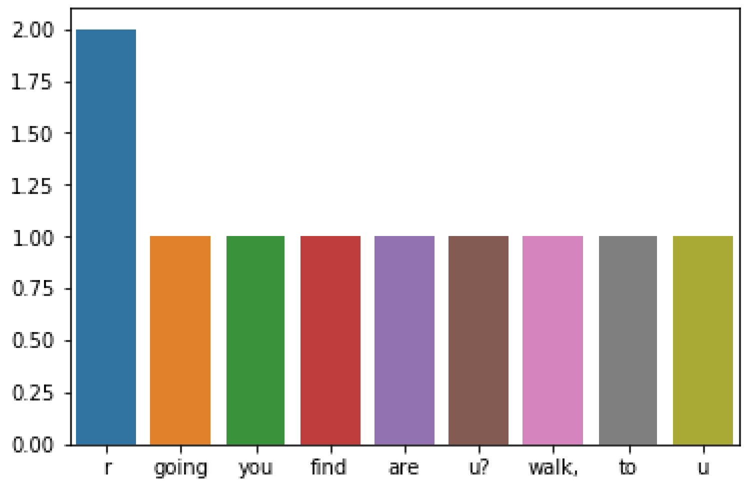
Out[694]:
```
r         2
going     1
you       1
find      1
are       1
u?        1
walk,     1
to        1
u         1
dtype: int64
```

Understanding data via graphs

In [695]:
```
print('Bar graph of Words used by a female in Test Data')
sns.barplot(x = words_count_female_test_data.keys(),
            y =words_count_female_test_data.values)
```

```
Bar graph of Words used by a female in Test Data
```

Out[695]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fa1ad07e940>
```



Step 2.3: Pre-process Data

In [696]:
```
print('Train dataset before pre-processing:')
train_data_unprocessed = train_data.copy(deep = True)
train_data
```

```
Train dataset before pre-processing:
```

Out[696]:

	comment_text	gender
0	r u cmng or u not cmng	male
1	r you cmng	female
2	I am fine, r u fine	male
3	m fn and you	female
4	my frnd is gr8, wll dn.	male
5	my best friend is great	female

In [697]:
```
print('Test dataset before pre-processing:')
test_data_unprocessed = test_data.copy(deep = True)
test_data
```

```
Test dataset before pre-processing:
```

Out[697]:

	comment_text	gender
0	plz go out, plz out with with frnd	male
1	r u going to walk, r u?	female
2	r you find	male
3	are you find	female

Convert text to lowercase

In [698]:
```
print('train data:\n' ,train_data)
print('\n\ntest data:\n' ,test_data)
```

```
train data:
                comment_text  gender
0   r u cmng or u not cmng    male
1               r you cmng  female
2      I am fine, r u fine    male
3             m fn and you  female
4  my frnd is gr8, wll dn.    male
5  my best friend is great  female


test data:
                           comment_text  gender
0  plz go out, plz out with with frnd    male
1            r u going to walk, r u?  female
2                         r you find    male
3                       are you find  female
```

In [699]:
```
train_data.comment_text = train_data.comment_text.str.lower()
test_data.comment_text = test_data.comment_text.str.lower()
```

In [700]:
```
print('Converted to lower case if any :\n\n')
print('train data:\n' ,train_data)
print('\n\ntest data:\n' ,test_data)
```

```
Converted to lower case if any :


train data:
                comment_text  gender
0   r u cmng or u not cmng    male
1              r you cmng  female
2      i am fine, r u fine    male
3            m fn and you  female
4  my frnd is gr8, wll dn.    male
5  my best friend is great  female


test data:
                           comment_text  gender
0  plz go out, plz out with with frnd    male
1            r u going to walk, r u?  female
2                         r you find    male
3                       are you find  female
```

Remove numbers

In [701]:
```
train_data.comment_text = train_data.comment_text.str.replace(r'\d+','')
test_data.comment_text = test_data.comment_text.str.replace(r'\d+','')
```

```
In [702]: print('Converted to lower case if any :\n\n')
          print('train data:\n' ,train_data)
          print('\n\ntest data:\n' ,test_data)
```

```
Converted to lower case if any :


train data:
                 comment_text  gender
0    r u cmng or u not cmng    male
1                r you cmng  female
2       i am fine, r u fine    male
3              m fn and you  female
4    my frnd is gr, wll dn.    male
5  my best friend is great  female


test data:
                               comment_text  gender
0  plz go out, plz out with with frnd    male
1              r u going to walk, r u?  female
2                           r you find    male
3                         are you find  female
```

Remove punctuation

The following code removes this set of symbols [!”#$%&’()*+,-./:;<=>?@[]^_`{|}~]:

```
In [703]: train_data.comment_text = train_data.comment_text.str.replace(r'[!|”|#|$|%|&|\'||(|)|*|+|,|-|.|/|:|;|<|=|>|?|@
          test_data.comment_text = test_data.comment_text.str.replace(r'[!|”|#|$|%|&|\'||(|)|*|+|,|-|.|/|:|;|<|=|>|?|@|[
```

In [704]:
```
print('Removed punctuation if any :\n\n')
print('train data:\n' ,train_data)
print('\n\ntest data:\n' ,test_data)
```

```
Removed punctuation if any :


train data:
                 comment_text  gender
0   r u cmng or u not cmng    male
1                r you cmng  female
2        i am fine r u fine    male
3              m fn and you  female
4      my frnd is gr wll dn    male
5  my best friend is great  female


test data:
                           comment_text  gender
0  plz go out plz out with with frnd    male
1               r u going to walk r u  female
2                          r you find    male
3                        are you find  female
```

Remove whitespaces

In [705]:
```
train_data.comment_text  = train_data.comment_text.str.strip()
test_data.comment_text  = test_data.comment_text.str.strip()
```

In [706]:
```
print('Removed white spaces if any :\n\n')
print('train data:\n' ,train_data)
print('\n\ntest data:\n' ,test_data)
```

```
Removed white spaces if any :


train data:
                comment_text  gender
0   r u cmng or u not cmng    male
1                r you cmng  female
2       i am fine r u fine    male
3              m fn and you  female
4     my frnd is gr wll dn    male
5  my best friend is great  female


test data:
                          comment_text  gender
0  plz go out plz out with with frnd    male
1             r u going to walk r u  female
2                        r you find    male
3                      are you find  female
```

In [707]:
```
from IPython.display import display_html

df1_styler = train_data_unprocessed.style.set_table_attributes("style='display:inline'").set_caption('Train da
df2_styler = train_data.style.set_table_attributes("style='display:inline'").set_caption('Train dataset after 

display_html(df1_styler._repr_html_()+df2_styler._repr_html_(), raw=True)
```

Train dataset before pre-processing:

	comment_text	gender
0	r u cmng or u not cmng	male
1	r you cmng	female
2	I am fine, r u fine	male
3	m fn and you	female
4	my frnd is gr8, wll dn.	male
5	my best friend is great	female

Train dataset after pre-processing:

	comment_text	gender
0	r u cmng or u not cmng	male
1	r you cmng	female
2	i am fine r u fine	male
3	m fn and you	female
4	my frnd is gr wll dn	male
5	my best friend is great	female

In [708]:
```
df1_styler = test_data_unprocessed.style.set_table_attributes("style='display:inline'").set_caption('Test data
df2_styler = test_data.style.set_table_attributes("style='display:inline'").set_caption('Test dataset after pr

display_html(df1_styler._repr_html_()+df2_styler._repr_html_(), raw=True)
```

Test dataset before pre-processing:

	comment_text	gender
0	plz go out, plz out with with frnd	male
1	r u going to walk, r u?	female
2	r you find	male
3	are you find	female

Test dataset after pre-processing:

	comment_text	gender
0	plz go out plz out with with frnd	male
1	r u going to walk r u	female
2	r you find	male
3	are you find	female

Step 3: Label Encoding for Train/Test Data

In [709]:
```
def encodegender(data):
    return data.gender.map({'female':0,'male':1}).astype(int)
```

In [710]:
```
def decodegender(data):
    return data.map({0:'female',1:'male'})
```

In [712]:
```
df = train_data.copy(deep=False)
df['encoded_gender'] = encodegender(train_data)
print('Train Dataset Labels Encoding:')
df
```

```
Train Dataset Labels Encoding:
```

Out[712]:

	comment_text	gender	encoded_gender
0	r u cmng or u not cmng	male	1
1	r you cmng	female	0
2	i am fine r u fine	male	1
3	m fn and you	female	0
4	my frnd is gr wll dn	male	1
5	my best friend is great	female	0

In [713]:
```
df = test_data.copy(deep=False)
df['encoded_gender'] = encodegender(test_data)
print('Test Dataset Labels Encoding:')
df
```

```
Test Dataset Labels Encoding:
```

Out[713]:

	comment_text	gender	encoded_gender
0	plz go out plz out with with frnd	male	1
1	r u going to walk r u	female	0
2	r you find	male	1
3	are you find	female	0

In [714]:
```
train_data.gender = encodegender(train_data)
```

In [715]:
```
print('Label Encoded Train data:')
train_data
```

```
Label Encoded Train data:
```

Out[715]:

	comment_text	gender
0	r u cmng or u not cmng	1
1	r you cmng	0
2	i am fine r u fine	1
3	m fn and you	0
4	my frnd is gr wll dn	1
5	my best friend is great	0

In [716]:
```
test_data.gender = encodegender(test_data)
print('Label Encoded Test data:')
test_data
```

```
Label Encoded Test data:
```

Out[716]:

	comment_text	gender
0	plz go out plz out with with frnd	1
1	r u going to walk r u	0
2	r you find	1
3	are you find	0

Step 4: Feature Extraction – Changing Representation of Data “from String to Vector”

vect = CountVectorizer(strip_accents='unicode', analyzer='word', token_pattern=r'\w{1,}', stop_words='english', ngram_range=(1, 1), max_features=10)

print("Parameters of TfidfVectorizer and its values:\n\n")

print(vect)

In [717]:
```
vect = CountVectorizer( strip_accents='unicode',
                        analyzer='word',
                        token_pattern=r'\w{1,}',
                        stop_words='english',
                        ngram_range=(1, 1), max_features=10)
print("Parameters of TfidfVectorizer and its values:\n\n")
print(vect)
```

```
Parameters of TfidfVectorizer and its values:


CountVectorizer(analyzer='word', binary=False, decode_error='strict',
        dtype=<class 'numpy.int64'>, encoding='utf-8', input='content',
        lowercase=True, max_df=1.0, max_features=10, min_df=1,
        ngram_range=(1, 1), preprocessor=None, stop_words='english',
        strip_accents='unicode', token_pattern='\\w{1,}', tokenizer=None,
        vocabulary=None)
```

In [718]:
```
X = vect.fit_transform(train_data.comment_text)
```

In [719]:
```
vect.get_feature_names()
train_vect = pd.DataFrame(X.toarray(),columns = vect.get_feature_names())
print('Train Features Before Assigning a \'gender\' Column:')
train_vect
```

```
Train Features Before Assigning a 'gender' Column:
```

Out[719]:

	best	cmng	dn	fine	fn	friend	frnd	gr	r	u
0	0	2	0	0	0	0	0	0	1	2
1	0	1	0	0	0	0	0	0	1	0
2	0	0	0	2	0	0	0	0	1	1
3	0	0	0	0	1	0	0	0	0	0
4	0	0	1	0	0	0	1	1	0	0
5	1	0	0	0	0	1	0	0	0	0

In [720]:
```
y = vect.transform(test_data.comment_text)
```

In [721]:
```
test_vect = pd.DataFrame(y.toarray(),columns = vect.get_feature_names())
print('Test Features Before Assigning a \'gender\' Column:')

test_vect
```

```
Test Features Before Assigning a 'gender' Column:
```

Out[721]:

	best	cmng	dn	fine	fn	friend	frnd	gr	r	u
0	0	0	0	0	0	0	1	0	0	0
1	0	0	0	0	0	0	0	0	2	2
2	0	0	0	0	0	0	0	0	1	0
3	0	0	0	0	0	0	0	0	0	0

In [722]:
```
print('Check shape of the Features:')
print("Train Features Shape " ,train_vect.shape)
print("Test  Features Shape ",test_vect.shape)
```

```
Check shape of the Features:
Train Features Shape  (6, 10)
Test  Features Shape  (4, 10)
```

In [723]:
```
print('Train Features after Assigning a \'gender\' Column:')
train_vect['gender'] = train_data.gender
train_vect
```

```
Train Features after Assigning a 'gender' Column:
```

Out[723]:

	best	cmng	dn	fine	fn	friend	frnd	gr	r	u	gender
0	0	2	0	0	0	0	0	0	1	2	1
1	0	1	0	0	0	0	0	0	1	0	0
2	0	0	0	2	0	0	0	0	1	1	1
3	0	0	0	0	1	0	0	0	0	0	0
4	0	0	1	0	0	0	1	1	0	0	1
5	1	0	0	0	0	1	0	0	0	0	0

In [724]:
```
print('Test Features after Assigning a \'gender\' Column:')
test_vect['gender'] = test_data.gender
test_vect
```

```
Test Features after Assigning a 'gender' Column:
```

Out[724]:

	best	cmng	dn	fine	fn	friend	frnd	gr	r	u	gender
0	0	0	0	0	0	0	1	0	0	0	1
1	0	0	0	0	0	0	0	0	2	2	0
2	0	0	0	0	0	0	0	0	1	0	1
3	0	0	0	0	0	0	0	0	0	0	0

In [725]:
```
print('Check shape of the Features After adding gender column:')
print("Train Features Shape " ,train_vect.shape)
print("Test  Features Shape ",test_vect.shape)
```

```
Check shape of the Features After adding gender column:
Train Features Shape  (6, 11)
Test  Features Shape  (4, 11)
```

Step 5: Train Machine Learning Algorithms using Training Data

In [726]:
```
train_X = train_vect.drop('gender',axis=1)
train_y = train_vect['gender']
```

In [727]:
```
print('Training Data:\n')
df1_styler = train_X.style.set_table_attributes("style='display:inline'").set_caption('Train Examples Input:')
df2_styler = pd.DataFrame(train_y).style.set_table_attributes("style='display:inline'").set_caption('Train Exa

display_html(df1_styler._repr_html_()+df2_styler._repr_html_(), raw=True)
```

```
Training Data:
```

Train Examples Input:

	best	cmng	dn	fine	fn	friend	frnd	gr	r	u
0	0	2	0	0	0	0	0	0	1	2
1	0	1	0	0	0	0	0	0	1	0
2	0	0	0	2	0	0	0	0	1	1
3	0	0	0	0	1	0	0	0	0	0
4	0	0	1	0	0	0	1	1	0	0
5	1	0	0	0	0	1	0	0	0	0

Train Examples Output:

	gender
0	1
1	0
2	1
3	0
4	1
5	0

In [728]:
```
test_X = test_vect.drop('gender',axis=1)
test_y = test_vect['gender']
```

In [729]:
```
t('Training Data:\n')
styler = test_X.style.set_table_attributes("style='display:inline'").set_caption('Test Examples Input:')
styler = pd.DataFrame(test_y).style.set_table_attributes("style='display:inline'").set_caption('Test Examples (

lay_html(df1_styler._repr_html_()+df2_styler._repr_html_(), raw=True)
```

```
Training Data:
```

Test Examples Input:

	best	cmng	dn	fine	fn	friend	frnd	gr	r	u
0	0	0	0	0	0	0	1	0	0	0
1	0	0	0	0	0	0	0	0	2	2
2	0	0	0	0	0	0	0	0	1	0
3	0	0	0	0	0	0	0	0	0	0

Test Examples Output:

	gender
0	1
1	0
2	1
3	0

Models of Machine Learning

Logistic Regression Parameters

Parameters and their values:

LogisticRegression(penalty='l2', dual=False, tol=0.0001, C=1.0, fit_intercept=True, intercept_scaling=1, class_weight=None, random_state=None, solver='liblinear', max_iter=100, multi_class='ovr', verbose=0, warm_start=False, n_jobs=1)

In [730]:
```
from sklearn.linear_model import LogisticRegression
LogisticRegression = LogisticRegression()
LogisticRegression.fit(train_X,train_y)
LogisticRegression_prediction = LogisticRegression.predict(test_X)
accuracy_LogisticRegression = accuracy_score(test_y,LogisticRegression_prediction)
```

Random forest Parameters

Parameters and their values:

RandomForestClassifier(n_estimators=10, criterion='gini', max_depth=None, min_samples_split=2, min_samples_leaf=1, min_weight_fraction_leaf=0.0, max_features='auto', max_leaf_nodes=None, min_impurity_decrease=0.0, min_impurity_split=None, bootstrap=True, oob_score=False, n_jobs=1, random_state=None, verbose=0, warm_start=False, class_weight=None) Docstring:
A random forest classifier.

A random forest is a meta estimator that fits a number of decision tree classifiers on various sub-samples of the dataset and use averaging to improve the predictive accuracy and control over-fitting. The sub-sample size is always the same as the original input sample size but the samples are drawn with replacement if `bootstrap=True` (default).

In [731]:
```
from sklearn.ensemble import RandomForestClassifier
RandomForestClassifier = RandomForestClassifier()
RandomForestClassifier.fit(train_X,train_y)
RandomForestClassifier_prediction = RandomForestClassifier.predict(test_X)
accuracy_RandomForestClassifier = accuracy_score(test_y,RandomForestClassifier_prediction)
```

Linear SVC Parameters

Parameters and their values:

LinearSVC(penalty='l2', loss='squared_hinge', dual=True, tol=0.0001, C=1.0, multi_class='ovr', fit_intercept=True, intercept_scaling=1, class_weight=None, verbose=0, random_state=None, max_iter=1000) Docstring:
Linear Support Vector Classification.

Similar to SVC with parameter kernel='linear', but implemented in terms of liblinear rather than libsvm, so it has more flexibility in the choice of penalties and loss functions and should scale better to large numbers of samples.

In [732]:
```
from sklearn.svm import LinearSVC
LinearSVC = LinearSVC()
LinearSVC.fit(train_X,train_y)
LinearSVC_prediction = LinearSVC.predict(test_X)
accuracy_LinearSVC = accuracy_score(test_y,prediction)
```

BernoulliNB

Parameters and their values:

BernoulliNB(alpha=1.0, binarize=0.0, fit_prior=True, class_prior=None)

In [733]:
```
from sklearn.naive_bayes import BernoulliNB
BernoulliNB = BernoulliNB()
BernoulliNB.fit(train_X,train_y)
BernoulliNB_prediction = BernoulliNB.predict(test_X)
accuracy_BernoulliNB = accuracy_score(test_y,prediction)
```

Step 6: Evaluate Machine Learning Algorithms using Test Data

Logistic Regression Classifier

In [737]:
```
test_vect
```

Out[737]:

	best	cmng	dn	fine	fn	friend	frnd	gr	r	u	gender
0	0	0	0	0	0	0	1	0	0	0	1
1	0	0	0	0	0	0	0	0	2	2	0
2	0	0	0	0	0	0	0	0	1	0	1
3	0	0	0	0	0	0	0	0	0	0	0

In [738]:
```
x=test_data.copy()
x.gender = decodegender(x.gender)
x['predicted_gender']=decodegender(pd.Series(LogisticRegression_prediction))
```

In [739]:
```
print('Prediction using Logistic Regression\n')
print(x)
print('\nAccuracy Score = ',accuracy_LogisticRegression)
```

```
Prediction using Logistic Regression

                        comment_text  gender predicted_gender
0  plz go out plz out with with frnd    male             male
1               r u going to walk r u  female             male
2                          r you find    male           female
3                        are you find  female           female

Accuracy Score =  0.5
```

Random Forest Classifier

In [740]:
```
x=test_data.copy()
x.gender = decodegender(x.gender)
x['predicted_gender']=decodegender(pd.Series(RandomForestClassifier_prediction))
```

In [741]:
```
print('Prediction using RandomForestClassifier\n')
print(x)
print('\nAccuracy Score = ',accuracy_RandomForestClassifier)
```

```
Prediction using RandomForestClassifier

                        comment_text  gender predicted_gender
0  plz go out plz out with with frnd    male           female
1               r u going to walk r u  female           female
2                          r you find    male           female
3                        are you find  female           female

Accuracy Score =  0.5
```

BernoulliNB

In [742]:
```
x=test_data.copy()
x.gender = decodegender(x.gender)
x['predicted_gender']=decodegender(pd.Series(BernoulliNB_prediction))
```

In [743]:
```
print('Prediction using BernoulliNB\n')
print(x)
print('\nAccuracy Score = ',accuracy_BernoulliNB)
```

```
Prediction using BernoulliNB

                        comment_text  gender predicted_gender
0  plz go out plz out with with frnd    male           female
1               r u going to walk r u  female             male
2                          r you find    male           female
3                        are you find  female           female

Accuracy Score =  0.25
```

LinearSVC

In [744]:
```
x=test_data.copy()
x.gender = decodegender(x.gender)
x['predicted_gender']=decodegender(pd.Series(LinearSVC_prediction))
```

In [745]:
```
print('Prediction using LinearSVC\n')
print(x)
print('\nAccuracy Score = ',accuracy_LinearSVC)
```

```
Prediction using LinearSVC

                        comment_text  gender predicted_gender
0  plz go out plz out with with frnd    male           female
1               r u going to walk r u  female             male
2                          r you find    male           female
3                        are you find  female           female

Accuracy Score =  0.25
```

Step 7: Selection of Best Model

In [746]:
```
models = pd.DataFrame({'Models':
                       ['LogisticRegression',
                        'RandomForestClassifier',
                        'LinearSVC',
                        'BernoulliN'],
                       'Accuracy':[accuracy_LogisticRegression,
                                   accuracy_RandomForestClassifier,
                                   accuracy_LinearSVC,
                                   accuracy_BernoulliNB]
                        })
```

In [747]:
```
print('Detail Performance of all the models')
models
```

```
Detail Performance of all the models
```

Out[747]:

	Models	Accuracy
0	LogisticRegression	0.50
1	RandomForestClassifier	0.50
2	LinearSVC	0.25
3	BernoulliN	0.25

In [748]:
```
print("Best Model")
models.max()
```

```
Best Model
```

Out[748]:
```
Models      RandomForestClassifier
Accuracy                       0.5
dtype: object
```

In [ ]:

Step 8: Application Phase

Step 8.1: Combine Data (Train + Test)

In [749]:
```
print('Train Features in form of Datafram:\n')
print(train_vect)
```

```
Train Features in form of Datafram:

   best  cmng  dn  fine  fn  friend  frnd  gr  r  u  gender
0     0     2   0     0   0       0     0   0  1  2       1
1     0     1   0     0   0       0     0   0  1  0       0
2     0     0   0     2   0       0     0   0  1  1       1
3     0     0   0     0   1       0     0   0  0  0       0
4     0     0   1     0   0       0     1   1  0  0       1
5     1     0   0     0   0       1     0   0  0  0       0
```

In [750]:
```
print('Test Features in form of Datafram:\n')
print(test_vect)
```

```
Test Features in form of Datafram:

   best  cmng  dn  fine  fn  friend  frnd  gr  r  u  gender
0     0     0   0     0   0       0     1   0  0  0       1
1     0     0   0     0   0       0     0   0  2  2       0
2     0     0   0     0   0       0     0   0  1  0       1
3     0     0   0     0   0       0     0   0  0  0       0
```

In [751]:
```
train_test_data = pd.concat([train_vect,test_vect],axis=0)
```

In [752]:
```
print('All Features in form of Dataframe:')
train_test_data
```

```
All Features in form of Dataframe:
```

Out[752]:

	best	cmng	dn	fine	fn	friend	frnd	gr	r	u	gender
0	0	2	0	0	0	0	0	0	1	2	1
1	0	1	0	0	0	0	0	0	1	0	0
2	0	0	0	2	0	0	0	0	1	1	1
3	0	0	0	0	1	0	0	0	0	0	0
4	0	0	1	0	0	0	1	1	0	0	1
5	1	0	0	0	0	1	0	0	0	0	0
0	0	0	0	0	0	0	1	0	0	0	1
1	0	0	0	0	0	0	0	0	2	2	0
2	0	0	0	0	0	0	0	0	1	0	1
3	0	0	0	0	0	0	0	0	0	0	0

In [ ]:

Step 8.2: Train Best Model (see Step 7) on all data(Train + Test)

Which is Random forest in our case

```
In [753]: RandomForestClassifier
```

```
Out[753]: RandomForestClassifier(bootstrap=True, class_weight=None, criterion='gini',
                      max_depth=None, max_features='auto', max_leaf_nodes=None,
                      min_impurity_decrease=0.0, min_impurity_split=None,
                      min_samples_leaf=1, min_samples_split=2,
                      min_weight_fraction_leaf=0.0, n_estimators=10, n_jobs=1,
                      oob_score=False, random_state=None, verbose=0,
                      warm_start=False)
```

```
In [754]: from sklearn.ensemble import RandomForestClassifier
          RandomForestClassifier = RandomForestClassifier()
          X = train_test_data.drop('gender',axis=1)
          y = train_test_data['gender']

          trainedModel = RandomForestClassifier.fit(scipy.sparse.csr_matrix(X),y)
```

```
In [ ]:
```

Step 8.3: Save the Trained Model as Pickle File

```
In [762]: f = open('trainedModelfile','wb')
          pickle.dump(trainedModel,f)
          f.close()
```

```
In [763]: f = open('vectorCounterfile','wb')
          pickle.dump(vect,f)
          f.close()
```

Step 9: Make prediction on unseen/new data

Step 9.1: Load the Trained Model (saved in Step 8.3)

In [764]:
```
print('Method for de-coding predicted value')
def decodegender(data):
    return data.map({0:'female',1:'male'})
```

```
Method for de-coding predicted value
```

Method for preproccessing of User Input

In [765]:
```
def preprocessdata(data):
    data.comment_text = data.comment_text.str.lower()
    data.comment_text = data.comment_text.str.replace(r'\d+','')
    data.comment_text = data.comment_text.str.replace(r'[!|”|#|$|%|&|\'||(|)|*|+|,|-|.|/|:|;|<|=|>|?|@|[||]|^|_
    data.comment_text  = data.comment_text.str.strip()
```

Load Trainned Model and text vectorizor from Memory

In [766]:
```

f = open('trainedModelfile','rb')

trained_model = pickle.load(f)
f.close()
f = open('vectorCounterfile','rb')
vect = pickle.load(f)
f.close()
```

Step 9.2: Take Input from User

In [767]:
```
text = input('Write your comment here: ')
```

```
Write your comment here: Plz go out, plz out with with frnd
```

Step 9.3: Convert User Input into Feature Vector (Same as Feature Vector of Trained Model)

In [768]:
```
input_vector = pd.DataFrame({'comment_text':text},index=[0])
```

In [774]:
```
print('User input in Actual DataFrame form:')
input_vector
```

```
User input in Actual DataFrame form:
```

Out[774]:

	comment_text
0	Plz go out, plz out with with frnd

In [775]:
```
print('Vector features:',vect.get_feature_names())
```

```
Vector features: ['best', 'cmng', 'dn', 'fine', 'fn', 'friend', 'frnd', 'gr', 'r', 'u']
```

In [776]:
```
print('preprocessed user input')
preprocessdata(input_vector)
```

```
preprocessed user input
```

In [777]:
```
print("User input after preprocessing:")
input_vector
```

```
User input after preprocessing:
```

Out[777]:

	comment_text
0	plz go out plz out with with frnd

In [779]:
```
input_vector_X = vect.transform(input_vector.comment_text)
vect_user_input = pd.DataFrame(input_vector_X.toarray(),
                               columns=vect.get_feature_names())
print('User input features with weights')
vect_user_input
```

```
User input features with weights
```

Out[779]:

	best	cmng	dn	fine	fn	friend	frnd	gr	r	u
0	0	0	0	0	0	0	1	0	0	0

Step 9.4: Apply Trained Model on Feature Vector of Unseen Data and Output Prediction (Male/Female) to User

In [780]:
```
prediction_of_user_input = trained_model.predict(vect_user_input)
prediction_of_user_input
```

Out[780]:
```
array([1])
```

In [781]:
```
decoded_prediction_of_user_input = decodegender(pd.Series(prediction_of_user_input))[0]
```

In [782]:
```
print("Prediction : ",decoded_prediction_of_user_input)
```

```
Prediction :  male
```

In [ ]: