

MARKET SEGMENTATION ON ELECTRIC VEHICLE

TEAM: RUTIK

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RUTIK YERUNKAR

ABHIISHEK TAK

KRISHAN KUMAR

KAUSHIKI CHATTERJEE

Problem statement:

Analyse electric vehicles in India using market segmentation and then develop a workable entry plan that focuses on the market groups most likely to purchase electric vehicles.

Introduction:

Modern life requires transportation as a basic necessity, yet the conventional combustion engine is gradually ageing. Since petrol and diesel vehicles produce a lot of pollution, fully electric vehicles are swiftly replacing them. EVs (fully electric cars) are considerably better for the environment and emit no pollutants at all.

Business Opportunities in Electric Vehicles Sector India:

Following is the list of business opportunities in the Indian EV Sector

- Public EV charging Stations
- Battery recycling Business
- Battery swapping Technology
- solar electric vehicle charging
- Home charging stations
- EV Equipment Manufacturing
- EV Franchise and Dealership

Data Source:

Dataset “Indian Consumers Cars purchasing behaviour” was taken from website Kaggle.com.

	Age	Profession	Marrital Status	Education	No of Dependents	Personal loan	House Loan	Wife Working	Salary	Wife Salary	Total Salary	Make	Price
0	27	Salaried	Single	Post Graduate	0	Yes	No	No	800000	0	800000	i20	800000
1	35	Salaried	Married	Post Graduate	2	Yes	Yes	Yes	1400000	600000	2000000	Ciaz	1000000
2	45	Business	Married	Graduate	4	Yes	Yes	No	1800000	0	1800000	Duster	1200000
3	41	Business	Married	Post Graduate	3	No	No	Yes	1600000	600000	2200000	City	1200000
4	31	Salaried	Married	Post Graduate	2	Yes	No	Yes	1800000	800000	2600000	SUV	1600000
...
94	27	Business	Single	Graduate	0	No	No	No	2400000	0	2400000	SUV	1600000
95	50	Salaried	Married	Post Graduate	3	No	No	Yes	3800000	1300000	5100000	SUV	1600000
96	51	Business	Married	Graduate	2	Yes	Yes	No	2200000	0	2200000	Ciaz	1100000
97	51	Salaried	Married	Post Graduate	2	No	No	Yes	2700000	1300000	4000000	Creata	1500000
98	51	Salaried	Married	Post Graduate	2	Yes	Yes	No	2200000	0	2200000	Ciaz	1100000

Imported Libraries:

```
#Importing Libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.preprocessing import StandardScaler
from sklearn.cluster import KMeans
```

DATA Preprocessing:

```
In [5]: df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 99 entries, 0 to 98
Data columns (total 13 columns):
#   Column                Non-Null Count  Dtype
---  -
0   Age                   99 non-null    int64
1   Profession            99 non-null    object
2   Marrital Status      99 non-null    object
3   Education             99 non-null    object
4   No of Dependents     99 non-null    int64
5   Personal loan        99 non-null    object
6   House Loan           99 non-null    object
7   Wife Working         99 non-null    object
8   Salary               99 non-null    int64
9   Wife Salary          99 non-null    int64
10  Total Salary         99 non-null    int64
11  Make                 99 non-null    object
12  Price                99 non-null    int64
dtypes: int64(6), object(7)
memory usage: 10.2+ KB
```

```
df.describe()
```

	Age	No of Dependents	Salary	Wife Salary	Total Salary	Price
count	99.000000	99.000000	9.900000e+01	9.900000e+01	9.900000e+01	9.900000e+01
mean	36.313131	2.181818	1.736364e+06	5.343434e+05	2.270707e+06	1.194040e+06
std	6.246054	1.335265	6.736217e+05	6.054450e+05	1.050777e+06	4.376955e+05
min	26.000000	0.000000	2.000000e+05	0.000000e+00	2.000000e+05	1.100000e+05
25%	31.000000	2.000000	1.300000e+06	0.000000e+00	1.550000e+06	8.000000e+05
50%	36.000000	2.000000	1.600000e+06	5.000000e+05	2.100000e+06	1.200000e+06
75%	41.000000	3.000000	2.200000e+06	9.000000e+05	2.700000e+06	1.500000e+06
max	51.000000	4.000000	3.800000e+06	2.100000e+06	5.200000e+06	3.000000e+06

```
Profession :- ['Salaried' 'Business']
Marrital Status :- ['Single' 'Married']
Education :- ['Post Graduate' 'Graduate']
Personal loan :- ['Yes' 'No']
House Loan :- ['No' 'Yes']
Wife Working :- ['No' 'Yes' 'm']
Make :- ['i20' 'Ciaz' 'Duster' 'City' 'SUV' 'Baleno' 'Verna' 'Luxuray' 'Creata']
```

From the above cell we get to know about the unique values of each features

Market Segmentation:

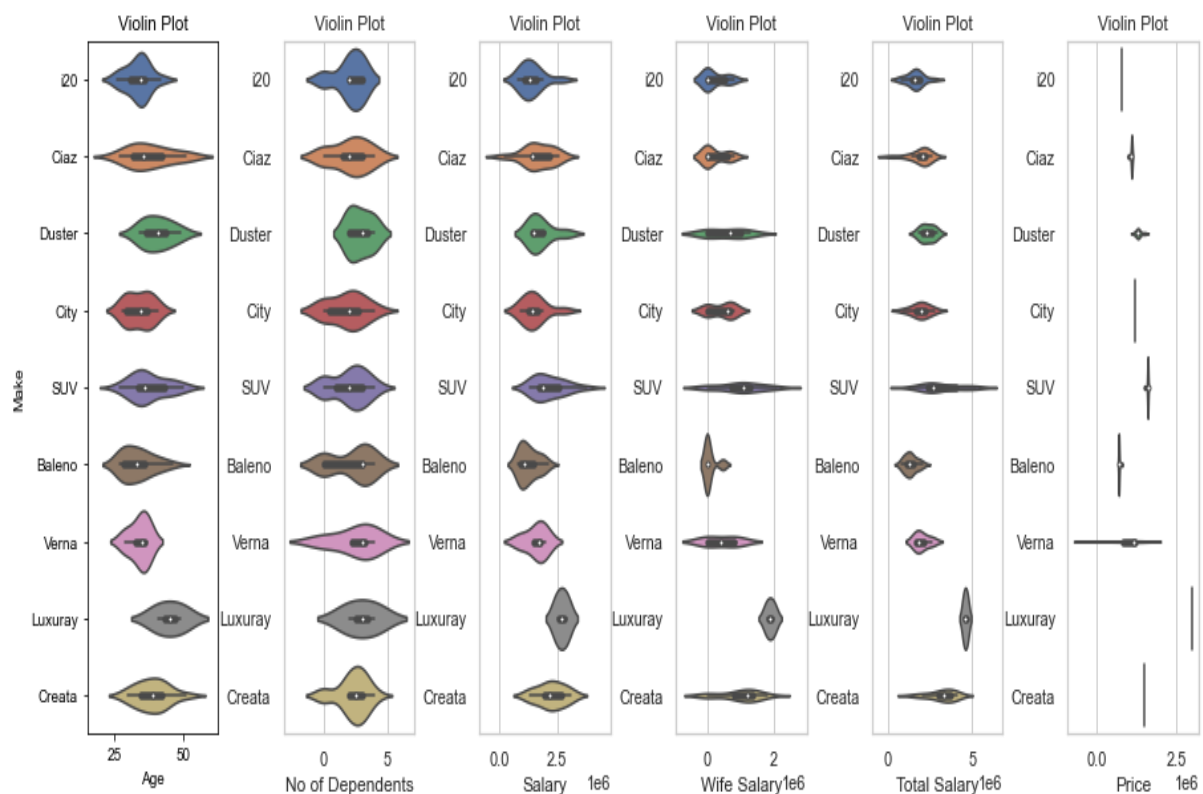
Behavioral and Psychographic Analysis:

A type of consumer segmentation known as "behavioural segmentation" is based on the patterns of behaviour that customers exhibit as they engage with brands or businesses or as they make decisions about what to buy. By dividing customers into groups based on their familiarity with, attitude toward, usage of, or reaction to a product, service, or brand, businesses are able to better target their marketing efforts.

A consumer's lifestyle, hobbies, and opinions are taken into consideration while using the psychographic segmentation strategy. Because a consumer's purchasing activity reflects their lifestyle, hobbies, and beliefs, we have merged the two sorts of study.

The dataset we have used in this project is a survey of people who own particular brands of fuel-based vehicles and it contains some basic information such as their age, salary, loan status, marital status, number of dependents, education, occupation and the make of their car and its price.

The violin plot below gives us some insight on the relation between the segmentation and descriptive variables in our data.

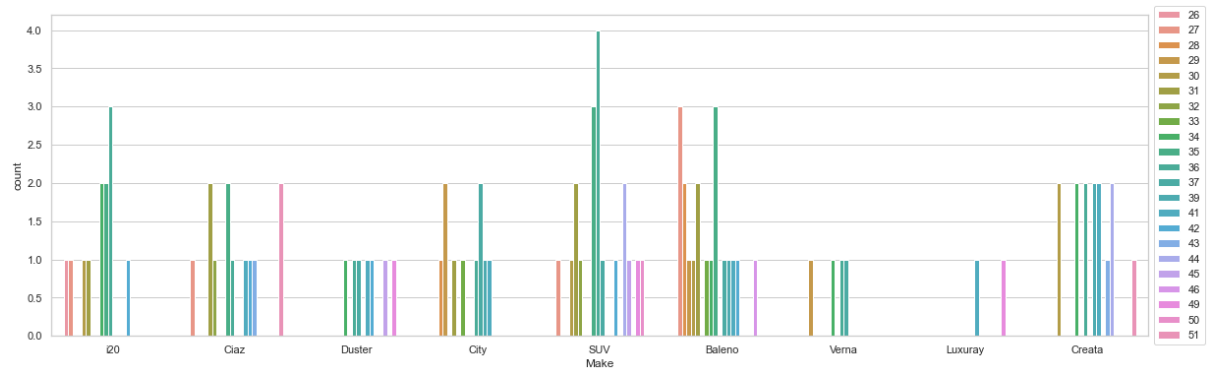


From the above figure we can conclude that:

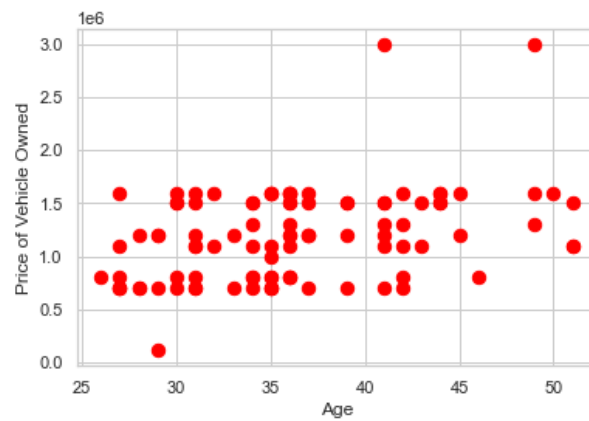
1. Consumers with less age purchase less expensive cars
2. Consumers with greater No. of Dependents buys vehicle like SUVs which has more seats
3. Salary plot matches with the Price plot.

1. Relation between consumers age and the vehicle they tend to purchase

❖ Make of vehicles they tend to purchase

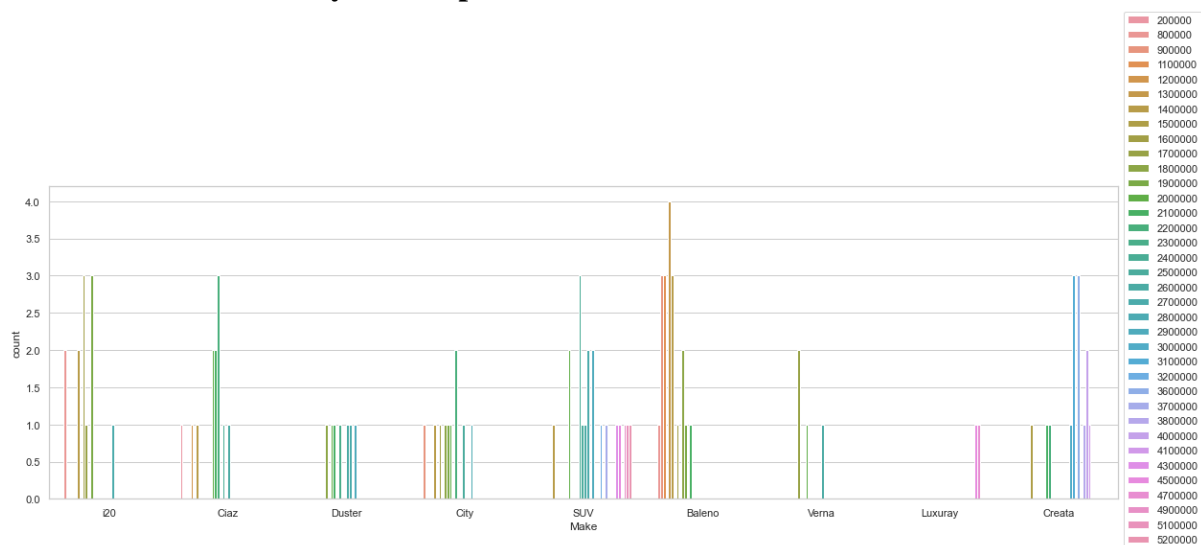


❖ Price of vehicle owned

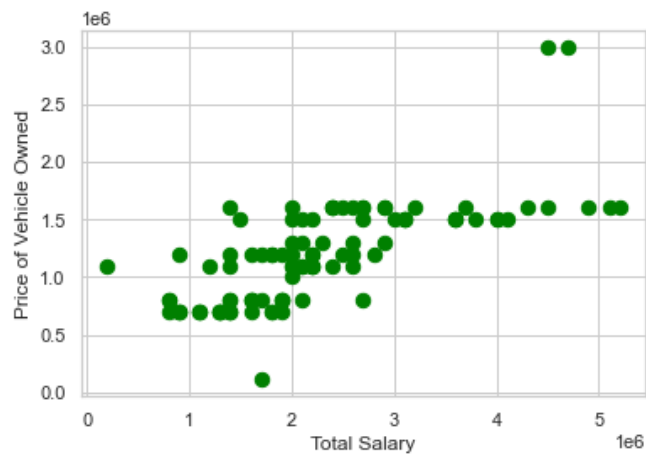


2. Relation between consumers total salary and the vehicle they tend to purchase

❖ Make of vehicles they tend to purchase

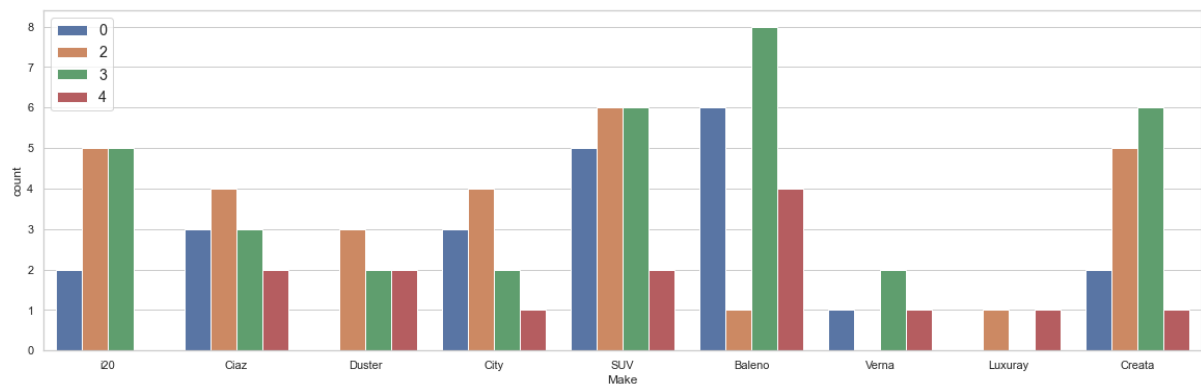


❖ Price of vehicle owned

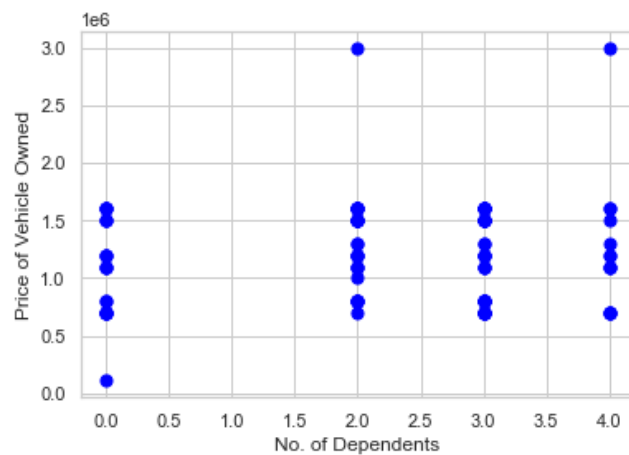


3. Relation between number of dependents on a consumer and the vehicles they tend to purchase

❖ Make of vehicles they tend to purchase

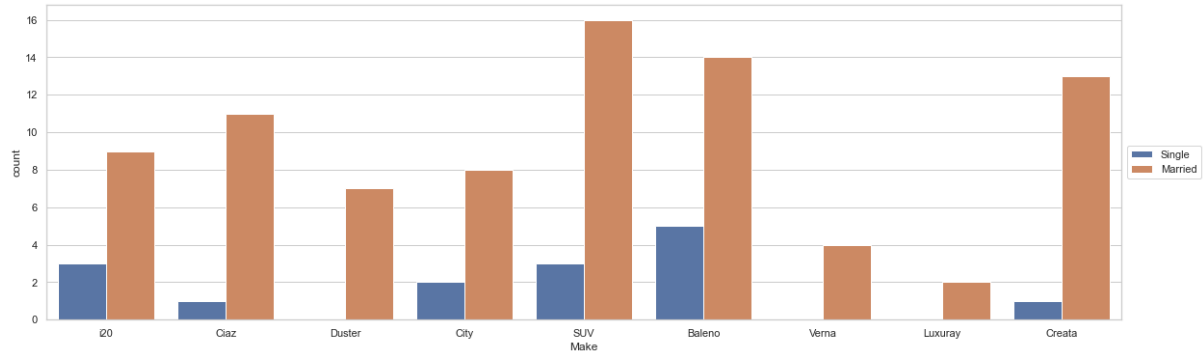


❖ Price of vehicle owned

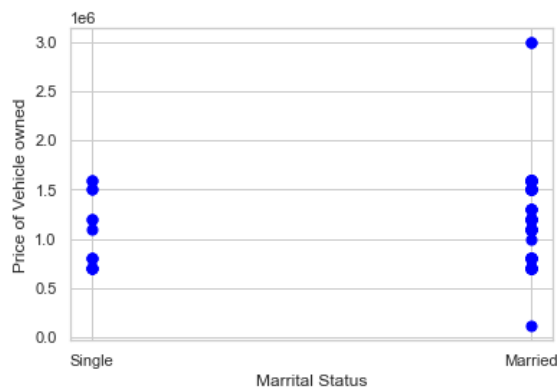


4. Relation between consumers marital status and the vehicles they tend to purchase

❖ Make of vehicles they tend to purchase

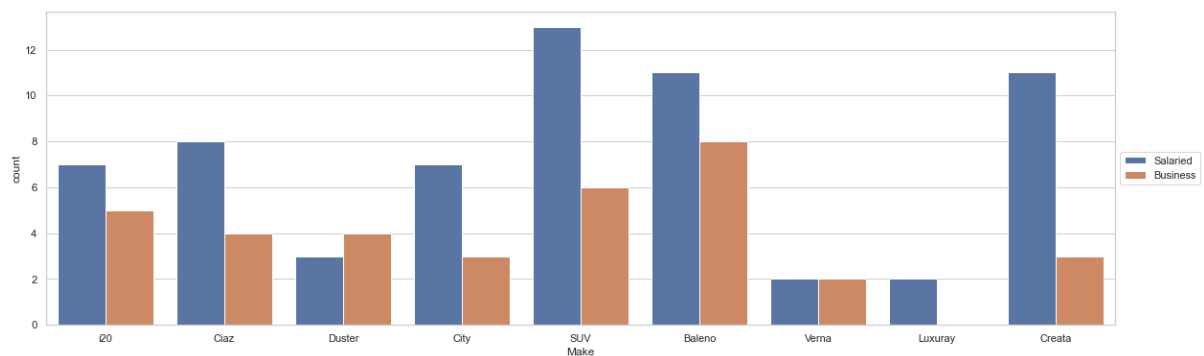


❖ Price of vehicle owned

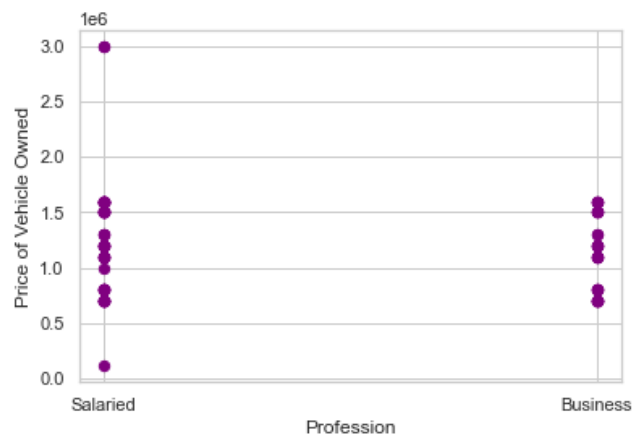


5. Relation between consumers profession and the vehicles they tend to purchase:

❖ Make of vehicles they tend to purchase

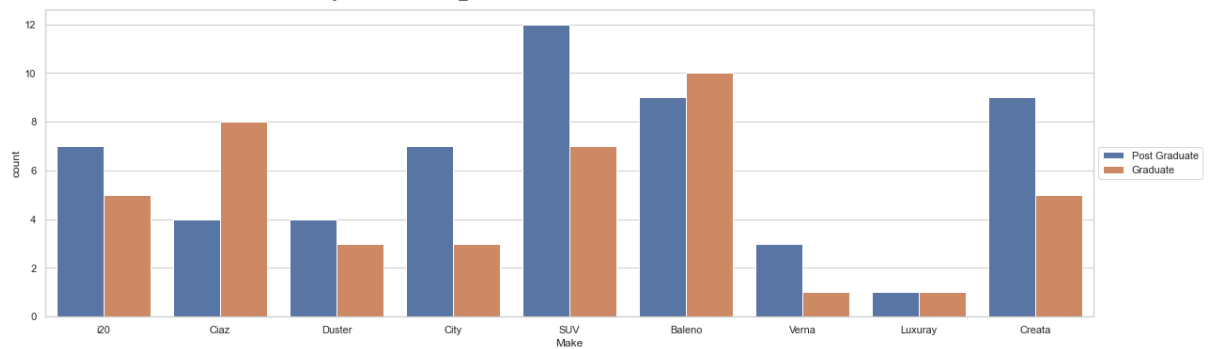


❖ Price of vehicle owned

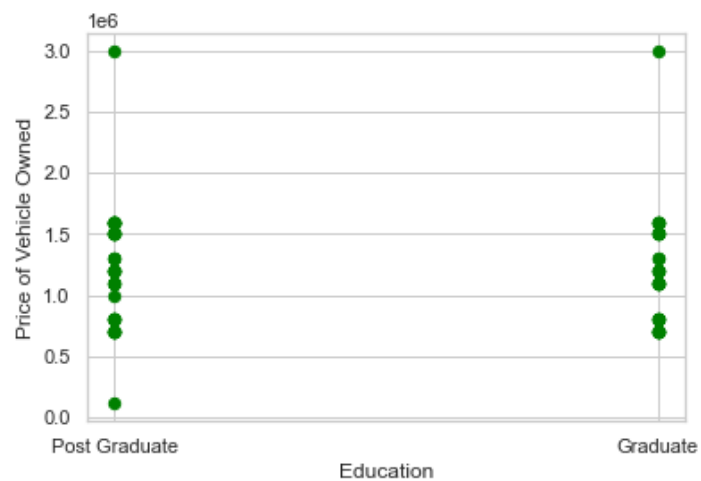


6. Relation between consumers education and the vehicles they tend to purchase

❖ Make of vehicles they tend to purchase

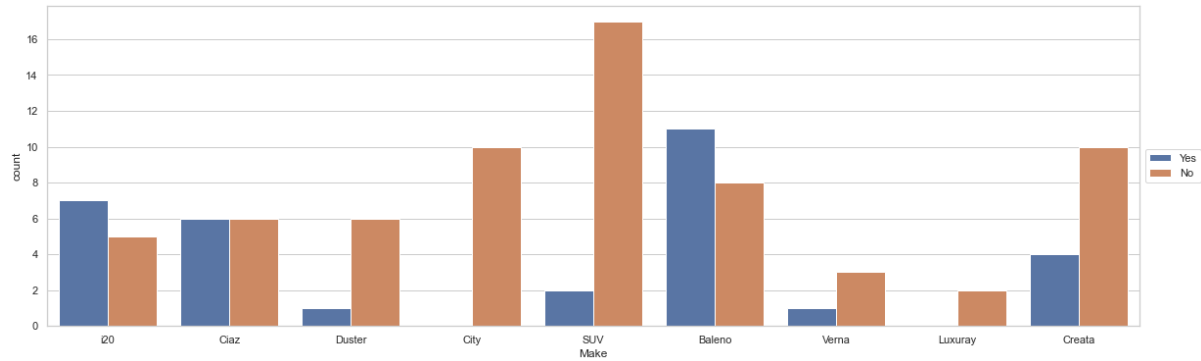


❖ Price of vehicle owned

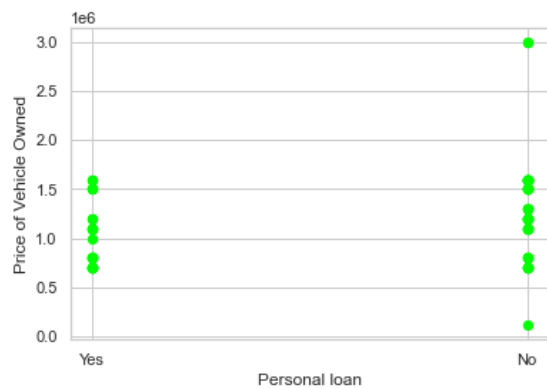


7. Relation between consumers loan status and the vehicles they tend to purchase

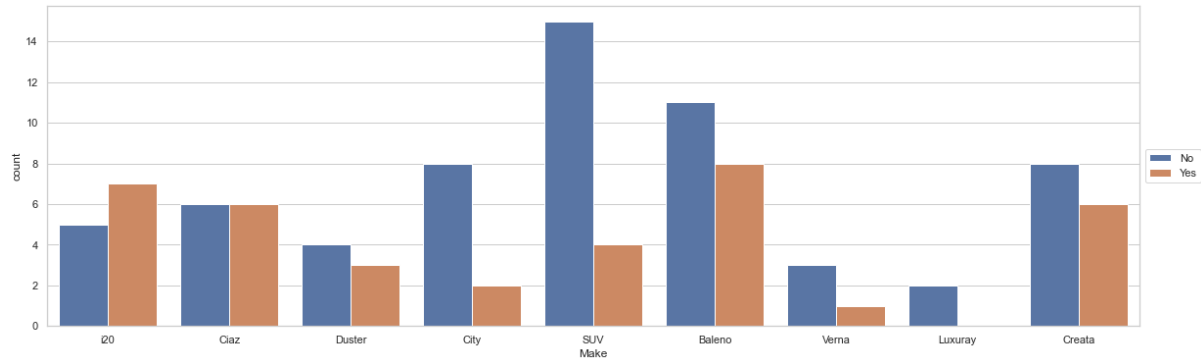
❖ Make of vehicles they tend to purchase (Personal loan):



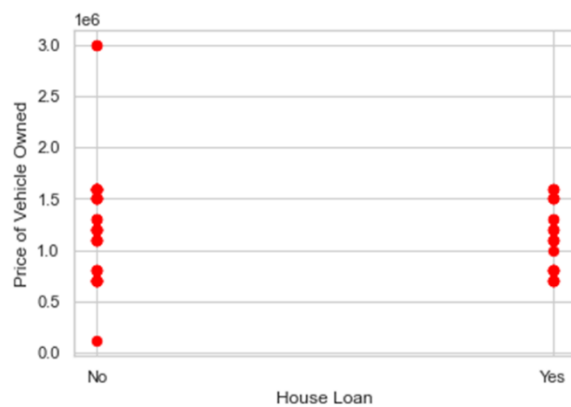
❖ Price of vehicle owned (Personal loan):



❖ Make of vehicles they tend to purchase (Home loan):

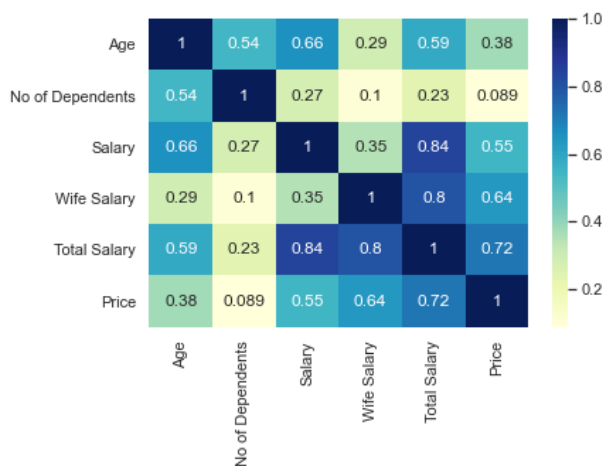
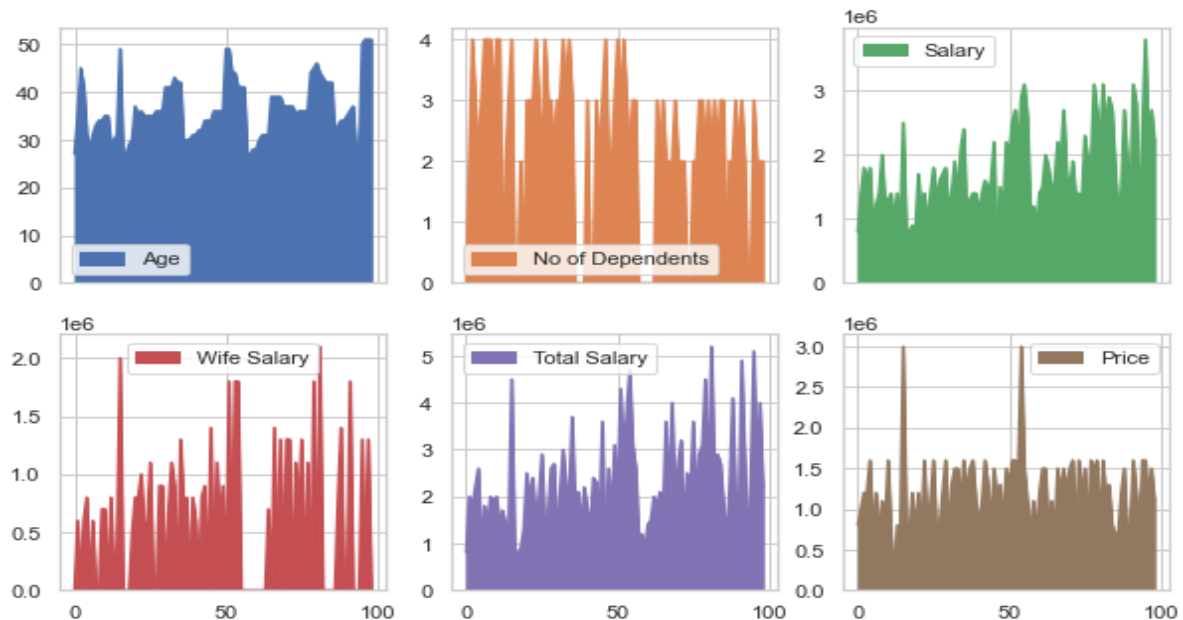


❖ Price of vehicle owned (Home loan):



Demographic analysis:

A market segmentation approach called demographic segmentation divides a company's target market based on demographic factors like age, gender, education, income, etc. In order to better meet their demands, it aids businesses in understanding who their consumers are. The folks who are most likely to purchase a product are the ones that a company considers when looking at the demographic segmentation. The target market may be determined using this.

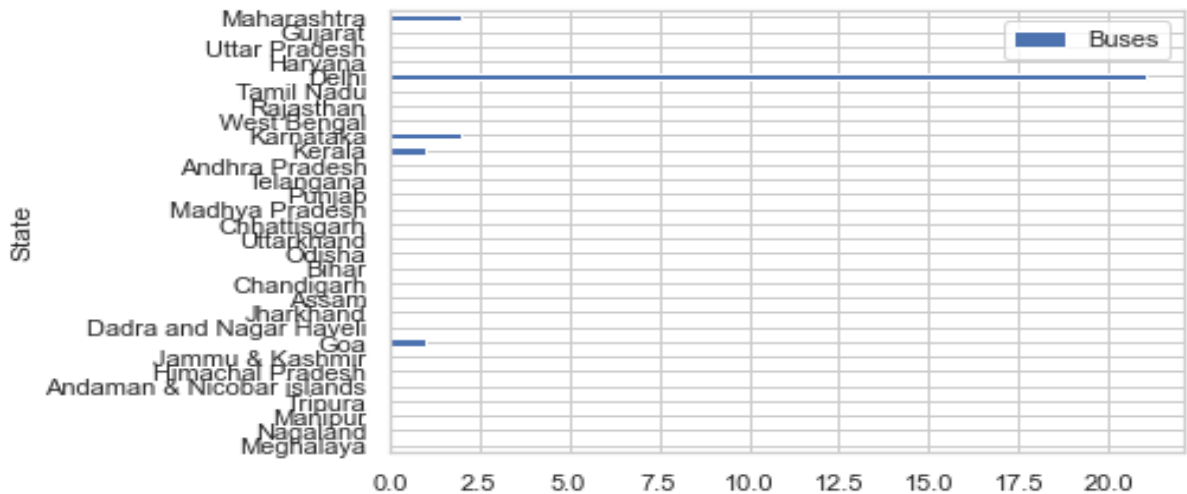
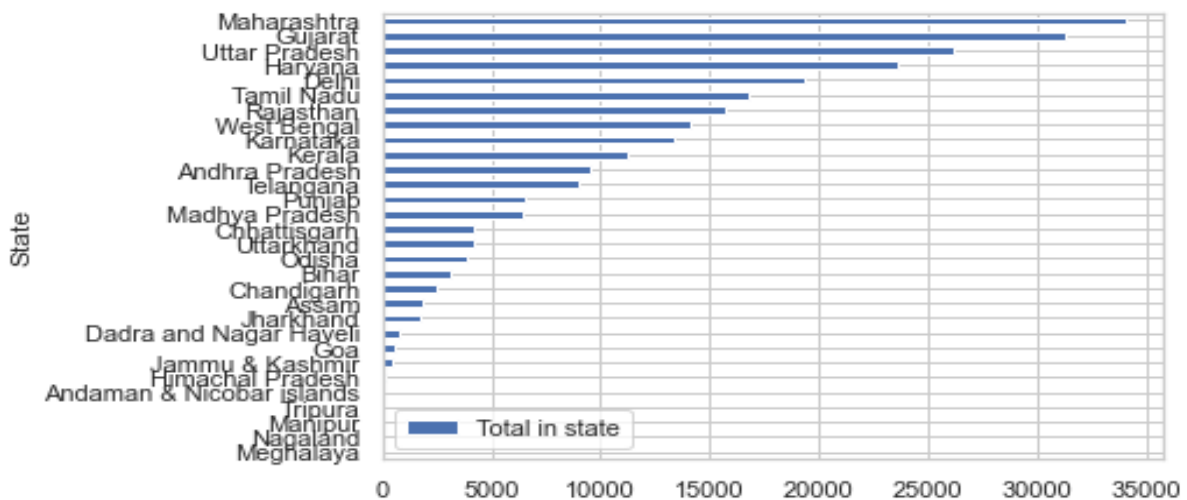


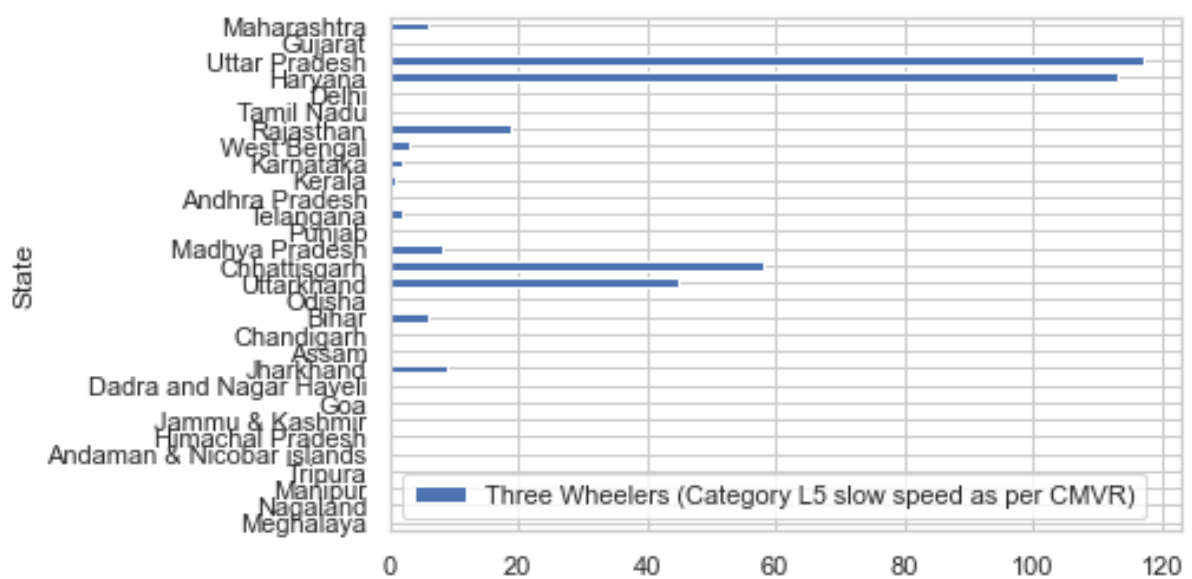
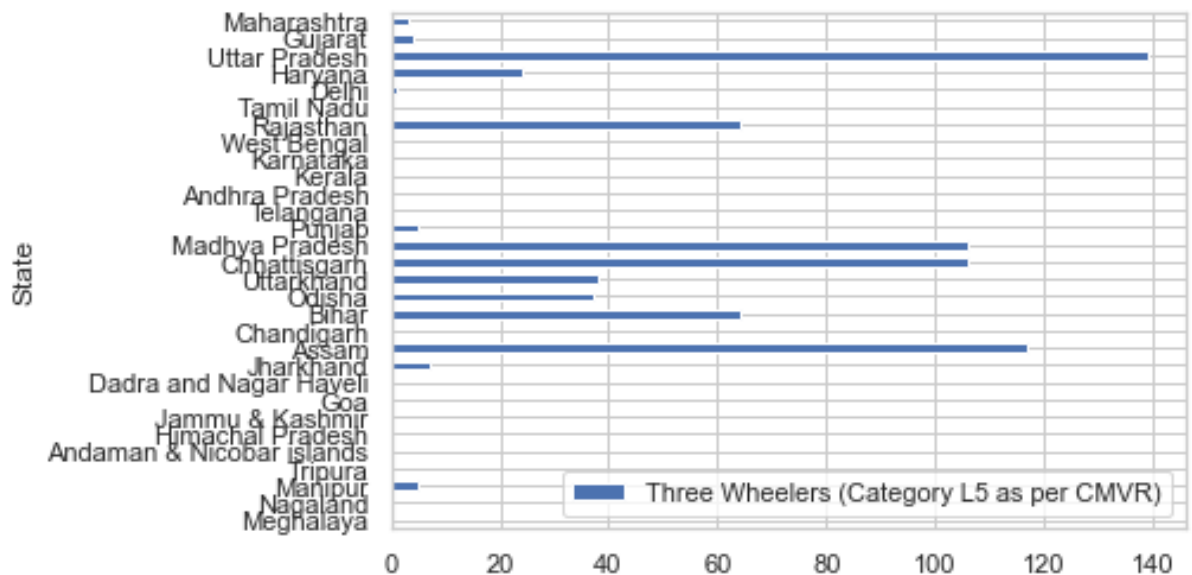
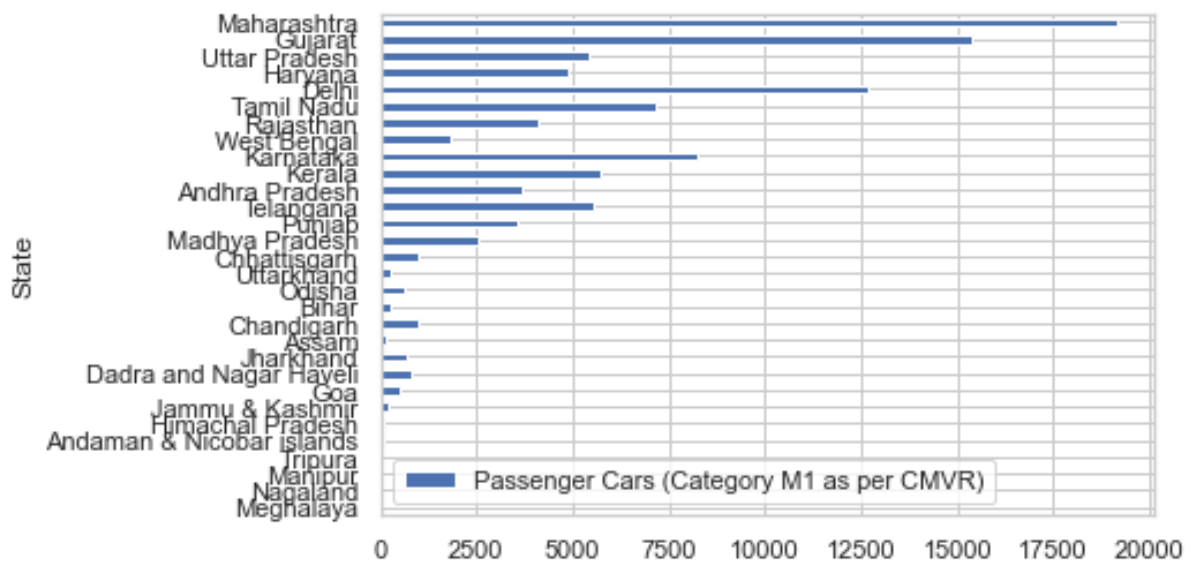
Observations:

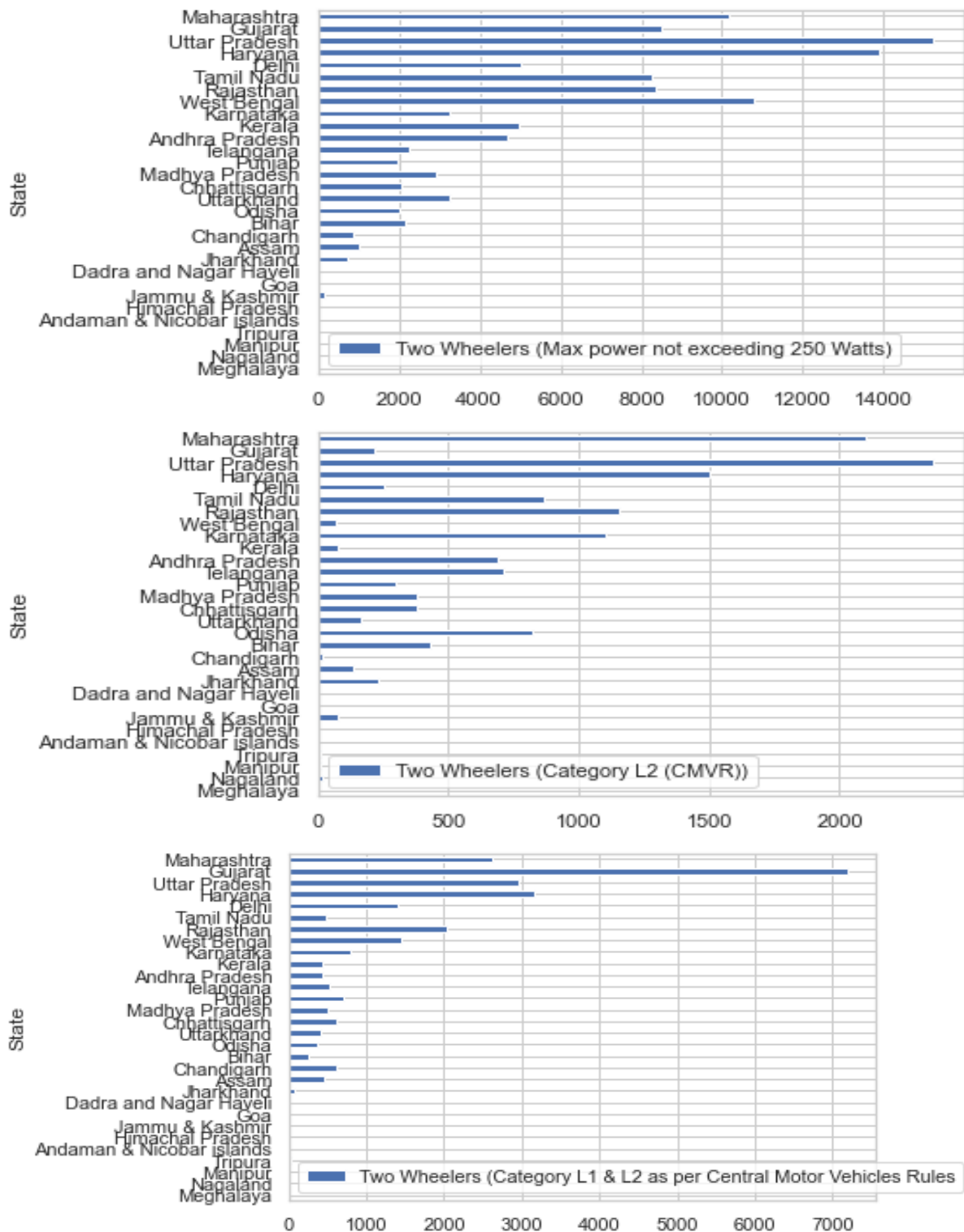
1. People between the ages of 25 and 50 make up the largest consumer market.
2. Most people with an average gross salary of around 30 lakhs buy vehicles.
3. Most of the people spend around 10 to 20 lakh rupees for vehicles.

Geographic Analysis:

It is an element that skillfully completes a marketing plan to target goods or services according to the locations of their clients. To identify the target market and tailor the marketing of a product or service, division is made according to nations, states, regions, cities, universities, or other geographic categories. In this section, we have divided India into its states and union territories. For our geographic research, we used a dataset that broke out sales of various types of electric vehicles by state for our research in order to better understand our target area. States with greater rates of electric vehicles can be targeted since residents in these states are more inclined to buy them, depending on the type of electric vehicle. Below are bar graphs displaying the top 5 states for a certain EV's sale.







Observation:

To increase the sales of electric vehicles we should target the states with high number of electric vehicles because people in these states tend to buy them.

Approaches used for segmentation:

K-Means Clustering Algorithm

K-Means Clustering is an unsupervised learning algorithm that is used to solve the clustering problems in machine learning or data science. In this topic, we will learn what is K-means clustering algorithm, how the algorithm works, along with the Python implementation of k-means clustering.

What is K-Means Algorithm?

K-Means Clustering is an Unsupervised Learning algorithm

, which groups the unlabeled dataset into different clusters. Here K defines the number of pre-defined clusters that need to be created in the process, as if $K=2$, there will be two clusters, and for $K=3$, there will be three clusters, and so on.

It allows us to cluster the data into different groups and a convenient way to discover the categories of groups in the unlabeled dataset on its own without the need for any training.

It is a centroid-based algorithm, where each cluster is associated with a centroid. The main aim of this algorithm is to minimize the sum of distances between the data point and their corresponding clusters.

The algorithm takes the unlabeled dataset as input, divides the dataset into k-number of clusters, and repeats the process until it does not find the best clusters. The value of k should be predetermined in this algorithm.

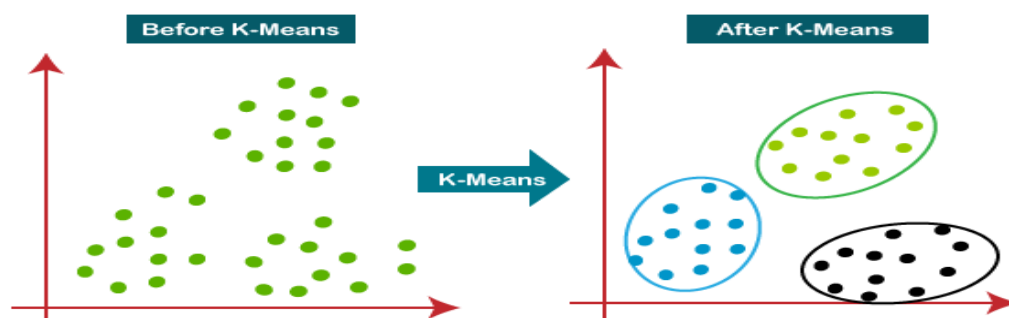
The k-means **clustering**

algorithm mainly performs two tasks:

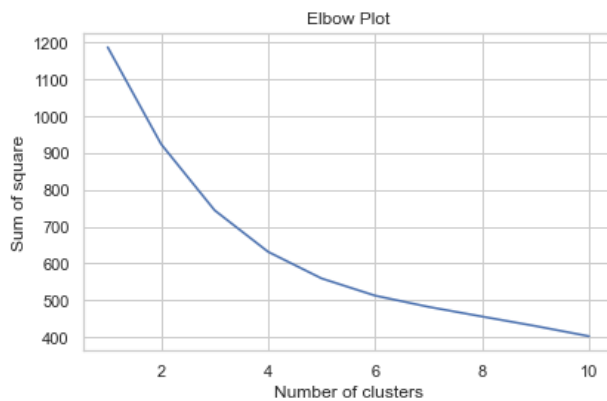
- Determines the best value for K center points or centroids by an iterative process.
- Assigns each data point to its closest k-center. Those data points which are near to the particular k-center, create a cluster.

Hence each cluster has datapoints with some commonalities, and it is away from other clusters.

The below diagram explains the working of the K-means Clustering Algorithm:

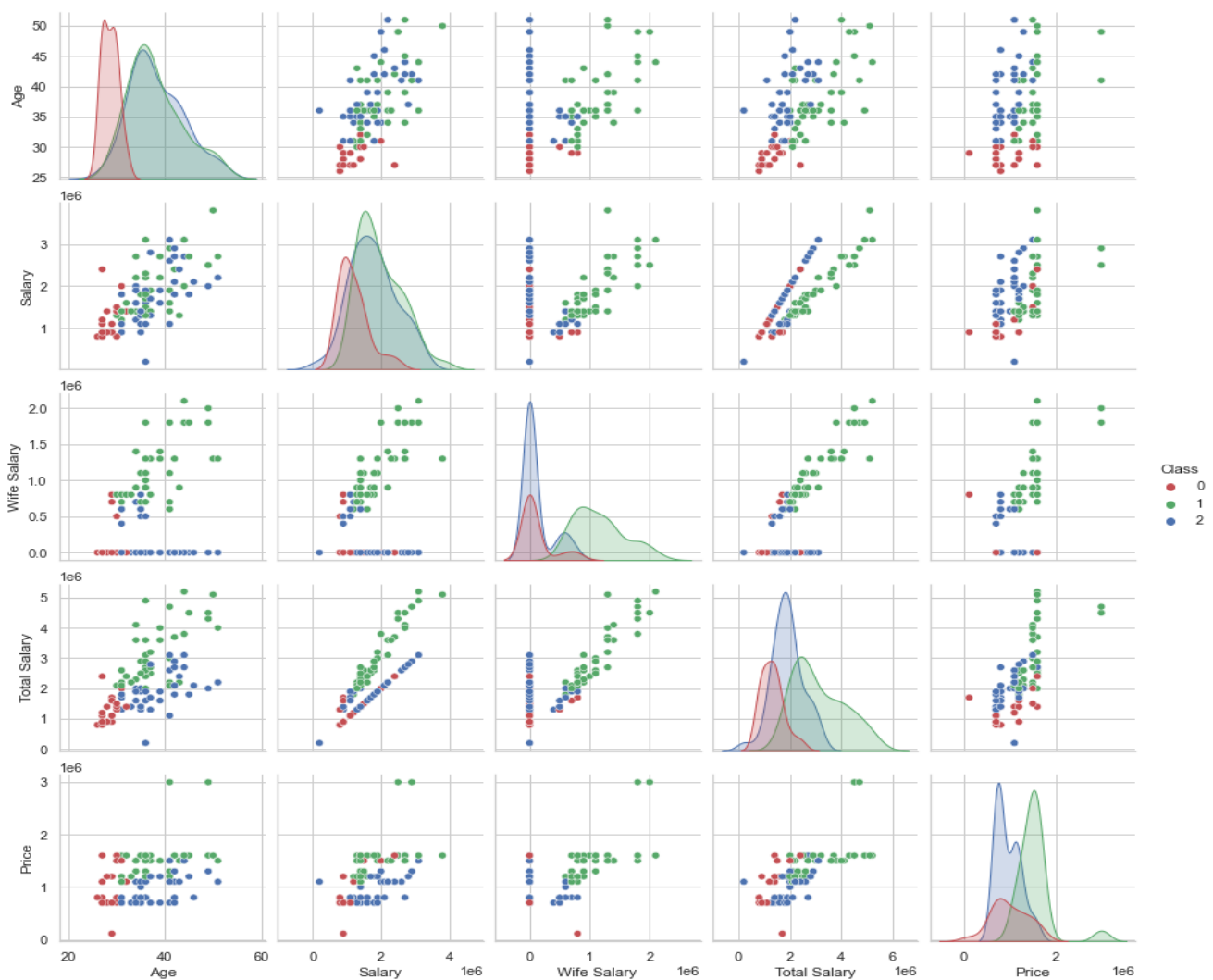


Choosing no. of clustering:

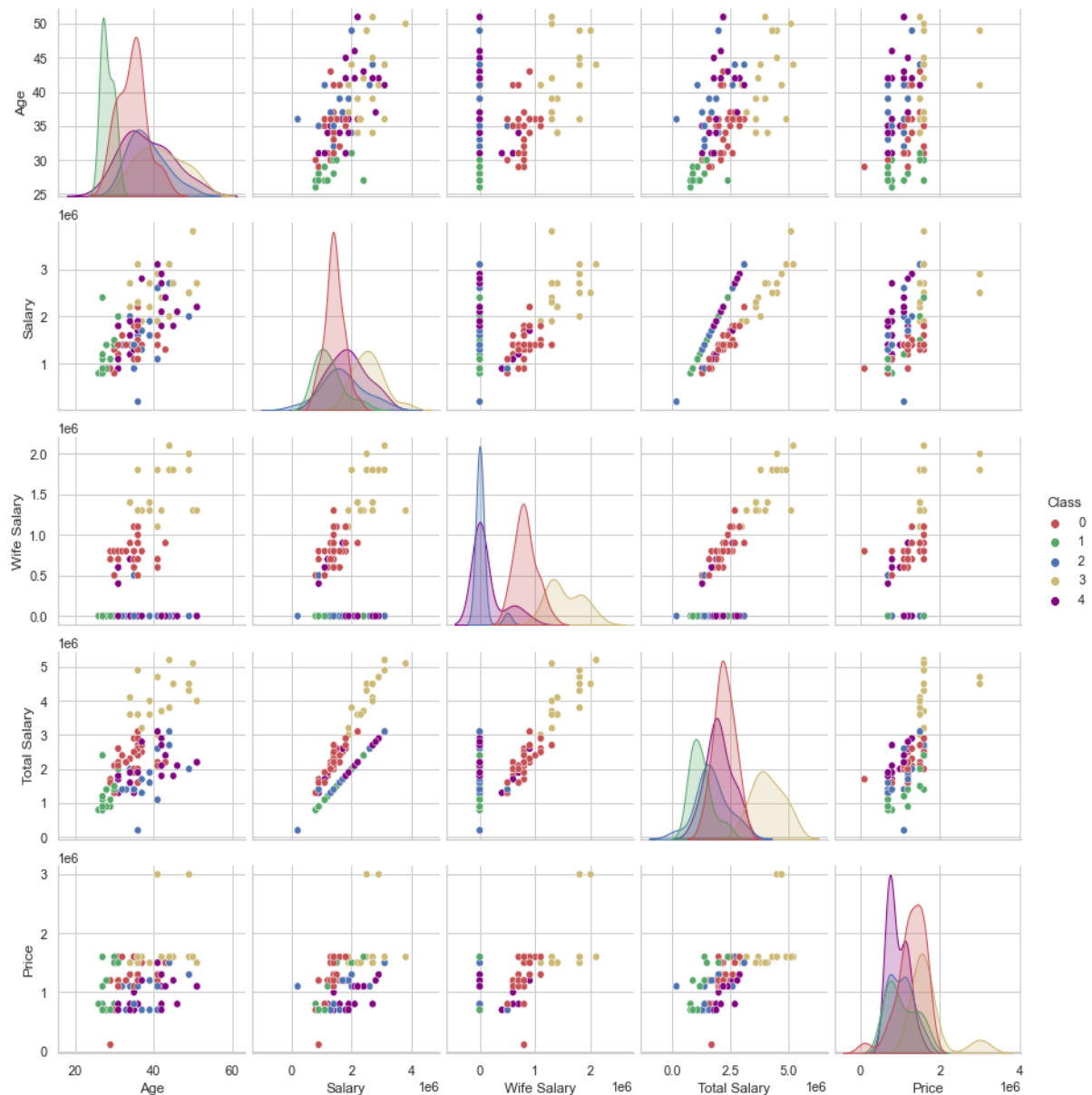


After analysing the plot, we can observe that there are 2 locations where elbows are produced (K=3 and K=5's modest bends serve as visual cues). After determining the potential ideal K value, we will seek out the K value that gives us the proper clustering. In order to train K-Means Clustering, we will use $K = 3$ and $K = 5$.

1. K=3:



2. K=5:



Target segment:

Younger people are more likely to buy products with new technology, especially electric vehicles, because they are aware of the benefits to the environment and want to bring about change. However, our report revealed that younger people tend to buy less expensive vehicles, so the inaffordability of electric vehicles can be a drawback. Then it is recommended to target a group that is still keen to explore new technologies but has sufficient financial means to be able to purchase electric vehicles. These individuals are most likely in the 35 to 50 year age range.

Urban residents who have access to infrastructure and are well-informed about technology's advantages are more likely to buy electric cars.

Marketing Mix:

Product:

The product type would certainly depend on the EV startup, but after conducting our analysis, we determined that for India, it would be better to launch with two-wheelers because they account for the majority of the car market. Due to its affordability and the ability of the present infrastructure to sustain it, most individuals would choose to buy a two-wheeler. Public transportation vehicles are a different product category that EV startups may want to consider because current government laws are in favour of modernising public transportation using electric-based motors.

Place:

Targeted areas should include the country's major cities, especially its metropolitan areas, as these are the locations where infrastructure is most likely to exist. The fact that more people are likely to be aware of and eager to acquire electric vehicles in metropolitan areas is another incentive to focus on them. Based on our geographic study, we have provided a list of the top states for various car kinds. This list promises a healthy market.

Price:

Affordability is a major issue with the growth of Electric Vehicles. It's crucial to remember that the company's product must be affordable to buy and maintain in order to appeal to consumers. The best pricing range for the vehicles is between 10 and 20 lakh, since the majority of consumers would buy in this range.

Promotion:

Promotion depends on the product. Informing people about the advantages of EV/HEV/PHEVs versus fuel-based cars is the finest form of promotion. If the startup develops a product that is reasonably priced, it should unquestionably be pushed.

Github Link :

<https://github.com/RutikYerunkar/Electric-Vehicle-Market-Segmentation.git>

Data source link:

- <https://electricvehicles.in/electric-vehicles-sales-report-in-india-2018/>
- <https://www.kaggle.com/datasets/karivedha/indian-consumers-cars-purchasing-behaviour>