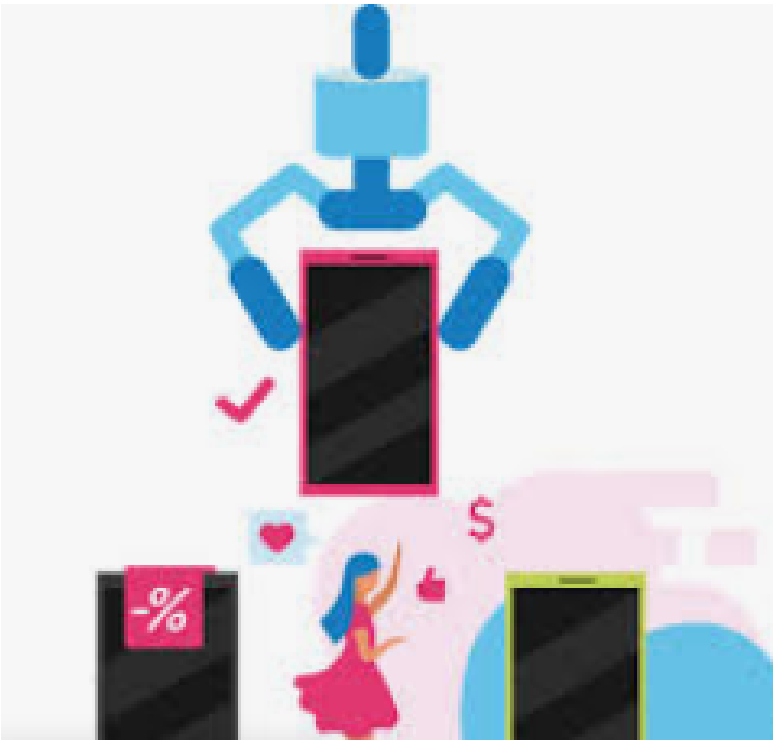
MOBILE PHONE PRICE PREDICTION

AI Product Service Prototype Development

and Business/Financial Modelling | Feynn Labs

Team Sloveni Nayak



1. PROBLEM STATEMENT:

In the modern era, smartphones have become an essential aspect of people's lives. When purchasing a smartphone, various factors such as display quality, processor speed, memory capacity, camera capabilities, thickness and battery life are often considered. However, one important factor that is frequently overlooked is whether the product justifies its cost. Due to a lack of resources for price validation, individuals struggle to make informed decisions regarding their purchases. This study aims to address this issue by utilizing historical data on key smartphone features and their corresponding costs in order to develop a model capable of accurately predicting the approximate price of new smartphones.

As a result, there is a clear need for a user-friendly website that can accurately predict the price of mobile phone based on individual user data. This platform aims to bridge the gap between technology and everyday users, offering a convenient and reliable solution to enable early prediction and informed decision-making regarding the purchase of mobile phones.

2. BUSINESS NEED ASSESSMENT:

The business landscape surrounding mobile phone is rapidly evolving, with a growing demand for personalized solutions that cater to individual price concerns. This project addresses the need for a digital platform that leverages predictive analytics to offer users insights into their desired price. By providing an easy-to-use userface, backed by robust predictive models, this website/app can tap into the burgeoning market of individuals seeking proactive health management tools. Morever, the providers and insurers can benefit from partnering with or

utilizing the website to enhance their interest of buying mobile phones of desired brands, further solidifying the business viability of this venture.

3. TARGET SPECIFICATION AND CHARACTERIZATION:

The target audience for this mobile phone price prediction website includes individuals of varying age groups who are concerned about their purchase limit and want to take pre-emptive and wise actions. The website caters to both tech-savvy users who are comfortable with online platforms and those who may be less familiar with digital tools but are motivated to explore solutions. The platform's user-friendly design ensures that both segments of audience can effortlessly input their information and recieve meaningful predictions. Through the online web portal, we can take user input and predict mobile phone price of the user with the help of ML algorithm. This web app can also recommend where people can have savings as well. It can be brought to the people through online website. So our web-app is the all-in-one solution to this emerging problem.

4. BENCHMARKING ALTERNATE PRODUCTS:

One of the primary alternate products in the field of mobile phone prediction posted on web app/website. This approach involves memory, battery power, price range, touch screen, etc. It provides accurate results but often require significant time and resources. In contrast, the prediction website aims to offer a convenient and rapid method for individuals to assess the rates of mobile phones. However, accuracy remains a key concern when benchmarking against wrong things. A thorough evaluation should address the website's predictive accuracy, sensitivity, specificity, and the ability to predict different types of rates.

Machine learning algorithms and predictive models for the prices of mobile phones risk assessment also constitute alternate products. These models leverage extensive datasets and advanced analytics techniques to make predictions based on an individual's demographic, lifestyle, and other information. Benchmarking the website against these models involves comparing its predictive performance, easy of use, and accessibility. It's essential to assess whether the website's predictions align with established machine learning models in terms of accuracy and reliability. Furthermore, considerations should be given to the interpretability of results, as complex models might lack the transparency that a user-friendly website can provide.

Other alternate products include mobile applications focused on price control and risk assessment. These apps often offer features. When benchmarking against these apps, the mobile phone price prediction website's usability, user interface, and integration of relevant data sources should be evaluated. The website's advantage lies in its singular focus on prediction, potentially offering a more streamlined and straightforward experience compared to multipurpose apps.

5. APPLICABLE REGULATIONS:

- ➔ It is important to inform users about the data being collected, obtain their consent, and implement appropriate security measures to protect user information.
- ➔ It is important to ensure that the product comply with relevant regulation.
- ➔ India has proposed regulations related to data localization, which may require certain data to be stored and processed within the country.
- ➔ It is important to protect our intellectual property rights through patents, copyrights, or other appropriate measures.

6. APPLICABLE CONSTRAINTS:

- ➔ *Privacy and Data Protection*: It must be ensured that the data collected from users is handled securely and in compliance with applicable privacy laws.
- ➔ *Data Availability and Quality*: Reliability and accuracy of a prediction model heavily depend on the quality and availability of the data used for training.
- ➔ *Ethical Considerations*: Measures should be taken to mitigate potential biases and it should be ensured that model is fair and reliable across different demographic groups.
- ➔ *User Interface and User Experience*: The prediction model should be integrated in a user-friendly manner, providing clear instructions and intuitive interactions to ensure a positive user experience.
- ➔ *Expertise and Resources*: Building and maintaining a prediction model requires expertise in machine learning, data science, and web development. Consider the availability o skilled professional.

7. EXTERNAL SEARCH:

https://www.analyticsvidhya.com/blog/2022/02/learn-mobile-price-prediction-through-four-classification-algorithms/

https://www.kaggle.com/code/vikramb/mobile-price-prediction

https://ijisrt.com/assets/upload/files/IJISRT22JAN380.pdf

https://medium.com/@Nivitus./mobile-price-prediction-using-machine-learning-fa9cab6fb242

8. CONCEPT GENERATION:

The increasing interest in buying the best phones worldwide poses a significant challenge to many things. As systems look for innovative solutions to manage the pricing, AI emerges as a promising avenue. It's not just about mobile price prediction but also monitoring, personalized care , and proactive interventions. With the success stories of AI applications in other fields, the intuition is that similar advancements can be made in the realm of problems.

Various feature selection algorithms are employed to eliminate insignificant and redundant features while keeping computational complexity at a minimum. Diverse classifiers are utilized with the aim of attaining the highest possible accuracy. The outcomes are compared based on the maximum achieved accuracy and minimal number of selected features. Based on this analysis, conclusions can be drawn regarding the most effective feature selection algorithm and classifier for a given dataset. This research has potential applications in marketing and business domains, where it can assist in identifying optimal products that strike a balance between cost-effectiveness and maximal functionality. Additionally, recommendations for future work include expanding upon this study by exploring more sophisticated solutions to address this problem further as well as developing more precise tools for price estimation purposes.

9. CONCEPT DEVELOPMENT:

Before plunging into predictive analytics for mobile phone price, it's imperative to comprehend the holistic environment for the same like geographical implications. With this contextual understanding, data collection becomes the next pivotal step. This should encompass not only usability histories but also daily activities, dietary patterns, and perhaps even real-time monitoring for richer insights. Following data accumulation, Exploratory Data Analysis (EDA)

is vital to discern patterns, trends, and anomalies with the dataset. Visualization tools can greatly aid in this process, enabling clearer interpretations of patient clusters, risk factors, and more.

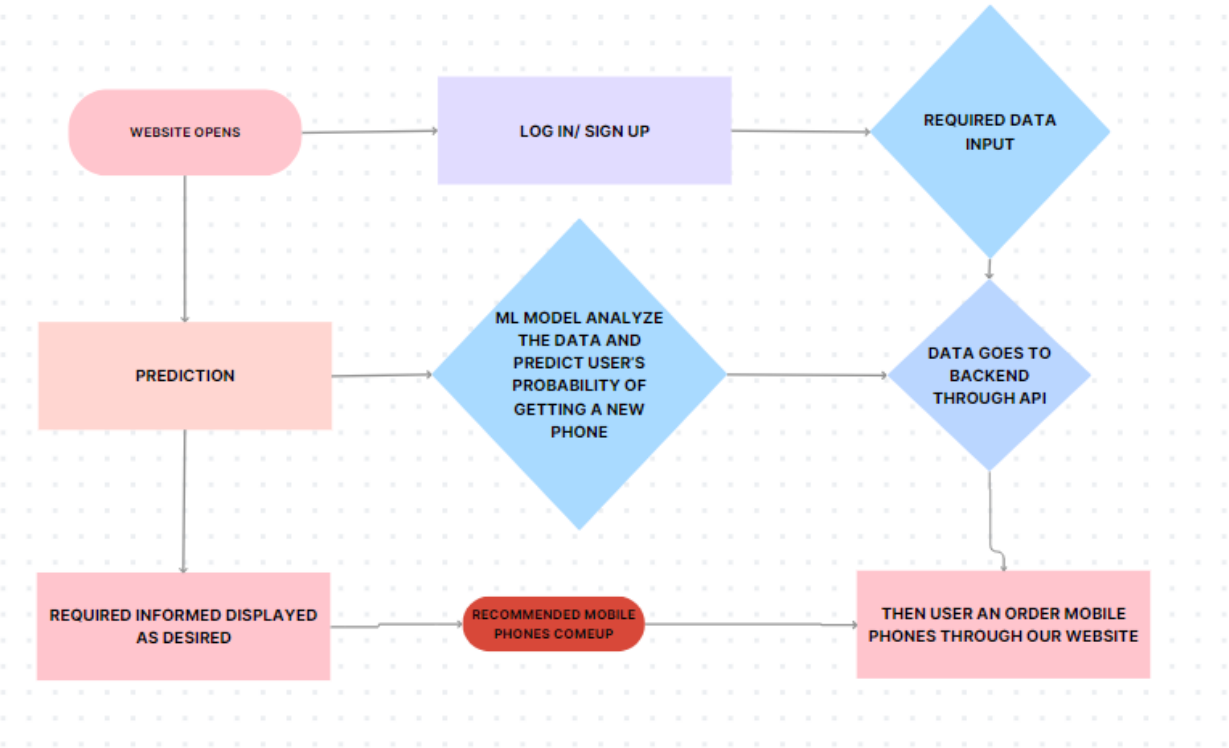
Building on this foundation, the yodelling phase can commence. Feature selection algorithms are commonly utilized to remove insignificant and redundant features while minimizing computational complexity. Various classifiers are employed in order to achieve the highest possible accuracy. The comparison of outcomes is based on the maximum achieved accuracy and minimum number of selected features. Through this analysis, conclusions can be drawn regarding the most effective feature selection algorithm and classifier for a given dataset. This research holds potential applications in marketing and business domains, as it can aid in identifying optimal products that offer a balance between cost effectiveness and maximal functionality. Furthermore, recommendations for future work include expanding upon this study by exploring more advanced solutions to further address these issues as well as developing more precise tools for price estimation purposes.

10. FINAL PRODUCT PROTOTYPE

Back-end calls for the gathering of data, pre-processing, and integration of the model with the web application, customer’s consent should be obtained before collecting and storing any of their entered data.

Front-end is the user interface that the customer will interact with. The web application could have mainly two pages. Input taking on first page, then result comes on the second page. Needs to be user-friendly; otherwise, users can enter undesirable information and the prediction will be completely wrong.

Flow Chart:



11. PRODUCT DETAILS

➔ User comes to the website and put the required input data after log in.

➔ Inputed data goes to the ML model through API.

➔ ML model predicts the price of mobile phones given by the user.

➔ Predicted result comes out in the result web-page.

➔ People can order the desired mobile phones for home-delivery.

Required Technologies include ML classification algorithm and python analytical libraries.

Team required to develop the model include ML engineer (design, experiment and implement ML models), Full-stack developer (design, test & implement applications), data scientist (identify, undertake and analyze data), business analyst (identify effective ways of boosting

organizational efficiency) and DevOps engineer (build, test and maintain infrastructure and tools, so that software can be developed and released).

12. CODE IMPLEMENTATION:

In [65]:
```
#LOADING DATASET
df = pd.read_csv('C:\\Users\\KIIT\\Downloads\\train.csv')
df.head()
```

Out[65]:

	battery_power	blue	clock_speed	dual_sim	fc	four_g	int_memory	m_dep	mobile_wt	n_cores	...	px_height
0	842	0	2.2	0	1	0	7	0.6	188	2	...	20
1	1021	1	0.5	1	0	1	53	0.7	136	3	...	905
2	563	1	0.5	1	2	1	41	0.9	145	5	...	1263
3	615	1	2.5	0	0	0	10	0.8	131	6	...	1216
4	1821	1	1.2	0	13	1	44	0.6	141	2	...	1208

5 rows × 21 columns

In [69]:
```
#GETTING DESCRIPTION OF DATA
df.describe()
```

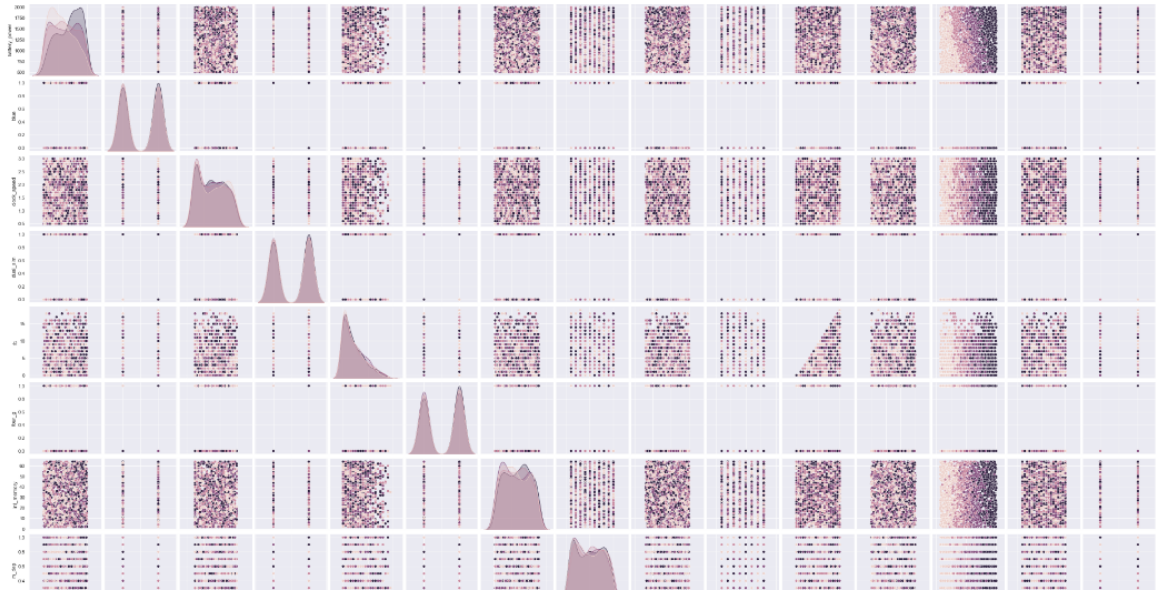
Out[69]:

	battery_power	blue	clock_speed	dual_sim	fc	four_g	int_memory	m_dep
count	2000.000000	2000.0000	2000.000000	2000.000000	2000.000000	2000.000000	2000.000000	2000.000000
mean	1238.518500	0.4950	1.522250	0.509500	4.309500	0.521500	32.046500	0.501750
std	439.418206	0.5001	0.816004	0.500035	4.341444	0.499662	18.145715	0.288416
min	501.000000	0.0000	0.500000	0.000000	0.000000	0.000000	2.000000	0.100000
25%	851.750000	0.0000	0.700000	0.000000	1.000000	0.000000	16.000000	0.200000
50%	1226.000000	0.0000	1.500000	1.000000	3.000000	1.000000	32.000000	0.500000
75%	1615.250000	1.0000	2.200000	1.000000	7.000000	1.000000	48.000000	0.800000
max	1998.000000	1.0000	3.000000	1.000000	19.000000	1.000000	64.000000	1.000000

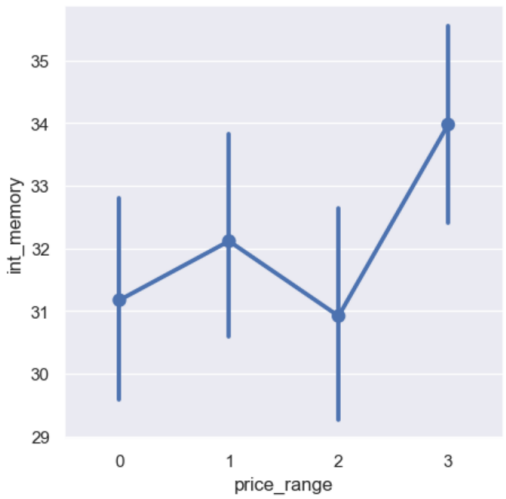
8 rows × 21 columns

In [62]:
```
sns.pairplot(df,hue='price_range')
```

Out[62]: <seaborn.axisgrid.PairGrid at 0x1a355950190>

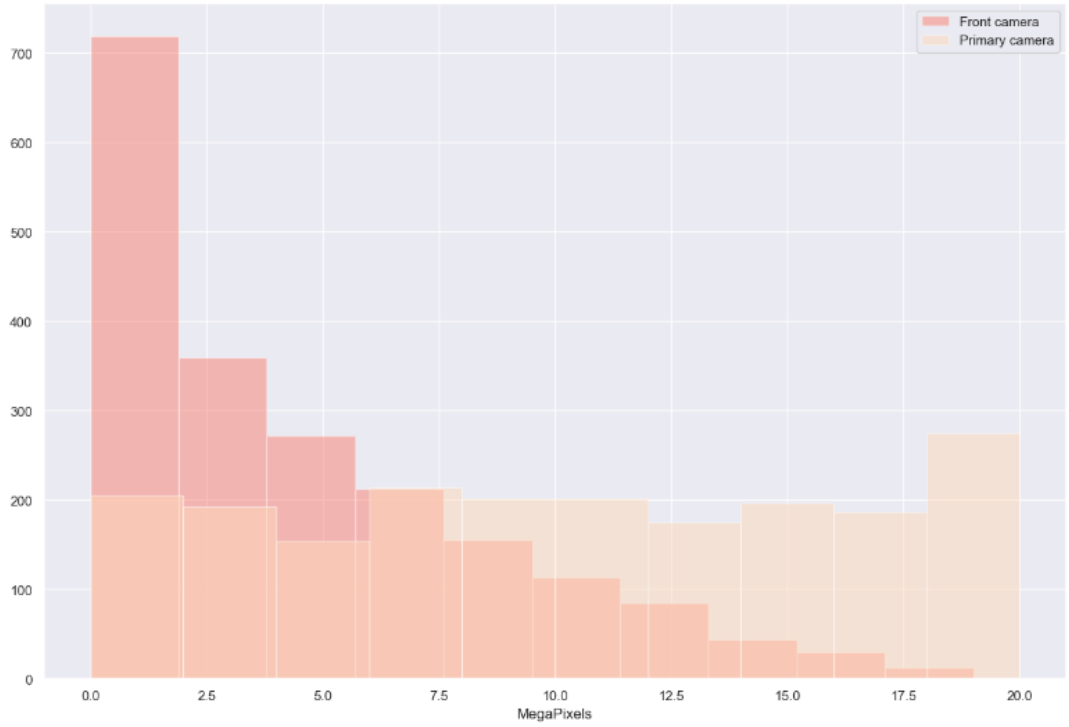


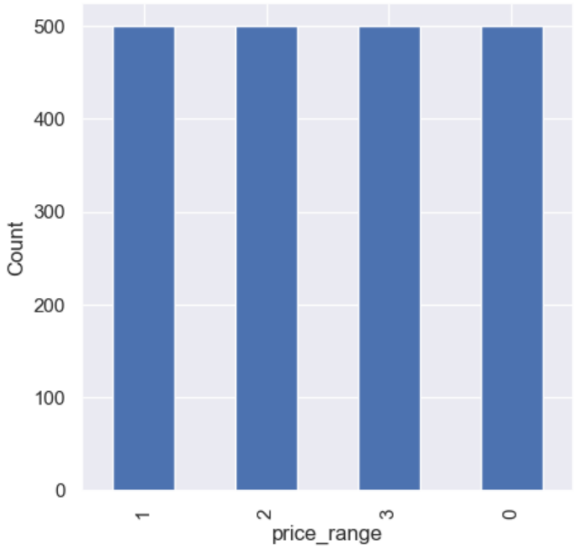
Out[90]: <Axes: xlabel='price_range', ylabel='int_memory'>

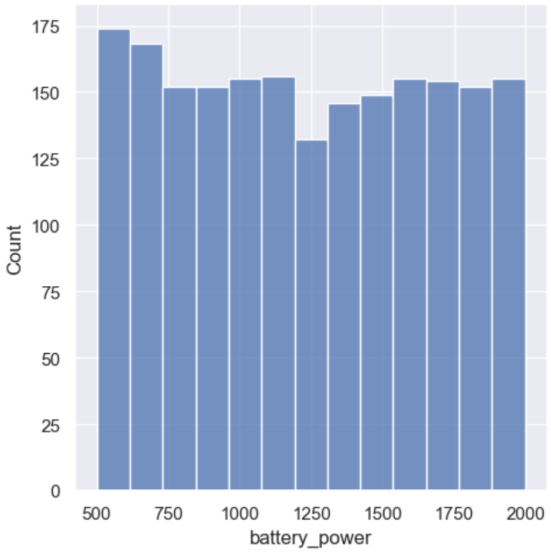


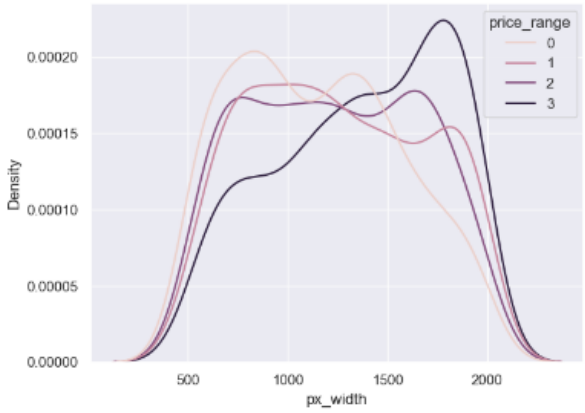
Out[94]: <Axes: xlabel='price_range', ylabel='talk_time'>

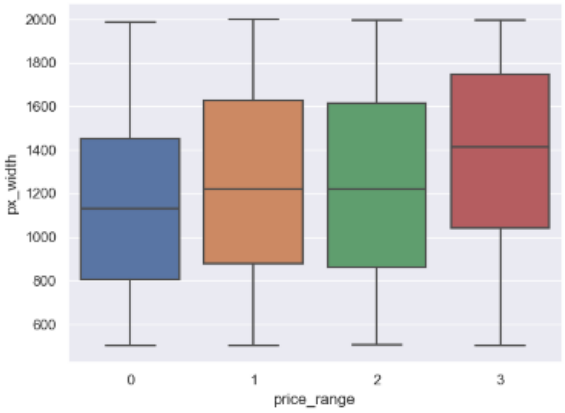
```
Out[93]: Text(0.5, 0, 'MegaPixels')
```

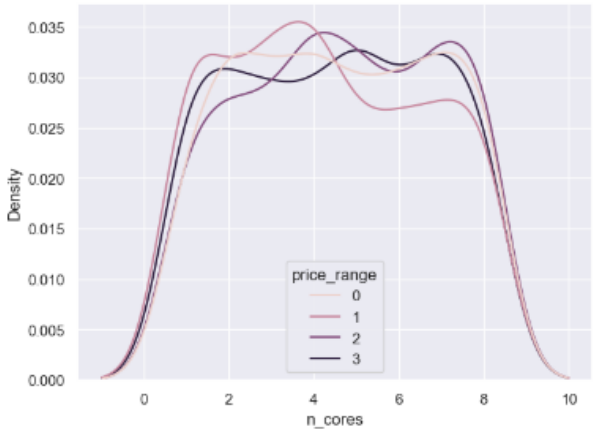


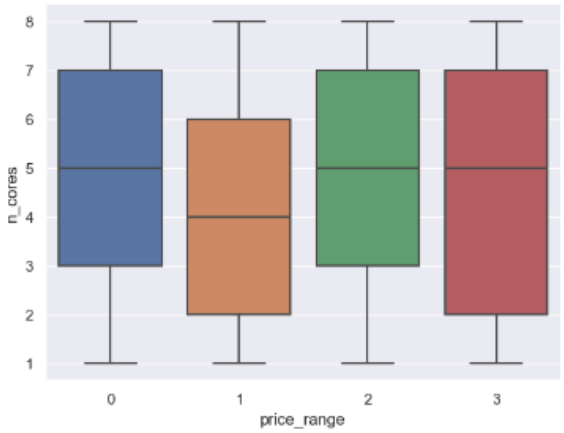


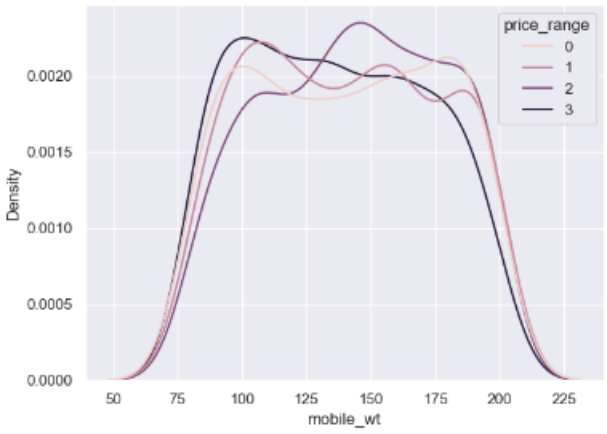


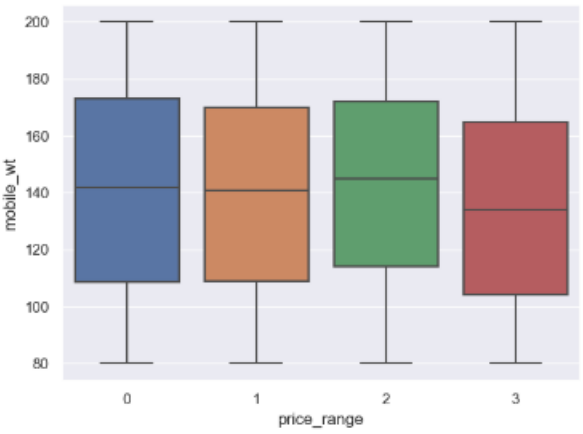

price_range
0
1
2
3
Density
0.00020
0.00015
0.00010
0.00005
0.00000
500
1000
1500
2000
px_width

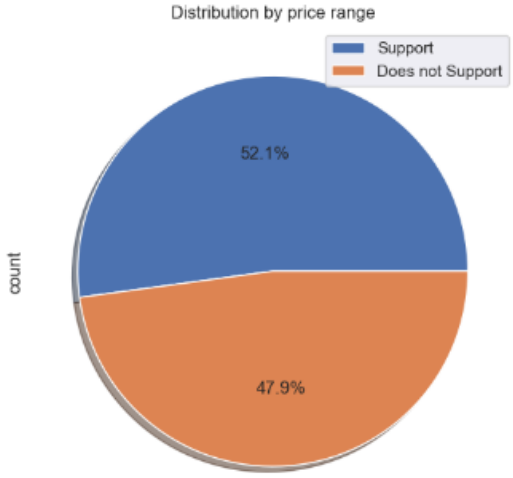

px_width
2000
1800
1600
1400
1200
1000
800
600
0
1
2
3
price_range

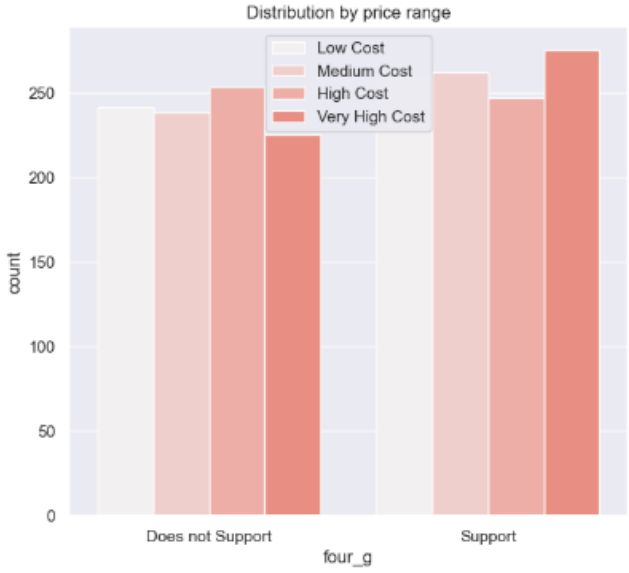

Density
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
price_range
0
1
2
3
0
2
4
6
8
10
n_cores

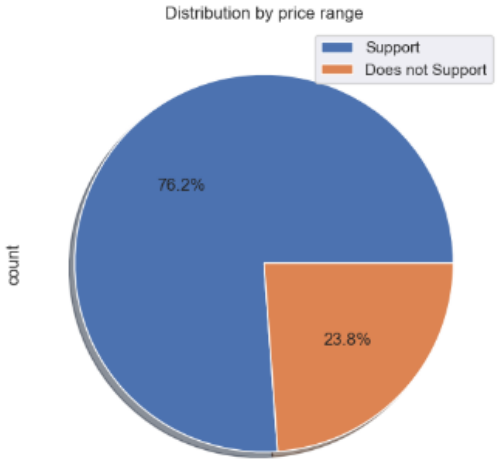

n_cores
8
7
6
5
4
3
2
1
0
1
2
3
price_range

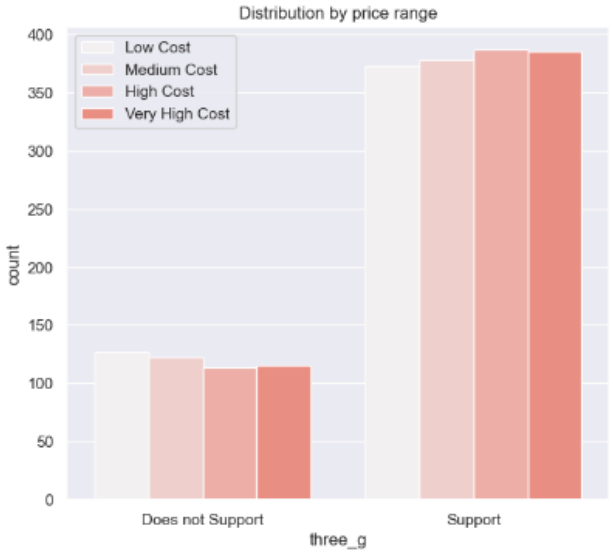

price_range
0
1
2
3
Density
0.0020
0.0015
0.0010
0.0005
0.0000
50
75
100
125
150
175
200
225
mobile_wt

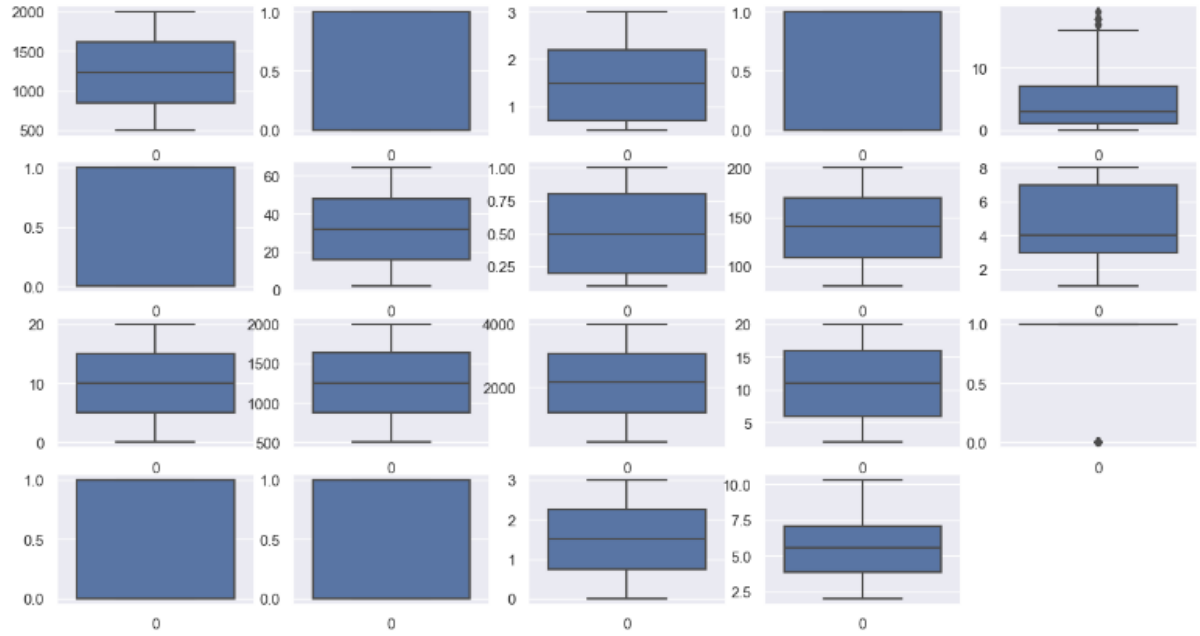

mobile_wt
200
180
160
140
120
100
80
0
1
2
3
price_range

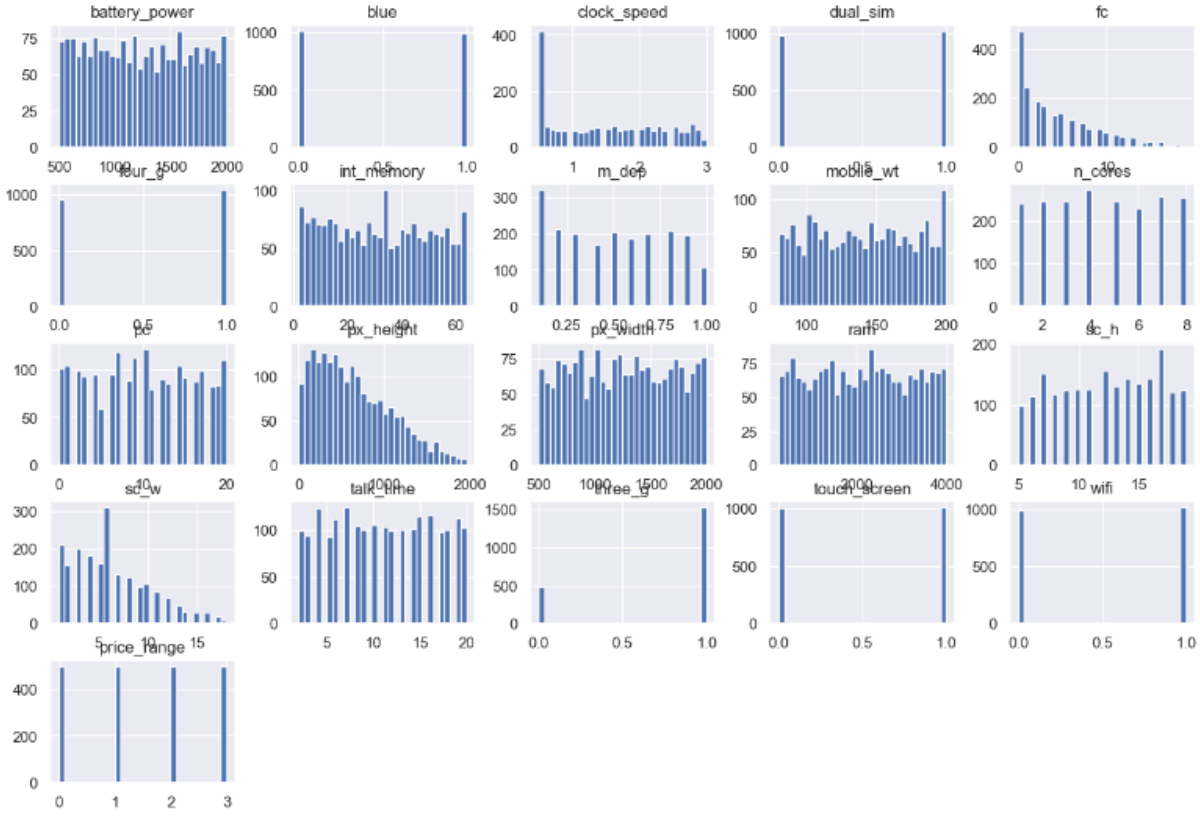

Distribution by price range
Support
Does not Support
52.1%
47.9%
count


Distribution by price range
Low Cost
Medium Cost
High Cost
Very High Cost
count
0
50
100
150
200
250
Does not Support
Support
four_g


Distribution by price range
Support
Does not Support
76.2%
23.8%
count


Distribution by price range
Low Cost
Medium Cost
High Cost
Very High Cost
count
0
50
100
150
200
250
300
350
400
Does not Support
Support
three_g

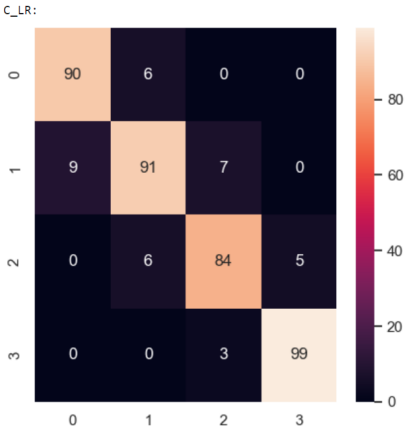


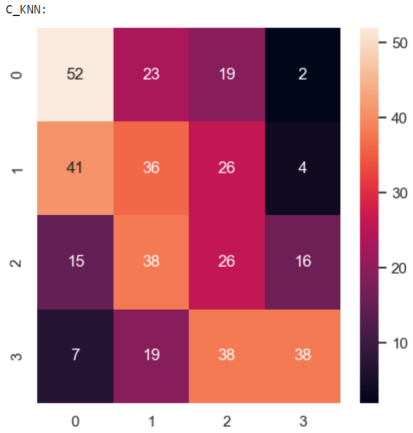

battery_power
blue
clock_speed
dual_sim
fc
four_g
int_memory
m_dep
mobile_wt
n_cores
pc
px_height
px_width
ram
sc_h
sc_w
talk_time
three_g
touch_screen
wifi
price_range

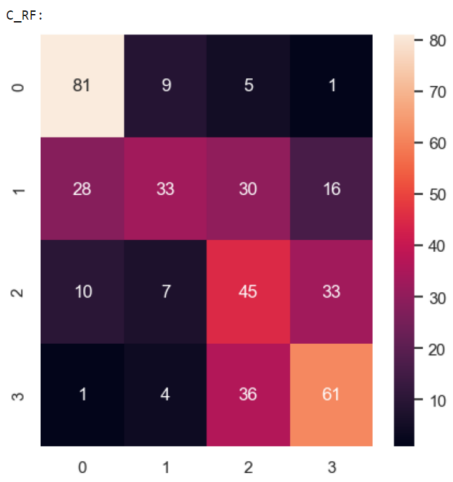
Performance on scaled-data with ANN model with an accuracy of 96%

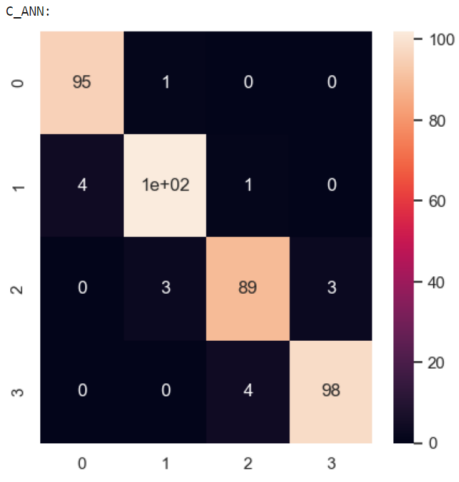
C_ANN:

	precision	recall	f1-score	support
0	0.96	0.99	0.97	96
1	0.96	0.95	0.96	107
2	0.95	0.94	0.94	95
3	0.97	0.96	0.97	102
accuracy			0.96	400
macro avg	0.96	0.96	0.96	400
weighted avg	0.96	0.96	0.96	400









GitHub link:

https://github.com/sloveninayak/Feynn_Labs/blob/main/Mobile%20Price%20Prediction.ipynb

Algorithm:

We are using Supervised ML Learning model for this project implementation. A classification algorithm is needed to classify our dataset into binary output (such as “yes” or “no”, “pass” or “fail” and so on). ANN has been implemented here and achieves 96% accuracy!

13.PYTHON LIBRARIES USED:

- ➔ Pandas is defined as an open-source library that provides high-performance data manipulation in Python. Data analysis becomes easier with this python library.
- ➔ NumPy is used for mathematical function purpose which are more memory efficient and compact than python lists.
- ➔ Matplotlib is visualization library of python. We can graphically represent data and their relations through Matplotlib.
- ➔ Sklearn is predictive analysis based python library of python. Data splitting, algorithm implementation are done by Sklearn.

14. BUSINESS MODEL:

A. The online interface allows for maximum reach and eliminates the need for physical presence to determine prices. This makes our model highly beneficial as it can be easily accessed on the website.

B. In order to enhance user experience and provide a personalized service, we have implemented a login system. This feature allows users to maintain a record of their price checks and access them conveniently.

C. To accurately estimate mobile phone prices, we require specific information from the user such as battery power, price, memory capacity, touchscreen functionality, among others. Our interface has been designed to collect these essential details.

D. From the user interface these attributes will be passed to the backend through API. And in the backend, we have kept our trained model which will show predictions based on those collected information from the respective user.

E. The prediction will be reflected in the webpage.

We can generate our revenue by subscription, web traffic, collaboration with brands, association with developers and partnership with smartphone stores.

15. FINANCIAL EQUATION:

Assuming that the development time for the machine learning model ranges from 1 to 3 weeks, and considering the cost as equivalent to the team members' salaries, we have two ML engineers with a salary denoted as 'ml' and one full stack web developer denoted as 'fs'. Therefore, the total cost can be calculated using c = 2*ml + fs. Accordingly, the profit or financial equation is given by ***y = 25000*x(t) - (2*ml + fs)***, where x(t) represents the function representing customer base growth and y denotes profit.

As we all know the demand for services will always remain high and it will increase with time. Our product will have higher chance to boom. To decide the approx. salary of our team, let’s assume that to recommend the bigger mobile brands we can charge around Rs. 12000 for three

months and for stores around Rs 8000 for 3 months. Once the customer base increases, we can either increase the price or reduce the duration for which our product will be available.

15. CONCLUSION

Integrating machine learning into the mobile price prediction landscape promises a paradigm shift. By facilitating early prediction, providing personalized risk assessments, and continuously evolving through data, AI-driven tools can be game changers. More sophisticated artificial intelligence techniques can be used to maximized the accuracy and predict the accurate price of the products. Software or Mobile app can be developed that will predict the market price of any new launched product. Best marketing strategy is to find optimal product (with minimum cost and maximum specifications). So products can be compared in terms of their specifications, cost, manufacturing company, etc. By specifying economic range, a good product can be suggested to a customer.