ML Assignment 3 Scikit Learn

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1 FA15-BCS-100

2 Omer Javed

2.1 Gender Prediction

2.1.1 Step 1: Import Libraries

```
In [38]: import re
         import string
```

```
In [80]: import scipy
         import pickle
         import pandas as pd
         import numpy
```

```
In [40]: import matplotlib as plt
         import seaborn as sns
```

```
In [41]: from sklearn.feature_extraction.text import *
         from sklearn.preprocessing import LabelEncoder
```

```
In [42]: from sklearn.linear_model import LogisticRegression
         from sklearn.naive_bayes import BernoulliNB
         from sklearn.ensemble import RandomForestClassifier
         from sklearn.svm import LinearSVC
         from sklearn.metrics import accuracy_score
```

```
In [43]: from prettytable import PrettyTable
         from astropy.table import Table,Column
```

```
In [44]: %matplotlib inline
```

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

Step 2.1: Read Data Reading Train data set from a csv file

```
In [45]: train_data = pd.read_csv('train.csv')
```

Reading Test data set from a csv file

```
In [46]: test_data = pd.read_csv('test.csv')
```

Step 2.2 : Understand Data

```
In [ ]:
```

```
In [47]: print('Train Dataset:')
         train_data
```

```
Train Dataset:
```

Out[47]:

	height	weight	hair	beard	scarf	gender
0	180.3000	196	Bald	Yes	No	Male
1	170.0000	120	Long	No	No	Female
2	178.5000	200	Short	No	No	Male
3	163.4000	110	Medium	No	Yes	Female
4	175.2222	220	Short	Yes	No	Male
5	165.0000	150	Medium	No	Yes	Female

```
In [48]: print('Train Dataset Columns:')
         train_data.columns
```

```
Train Dataset Columns:
```

```
Out[48]: Index(['height', 'weight', 'hair', 'beard', 'scarf', 'gender'], dtype='object')
```

```
In [49]: train_data.shape
```

```
Out[49]: (6, 6)
```

```
In [50]: print('Number of instaces in Train Dataset:')
         print("Train Instances: ",len(train_data))
```

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

```
In [51]: print('Test Dataset:')
         test_data
```

```
Test Dataset:
```

Out[51]:

	height	weight	hair	beard	scarf	gender
0	179.1	185	Long	Yes	No	Male
1	160.5	130	Short	No	No	Female
2	177.8	160	Bald	No	No	Male
3	161.1	100	Medium	No	No	Female

```
In [52]: print('Number of instaces in Test Dataset:')
         print("Test Instances: ",len(test_data))
```

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

```
In [53]: train_data.gender.value_counts()
```

```
Out[53]: Male      3
         Female    3
         Name: gender, dtype: int64
```

```
In [54]: print("""
         Training data set contain 6 instances:

         \t3 train instances having label 'Male'
         \t3 train instances having label 'Female'
         """)
```

```
Training data set contain 6 instances:

        3 train instances having label 'Male'
        3 train instances having label 'Female'
```

```
In [55]: train_data[train_data.gender == 'Male']
```

```
Out[55]:      height  weight   hair beard scarf gender
         0  180.3000     196   Bald   Yes    No   Male
         2  178.5000     200  Short    No    No   Male
         4  175.2222     220  Short   Yes    No   Male
```

```
In [56]: train_data[train_data.gender == 'Female']
```

```
Out[56]:    height  weight    hair beard scarf  gender
         1   170.0     120    Long    No    No  Female
         3   163.4     110  Medium    No   Yes  Female
         5   165.0     150  Medium    No   Yes  Female
```

```
In [57]: test_data.gender.value_counts()
```

```
Out[57]: Male      2
         Female    2
         Name: gender, dtype: int64
```

```
In [58]: test_data[train_data.gender == 'Male']
```

```
/home/omer/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.py:1: UserWarning: Boolean
  """Entry point for launching an IPython kernel.
```

```
Out[58]:    height  weight  hair beard scarf gender
         0   179.1     185  Long   Yes    No   Male
         2   177.8     160  Bald    No    No   Male

In [59]: test_data[train_data.gender == 'Female']

/home/omer/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.py:1: UserWarning: Boolean
  """Entry point for launching an IPython kernel.


Out[59]:    height  weight    hair beard scarf  gender
         1   160.5     130   Short    No    No  Female
         3   161.1     100  Medium    No    No  Female

In [60]: print("""
         Testing data set contain 6 instances:

         \t3 test Dataset instances having label 'Male'
         \t3 test Dateset instances having label 'Female'
         """)


Testing data set contain 6 instances:

        3 test Dataset instances having label 'Male'
        3 test Dateset instances having label 'Female'



In [61]: train_data.describe()

Out[61]:            height      weight
         count    6.000000    6.000000
         mean   172.070367  166.000000
         std      7.049154   45.782093
         min    163.400000  110.000000
         25%    166.250000  127.500000
         50%    172.611100  173.000000
         75%    177.680550  199.000000
         max    180.300000  220.000000

In [62]: train_data.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 6 entries, 0 to 5
Data columns (total 6 columns):
height    6 non-null float64
weight    6 non-null int64
hair      6 non-null object
```

```
beard     6 non-null object
scarf     6 non-null object
gender    6 non-null object
dtypes: float64(1), int64(1), object(4)
memory usage: 368.0+ bytes
```

```
In [63]: train_data.dtypes
```

```
Out[63]: height    float64
         weight      int64
         hair       object
         beard      object
         scarf      object
         gender     object
         dtype: object
```

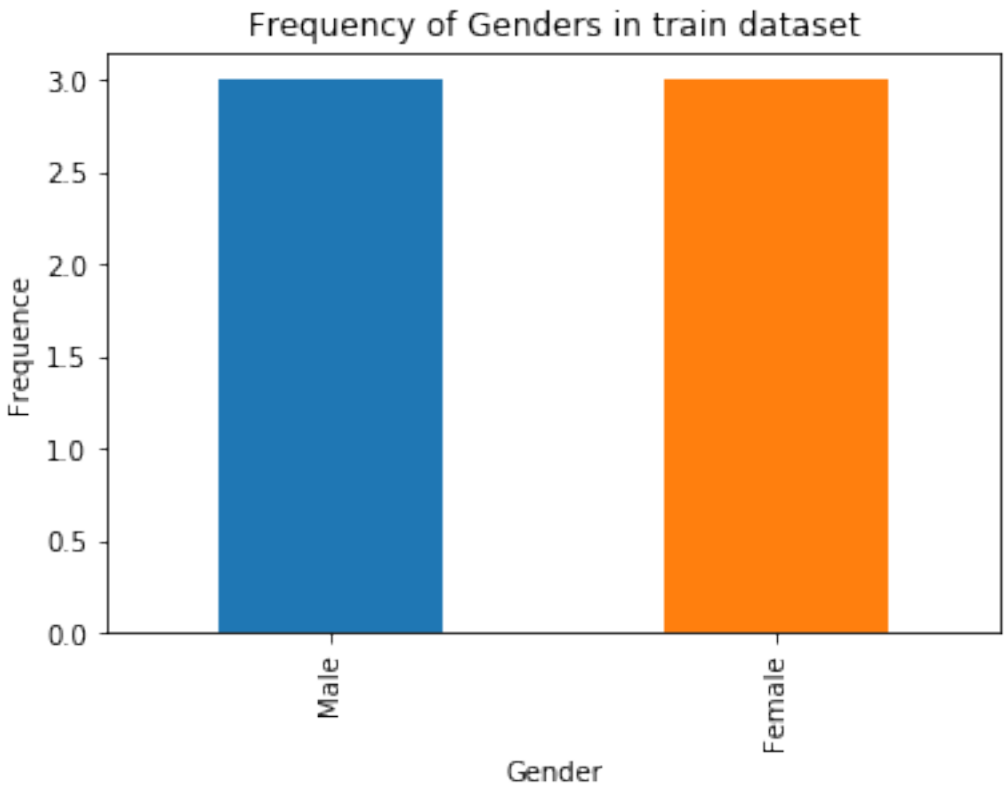
Understanding Data via Graphs

```
In [64]: print('Total number of \'Males\' and \'Females\' in Train Dataset ')

         x=train_data.gender.value_counts().plot.bar(title='Frequency of Genders in train datas
         x.set_xlabel('Gender')
         x.set_ylabel('Frequence')
```

```
Total number of 'Males' and 'Females' in Train Dataset
```

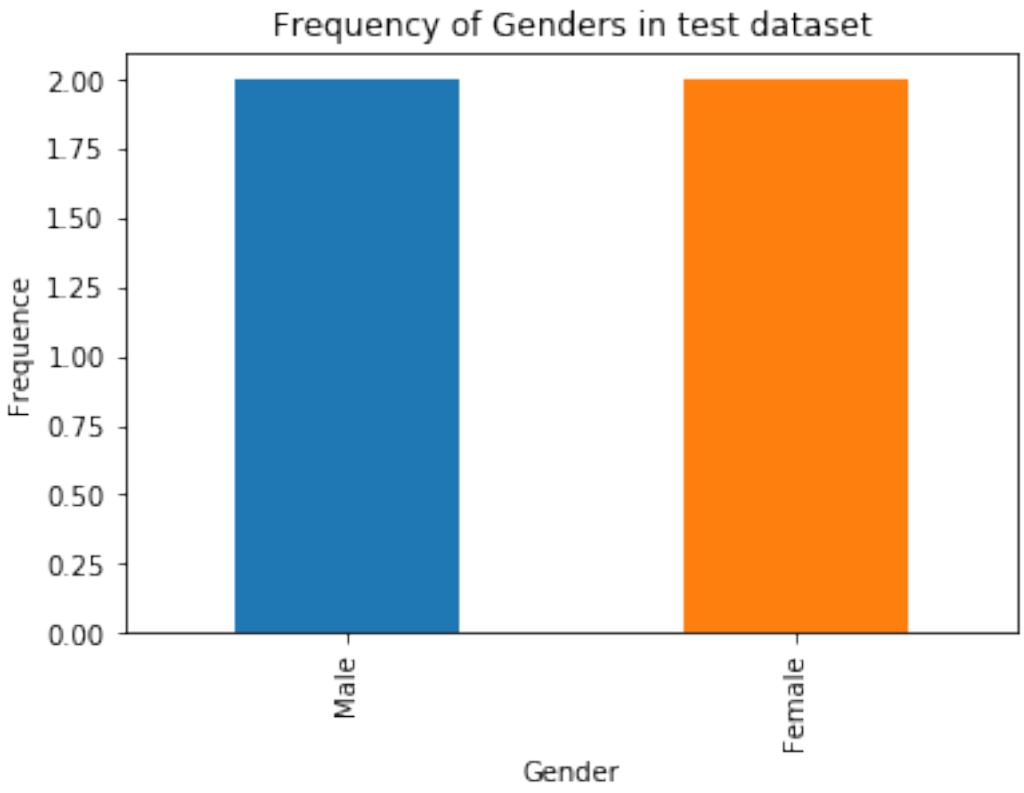
```
Out[64]: Text(0,0.5,'Frequence')
```




```
In [65]: print('Total number of \'Males\' and \'Females\' in Test Dataset ')
         x=test_data.gender.value_counts().plot.bar(title='Frequency of Genders in test dataset
         x.set_xlabel('Gender')
         x.set_ylabel('Frequence')
```

```
Total number of 'Males' and 'Females' in Test Dataset
```

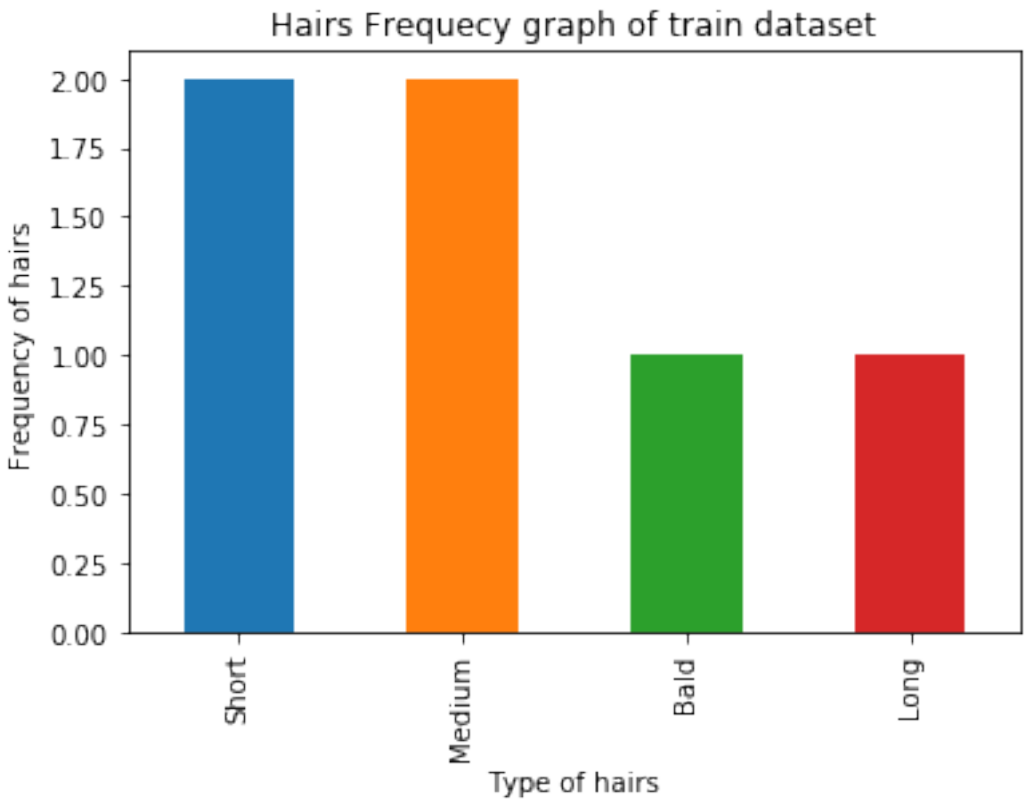
```
Out[65]: Text(0,0.5,'Frequence')
```




```
In [66]: print('Number of people having various hair length in Train datset:')
         ax = train_data.hair.value_counts().plot.bar()
         ax.set_xlabel('Type of hairs')
         ax.set_ylabel('Frequency of hairs')
         ax.set_title('Hairs Frequecy graph of train dataset')
```

```
Number of people having various hair length in Train datset:
```

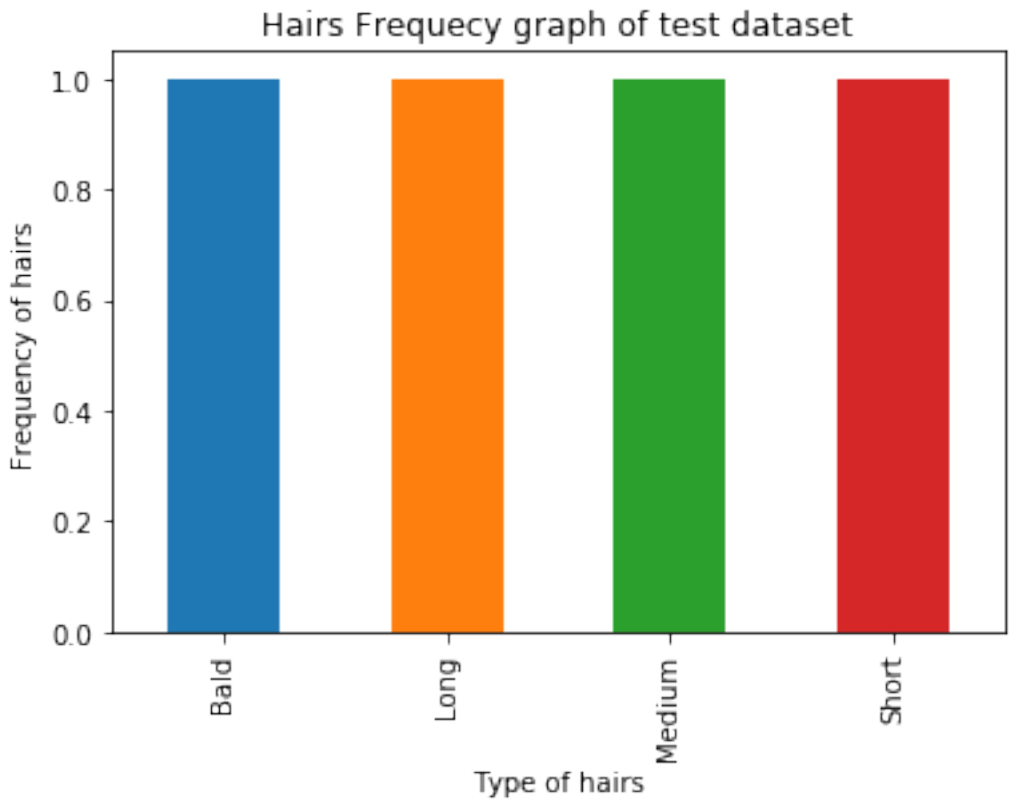
```
Out[66]: Text(0.5,1,'Hairs Frequecy graph of train dataset')
```




```
In [67]: print('Number of people having various hair length in Test datset:')
         ax = test_data.hair.value_counts().plot.bar()
         ax.set_xlabel('Type of hairs')
         ax.set_ylabel('Frequency of hairs')
         ax.set_title('Hairs Frequecy graph of test dataset')
```

```
Number of people having various hair length in Test datset:
```

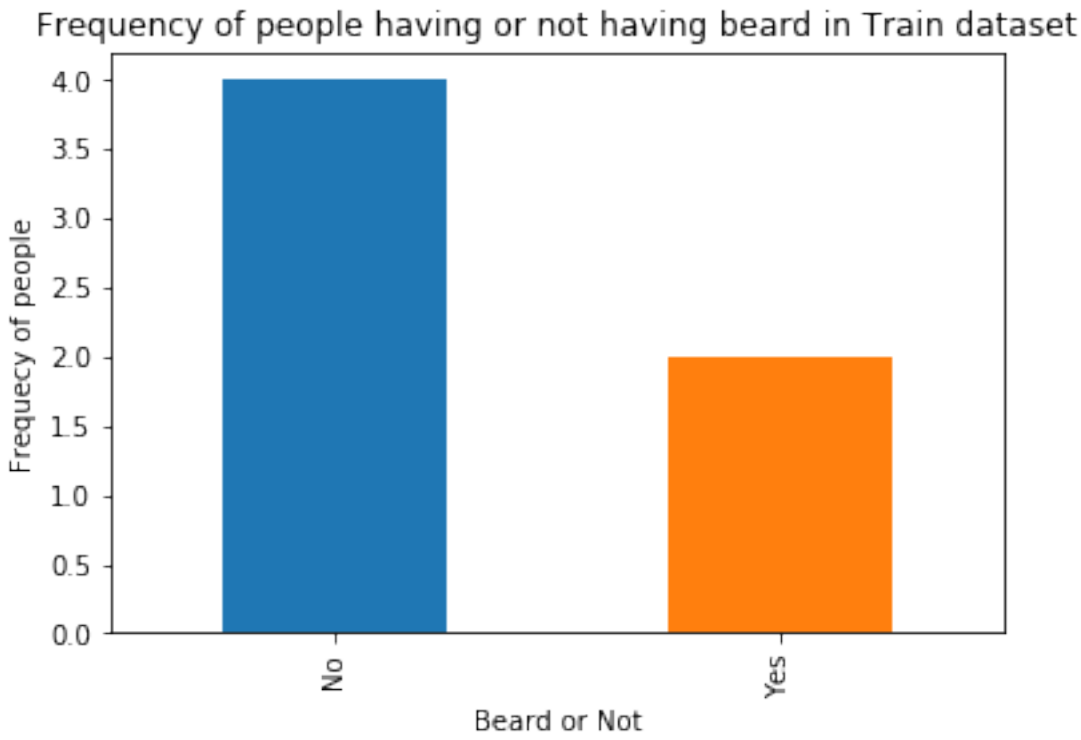
```
Out[67]: Text(0.5,1,'Hairs Frequecy graph of test dataset')
```




```
In [68]: print('Number of people have/haven\'t beard in Train dataset')
         ax = train_data.beard.value_counts().plot.bar()
         ax.set_xlabel('Beard or Not')
         ax.set_ylabel('Frequecy of people')
         ax.set_title('Frequency of people having or not having beard in Train dataset')
```

```
Number of people have/haven't beard in Train dataset
```

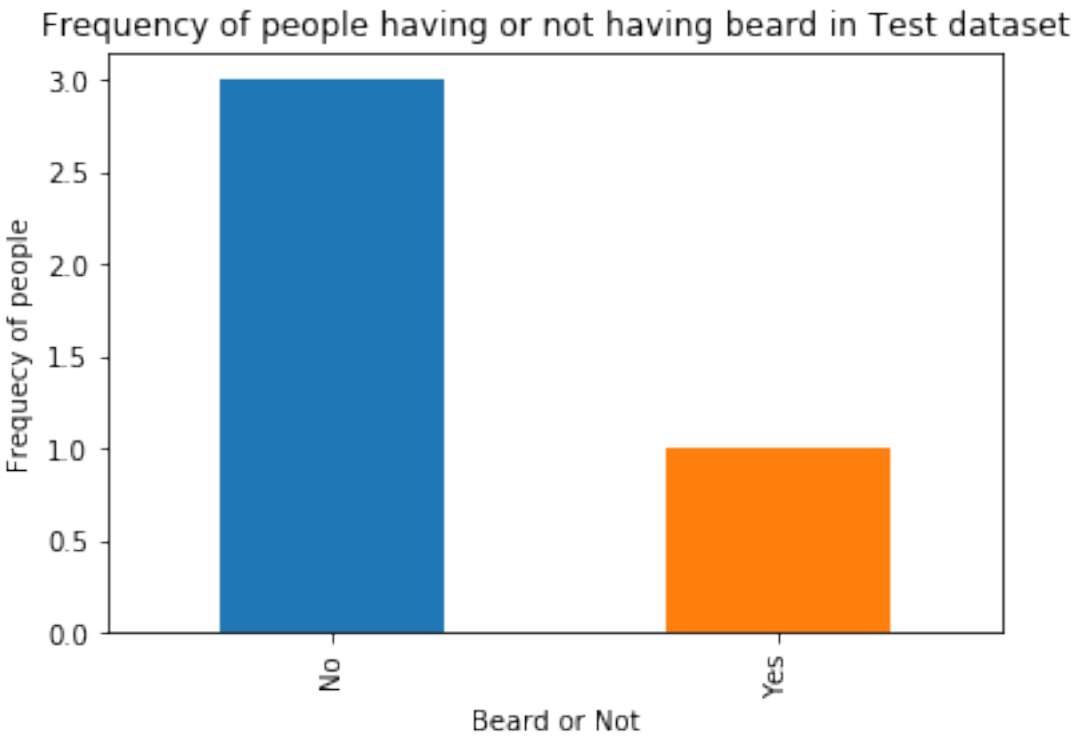
```
Out[68]: Text(0.5,1,'Frequency of people having or not having beard in Train dataset')
```




```
In [69]: print('Number of people have/haven\'t beard in Test dataset')
         ax = test_data.beard.value_counts().plot.bar()
         ax.set_xlabel('Beard or Not')
         ax.set_ylabel('Frequecy of people')
         ax.set_title('Frequency of people having or not having beard in Test dataset')
```

```
Number of people have/haven't beard in Test dataset
```

```
Out[69]: Text(0.5,1,'Frequency of people having or not having beard in Test dataset')
```



2.1.3 2.3: Pre-Process Data

```
In [70]: print('Train dataset before pre-processing:')
         train_data.head()
```

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

Out[70]:

	height	weight	hair	beard	scarf	gender
0	180.3000	196	Bald	Yes	No	Male
1	170.0000	120	Long	No	No	Female
2	178.5000	200	Short	No	No	Male
3	163.4000	110	Medium	No	Yes	Female
4	175.2222	220	Short	Yes	No	Male

```
In [71]: train_data.height=train_data.height.round(1)
```

```
In [72]: print('Train dataset after pre-processing')
         train_data
```

```
Train dataset after pre-processing
```

Out[72]:

	height	weight	hair	beard	scarf	gender
0	180.3	196	Bald	Yes	No	Male
1	170.0	120	Long	No	No	Female
2	178.5	200	Short	No	No	Male
3	163.4	110	Medium	No	Yes	Female
4	175.2	220	Short	Yes	No	Male
5	165.0	150	Medium	No	Yes	Female

2.1.4 Step 3 : Label Encoding for Train/Test Data

```
In [73]: encoder = LabelEncoder()
```

```
In [82]: encoder_class = dict()
         for col in train_data.columns[2:]:
             encoder_class[col] = LabelEncoder()
             encoder_class[col].fit(train_data.loc[:,col])
         numpy.save('Encoder_class.npy',encoder_class)
```

```
In [83]: print('Gender Attribute Encoding in Train Dataset:')
         x = pd.DataFrame(train_data.gender)
         x['Encoded Gender ']=encoder_class['gender'].transform(train_data.gender)
         x
```

```
Gender Attribute Encoding in Train Dataset:
```

Out[83]:

	gender	Encoded Gender
0	Male	1
1	Female	0
2	Male	1
3	Female	0
4	Male	1
5	Female	0

```
In [84]: print('Beard Attribute Encoding in Train Dataset:')
         x = pd.DataFrame(train_data.beard)
         x['Encoded Beard ']= encoder_class['beard'].transform(train_data.beard)
         x
```

```
Beard Attribute Encoding in Train Dataset:
```

Out[84]:

	beard	Encoded Beard
0	Yes	1
1	No	0
2	No	0
3	No	0
4	Yes	1
5	No	0

```
In [ ]:
```

```
In [85]: print('Scarf Attribute Encoding in Train Dataset:')
         x = pd.DataFrame(train_data.scarf)
         x['Encoded Scraf ']= encoder_class['scarf'].transform(train_data.scarf)
         x
```

```
Scarf Attribute Encoding in Train Dataset:
```

```
Out[85]:   scarf  Encoded Scraf
         0    No               0
         1    No               0
         2    No               0
         3   Yes               1
         4    No               0
         5   Yes               1
```

```
In [86]: print('Hair Attribute Encoding in Train Dataset:')
         x = pd.DataFrame(train_data.hair)
         x['Encoded Hair ']= encoder_class['hair'].transform(train_data.hair)
         x
```

```
Hair Attribute Encoding in Train Dataset:
```

```
Out[86]:      hair  Encoded Hair
         0    Bald              0
         1    Long              1
         2   Short              3
         3  Medium              2
         4   Short              3
         5  Medium              2
```

```
In [87]: print('Orignal Train Data:')
         train_data
```

```
Orignal Train Data:
```

```
Out[87]:    height  weight    hair beard scarf  gender
         0   180.3     196    Bald   Yes    No    Male
         1   170.0     120    Long    No    No  Female
         2   178.5     200   Short    No    No    Male
         3   163.4     110  Medium    No   Yes  Female
         4   175.2     220   Short   Yes    No    Male
         5   165.0     150  Medium    No   Yes  Female
```

```
In [88]: Encoded_train_data = train_data.copy()
         for c in Encoded_train_data.iloc[:,2:].columns:
             Encoded_train_data[c] = encoder_class[c].transform(Encoded_train_data[c])
         print('Train Data after Label Encoding:')
         Encoded_train_data
```

```
Train Data after Label Encoding:
```

Out[88]:

	height	weight	hair	beard	scarf	gender
0	180.3	196	0	1	0	1
1	170.0	120	1	0	0	0
2	178.5	200	3	0	0	1
3	163.4	110	2	0	1	0
4	175.2	220	3	1	0	1
5	165.0	150	2	0	1	0

```
In [89]: print('Orignal Test Data:')
         test_data
```

```
Orignal Test Data:
```

Out[89]:

	height	weight	hair	beard	scarf	gender
0	179.1	185	Long	Yes	No	Male
1	160.5	130	Short	No	No	Female
2	177.8	160	Bald	No	No	Male
3	161.1	100	Medium	No	No	Female

```
In [90]: Encoded_test_data = test_data.copy()
         for c in Encoded_test_data.iloc[:,2:].columns:
             Encoded_test_data[c] = encoder_class[c].transform(Encoded_test_data[c])
         print('Test Data after Label Encoding:')
         Encoded_test_data
```

```
Test Data after Label Encoding:
```

Out[90]:

	height	weight	hair	beard	scarf	gender
0	179.1	185	1	1	0	1
1	160.5	130	3	0	0	0
2	177.8	160	0	0	0	1
3	161.1	100	2	0	0	0

2.2 Step 5: Train ML Algorithm using Train Data

```
In [91]: train_X = Encoded_train_data.drop('gender',axis = 1)
         train_y = Encoded_train_data['gender']
```

```
In [92]: train_X
```

```
Out[92]:    height  weight  hair  beard  scarf
         0   180.3     196     0      1      0
         1   170.0     120     1      0      0
         2   178.5     200     3      0      0
         3   163.4     110     2      0      1
         4   175.2     220     3      1      0
         5   165.0     150     2      0      1

In [93]: train_y

Out[93]: 0    1
         1    0
         2    1
         3    0
         4    1
         5    0
         Name: gender, dtype: int64

In [94]: test_X = Encoded_test_data.drop('gender',axis = 1)
         test_y = Encoded_test_data['gender']

In [95]: test_X

Out[95]:    height  weight  hair  beard  scarf
         0   179.1     185     1      1      0
         1   160.5     130     3      0      0
         2   177.8     160     0      0      0
         3   161.1     100     2      0      0

In [96]: test_y

Out[96]: 0    1
         1    0
         2    1
         3    0
         Name: gender, dtype: int64
```

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 [117]: 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 [118]: 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_predi
```

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 [119]: from sklearn.svm import LinearSVC
          LinearSVC = LinearSVC()
          LinearSVC.fit(train_X,train_y)
          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 [120]: from sklearn.naive_bayes import BernoulliNB
          BernoulliNB = BernoulliNB()
          BernoulliNB.fit(train_X,train_y)
          prediction = BernoulliNB.predict(test_X)
          accuracy_BernoulliNB = accuracy_score(test_y,prediction)
```

2.2.1 Step 6: Evaluate ML Algorithms using Test Data

Logistic Regression Classifier

```
In [121]: x=test_data.copy()
          x['predicted_gender']=encoder_class['gender'].inverse_transform(LogisticRegression_pr
```

```
/home/omer/anaconda3/lib/python3.7/site-packages/sklearn/preprocessing/label.py:151: Deprecatio
  if diff:
```

```
In [122]: print('Prediction using Logistic Regression\n')
          print(x)
          print('\nAccuracy Score = ',accuracy_LogisticRegression)
```

```
Prediction using Logistic Regression

   height  weight    hair beard scarf  gender predicted_gender
0   179.1     185    Long   Yes    No    Male             Male
1   160.5     130   Short    No    No  Female           Female
2   177.8     160    Bald    No    No    Male           Female
3   161.1     100  Medium    No    No  Female           Female

Accuracy Score =  0.75
```

Random Forest Classifier

```
In [123]: x=test_data.copy()
          x['predicted_gender']=encoder_class['gender'].inverse_transform(RandomForestClassifie
```

```
/home/omer/anaconda3/lib/python3.7/site-packages/sklearn/preprocessing/label.py:151: Deprecatio
  if diff:
```

```
In [124]: print('Prediction using RandomForestClassifier\n')
          print(x)
          print('\nAccuracy Score = ',accuracy_RandomForestClassifier)
```

```
Prediction using RandomForestClassifier

   height  weight    hair beard scarf  gender predicted_gender
0   179.1     185    Long   Yes    No    Male             Male
1   160.5     130   Short    No    No  Female           Female
2   177.8     160    Bald    No    No    Male             Male
3   161.1     100  Medium    No    No  Female           Female

Accuracy Score =  1.0
```

BernoulliNB

```
In [125]: x=test_data.copy()
          x['predicted_gender']=encoder_class['gender'].inverse_transform(prediction)
```

```
/home/omer/anaconda3/lib/python3.7/site-packages/sklearn/preprocessing/label.py:151: Deprecatio
  if diff:
```

```
In [126]: print('Prediction using BernoulliNB\n')
          print(x)
          print('\nAccuracy Score = ',accuracy_BernoulliNB)
```

```
Prediction using BernoulliNB

   height  weight    hair beard scarf  gender predicted_gender
0   179.1     185    Long   Yes    No    Male             Male
1   160.5     130   Short    No    No  Female           Female
2   177.8     160    Bald    No    No    Male             Male
3   161.1     100  Medium    No    No  Female           Female

Accuracy Score =  1.0
```

LinearSVC

```
In [127]: x=test_data.copy()
          x['predicted_gender']=encoder_class['gender'].inverse_transform(prediction)
```

```
/home/omer/anaconda3/lib/python3.7/site-packages/sklearn/preprocessing/label.py:151: Deprecati
  if diff:
```

```
In [128]: print('Prediction using LinearSVC\n')
          print(x)
          print('\nAccuracy Score = ',accuracy_LinearSVC)
```

```
Prediction using LinearSVC

   height  weight    hair beard scarf  gender predicted_gender
0   179.1     185    Long   Yes    No    Male             Male
1   160.5     130   Short    No    No  Female           Female
2   177.8     160    Bald    No    No    Male             Male
3   161.1     100  Medium    No    No  Female           Female

Accuracy Score =  0.75
```

2.2.2 Step 7: Selection of Best Model

```
In [130]: models = pd.DataFrame({'Models':
                                 ['LogisticRegression',
                                  'RandomForestClassifier',
                                  'LinearSVC',
                                  'BernoulliN'],
                                 'Accuracy':[accuracy_LogisticRegression,
                                             accuracy_RandomForestClassifier,
                                             accuracy_LinearSVC,
```

```
                                        accuracy_BernoulliNB]
                                    })
```

```
In [131]: print('Detail Performance of all the models')
          models
```

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

```
Out[131]:                    Models  Accuracy
          0      LogisticRegression      0.75
          1  RandomForestClassifier      1.00
          2               LinearSVC      0.75
          3             BernoulliN      1.00
```

```
In [132]: print("Best Model")
          models.max()
```

```
Best Model
```

```
Out[132]: Models      RandomForestClassifier
          Accuracy                         1
          dtype: object
```

2.2.3 Step 8: Application Phase

2.2.4 Step 8.1: Combine Data (Train+Test)

```
In [133]: print('Train Features in form of Datafram:\n')
          print(Encoded_train_data)
```

```
Train Features in form of Datafram:

   height  weight  hair  beard  scarf  gender
0   180.3     196     0      1      0       1
1   170.0     120     1      0      0       0
2   178.5     200     3      0      0       1
3   163.4     110     2      0      1       0
4   175.2     220     3      1      0       1
5   165.0     150     2      0      1       0
```

```
In [134]: print('Test Features in form of Datafram:\n')
          print(Encoded_test_data)
```

```
Test Features in form of Datafram:

   height  weight  hair  beard  scarf  gender
0   179.1     185     1      1      0       1
```

```
1   160.5     130     3      0      0       0
2   177.8     160     0      0      0       1
3   161.1     100     2      0      0       0
```

```
In [135]: train_test_data = pd.concat([Encoded_train_data,Encoded_test_data],axis=0)
```

```
In [136]: print('All Features in form of Dataframe:')
          train_test_data
```

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

Out[136]:

	height	weight	hair	beard	scarf	gender
0	180.3	196	0	1	0	1
1	170.0	120	1	0	0	0
2	178.5	200	3	0	0	1
3	163.4	110	2	0	1	0
4	175.2	220	3	1	0	1
5	165.0	150	2	0	1	0
0	179.1	185	1	1	0	1
1	160.5	130	3	0	0	0
2	177.8	160	0	0	0	1
3	161.1	100	2	0	0	0

2.2.5 Step 8.2 : Train Best Model on All Data

Which is Random forest in our case

```
In [137]: RandomForestClassifier
```

```
Out[137]: 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 [138]: 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)
```

2.2.6 Step 8.3 : Save the trained Model

```
In [139]: f = open('trainedModelfile','wb')
          pickle.dump(trainedModel,f)
          f.close()
```

2.3 Step 9.1 Load the Traind Model

```
In [140]: f = open('trainedModelfile','rb')

          trained_model = pickle.load(f)
          f.close()
```

2.3.1 Step 9.2: Take inputs from User

```
In [142]: height = input('Please enter your Height here (centimeter): ')
```

```
Please enter your Height here (centimeter): 170
```

```
In [143]: round(float(height),3)
```

```
Out[143]: 170.0
```

```
In [144]: weight = input('Please enter your Weight here (Kg): ')
```

```
Please enter your Weight here (Kg): 120
```

```
In [145]: hair = input('Please enter your Hair Length here (Bald/Long/Short/Medium): ')
```

```
Please enter your Hair Length here (Bald/Long/Short/Medium): Long
```

```
In [146]: beard = input('Do you have beard? (Yes/No)')
```

```
Do you have beard? (Yes/No)Yes
```

```
In [147]: scraf = input('Do you wear Scarf? (Yes/No)')
```

```
Do you wear Scarf? (Yes/No)Yes
```

2.3.2 Step 9.3: Convert User input into Feature Vector

```
In [148]: input_feature_vector = pd.DataFrame({'height':[round(float(height),1)],
                                               'weight':[weight],
                                              'hair':[hair],
                                               'beard':[beard],
                                               'scarf':[scraf]
                                              })
```

```
In [149]: Encoded_input_feature_vector = input_feature_vector.copy()
```

```
In [150]: print('User input in Actual DataFrame form:')
          input_feature_vector
```

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

Out[150]:

	height	weight	hair	beard	scarf
0	170.0	120	Long	Yes	Yes

```
In [151]: encoder_class =numpy.load('Encoder_class.npy').all()

In [152]: Encoded_input_feature_vector = input_feature_vector.copy()
          for c in Encoded_input_feature_vector.iloc[:,2:].columns:
              Encoded_input_feature_vector[c] = encoder_class[c].transform(Encoded_input_featu
          print('User input in Encoded DataFrame form:')
          Encoded_input_feature_vector

User input in Encoded DataFrame form:
```

Out[152]:

	height	weight	hair	beard	scarf
0	170.0	120	1	1	1

```
In [153]: print('User input in Actual DataFrame form:\n\n',input_feature_vector)
          print('\nUser input in Encoded DataFrame form:\n\n',Encoded_input_feature_vector)

User input in Actual DataFrame form:

    height weight  hair beard scarf
0   170.0    120  Long   Yes   Yes

User input in Encoded DataFrame form:

    height weight  hair  beard  scarf
0   170.0    120     1      1      1
```

2.3.3 Step 9.4 Apply Trained Model on Feature Vector of Unseen Data and Output Prediction to User

```
In [154]: prediction_of_user_input = trained_model.predict(Encoded_input_feature_vector)
          prediction_of_user_input

Out[154]: array([0])

In [155]: decoded_prediction_of_user_input = encoder_class['gender'].inverse_transform(predicti

/home/omer/anaconda3/lib/python3.7/site-packages/sklearn/preprocessing/label.py:151: Deprecatio
  if diff:

In [156]: print("Prediction : ",decoded_prediction_of_user_input)

Prediction :  Female
```