Capstone Project

Mobile Price Range Prediction

By

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Problem statement

In the competitive mobile phone market companies want to understand sales data of mobile phones and factors which drive the prices. The objective is to find out some relation between features of a mobile phone(eg:- RAM, Internal Memory, etc) and its selling price. In this problem, we do not have to predict the actual price but a price range indicating how high the price is.

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Discussion points

- ❑ Data description
- ❑ Data Cleaning
- ❑ Exploratory data analysis
- ❑ Correlation Analysis
- ❑ All models Evaluation Metrics
- ❑ Model Selection
- ❑ Conclusion

Data Description

- **Battery_power** - Total energy a battery can store in one time measured in mAh
- **Blue** - Has bluetooth or not
- ***Clock_speed*** - speed at which microprocessor executes instructions
- ***Dual_sim*** - Has dual sim support or not
- ***Fc*** - Front Camera megapixels
- ***Four_g*** - Has 4G or not
- ***Int_memory*** - Internal Memory in Gigabytes
- ***M_dep*** - Mobile Depth in cm
- ***Mobile_wt*** - Weight of mobile phone
- ***N_cores*** - Number of cores of processor
- ***Pc*** - Primary Camera megapixels
- ***Px_height*** - Pixel Resolution Height
- ***Px_width*** - Pixel Resolution Width
- ***Ram*** - Random Access Memory in MegaBytes
- ***Sc_h*** - Screen Height of mobile in cm
- ***Sc_w*** - Screen Width of mobile in cm
- ***Talk_time*** - longest time that a single battery charge will last when you are
- ***Three_g*** - Has 3G or not
- ***Touch_screen*** - Has touch screen or not
- ***Wifi*** - Has wifi or not
- ***Price_range*** - This is the target variable with value of

Data Overview

- There are 2000 observation
- There are 21 feature variable
- There is no null values
- Price Range is the target variable

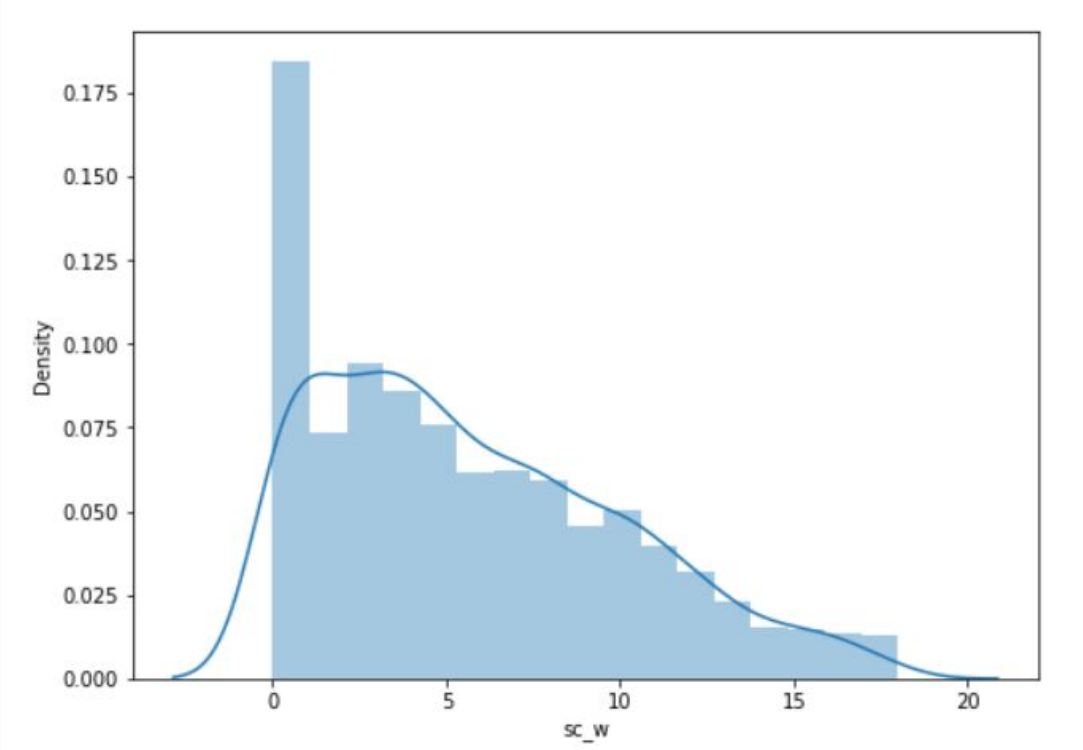
```
[ ]  # overlook to data information using info function

     df.info()
```

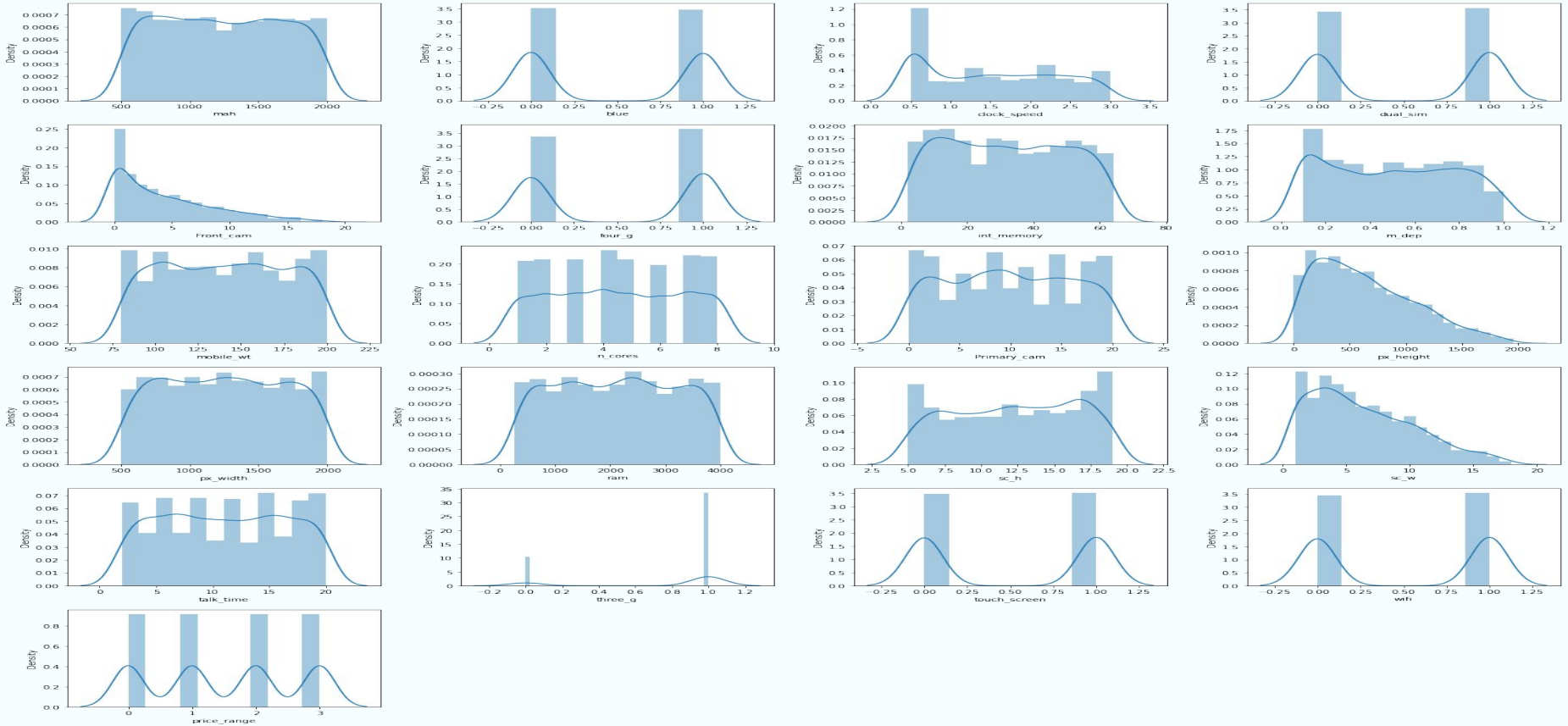
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2000 entries, 0 to 1999
Data columns (total 21 columns):
 #   Column         Non-Null Count  Dtype  
---  ------         --------------  -----  
 0   battery_power  2000 non-null   int64  
 1   blue           2000 non-null   int64  
 2   clock_speed    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
```

Handling inappropriate values

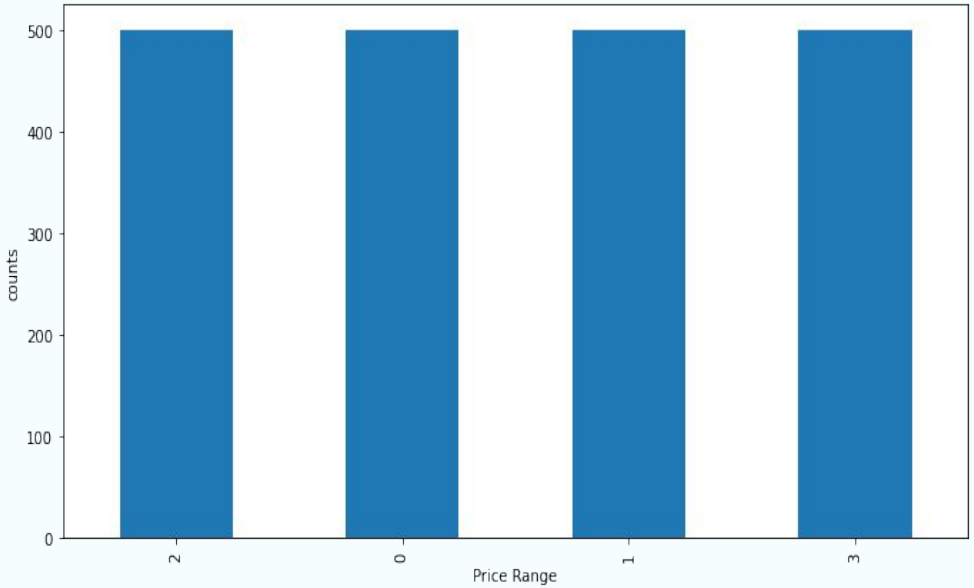
- In this screen width column, there Are 179 observation whose width is Zero which is not possible
- 179 is a big part of the dataset Filling is the only option so
- KNN Imputer with one neighbour is Best option to fill these values

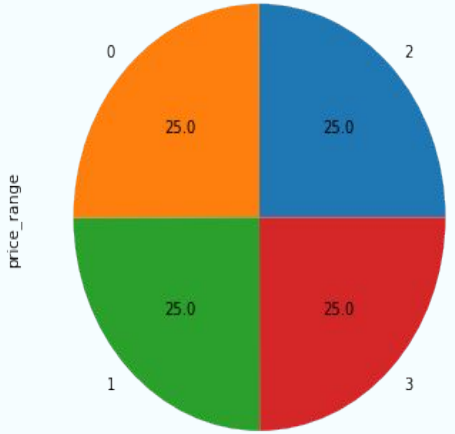


Distribution of Features

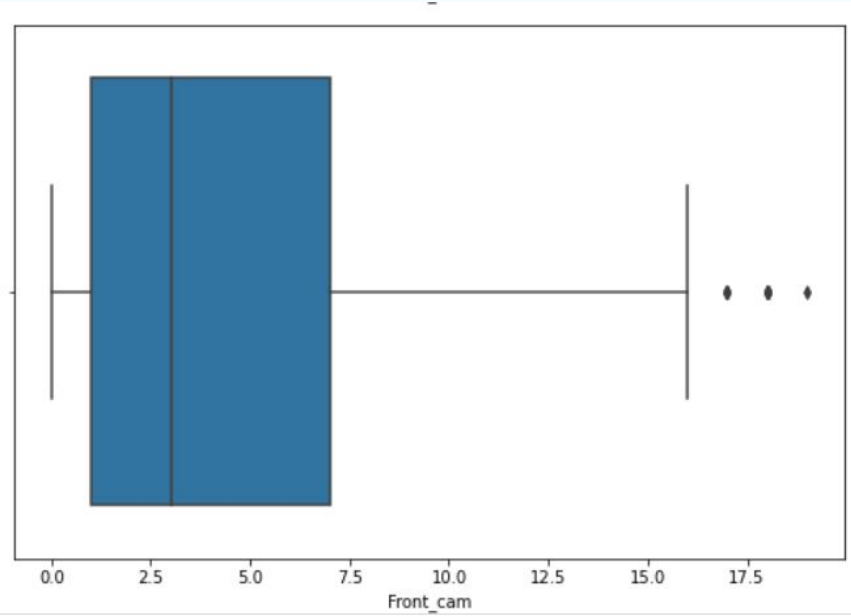


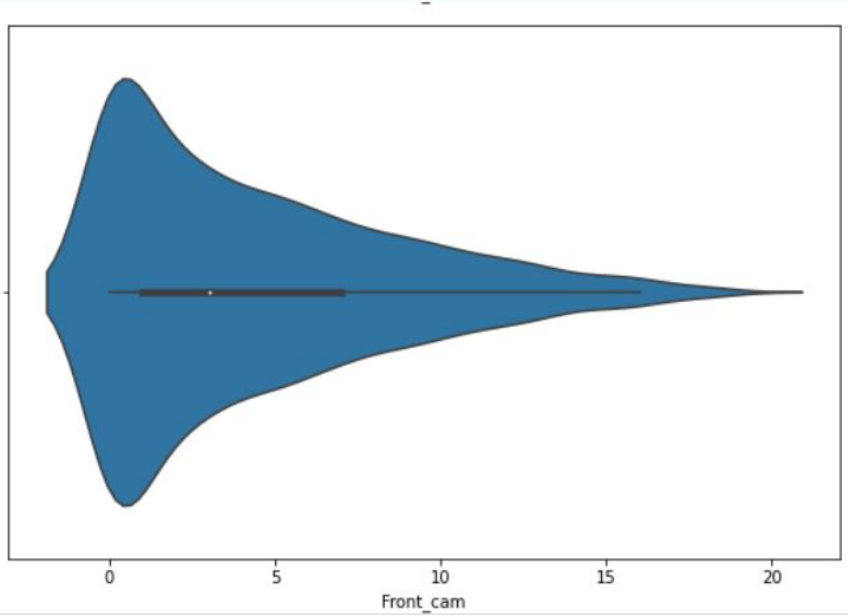
Checking Class Imbalance





Outliers

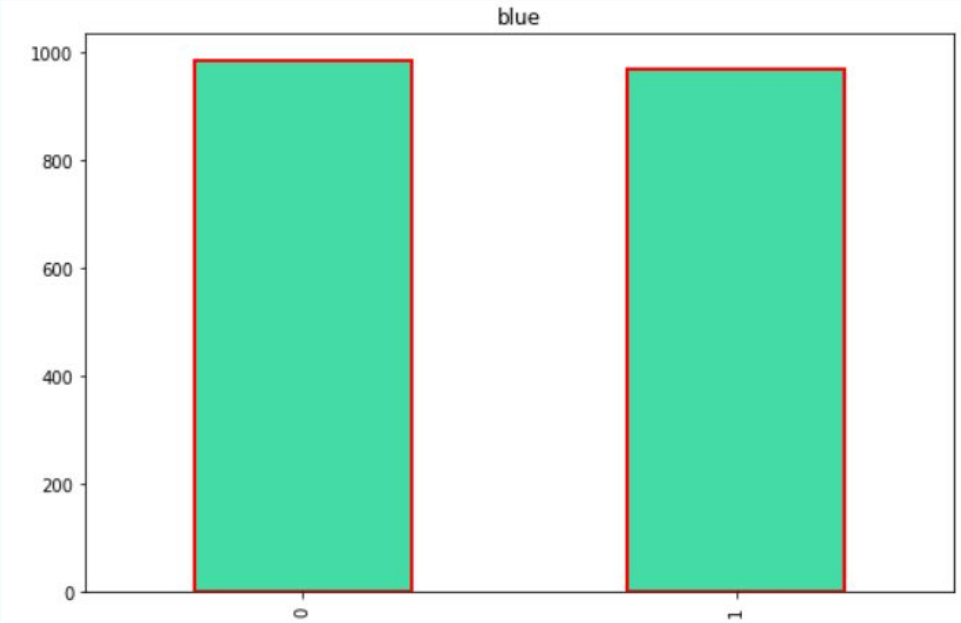


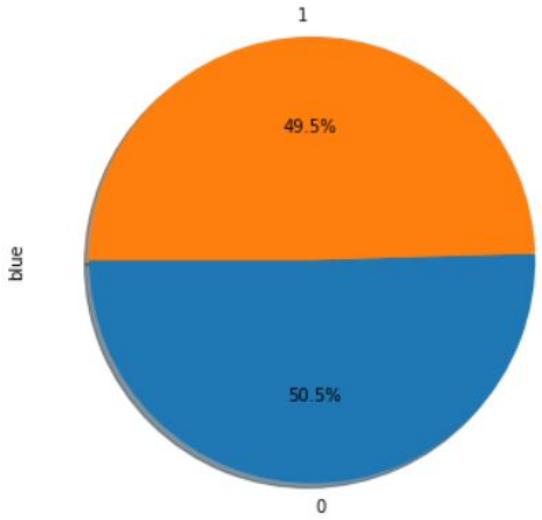


- There are 20 outliers in front camera column

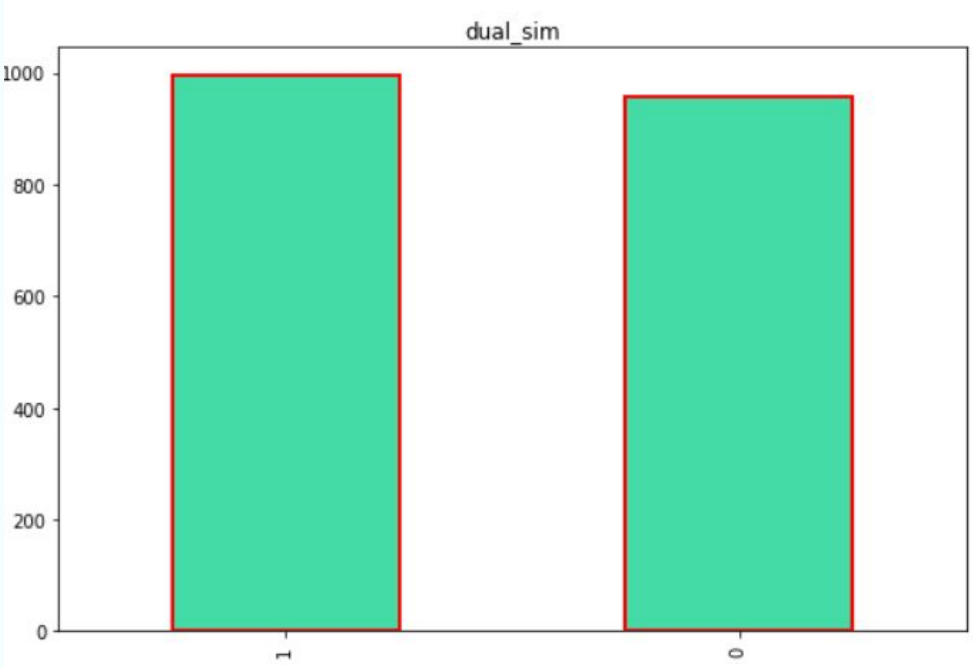
EDA

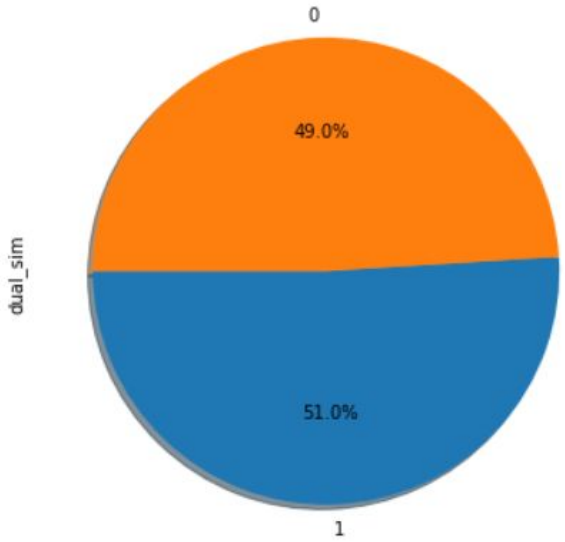
Values Counts on bluetooth



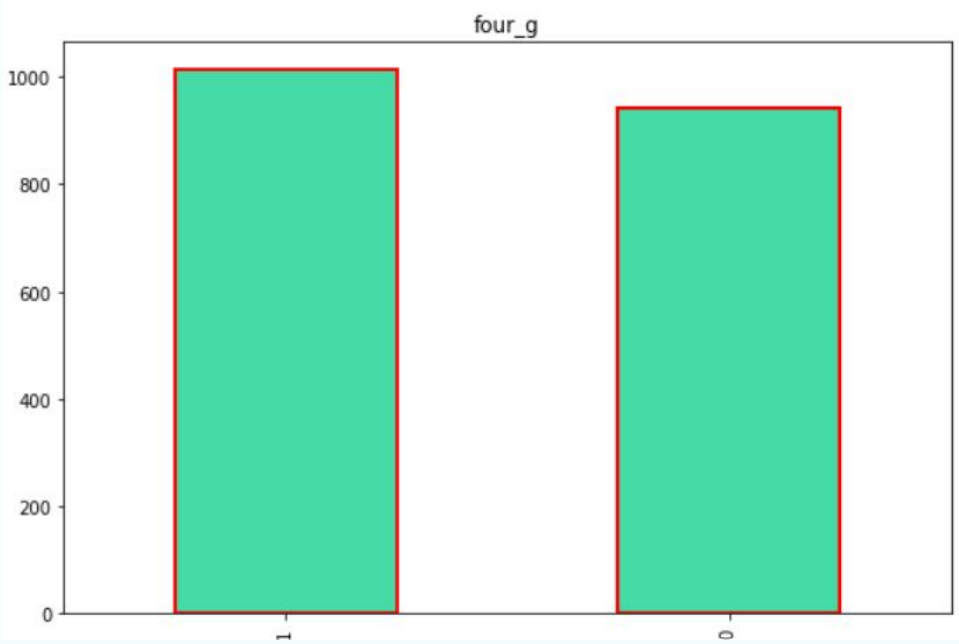


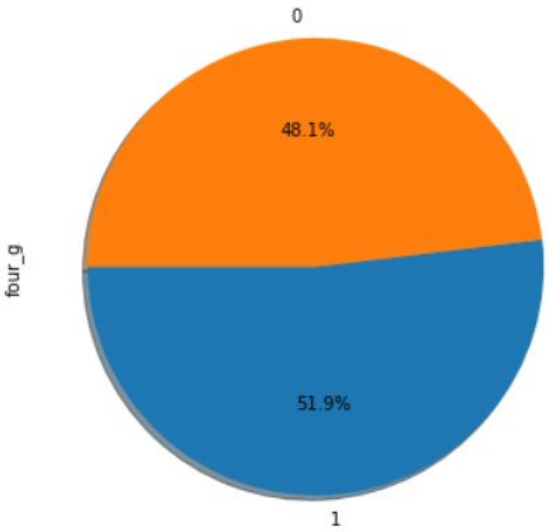
Value Counts on Dual Sim



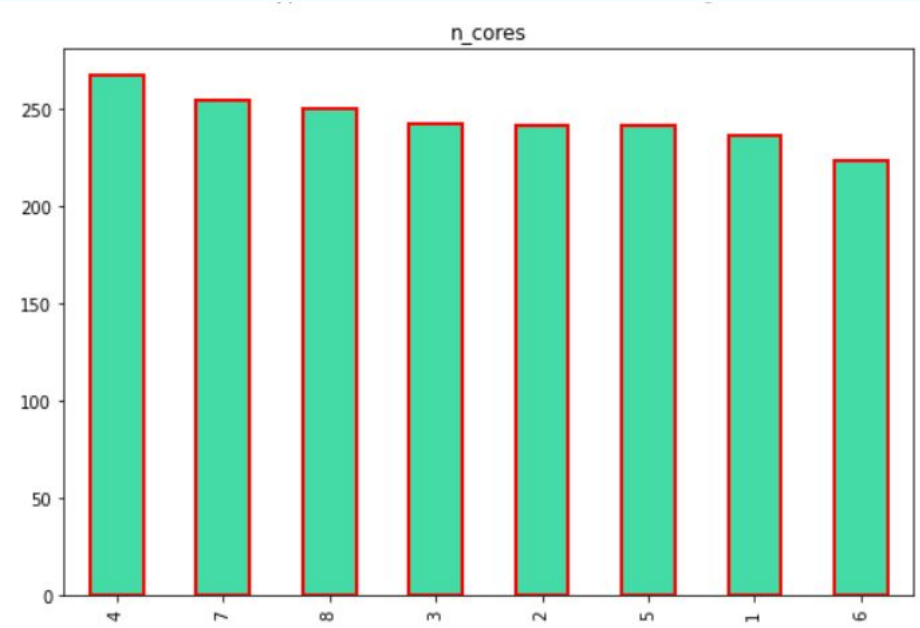


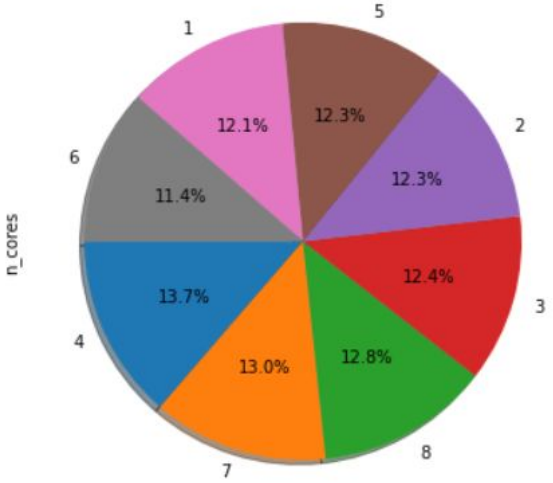
Values Counts on Four G



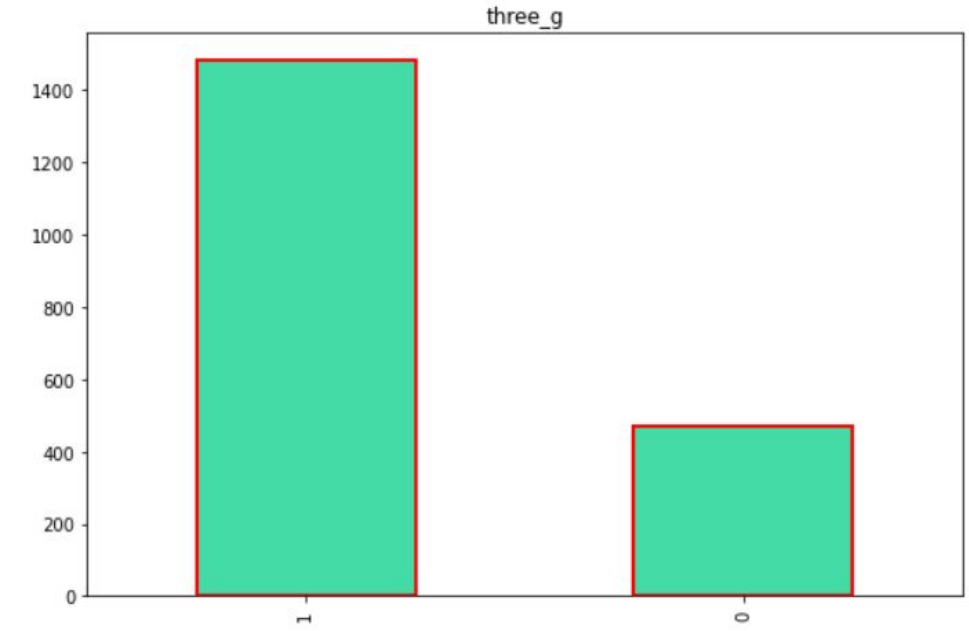


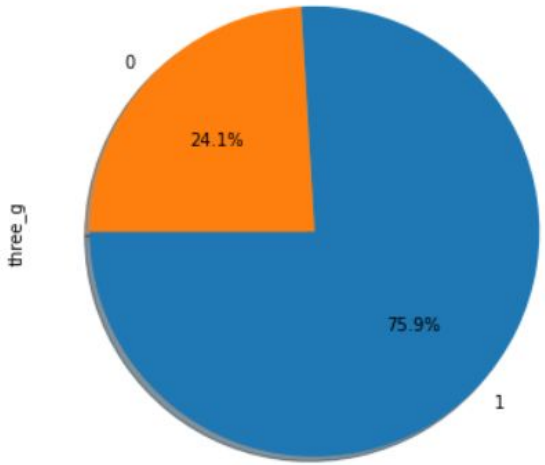
Values Counts on ncores



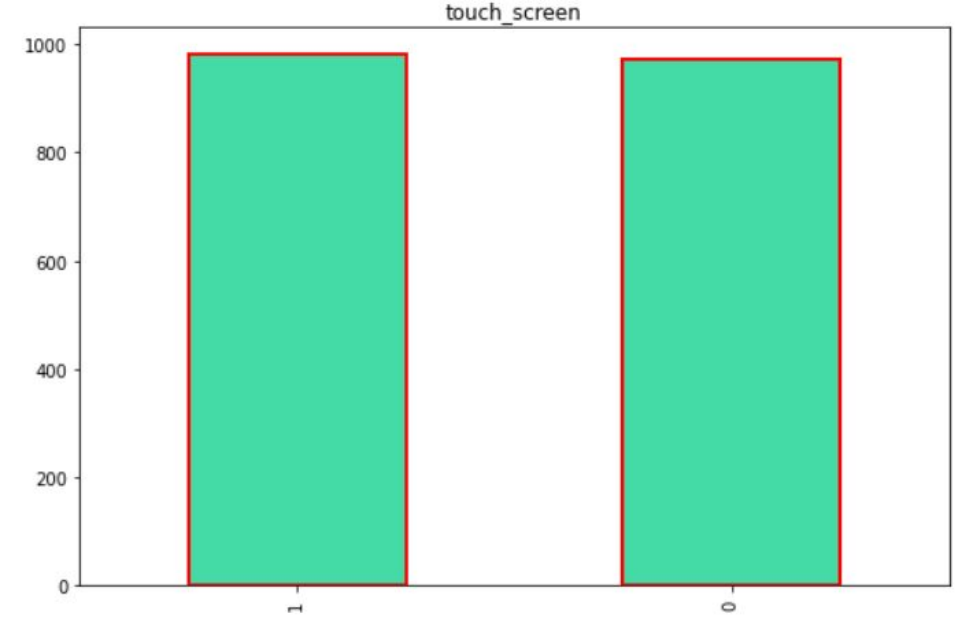


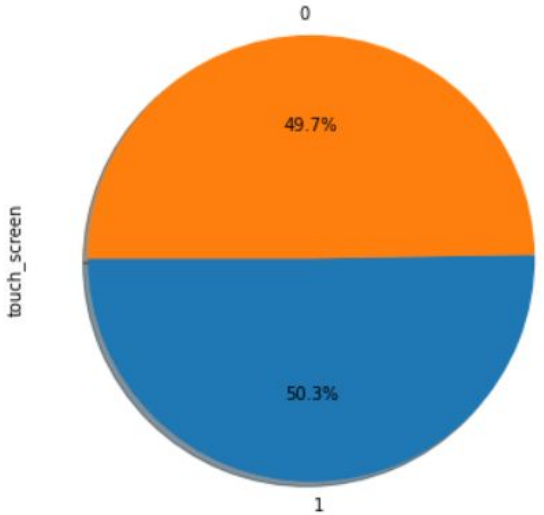
Value Counts on Three G



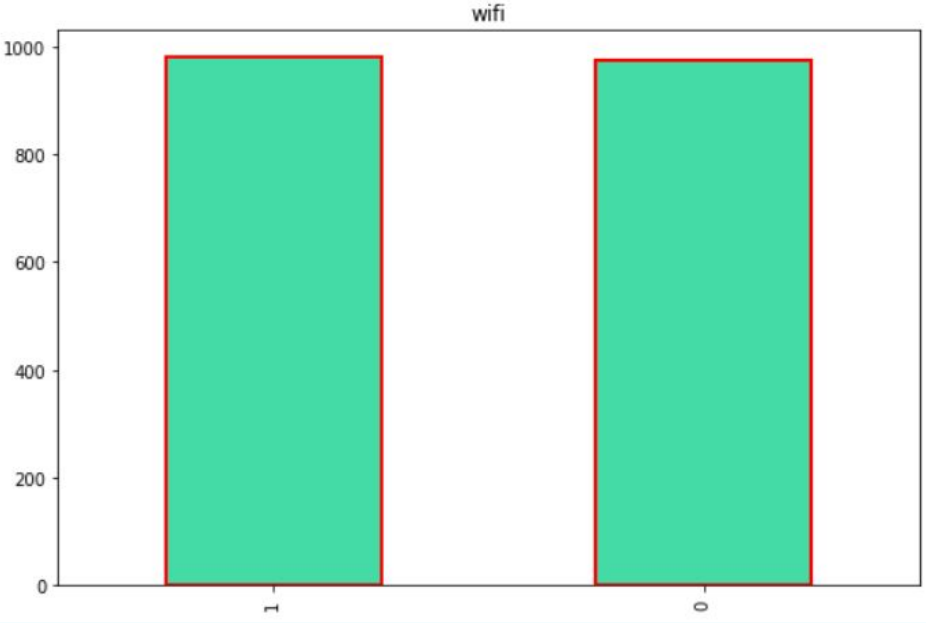


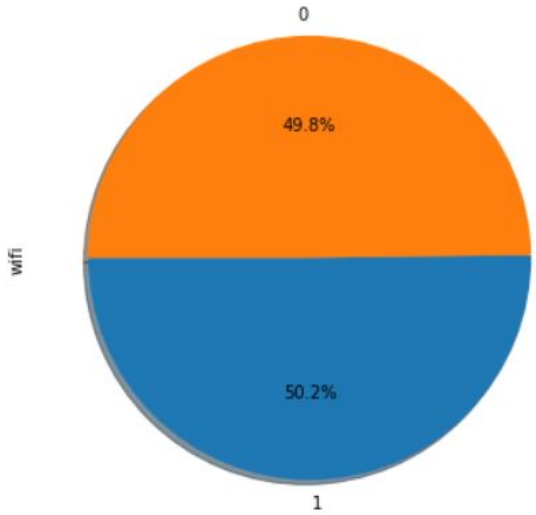
Value Count on Touch Screen



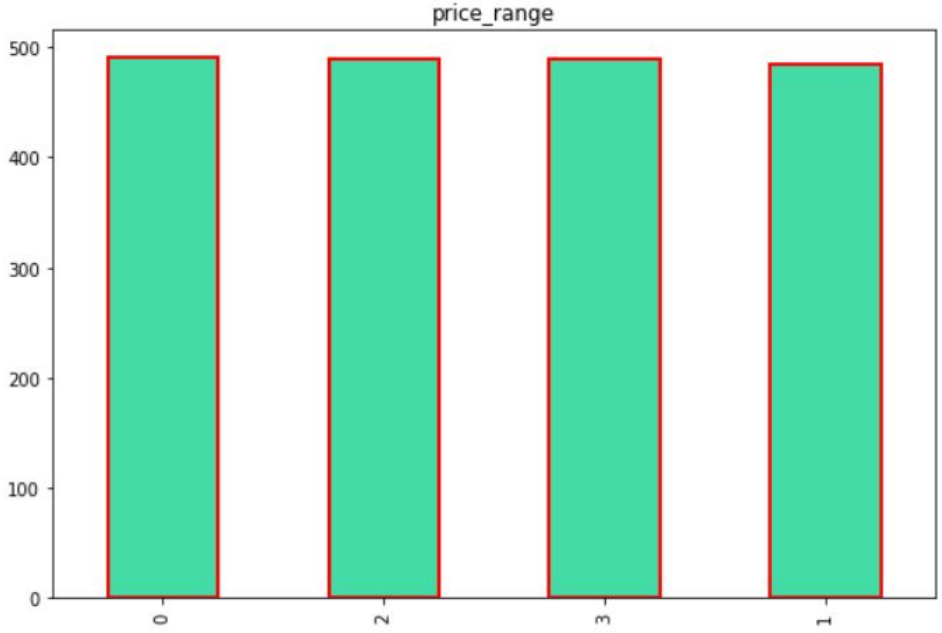


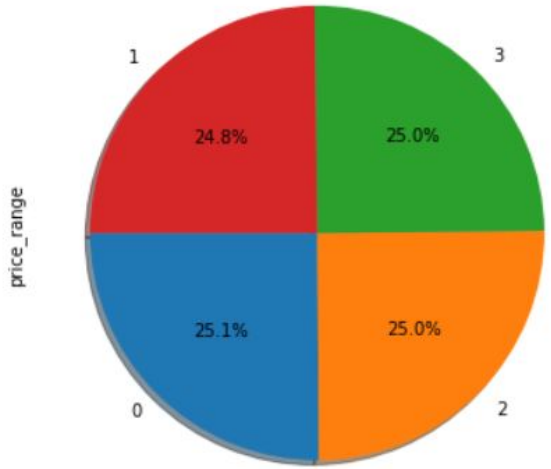
Value Counts on WiFi



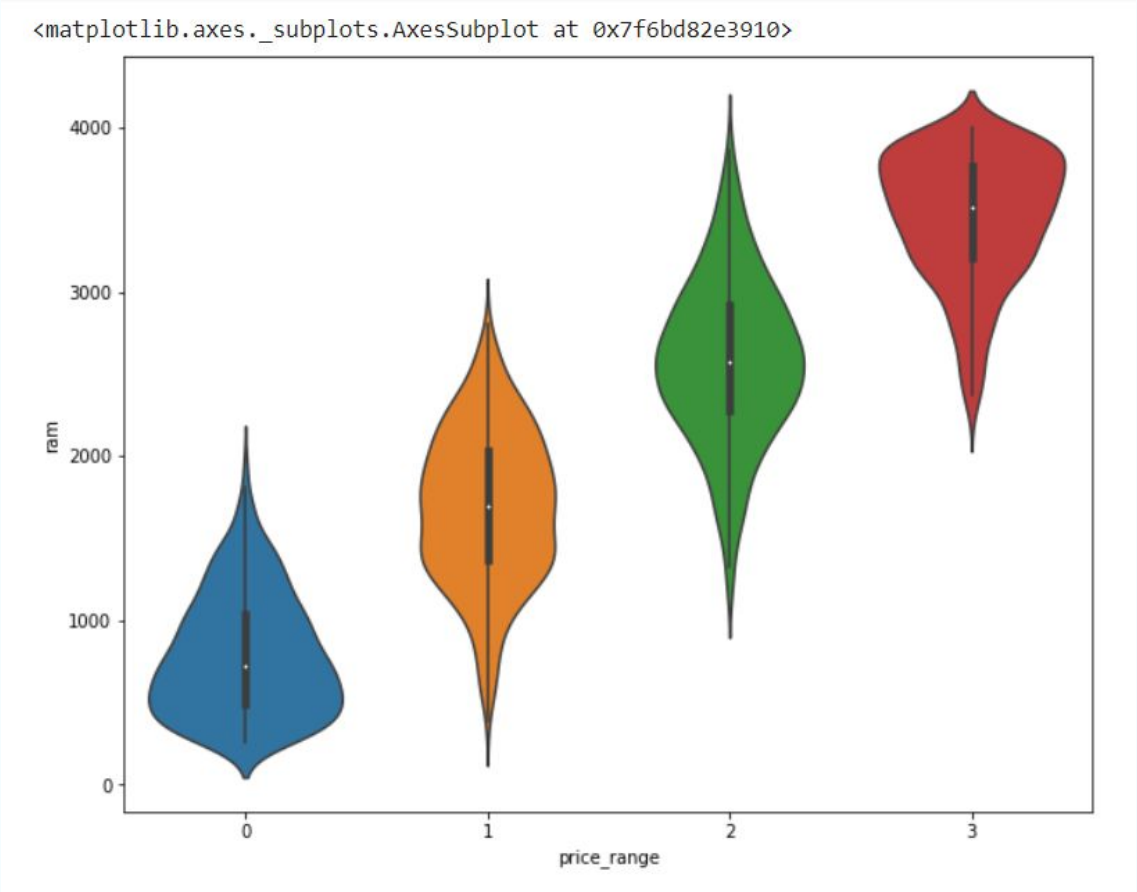


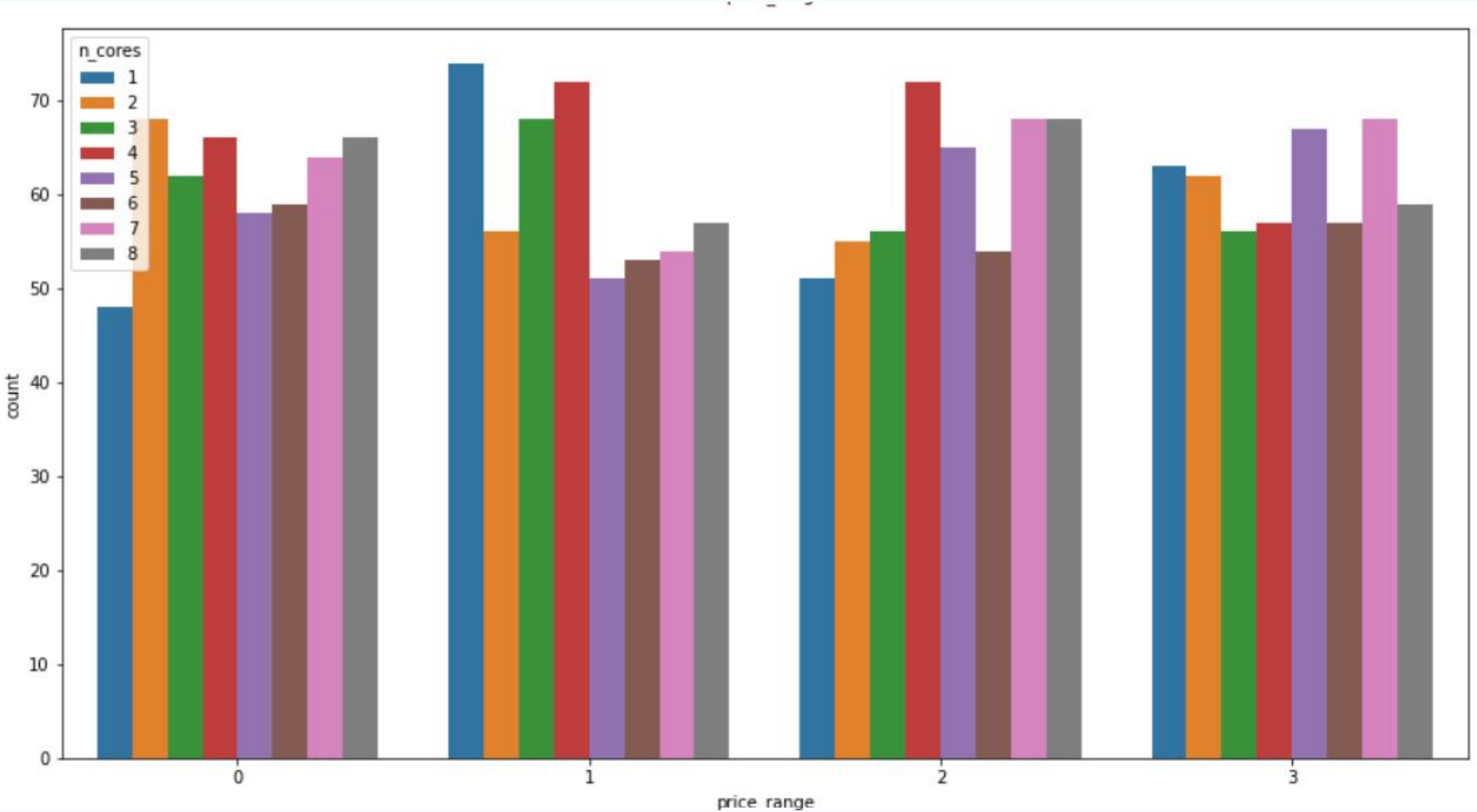
Values Counts on Price Range Prediction



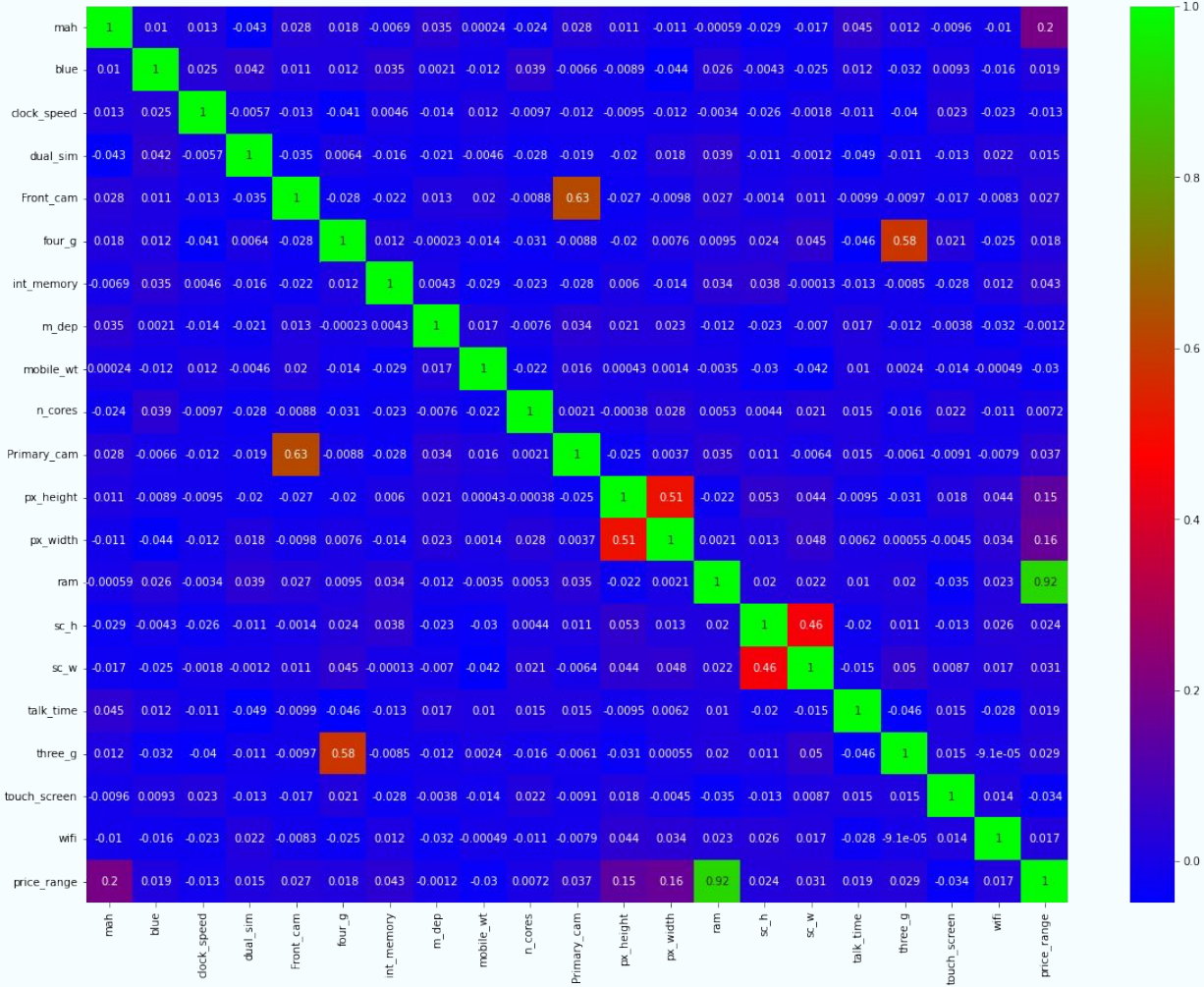


Bivariate Analysis




n_cores
1
2
3
4
5
6
7
8
count
0
10
20
30
40
50
60
70
0
1
2
3
price_range

Correlation Matrix



Feature Selection

- There are 21 column but all are not Contributed equally so, I pick up ¾ Part of the dataset columns which is Highly contributed in Mobile price

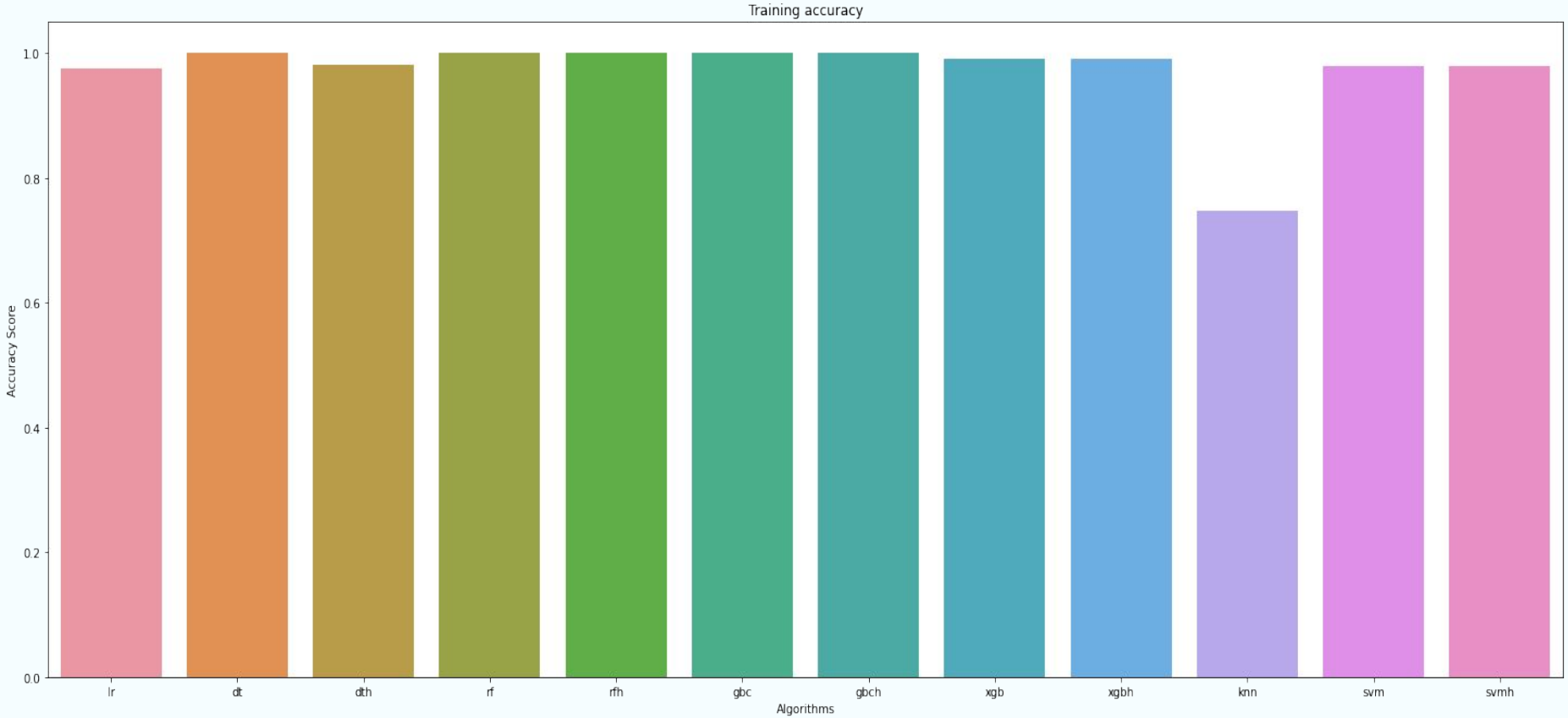
```
[ ]  print(featureScores.nlargest(15,'Score'))
```

	Feature	Score
13	ram	909561.357223
11	px_height	15908.164022
0	mah	13505.022467
12	px_width	9079.507773
8	mobile_wt	93.737357
6	int_memory	79.957546
16	talk_time	12.131473
4	Front_cam	10.834975
10	Primary_cam	10.221820
14	sc_h	9.168885
9	n_cores	8.379480
15	sc_w	8.374349
18	touch_screen	1.884086
5	four_g	1.698998
2	clock_speed	0.823457

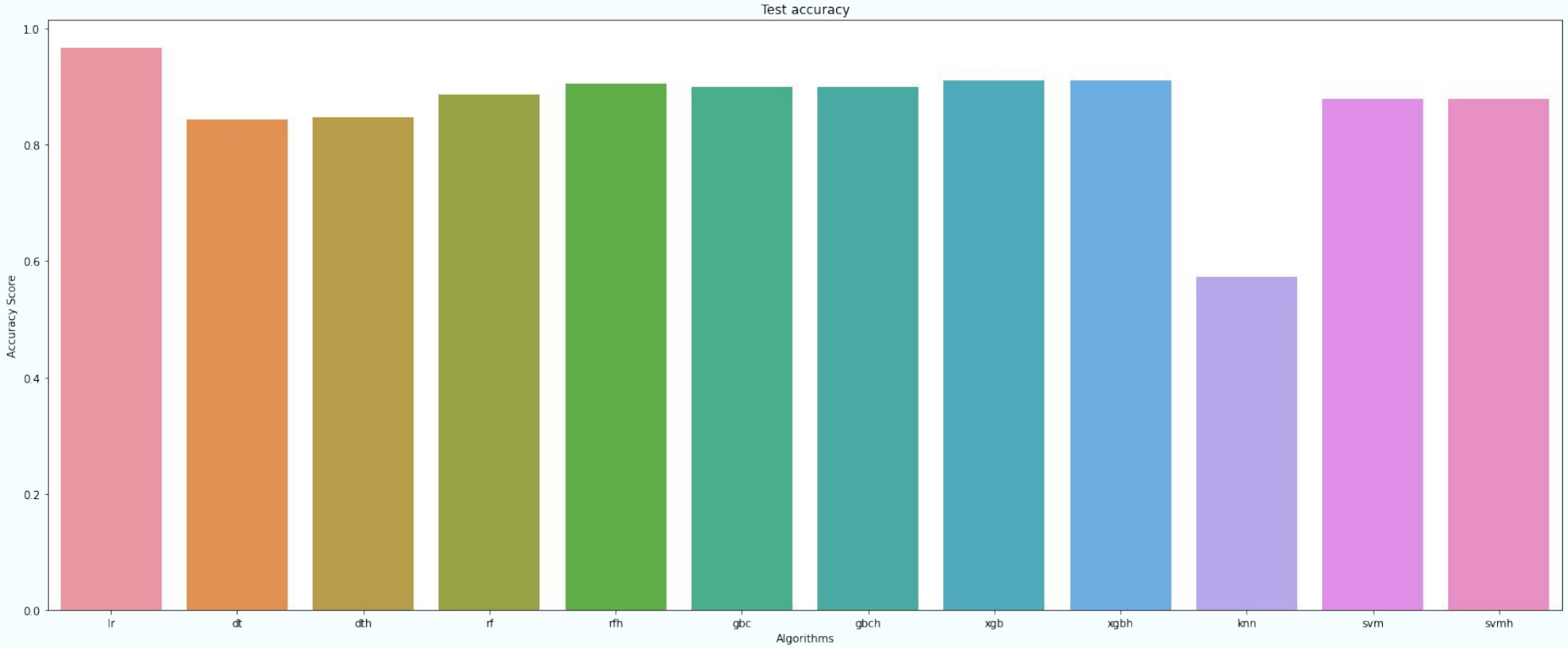
Algorithms for Machine Learning

- Logistic Regression
- Decision tree Classifier
- Random Forest Classifier
- Gradient Boosting Classifier
- XGBoost Classifier
- K-Nearest-Neighbour Classifier
- Support Vector Classifier

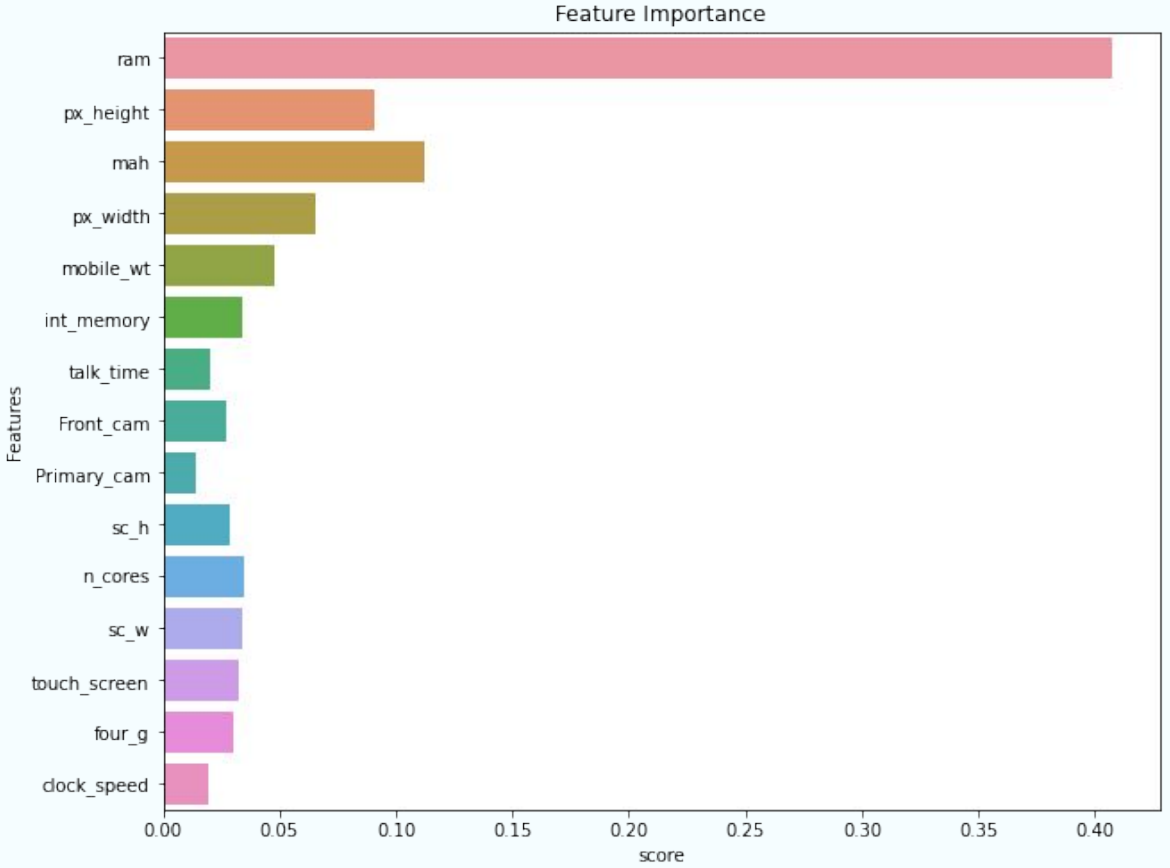
Performance On Training Dataset



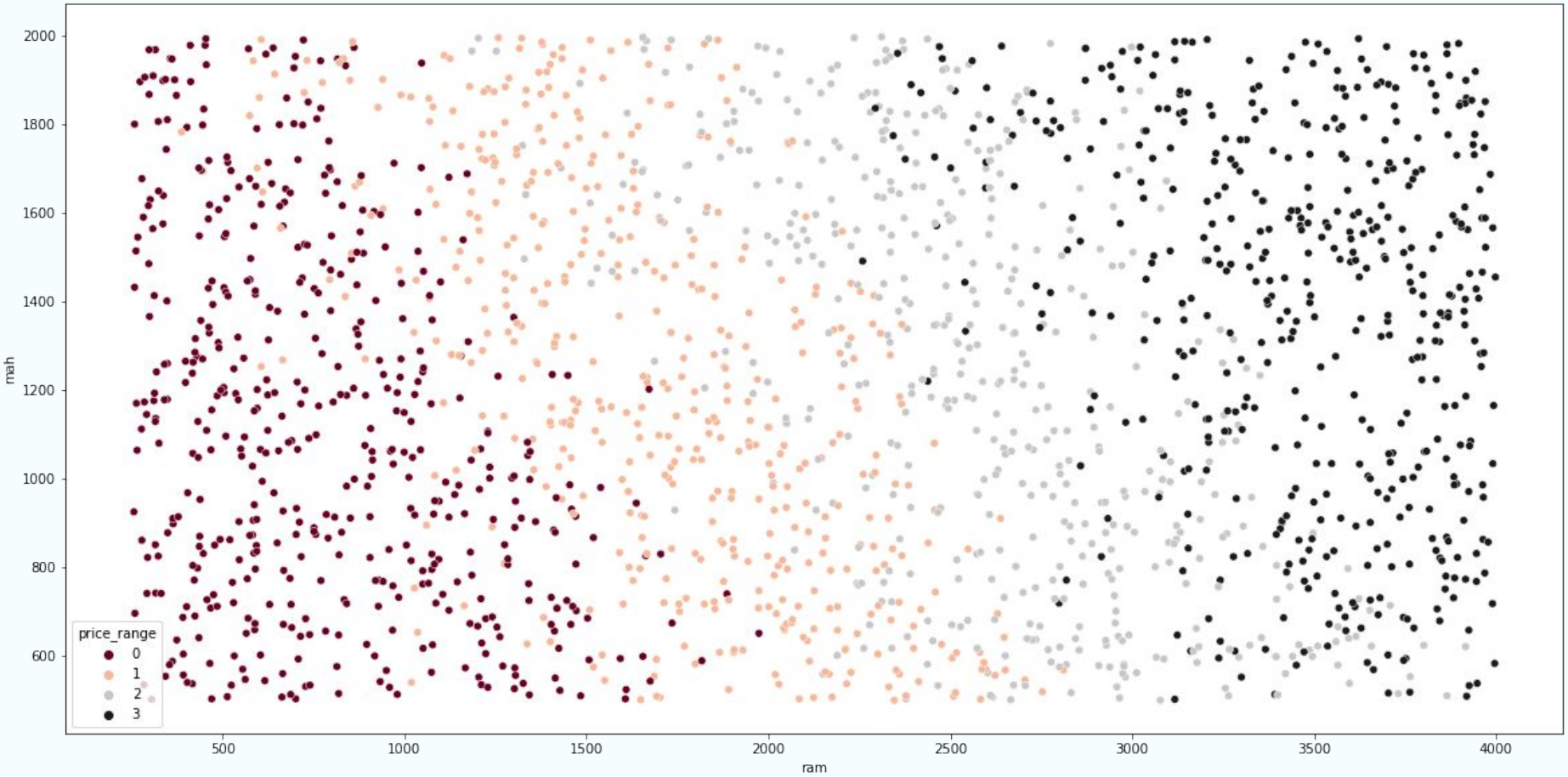
Performance On Test Dataset



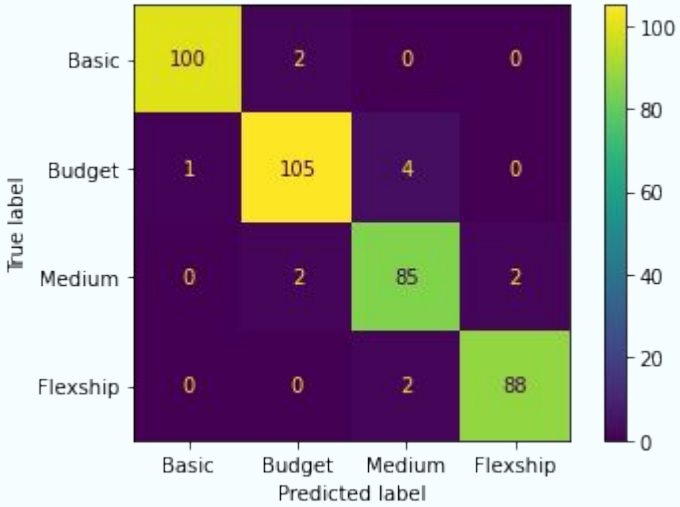
Feature Importance



Classification through two best feature RAM and Battery Power



Classification Report



classification report on traing data

	precision	recall	f1-score	support
0	0.98	0.99	0.98	389
1	0.97	0.96	0.97	375
2	0.98	0.95	0.97	400
3	0.98	0.99	0.99	399
accuracy			0.98	1563
macro avg	0.98	0.98	0.98	1563
weighted avg	0.98	0.98	0.98	1563

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classification report on test data

	precision	recall	f1-score	support
0	0.99	0.98	0.99	102
1	0.96	0.95	0.96	110
2	0.93	0.96	0.94	89
3	0.98	0.98	0.98	90
accuracy			0.97	391
macro avg	0.97	0.97	0.97	391
weighted avg	0.97	0.97	0.97	391

Model Report

- Decision Tree Classifier , Random Forest Classifier , Gradient Boosting Classifier , XGBoost Classifier and Support vector Classifier all are tends to Overfit on Training Data with Accuracy of 100%
- These above algorithms after hyperparameter tuning gives almost same result as they give in default condition
- These above algorithms gives almost 90% accuracy on test data because of overfitting issue
- K-Nearest-Neighbour algorithm performance is poorest as compare to others because it gives accuracy of 75% on training data and gives only 58% accuracy on test data. which is not good
- Logistic Regression performance is very good on this dataset because it gives 97.5% accuracy on training data and

  96.7% accuracy on test dataset

Conclusion

- RAM is responsible for price of mobile phone Range
- After RAM, Battery Power and Pixel are play a crucial role in price of mobile.
- Mobile Weight is negatively correlated with price
- More features increases price little bit.
- Logistic Regression algorithm gives accuracy of 97.5% on training data and 96.7% on test data which is highest in all the algorithms So Logistic Regression
- Is the best Algorithm to predict Mobile price range

THANK YOU