RANDOM_FOREST

June 12, 2023

#DATE:-9-6-2023 _____**MOBILE _PRICE _CLASSIFICATION, **using -** RANDOM FOREST**

```
[ ]: import pandas as pd
     import numpy as np
     import matplotlib.pyplot as plt ,seaborn as sns
```

```
[ ]: train_df=pd.read_csv(r"/content/Mobile_Price_Classification_train.csv")
     train_df
```

```
[ ]:       battery_power  blue  clock_speed  dual_sim  fc  four_g  int_memory  \
     0               842     0          2.2         0   1       0           7
     1              1021     1          0.5         1   0       1          53
     2               563     1          0.5         1   2       1          41
     3               615     1          2.5         0   0       0          10
     4              1821     1          1.2         0  13       1          44
     …                …   …          …           …  ..     …         …
     1995            794     1          0.5         1   0       1           2
     1996           1965     1          2.6         1   0       0          39
     1997           1911     0          0.9         1   1       1          36
     1998           1512     0          0.9         0   4       1          46
     1999            510     1          2.0         1   5       1          45

           m_dep  mobile_wt  n_cores  …  px_height  px_width   ram  sc_h  sc_w  \
     0       0.6        188        2  …         20       756  2549     9     7
     1       0.7        136        3  …        905      1988  2631    17     3
     2       0.9        145        5  …       1263      1716  2603    11     2
     3       0.8        131        6  …       1216      1786  2769    16     8
     4       0.6        141        2  …       1208      1212  1411     8     2
     …     …         …       …  …        …     …    …   …
     1995    0.8        106        6  …       1222      1890   668    13     4
     1996    0.2        187        4  …        915      1965  2032    11    10
     1997    0.7        108        8  …        868      1632  3057     9     1
     1998    0.1        145        5  …        336       670   869    18    10
     1999    0.9        168        6  …        483       754  3919    19     4

           talk_time  three_g  touch_screen  wifi  price_range
     0            19        0             0     1            1
```

```
1           7       1           1     0           2
2           9       1           1     0           2
3          11       1           0     0           2
4          15       1           1     0           1
…        …     …         …   …          …
1995       19       1           1     0           0
1996       16       1           1     1           2
1997        5       1           1     0           3
1998       19       1           1     1           0
1999        2       1           1     1           3

[2000 rows x 21 columns]
```

[ ]:
```
test_df=pd.read_csv(r"/content/Mobile_Price_Classification_test.csv")
test_df
```

[ ]:
```
       id  battery_power  blue  clock_speed  dual_sim  fc  four_g  int_memory  \
0       1           1043     1          1.8         1  14       0           5
1       2            841     1          0.5         1   4       1          61
2       3           1807     1          2.8         0   1       0          27
3       4           1546     0          0.5         1  18       1          25
4       5           1434     0          1.4         0  11       1          49
..    …            …    …         …       …  ..     …         …
995   996           1700     1          1.9         0   0       1          54
996   997            609     0          1.8         1   0       0          13
997   998           1185     0          1.4         0   1       1           8
998   999           1533     1          0.5         1   0       0          50
999  1000           1270     1          0.5         0   4       1          35

     m_dep  mobile_wt  …  pc  px_height  px_width   ram  sc_h  sc_w  \
0      0.1        193  …  16        226      1412  3476    12     7
1      0.8        191  …  12        746       857  3895     6     0
2      0.9        186  …   4       1270      1366  2396    17    10
3      0.5         96  …  20        295      1752  3893    10     0
4      0.5        108  …  18        749       810  1773    15     8
..     …        …  …  ..       …       …    …    …   …
995    0.5        170  …  17        644       913  2121    14     8
996    0.9        186  …   2       1152      1632  1933     8     1
997    0.5         80  …  12        477       825  1223     5     0
998    0.4        171  …  12         38       832  2509    15    11
999    0.1        140  …  19        457       608  2828     9     2

     talk_time  three_g  touch_screen  wifi
0            2        0             1     0
1            7        1             0     0
2           10        0             1     1
3            7        1             1     0
```

```
4             7         1              0     1
..           …        …              …    …
995          15         1              1     0
996          19         0              1     1
997          14         1              0     0
998           6         0              1     0
999           3         1              0     1

[1000 rows x 21 columns]
```

[ ]:
```
train_df.head()
```

[ ]:
```
   battery_power  blue  clock_speed  dual_sim  fc  four_g  int_memory  m_dep  \
0            842     0          2.2         0   1       0           7    0.6
1           1021     1          0.5         1   0       1          53    0.7
2            563     1          0.5         1   2       1          41    0.9
3            615     1          2.5         0   0       0          10    0.8
4           1821     1          1.2         0  13       1          44    0.6

   mobile_wt  n_cores  …  px_height  px_width   ram  sc_h  sc_w  talk_time  \
0        188        2  …         20       756  2549     9     7         19
1        136        3  …        905      1988  2631    17     3          7
2        145        5  …       1263      1716  2603    11     2          9
3        131        6  …       1216      1786  2769    16     8         11
4        141        2  …       1208      1212  1411     8     2         15

   three_g  touch_screen  wifi  price_range
0        0             0     1            1
1        1             1     0            2
2        1             1     0            2
3        1             0     0            2
4        1             1     0            1

[5 rows x 21 columns]
```

[ ]:
```
test_df.head()
```

[ ]:
```
   id  battery_power  blue  clock_speed  dual_sim  fc  four_g  int_memory  \
0   1           1043     1          1.8         1  14       0           5
1   2            841     1          0.5         1   4       1          61
2   3           1807     1          2.8         0   1       0          27
3   4           1546     0          0.5         1  18       1          25
4   5           1434     0          1.4         0  11       1          49

   m_dep  mobile_wt  …  pc  px_height  px_width   ram  sc_h  sc_w  \
0    0.1        193  …  16        226      1412  3476    12     7
1    0.8        191  …  12        746       857  3895     6     0
```

```
2    0.9        186  …   4       1270       1366  2396    17     10
3    0.5         96  …  20        295       1752  3893    10      0
4    0.5        108  …  18        749        810  1773    15      8

   talk_time  three_g  touch_screen  wifi
0          2        0             1     0
1          7        1             0     0
2         10        0             1     1
3          7        1             1     0
4          7        1             0     1

[5 rows x 21 columns]
```

[ ]:
```
train_df.shape
```

[ ]:
```
(2000, 21)
```

[ ]:
```
test_df.shape
```

[ ]:
```
(1000, 21)
```

[ ]:
```
train_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2000 entries, 0 to 1999
Data columns (total 21 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   battery_power  2000 non-null   int64
 1   blue           2000 non-null   int64
 2   clock_speed    2000 non-null   float64
 3   dual_sim       2000 non-null   int64
 4   fc             2000 non-null   int64
 5   four_g         2000 non-null   int64
 6   int_memory     2000 non-null   int64
 7   m_dep          2000 non-null   float64
 8   mobile_wt      2000 non-null   int64
 9   n_cores        2000 non-null   int64
 10  pc             2000 non-null   int64
 11  px_height      2000 non-null   int64
 12  px_width       2000 non-null   int64
 13  ram            2000 non-null   int64
 14  sc_h           2000 non-null   int64
 15  sc_w           2000 non-null   int64
 16  talk_time      2000 non-null   int64
 17  three_g        2000 non-null   int64
 18  touch_screen   2000 non-null   int64
 19  wifi           2000 non-null   int64
 20  price_range    2000 non-null   int64
dtypes: float64(2), int64(19)
memory usage: 328.2 KB
```

```
[ ]: test_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000 entries, 0 to 999
Data columns (total 21 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   id             1000 non-null   int64
 1   battery_power  1000 non-null   int64
 2   blue           1000 non-null   int64
 3   clock_speed    1000 non-null   float64
 4   dual_sim       1000 non-null   int64
 5   fc             1000 non-null   int64
 6   four_g         1000 non-null   int64
 7   int_memory     1000 non-null   int64
 8   m_dep          1000 non-null   float64
 9   mobile_wt      1000 non-null   int64
 10  n_cores        1000 non-null   int64
 11  pc             1000 non-null   int64
 12  px_height      1000 non-null   int64
 13  px_width       1000 non-null   int64
 14  ram            1000 non-null   int64
 15  sc_h           1000 non-null   int64
 16  sc_w           1000 non-null   int64
 17  talk_time      1000 non-null   int64
 18  three_g        1000 non-null   int64
 19  touch_screen   1000 non-null   int64
 20  wifi           1000 non-null   int64
dtypes: float64(2), int64(19)
memory usage: 164.2 KB
```

```
[ ]: x=train_df.drop('wifi',axis=1)
     y=train_df['wifi']
```

```
[ ]: x=test_df.drop('wifi',axis=1)
     y=test_df['wifi']
```

```
[ ]: train_df['dual_sim'].value_counts()
```

```
[ ]: 1    1019
     0     981
     Name: dual_sim, dtype: int64
```

```
[ ]: test_df['dual_sim'].value_counts()
```

```
[ ]: 1    517
     0    483
     Name: dual_sim, dtype: int64
```

```
[ ]: m={"three_g":{"yes":1,"No":0}}
     train_df=train_df.replace(m)
     print(train_df)
```

```
      battery_power  blue  clock_speed  dual_sim  fc  four_g  int_memory  \
0               842     0          2.2         0   1       0           7
1              1021     1          0.5         1   0       1          53
2               563     1          0.5         1   2       1          41
3               615     1          2.5         0   0       0          10
4              1821     1          1.2         0  13       1          44
…               …   …            …        …  ..    …         …
1995            794     1          0.5         1   0       1           2
1996           1965     1          2.6         1   0       0          39
1997           1911     0          0.9         1   1       1          36
1998           1512     0          0.9         0   4       1          46
1999            510     1          2.0         1   5       1          45

      m_dep  mobile_wt  n_cores  …  px_height  px_width   ram  sc_h  sc_w  \
0       0.6        188        2  …         20       756  2549     9     7
1       0.7        136        3  …        905      1988  2631    17     3
2       0.9        145        5  …       1263      1716  2603    11     2
3       0.8        131        6  …       1216      1786  2769    16     8
4       0.6        141        2  …       1208      1212  1411     8     2
…       …          …       …  …         …         …    …     …
1995    0.8        106        6  …       1222      1890   668    13     4
1996    0.2        187        4  …        915      1965  2032    11    10
1997    0.7        108        8  …        868      1632  3057     9     1
1998    0.1        145        5  …        336       670   869    18    10
1999    0.9        168        6  …        483       754  3919    19     4

      talk_time  three_g  touch_screen  wifi  price_range
0            19        0             0     1            1
1             7        1             1     0            2
2             9        1             1     0            2
3            11        1             0     0            2
4            15        1             1     0            1
…          …       …            …    …           …
1995         19        1             1     0            0
1996         16        1             1     1            2
1997          5        1             1     0            3
1998         19        1             1     1            0
```

```
1999           2         1              1     1            3

[2000 rows x 21 columns]
```

```
[ ]: m={"three_g":{"yes":1,"No":0}}
     test_df=test_df.replace(m)
     print(test_df)
```

```
       id  battery_power  blue  clock_speed  dual_sim  fc  four_g  int_memory  \
0       1           1043     1          1.8         1  14       0           5
1       2            841     1          0.5         1   4       1          61
2       3           1807     1          2.8         0   1       0          27
3       4           1546     0          0.5         1  18       1          25
4       5           1434     0          1.4         0  11       1          49
..    …            …  …         …       …  ..    …       …
995   996           1700     1          1.9         0   0       1          54
996   997            609     0          1.8         1   0       0          13
997   998           1185     0          1.4         0   1       1           8
998   999           1533     1          0.5         1   0       0          50
999  1000           1270     1          0.5         0   4       1          35

     m_dep  mobile_wt  …  pc  px_height  px_width   ram  sc_h  sc_w  \
0      0.1        193  …  16        226      1412  3476    12     7
1      0.8        191  …  12        746       857  3895     6     0
2      0.9        186  …   4       1270      1366  2396    17    10
3      0.5         96  …  20        295      1752  3893    10     0
4      0.5        108  …  18        749       810  1773    15     8
..     …        …  …  ..     …        …   …    …   …
995    0.5        170  …  17        644       913  2121    14     8
996    0.9        186  …   2       1152      1632  1933     8     1
997    0.5         80  …  12        477       825  1223     5     0
998    0.4        171  …  12         38       832  2509    15    11
999    0.1        140  …  19        457       608  2828     9     2

     talk_time  three_g  touch_screen  wifi
0            2        0             1     0
1            7        1             0     0
2           10        0             1     1
3            7        1             1     0
4            7        1             0     1
..         …      …           …   …
995         15        1             1     0
996         19        0             1     1
997         14        1             0     0
998          6        0             1     0
999          3        1             0     1

[1000 rows x 21 columns]
```

```
[ ]: from sklearn.model_selection import train_test_split
     x_train,x_test,y_train,y_test=train_test_split(x,y,train_size=0.
      ↪7,random_state=42)
     x_train.shape,x_test.shape
```

```
[ ]: ((700, 20), (300, 20))
```

```
[ ]: from sklearn.ensemble import RandomForestClassifier
     rfc=RandomForestClassifier()
     rfc.fit(x_train,y_train)
```

```
[ ]: RandomForestClassifier()
```

```
[ ]: rf=RandomForestClassifier()
     params={'max_depth':[2,3,5,10,20],
      'min_samples_leaf':[5,10,20,50,100,200],
      'n_estimators':[10,25,30,50,100,200]}
```

```
[ ]: from sklearn.model_selection import GridSearchCV
     grid_search=GridSearchCV(estimator=rf,param_grid=params,cv=2,scoring="accuracy")
     grid_search.fit(x_train,y_train)
```

```
[ ]: GridSearchCV(cv=2, estimator=RandomForestClassifier(),
                  param_grid={'max_depth': [2, 3, 5, 10, 20],
                              'min_samples_leaf': [5, 10, 20, 50, 100, 200],
                              'n_estimators': [10, 25, 30, 50, 100, 200]},
                  scoring='accuracy')
```

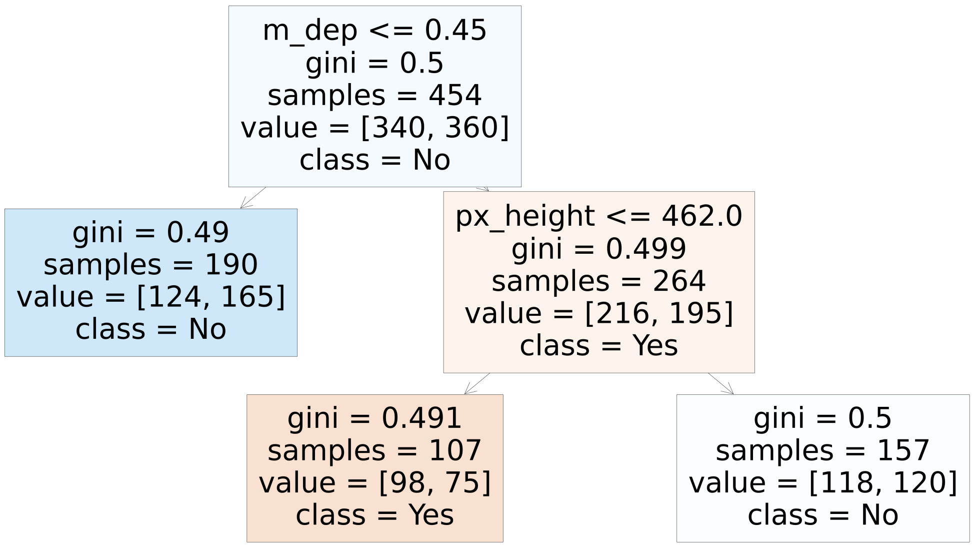
```
[ ]: grid_search.best_score_
```

```
[ ]: 0.5642857142857143
```

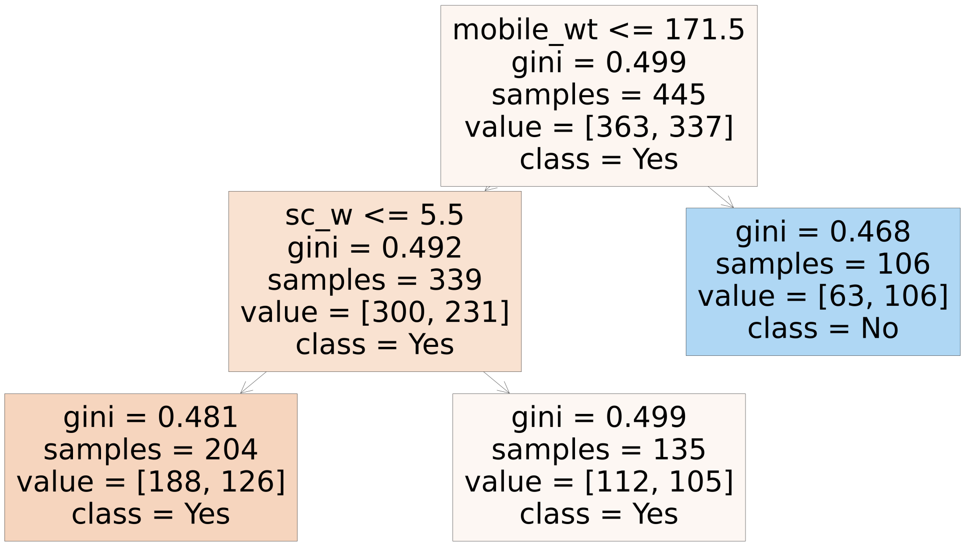
```
[ ]: rf_best=grid_search.best_estimator_
     print(rf_best)
```

```
    RandomForestClassifier(max_depth=2, min_samples_leaf=100, n_estimators=50)
```

```
[ ]: from sklearn.tree import plot_tree
     plt.figure(figsize=(80,40))
     plot_tree(rf_best.estimators_[5],feature_names=x.
      ↪columns,class_names=["Yes","No"],filled=True);
```



```
[ ]: from sklearn.tree import plot_tree
     plt.figure(figsize=(80,40))
     plot_tree(rf_best.estimators_[6],feature_names=x.
       ↪columns,class_names=["Yes","No"],filled=True);
```



```
[ ]: rf_best.feature_importances_
```

```
[ ]: array([0.05791869, 0.07187716, 0.00564471, 0.08348674, 0.00433501,
            0.07757976, 0.03435722, 0.12360436, 0.07147417, 0.14299703,
            0.        , 0.01379549, 0.04942909, 0.09405257, 0.1162142 ,
         0.03188349, 0.00312057, 0.01822975, 0.        , 0.        ])
```

```
[ ]: imp_df=pd.DataFrame({"Varname":x_train.columns,"IMP":rf_best.
      ↪feature_importances_})
     imp_df.sort_values(by="IMP",ascending=False)
```

```
[ ]:          Varname       IMP
     9       mobile_wt  0.142997
     7      int_memory  0.123604
     14            ram  0.116214
     13       px_width  0.094053
     3     clock_speed  0.083487
     5              fc  0.077580
     1   battery_power  0.071877
     8           m_dep  0.071474
     0              id  0.057919
     12      px_height  0.049429
     6          four_g  0.034357
     15           sc_h  0.031883
     17      talk_time  0.018230
     11             pc  0.013795
     2            blue  0.005645
     4        dual_sim  0.004335
     16           sc_w  0.003121
     18        three_g  0.000000
     10        n_cores  0.000000
     19   touch_screen  0.000000
```