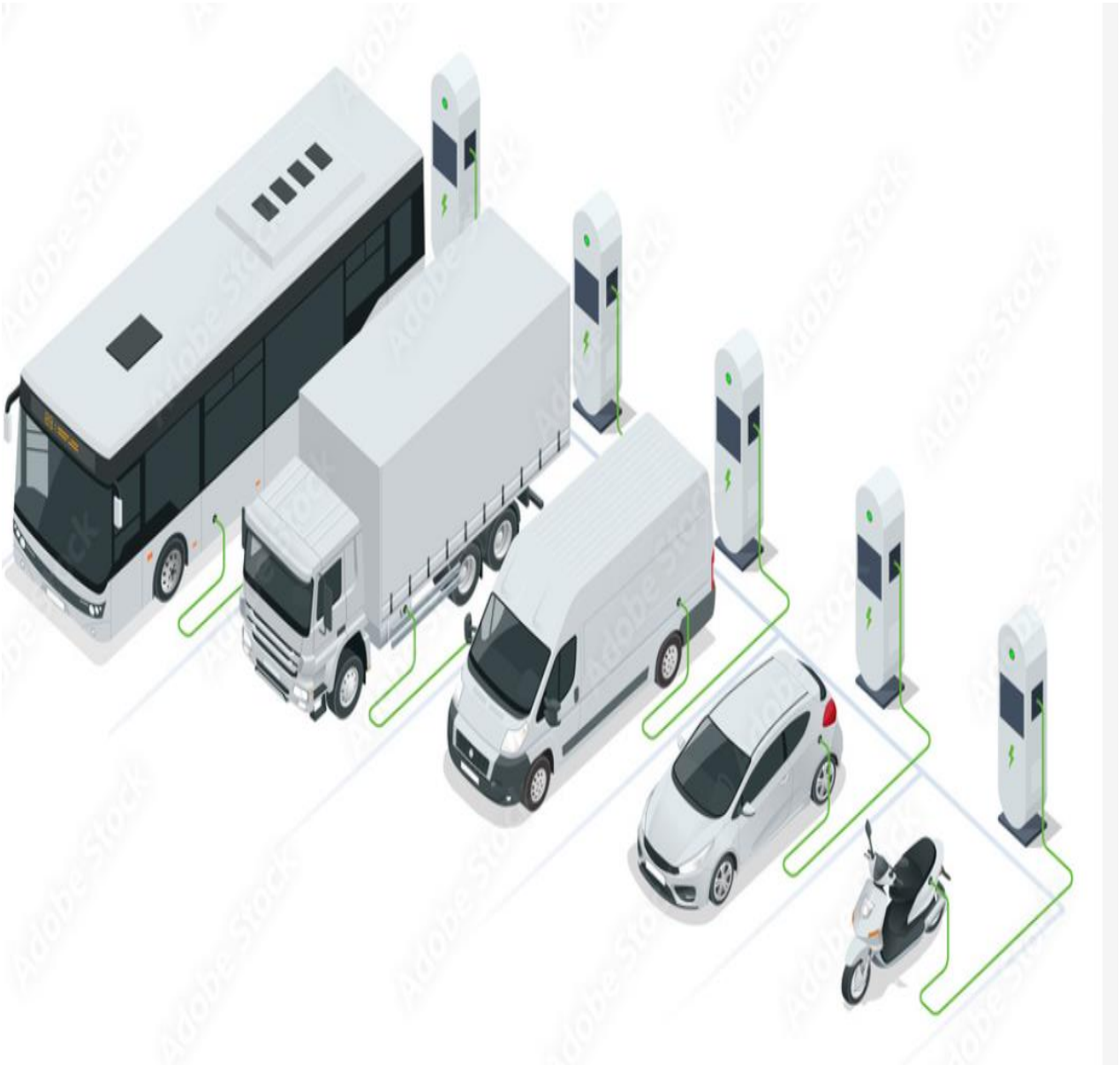
Feynn Labs
Internship Project 2

EV Market Segmentation Analysis for Indian Market



Contributor: Vinay K
Date: 30-08-2024

Introduction

The global electric vehicle (EV) market witnessed substantial growth in 2023, with sales reaching nearly 14 million,a 35% increase from the previous year. This growth expanded the global EV fleet to 40 million vehicles. Projections for 2024 suggest sales could reach 17 million, potentially accounting for 20% of total car sales. While China, Europe, and the USA lead the market, e-mobility is gradually spreading to other regions. Europe saw a notable increase in sales due to stricter CO2 standards and government incentives, despite a decline in Germany caused by subsidy reductions. The number of available EV models is also rising, from 590 in 2023 to a projected 1,000 by 2028.

Indian Context

India's EV market is rapidly expanding, valued at USD 8.03 billion in 2023 and expected to reach USD 117.78 billion by 2032, with a CAGR of 22.4%. The push towards EVs is driven by rising fuel prices, government incentives (such as FAME India), and the need to reduce dependence on imported crude oil. States like Uttar Pradesh, Karnataka, and Tamil Nadu are leading in EV adoption, particularly in two- and three-wheelers due to their affordability and suitability for India's traffic conditions. Major players like Tata Motors and Mahindra & Mahindra are also increasing their EV offerings, further boosting market growth.

Problem Statement

The primary objective of this project is to collect and analyze data related to vehicles, markets, customers, demographics, and more, including electric vehicles. The goal is to extract meaningful insights from these datasets and conduct segmentation of vehicles, markets, and customers. This will provide companies wishing to enter the Indian EV market with valuable insights, helping them decide on strategies such as vehicle segment, customer segment, technical aspects, and pricing.

Data Collection

Data has been collected from the following sources:

1. Data Source 1
2. Data Source 2

Finalized Datasets

After considering various parameters such as geography, cities, vehicle types, and customers, the following datasets were finalized for extracting meaningful insights:

1. Indian Automobile Buying Behavior Study 1.0
2. EV Stats-1
3. Indian-EV-Data

Dataset Columns Explanation

1. Indian Automobile Buying Behavior Study 1.0

- Age: Age of the customer purchasing a car
- Profession: Profession of the customer (Business/Employed)

- Marital Status: Married or Unmarried
- Education: Graduate or Postgraduate
- Number of Dependents: Number of dependents
- Personal Loan: Whether the person has an existing personal loan
- House Loan: Whether the person has a house loan
- Wife's Occupation: Whether the wife has an occupation
- Wife's Salary: Salary of the wife (if working)
- Salary: Salary of the customer
- Total Salary: Combined salary of the customer and wife
- Car Make: Make of the car purchased
- Car Price: Price of the car

2. EV Stats-1

- Serial Number: Unique identifier for records
- State: Indian state
- Two-Wheelers (Category L1 & L2): Specific two-wheeler categories as per Central Motor Vehicles Rules (CMVR)
- Three-Wheelers (Category L5): Specific three-wheeler categories as per CMVR
- Passenger Cars (Category M1): Passenger car category as per CMVR
- Buses: Number of buses in the state
- Total Vehicles in State: Total count of vehicles in the state

Note: Two-wheelers and three-wheelers data are grouped under 'Two-Wheeler' and 'Three-Wheeler' categories to simplify classification.

3**. Indian-EV-Data**

- Model: Vehicle model
- Manufacturer: Vehicle make
- Vehicle Type: Type of two-wheeler (Scooter/Bike)
- Battery Capacity (kWh): Battery capacity of the two-wheeler
- Range per Charge (km): Distance covered on a single charge
- Charging Time: Time taken to fully charge the vehicle
- Price: Price of the two-wheeler

- Power (HP or kW): Power output of the two-wheeler
- Top Speed (km/h): Maximum speed of the vehicle
- Year of Manufacture: Year the vehicle was manufactured
-

Steps Involved in Market Segmentation Project

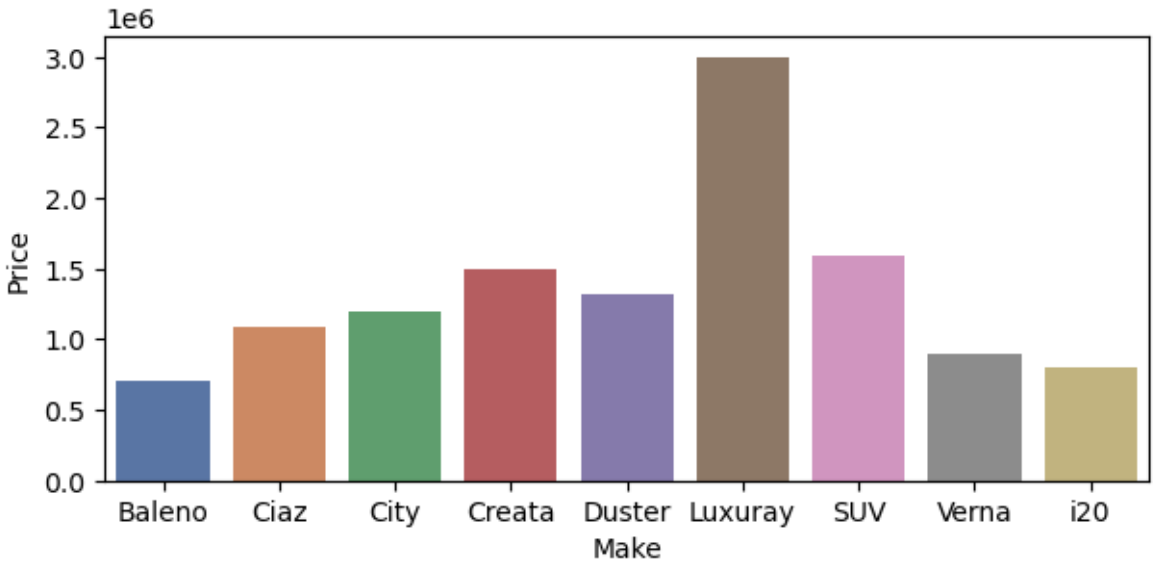
1. Data Import: Import data into Jupyter Notebook using the Pandas library.
2. Data Cleaning: Check for null values, duplicates, missing values, and errors in the datasets.
3. Exploratory Data Analysis (EDA): Perform EDA to gain meaningful insights and visualize them through charts, graphs, etc.
4. Feature Selection: Select features with positive correlations and eliminate those that do not significantly contribute to the analysis.
5. Label Encoding & One-Hot Encoding: Prepare categorical data for analysis.
6. Principal Component Analysis (PCA): Reduce dimensionality for better clustering.
7. Clustering Algorithm: Apply clustering algorithms to segment the data.
8. Plot Clusters: Visualize the clusters.
9. Extract Insights: Derive meaningful insights from the generated clusters.

Exploratory Data Analysis (EDA)

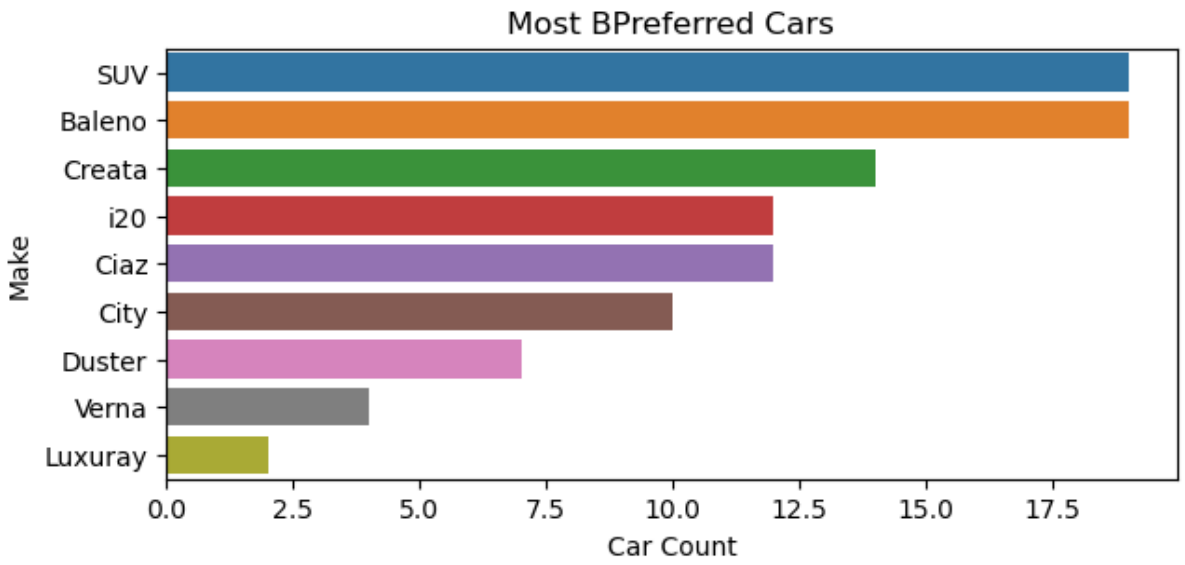
EDA involves analyzing the data to uncover hidden trends and patterns. It includes visualizing the data through graphs such as line graphs, bar graphs, scatter plots, histograms, and maps. EDA helps in understanding the data better without assumptions and can be univariate, bivariate, or multivariate.

EDA for Indian Automobile Buying Behavior Study 1.0

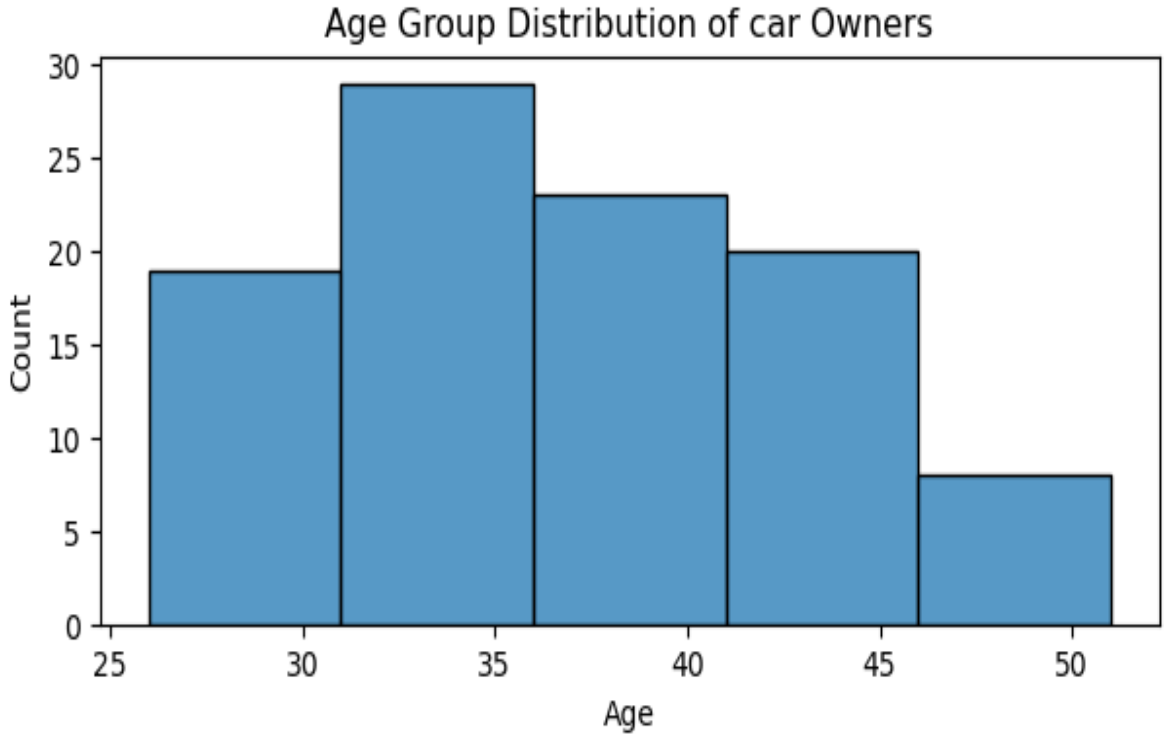
This Data set focuses on Customer, Age, Salary, Car Bought, No of Dependents,spouse salary, Brand Purchased etc .Lets get insights to the data set



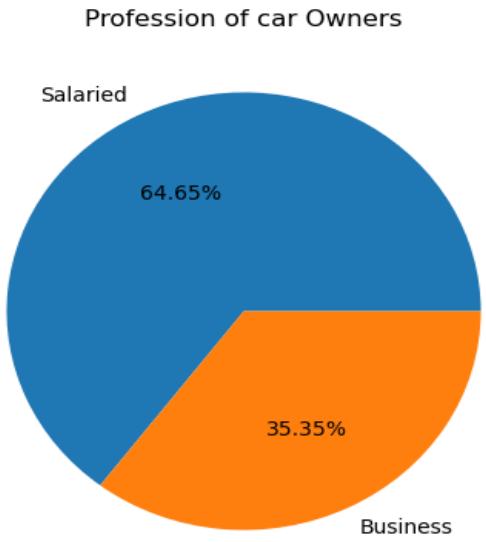
f **Above Bar Graph Illustrates the Average Price of a Car available in Indian Market.**



2.Above Bar Chart Indicates the Most Preferred Car Brands in India



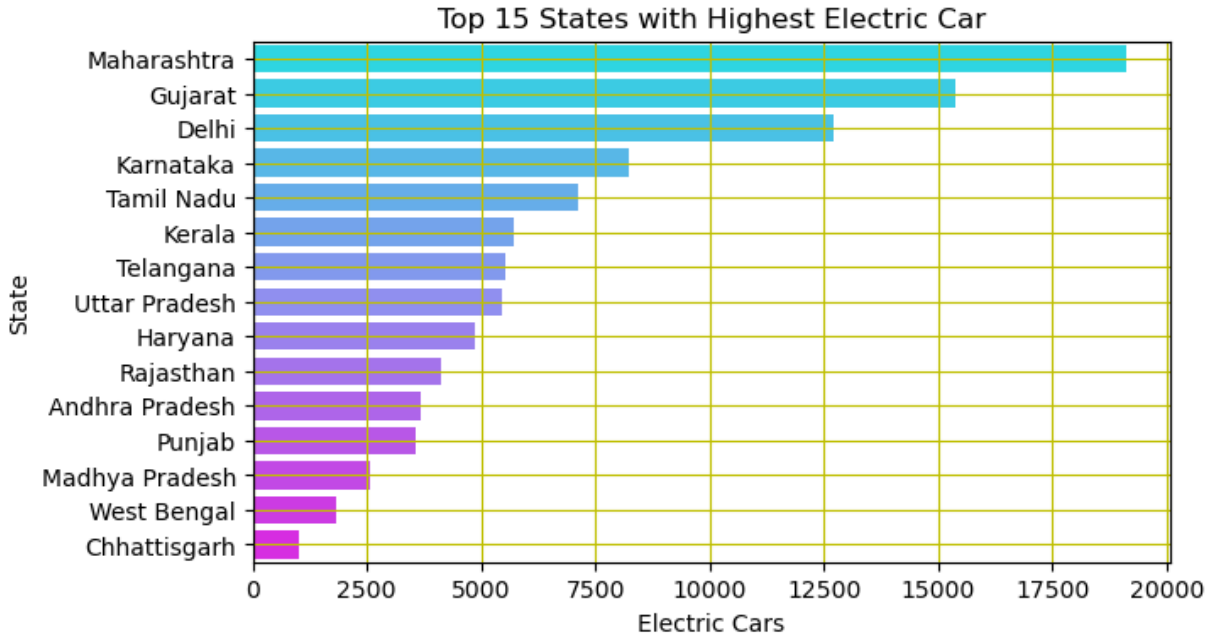
3.Above Histogram Summarizes the Frequency Distribution of Car Owners. Largest Number of Customers are spread in age group 35-40



4)Above Pie Chart Indicated Profession of Car Owners as Percentage of Total

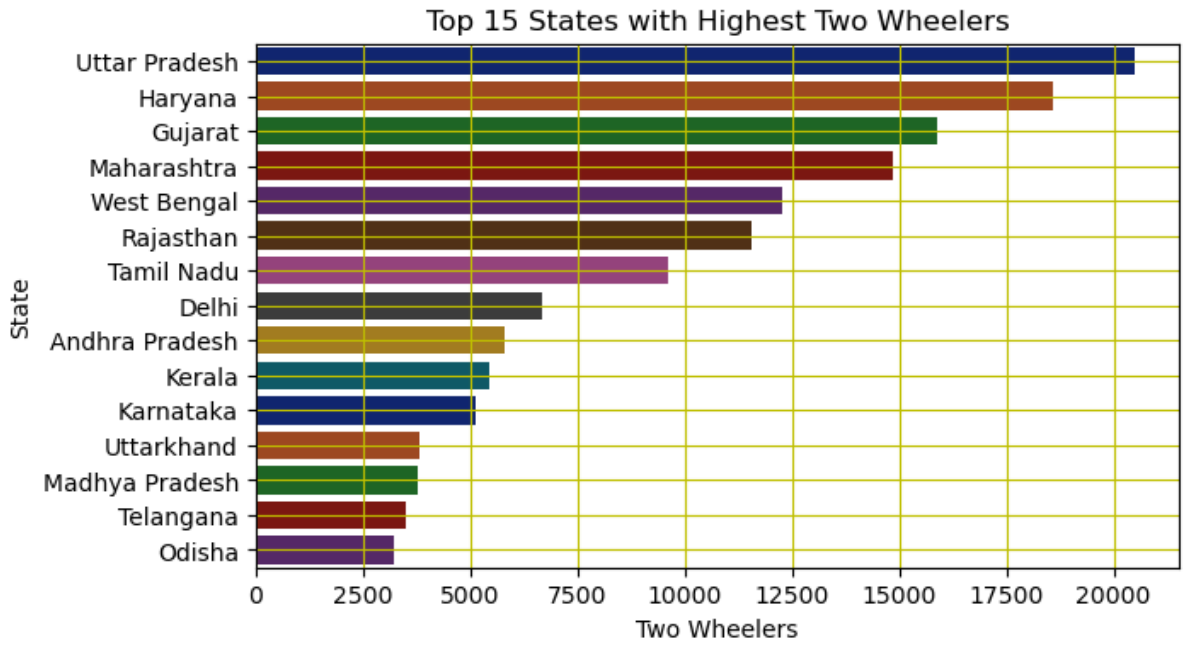
2. EDA for EV Stats-1 Data Set

This Data set Gives an idea of EV'S of Distinct Segments operating in India and their Count. Analysis should focus on states in which specific type of 2 wheeler is operating and Numbers, Further Analysis should be made on observations.



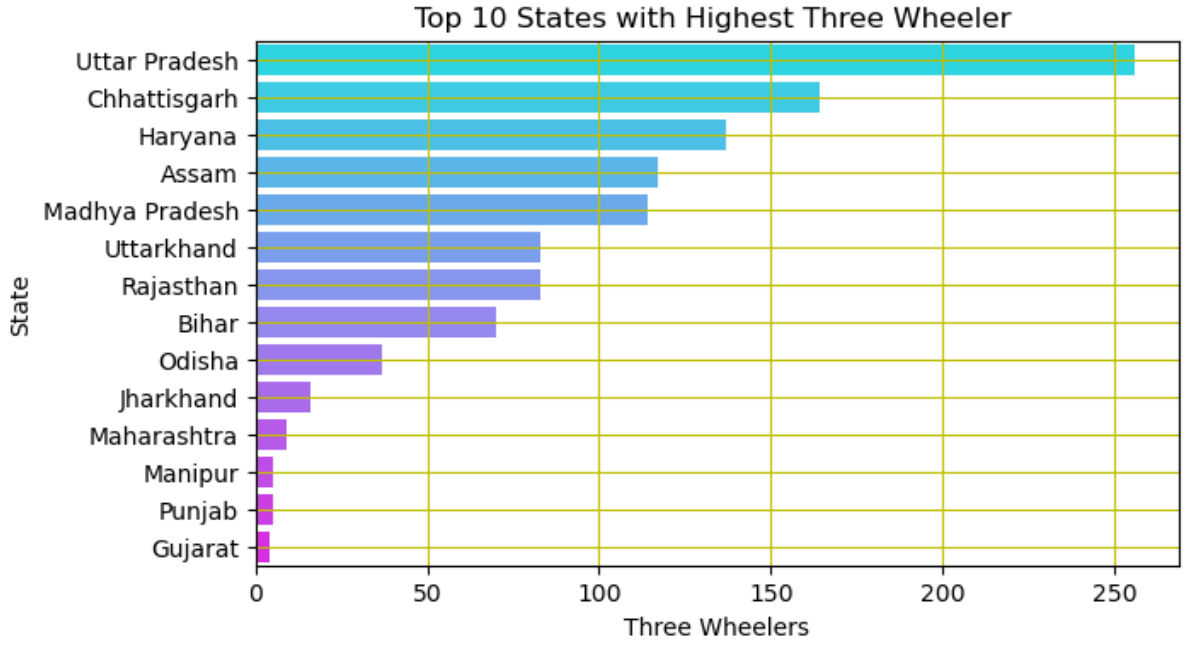
1. A.

Above Bar Chart Shows Top 15 States with Highest Number of Electric Cars. Electric Cars are operating across india with negligible Numbers in North East. Hence further Analysis is needed to expand the scope in North East.

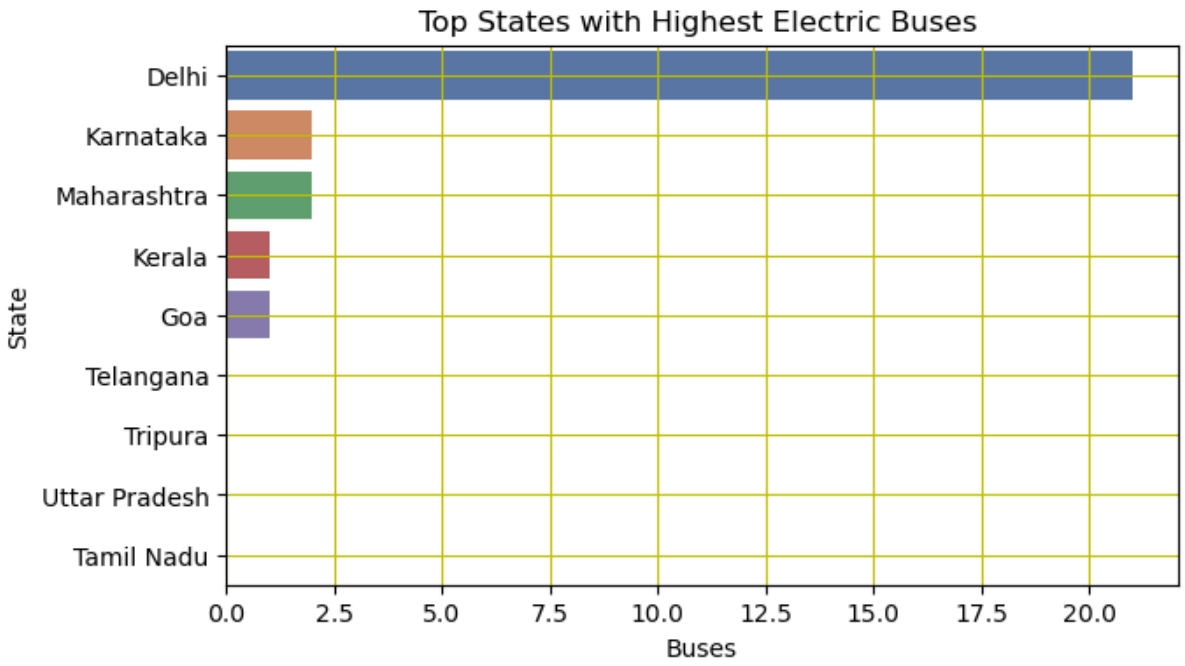


B.

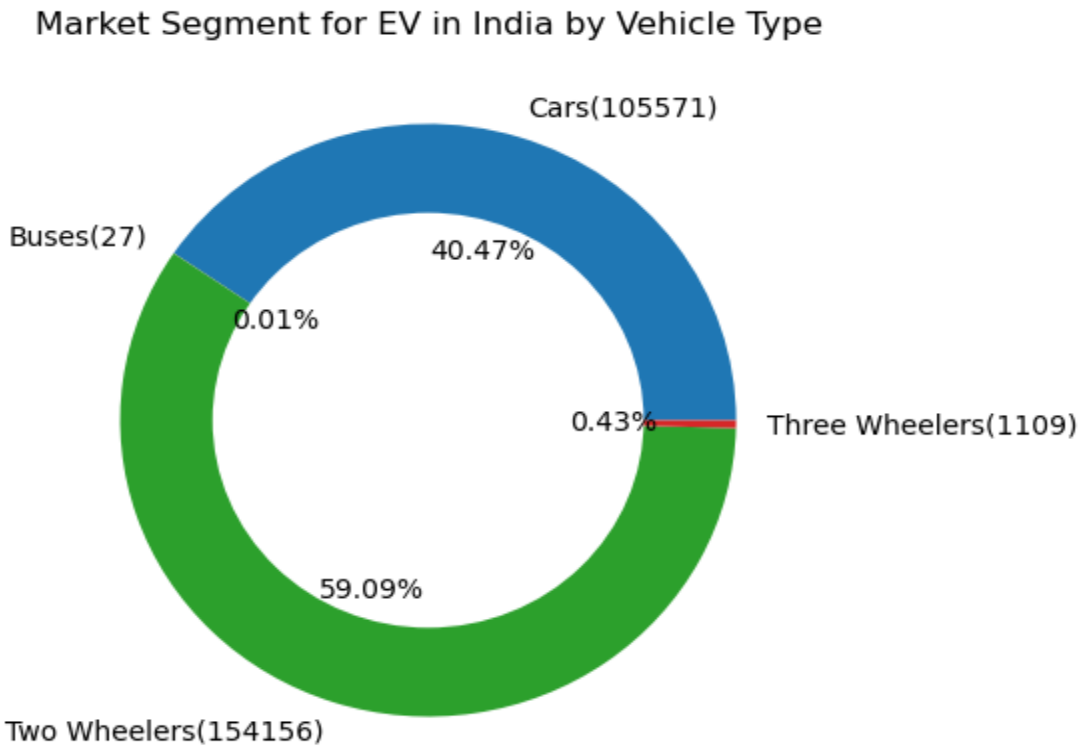
Above Bar Chart Shows Top 15 States with Highest Number of Electric Two Wheelers. Again Two Wheelers operate across india except NorthEast.No conclusion can be made for poor development pf E lectric 2 Wheelers in North East



3.Above Bar Chart Shows Top 15 States with Highest Number of Electric Three Wheelers. Highest Number of 3 Wheelers are operating in Nort india and North East as a means of Public Transport and Neglegible in South india and West india as per Data in Data set.



4. Above Bar Chart Shows Top 15 States with Highest Number of Buses. The Above Graph is a clear indication that Public Transport segment is not well developed and there is a huge scope for vehicles in this segment in all states across india.Total only 5 States has Electric Buses operating.



Above Donut Chart indicates the Market Share of each segment of each Vehicle Category in India. As Indicated Maximum Market of EV'S is Dominated by Two Wheelers(59%),followed by Cars Wheelers(40%).Less than 1 percent is contribution of Three Wheelers and Two Wheelers. Further Data Analysis can potentially open a Market for 3 Wheelers, Buses and Trucks in india.

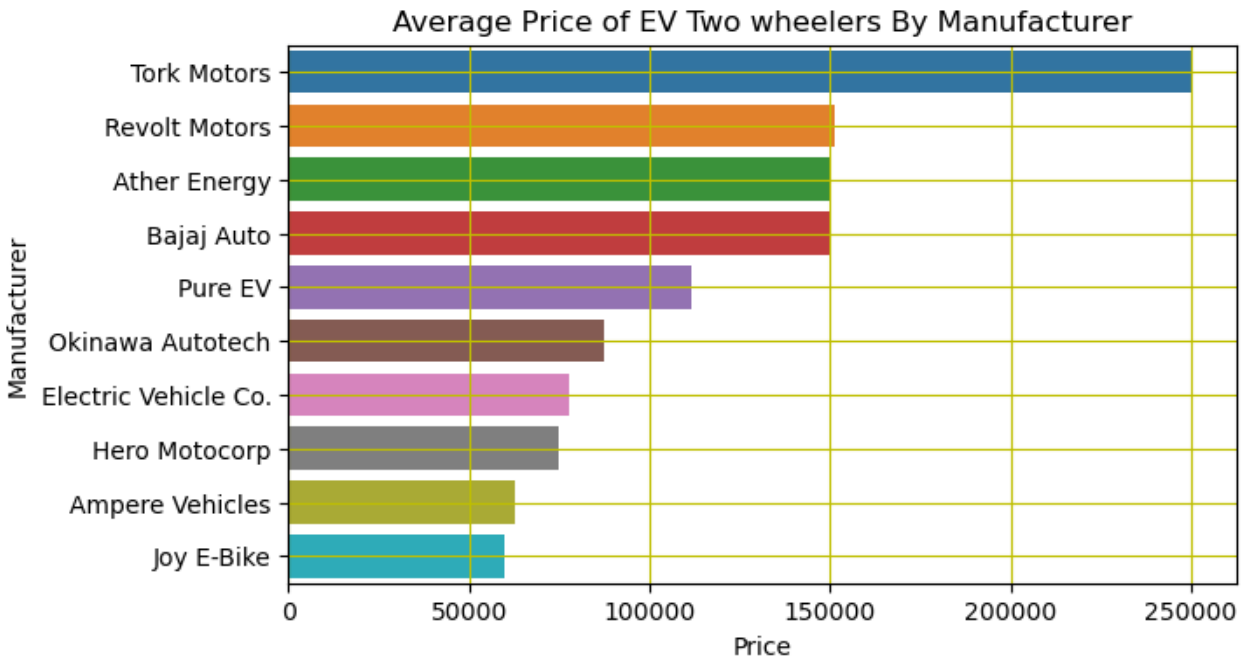
3.Indian-EV-Data

This Data set Has Lists all the Electric Two Wheelers available in India and Price for the same with other parameters like Make, Model, Power Torque etc, Lets Analyse this Data Set using EDA.

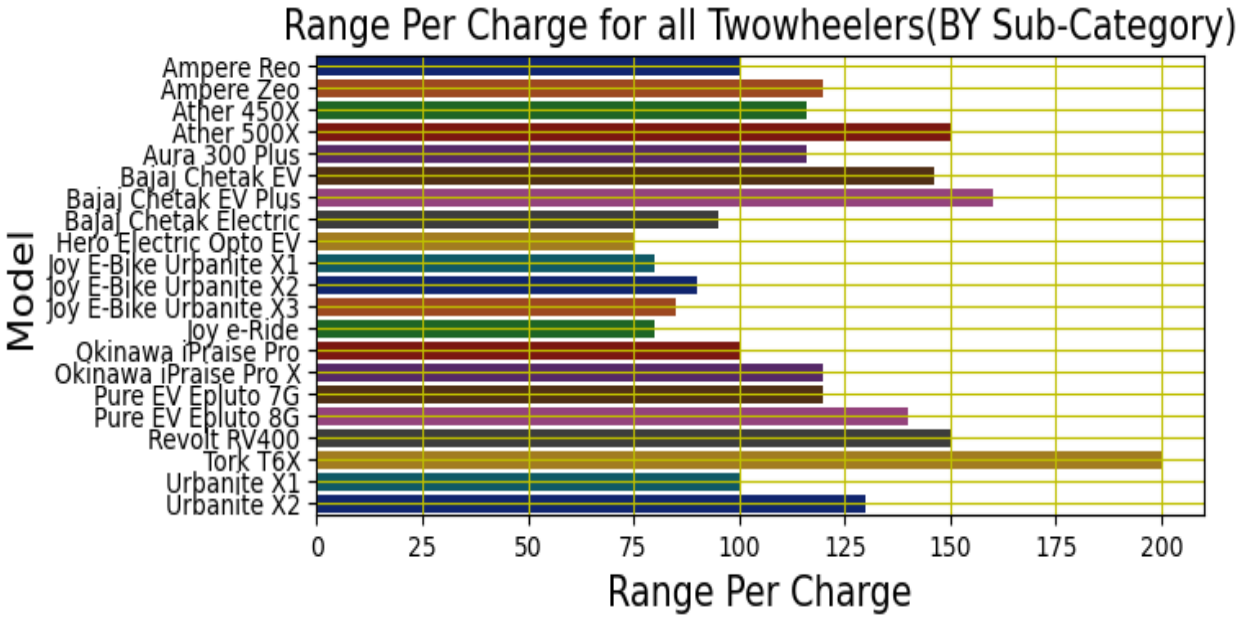
Top Brands in India Manufacturing EV

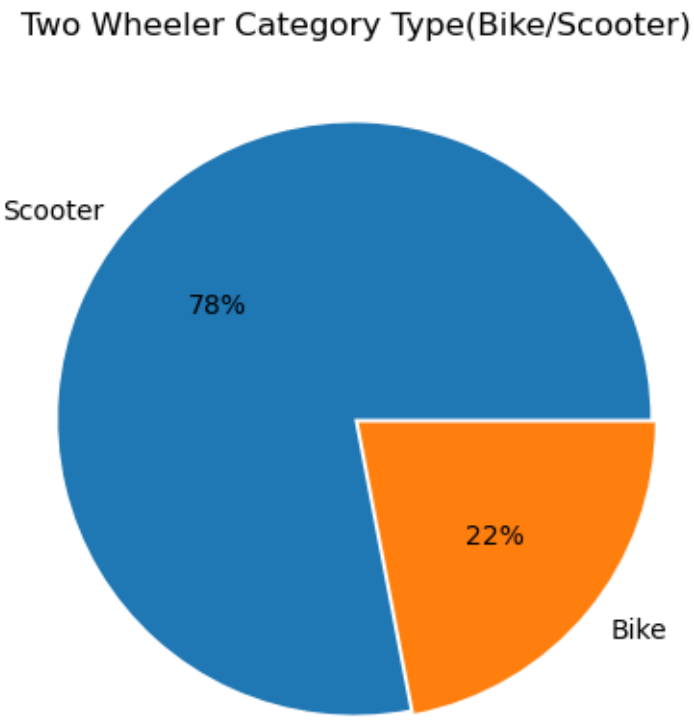
e

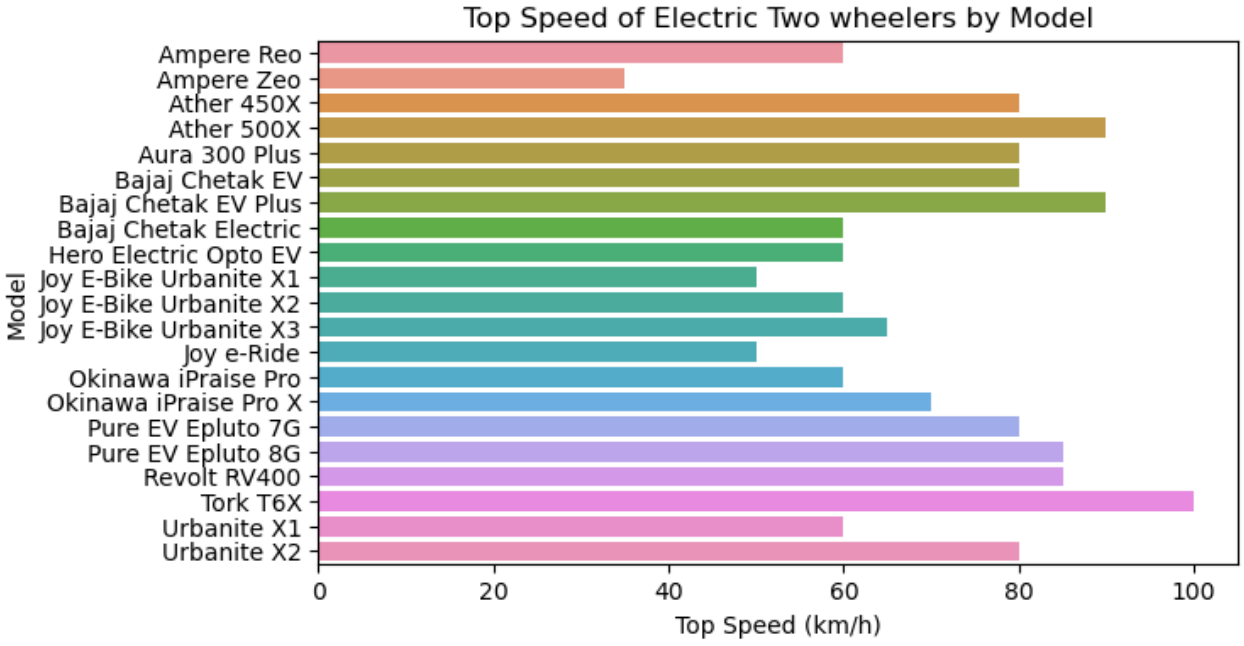
EV Two Wheelers Models in India

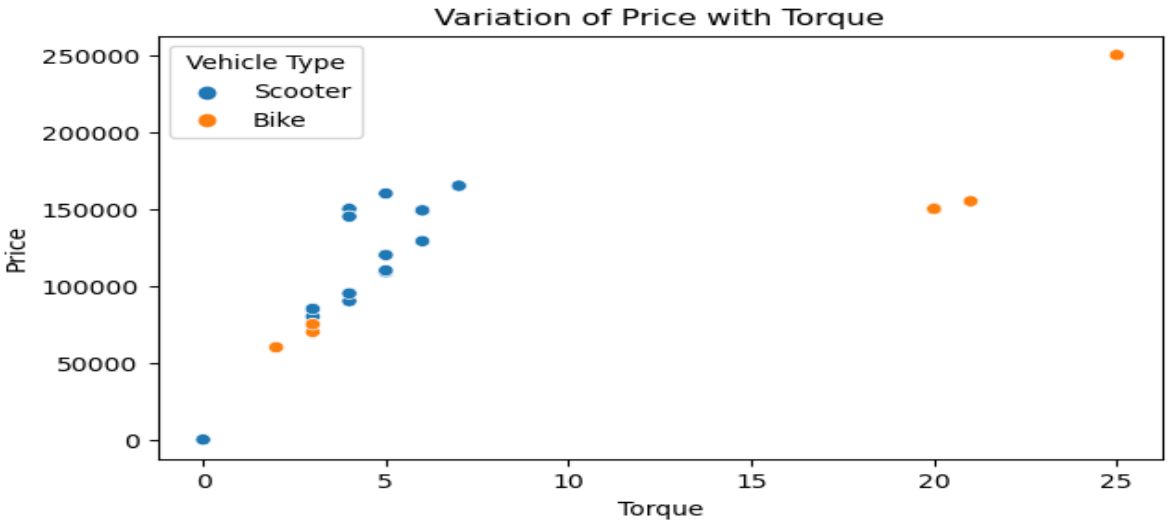


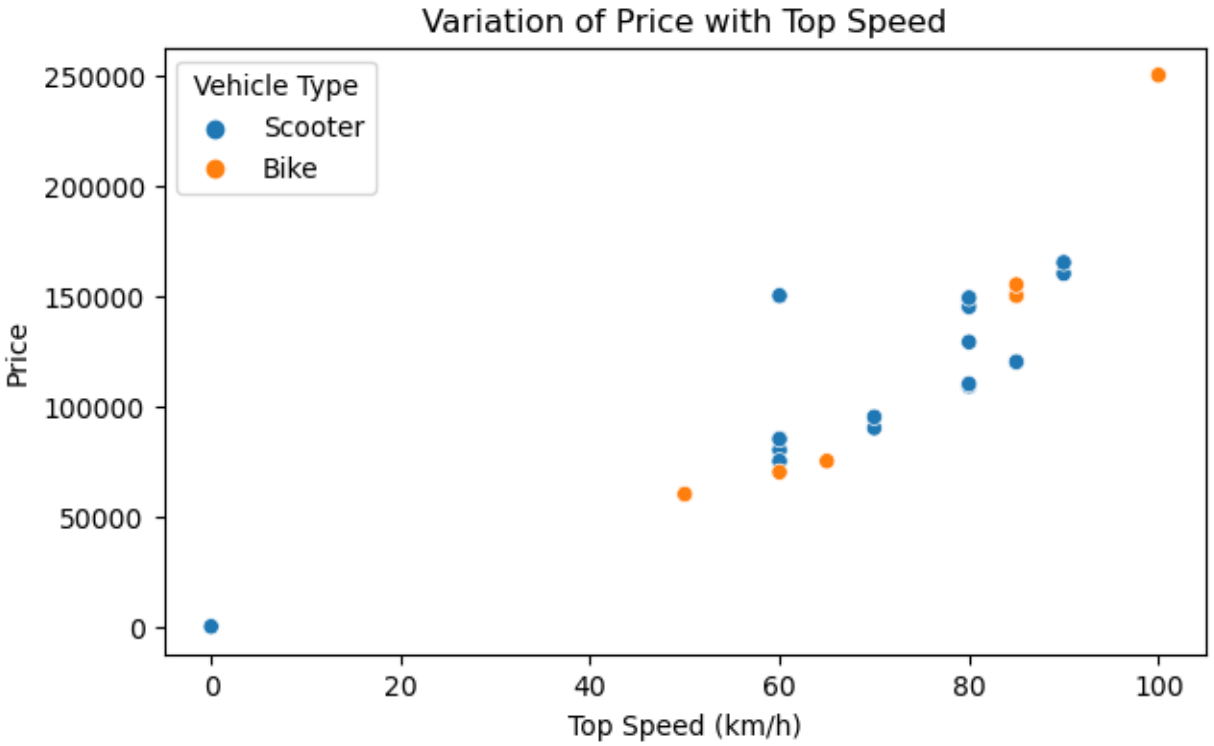
Average Price of Electric Two Wheelers By Manufacturer



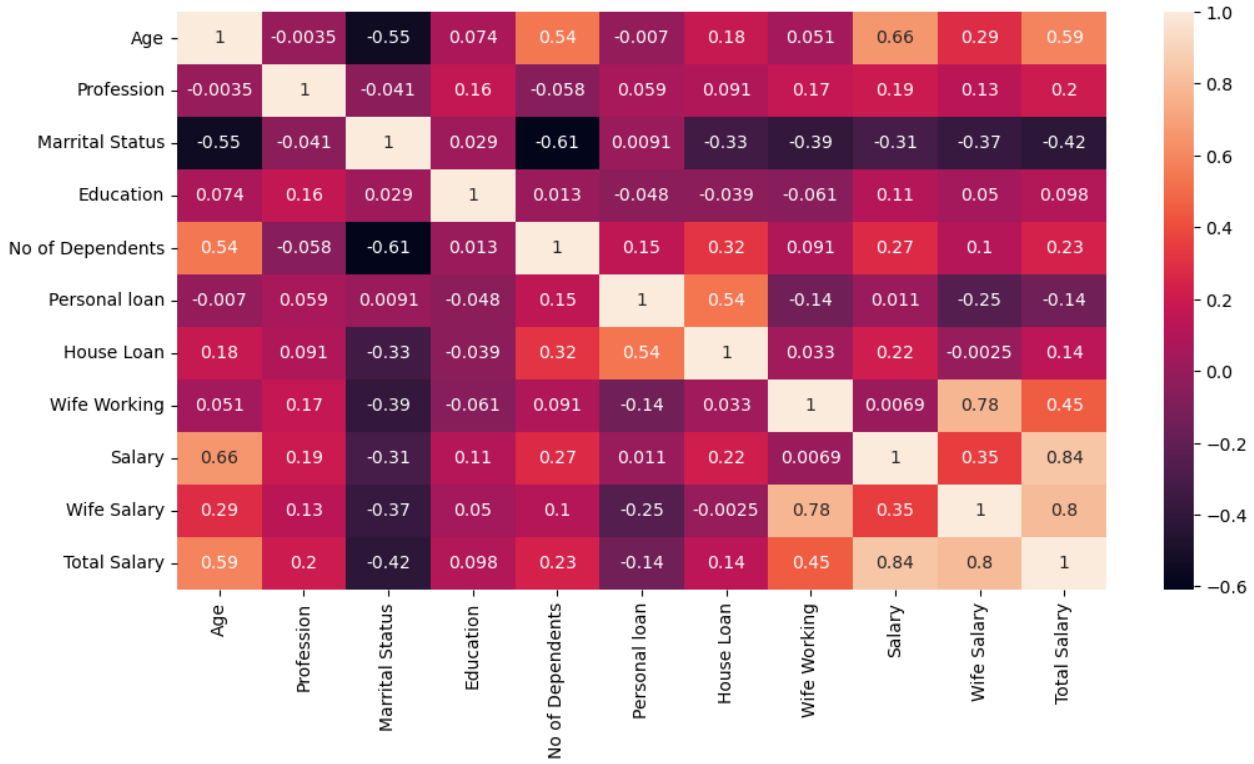

Two Wheeler Category Type(Bike/Scooter)
Scooter
78%
22%
Bike


Top Speed of Electric Two wheelers by Model
Model
Ampere Reo
Ampere Zeo
Ather 450X
Ather 500X
Aura 300 Plus
Bajaj Chetak EV
Bajaj Chetak EV Plus
Bajaj Chetak Electric
Hero Electric Opto EV
Joy E-Bike Urbanite X1
Joy E-Bike Urbanite X2
Joy E-Bike Urbanite X3
Joy e-Ride
Okinawa iPraise Pro
Okinawa iPraise Pro X
Pure EV Epluto 7G
Pure EV Epluto 8G
Revolt RV400
Tork T6X
Urbanite X1
Urbanite X2
0
20
40
60
80
100
Top Speed (km/h)


Variation of Price with Torque
Vehicle Type
Scooter
Bike
Price
250000
200000
150000
100000
50000
0
0
5
10
15
20
25
Torque


Variation of Price with Top Speed
Vehicle Type
Scooter
Bike
Price
250000
200000
150000
100000
50000
0
0
20
40
60
80
100
Top Speed (km/h)

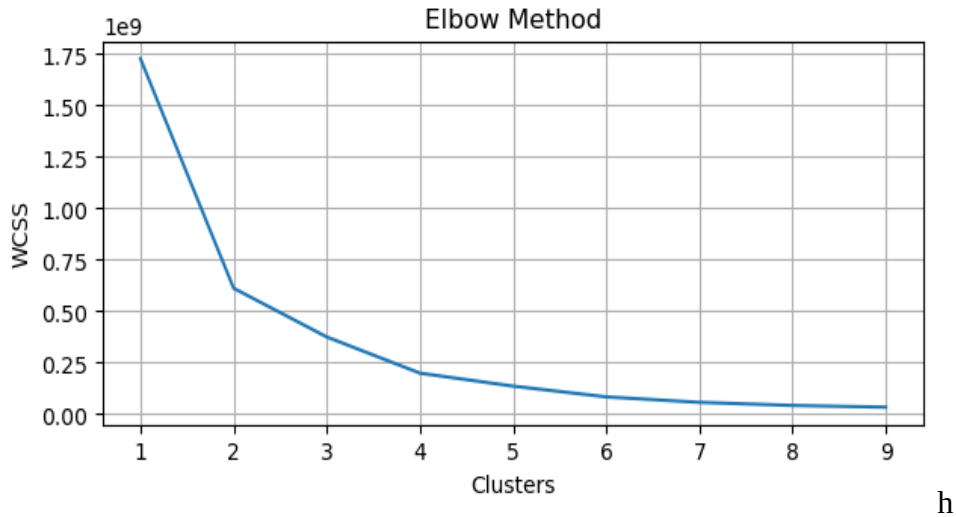
Corelation for one of the Data sets Used



Corelation Matrix for Customer Behaviour Data set. Please Note that Higher the Value higher is correlation. Those with a negative correlation can be excluded and this way we can eliminate few Features.

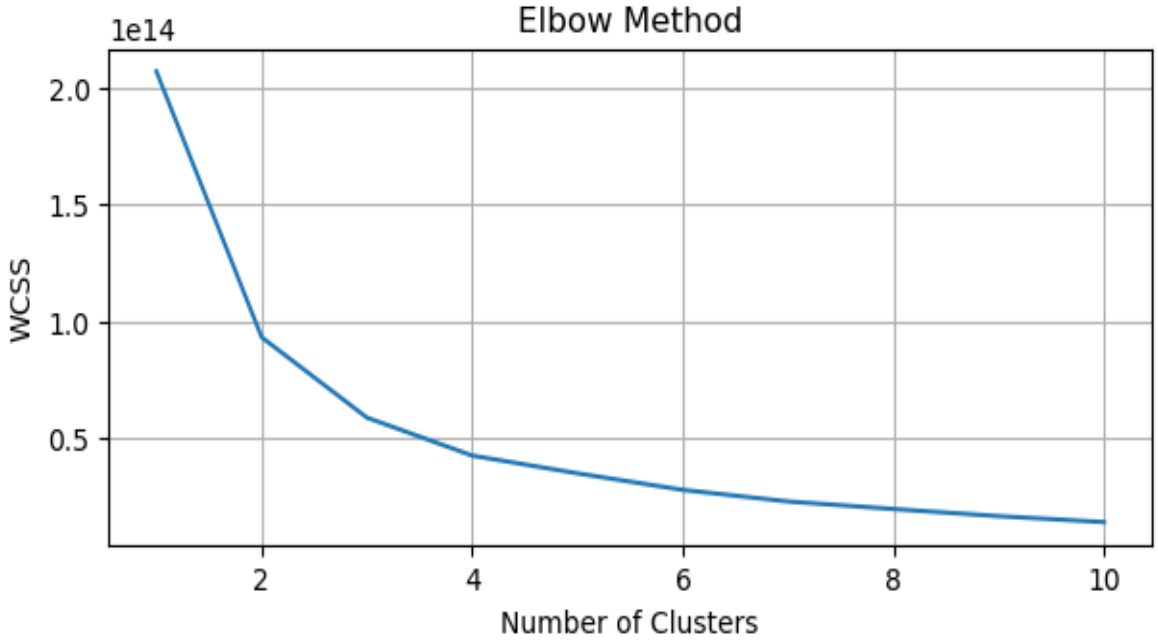
K-Means Clustering

K-Means clustering is an Unsupervised learning technique that's used for clustering the data set into clusters based on patterns in the data we are calculating WCSS (Within-Cluster Sum of Square). WCSS is the sum of squared distance between each point and the centroid in a cluster. When we plot the WCSS with the K value, the plot looks like an Elbow. WCSS is highest when Number of clusters is 1 and keeps on increasing. We Iterate from 1 to 11 and plot the graph and point where elbow is formed indicates number of segments.



h

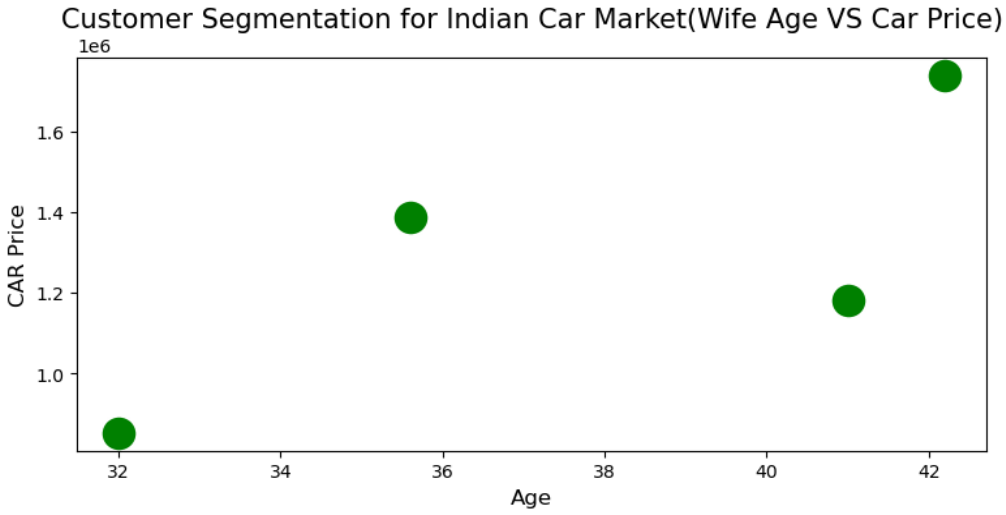
A.Market Segmentation for Indian Automobile Buying Behavior Study 1.0
Attached is the Elbow Chart for the above Data set.

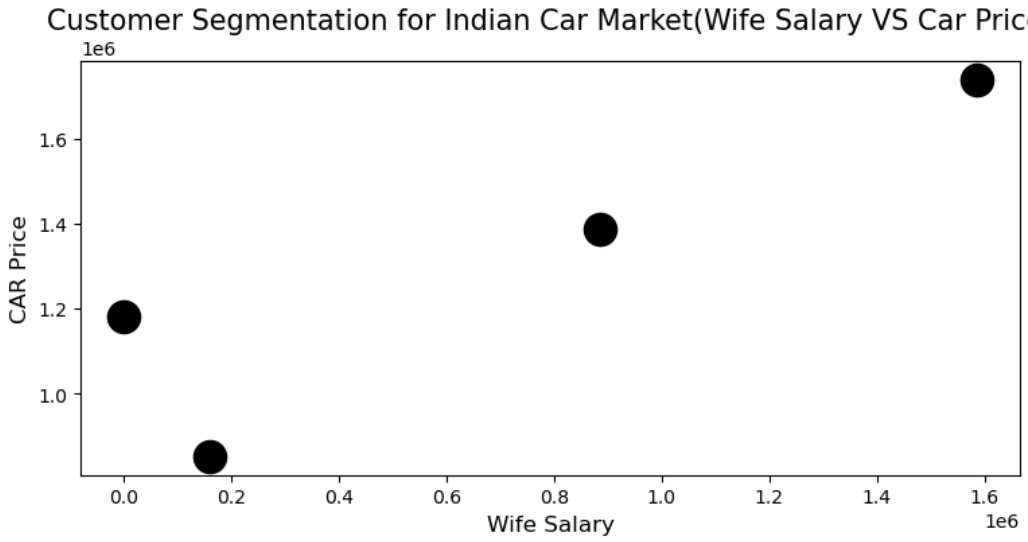


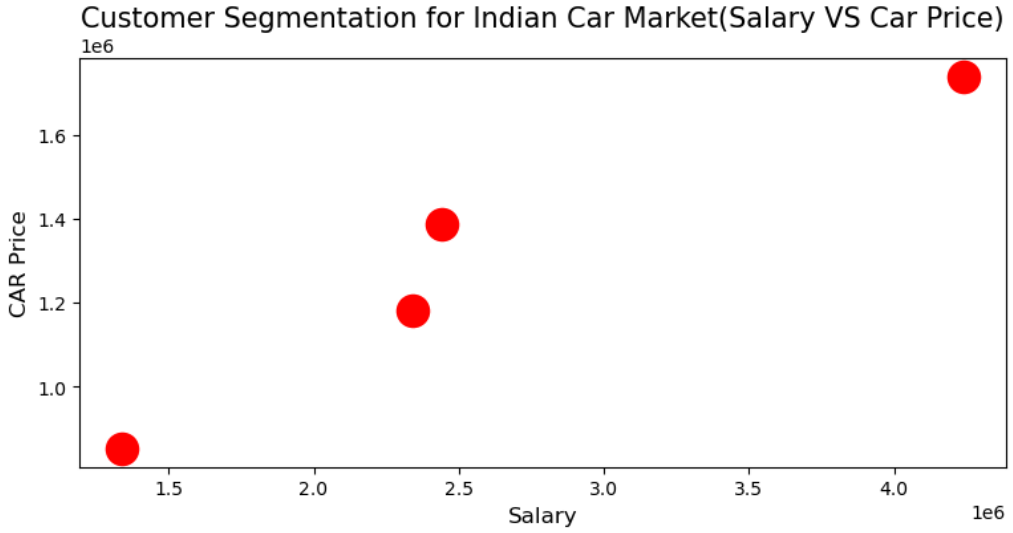
From the above we can observe that Number of clusters=3 and entire Data set will be divided to 3 Clusters and below is the count of each segment.

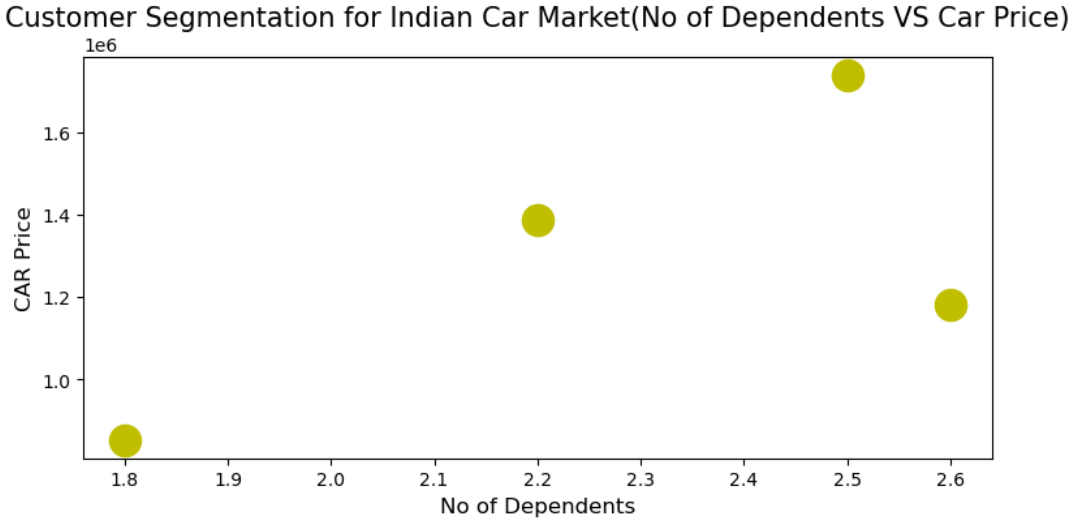
Cluster_No	count
1	38
3	26
0	20
2	15

Split Based on Distinct Parameters is as follows.




Customer Segmentation for Indian Car Market(Wife Salary VS Car Price)
1e6
1.6
1.4
1.2
1.0
CAR Price
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1e6
Wife Salary


Customer Segmentation for Indian Car Market(Salary VS Car Price)
1e6
1.6
1.4
1.2
1.0
CAR Price
1.5
2.0
2.5
3.0
3.5
4.0
1e6
Salary

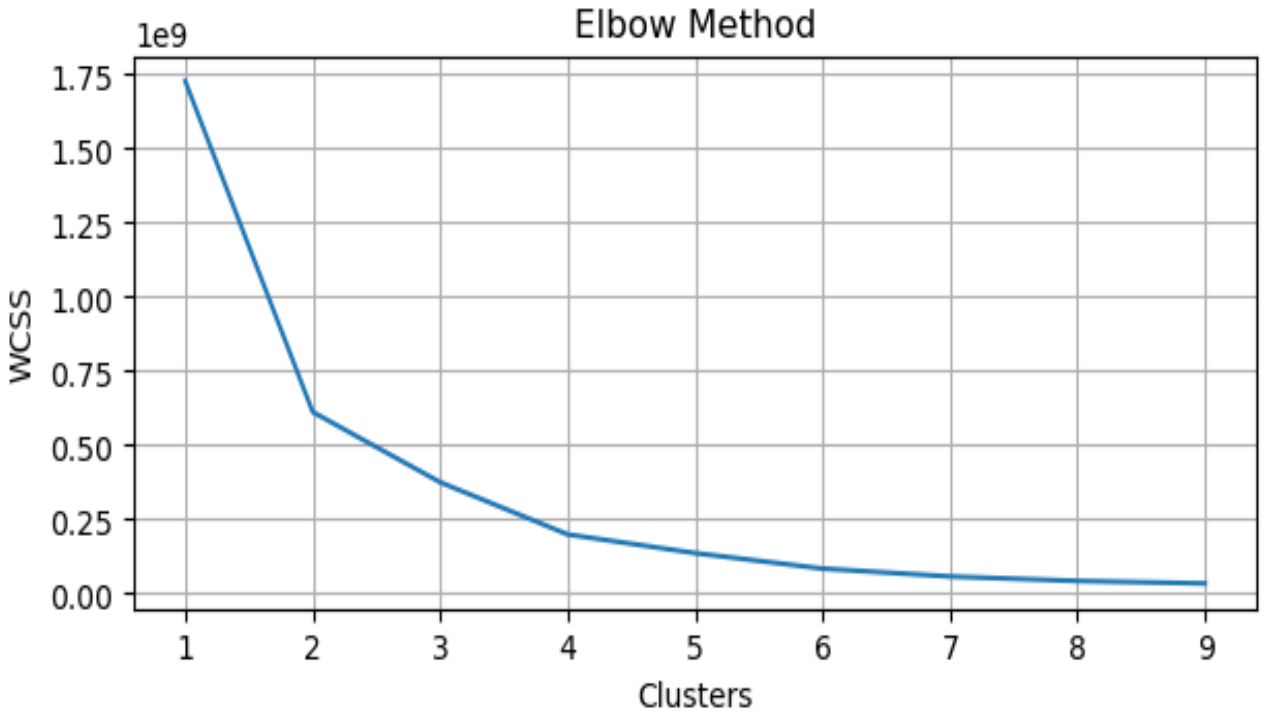

Customer Segmentation for Indian Car Market(No of Dependents VS Car Price)
1e6
1.6
1.4
1.2
1.0
CAR Price
1.8
1.9
2.0
2.1
2.2
2.3
2.4
2.5
2.6
No of Dependents

Clustered Data Set for Customers

	Age	Profession	Marrital Statu	Education	No of Dependents	Personal loan	House Loan	Wife Working	Salary	Wife Salary	Total Salary	Make	Price	Segme
2	45	0	0	0	4	1	1	0	1800000	0	1800000	Duster	1200000	3
8	34	0	0	1	4	0	0	0	2000000	0	2000000	Verna	1100000	3
34	42	1	0	0	4	1	1	0	2100000	0	2100000	Ciaz	1100000	3
50	49	0	0	1	4	0	0	0	2000000	0	2000000	Duster	1300000	3
52	44	1	0	1	4	0	0	0	2700000	0	2700000	SUV	1600000	3
55	41	1	0	1	3	1	1	0	3100000	0	3100000	Creata	1500000	3
56	41	1	0	0	3	0	0	0	2600000	0	2600000	Ciaz	1100000	3
62	31	0	1	0	0	0	0	0	2000000	0	2000000	SUV	1500000	3
67	39	1	0	1	2	0	0	0	1900000	0	1900000	City	1200000	3
76	36	0	0	1	2	1	1	0	1900000	0	1900000	i20	800000	3
78	44	1	0	1	3	0	0	0	3100000	0	3100000	Creata	1500000	3
80	46	1	0	0	3	1	1	0	2100000	0	2100000	Baleno	800000	3
82	43	1	0	1	3	1	1	0	2400000	0	2400000	Ciaz	1100000	3
83	42	1	0	1	2	0	1	0	2900000	0	2900000	Duster	1300000	3
84	42	1	0	0	3	1	1	0	2700000	0	2700000	i20	800000	3
89	34	0	0	1	3	1	1	0	1900000	0	1900000	Baleno	700000	3
92	37	1	0	0	2	0	1	0	2800000	0	2800000	City	1200000	3
94	27	0	1	0	0	0	0	0	2400000	0	2400000	SUV	1600000	3
96	51	0	0	0	2	1	1	0	2200000	0	2200000	Ciaz	1100000	3
98	51	1	0	1	2	1	1	0	2200000	0	2200000	Ciaz	1100000	3
1	35	1	0	1	2	1	1	1	1400000	600000	2000000	Ciaz	1000000	2
3	41	0	0	1	3	0	0	1	1600000	600000	2200000	City	1200000	2
4	31	1	0	1	2	1	0	1	1800000	800000	2600000	SUV	1600000	2
10	35	1	0	1	4	0	0	1	1300000	700000	2000000	SUV	1600000	2
20	37	1	0	1	3	0	1	1	1700000	800000	2500000	City	1200000	2
22	36	0	0	0	3	0	0	1	1400000	1000000	2400000	SUV	1600000	2
24	35	1	0	0	3	1	0	1	1400000	600000	2000000	Ciaz	1100000	2
25	35	1	0	0	2	0	0	1	1800000	1100000	2900000	SUV	1600000	2
28	36	1	0	1	3	1	1	1	1700000	900000	2600000	Verna	1200000	2
29	36	1	0	1	2	0	0	1	1800000	900000	2700000	SUV	1600000	2
31	41	1	0	0	3	0	0	1	1400000	700000	2100000	Duster	1300000	2
32	41	1	0	1	4	0	1	1	1900000	1100000	3000000	Creata	1500000	2
33	43	0	0	0	3	0	0	1	1300000	900000	2200000	Creata	1500000	2
37	30	1	0	1	0	0	0	1	1300000	800000	2100000	Creata	1500000	2
39	31	1	0	0	0	0	0	1	1400000	800000	2200000	Ciaz	1100000	2
42	32	1	0	0	0	0	0	1	1600000	800000	2400000	SUV	1600000	2
43	34	1	0	1	3	0	0	1	1400000	900000	2300000	Duster	1300000	2
47	36	0	0	0	2	0	1	1	1500000	1100000	2600000	Duster	1300000	2
49	36	1	0	0	3	1	0	1	2200000	900000	3100000	Creata	1500000	2
64	31	1	0	0	2	0	1	1	1400000	700000	2100000	Ciaz	1100000	2
70	37	0	0	1	2	0	0	1	1400000	1300000	2700000	Duster	1500000	2
71	37	1	0	1	2	0	1	1	1900000	1300000	3200000	SUV	1600000	2
73	35	1	0	1	0	0	0	1	1400000	1100000	2500000	SUV	1600000	2
74	36	0	0	0	0	0	0	1	1300000	700000	2000000	City	1200000	2
77	36	0	0	0	3	0	1	1	1800000	1100000	2900000	SUV	1600000	2
87	33	1	0	1	2	0	0	1	1400000	800000	2200000	City	1200000	2
15	49	1	0	1	4	0	0	1	2500000	2000000	4500000	Luxuray	3000000	1
35	42	1	0	1	3	0	0	1	2400000	1300000	3700000	SUV	1600000	1
45	34	1	0	0	3	0	1	1	2200000	1400000	3600000	Creata	1500000	1
51	49	1	0	1	3	0	0	1	2500000	1800000	4300000	SUV	1600000	1
53	44	0	0	1	3	0	0	1	2000000	1800000	3800000	Creata	1500000	1
54	41	1	0	0	2	0	0	1	2900000	1800000	4700000	Luxuray	3000000	1
66	39	0	0	0	2	1	1	1	2200000	1400000	3600000	Creata	1500000	1
68	39	1	0	1	2	1	1	1	2700000	1300000	4000000	Creata	1500000	1
75	36	1	0	1	2	0	0	1	2300000	1300000	3600000	Creata	1500000	1
79	45	1	0	1	2	0	1	1	2700000	1800000	4500000	SUV	1600000	1
81	44	0	0	0	2	0	0	1	3100000	2100000	5200000	SUV	1600000	1
88	34	1	0	0	2	0	1	1	2700000	1400000	4100000	Creata	1500000	1
91	36	1	0	1	3	1	1	1	3100000	1800000	4900000	SUV	1600000	1
95	50	1	0	1	3	0	0	1	3800000	1300000	5100000	SUV	1600000	1
97	51	1	0	1	2	0	0	1	2700000	1300000	4000000	Creata	1500000	1
0	27	1	1	1	0	1	0	0	800000	0	800000	i20	800000	0
5	28	1	0	0	3	1	1	0	900000	0	900000	Baleno	700000	0
6	31	1	0	0	4	0	0	1	1200000	600000	1800000	City	1200000	0
7	33	0	0	1	4	0	0	0	1400000	0	1400000	Baleno	700000	0
9	34	1	0	0	3	1	1	1	1200000	700000	1900000	i20	800000	0
11	35	1	0	0	4	1	1	2	1400000	0	1400000	Baleno	700000	0
12	29	1	0	1	0	0	0	1	900000	800000	1700000	Verna	110000	0
13	30	0	1	1	2	1	0	0	1400000	0	1400000	i20	800000	0
14	31	0	0	0	3	1	1	1	900000	400000	1300000	Baleno	700000	0
16	26	1	1	1	0	0	0	0	800000	0	800000	i20	800000	0
17	27	1	1	0	0	1	0	1	800000	0	800000	Baleno	700000	0
18	29	1	1	1	2	0	0	0	900000	0	900000	City	1200000	0
19	30	1	0	0	0	0	0	1	800000	500000	1300000	Baleno	700000	0
21	35	0	0	0	3	0	1	1	1100000	800000	1900000	i20	800000	0
23	35	0	0	1	4	0	0	1	900000	500000	1400000	Baleno	700000	0
26	35	1	0	1	4	1	1	0	1300000	0	1300000	Baleno	700000	0
27	36	0	0	0	3	0	0	0	1600000	0	1600000	i20	800000	0
30	41	0	0	0	3	0	0	0	1100000	0	1100000	Baleno	700000	0
36	29	0	0	1	0	0	0	1	900000	700000	1600000	City	1200000	0
38	30	0	1	1	0	0	0	0	1400000	0	1400000	SUV	1600000	0
40	31	0	0	1	3	1	1	1	1100000	600000	1700000	i20	800000	0
41	32	0	0	1	0	0	0	0	1400000	0	1400000	Ciaz	1100000	0
44	34	1	0	1	2	1	1	0	1600000	0	1600000	i20	800000	0
46	36	0	0	0	4	0	0	0	200000	0	200000	Ciaz	1100000	0
48	36	1	0	1	2	0	1	1	1100000	500000	1600000	i20	800000	0
57	27	1	1	1	0	0	0	0	1100000	0	1100000	Baleno	700000	0
58	27	0	1	0	0	0	0	0	1200000	0	1200000	Ciaz	1100000	0
59	28	1	1	0	0	1	0	0	900000	0	900000	Baleno	700000	0
60	28	1	1	1	0	0	0	0	1400000	0	1400000	City	1200000	0
61	30	1	1	1	0	0	0	0	1500000	0	1500000	Creata	1500000	0
63	31	1	0	1	3	1	1	0	1800000	0	1800000	Baleno	700000	0
65	39	0	0	1	3	0	0	0	1600000	0	1600000	Baleno	700000	0
69	37	0	0	0	3	0	0	0	1700000	0	1700000	Verna	1200000	0
72	37	1	0	0	2	0	0	0	1300000	0	1300000	Baleno	700000	0
85	42	0	0	1	3	1	1	0	1800000	0	1800000	Baleno	700000	0
86	29	0	1	0	0	1	0	0	1100000	0	1100000	Baleno	700000	0
90	35	1	0	0	2	0	0	0	1400000	0	1400000	i20	800000	0
93	27	1	1	1	0	0	0	0	900000	0	900000	Baleno	700000	0

B. Market Segmentation for EV Stats-1

This Data Set has Data of Distinct EV S with Number of vehicles in each segment and respective states,so clustering will be purely based on segmenting States to distinct segments based on vehicles and Vehicle Count. Segmentation is as follows.



From the above Number of Clusters=4 and Number of units in each Cluster is as follows.

Cluster	count
0	18
3	6
1	4
2	2

Assigning Clusters to Respective States

	State	cars	Buses	Two Wheelers	Three Wheelers	Total	Cluster_Number
24	Uttar Pradesh	5445	0	20508	256	26209	**3**
7	Haryana	4878	0	18574	137	23589	**3**
20	Rajasthan	4116	0	11564	83	15763	**3**
26	West Bengal	1840	0	12297	3	14140	**3**
14	Maharashtra	19129	2	14873	9	34013	**2**
6	Gujarat	15388	0	15875	4	31267	**2**
19	Punjab	3567	0	2966	5	6538	**1**
13	Madhya Pradesh	2562	0	3785	114	6461	**1**
3	Chhattisgarh	997	0	3073	164	4234	**1**
25	Uttarkhand	265	0	3830	83	4178	**1**
18	Odisha	594	0	3232	37	3863	**1**
2	Bihar	271	0	2830	70	3171	**1**
28	Chandigarh	974	0	1526	0	2500	**1**
1	Assam	151	0	1607	117	1875	**1**
10	Jharkhand	655	0	1039	16	1710	**1**
29	Dadra and Nagar Havel	803	0	13	0	816	**1**
5	Goa	513	1	0	0	514	**1**
9	Jammu & Kashmir	208	0	230	0	438	**1**
8	Himachal Pradesh	98	0	0	0	98	**1**
27	Andaman & Nicobar isl	82	0	0	0	82	**1**
23	Tripura	8	0	73	0	81	**1**
15	Manipur	12	0	35	5	52	**1**
17	Nagaland	1	0	23	0	24	**1**
16	Meghalaya	6	0	0	0	6	**1**
4	Delhi	12695	21	6664	1	19381	**0**
21	Tamil Nadu	7132	0	9614	0	16746	**0**
11	Karnataka	8242	2	5140	2	13386	**0**
12	Kerala	5729	1	5471	1	11202	**0**
0	Andhra Pradesh	3680	0	5812	0	9492	**0**
22	Telangana	5530	0	3502	2	9034	**0**
30	Total	105571	27	154156	1109	260863	

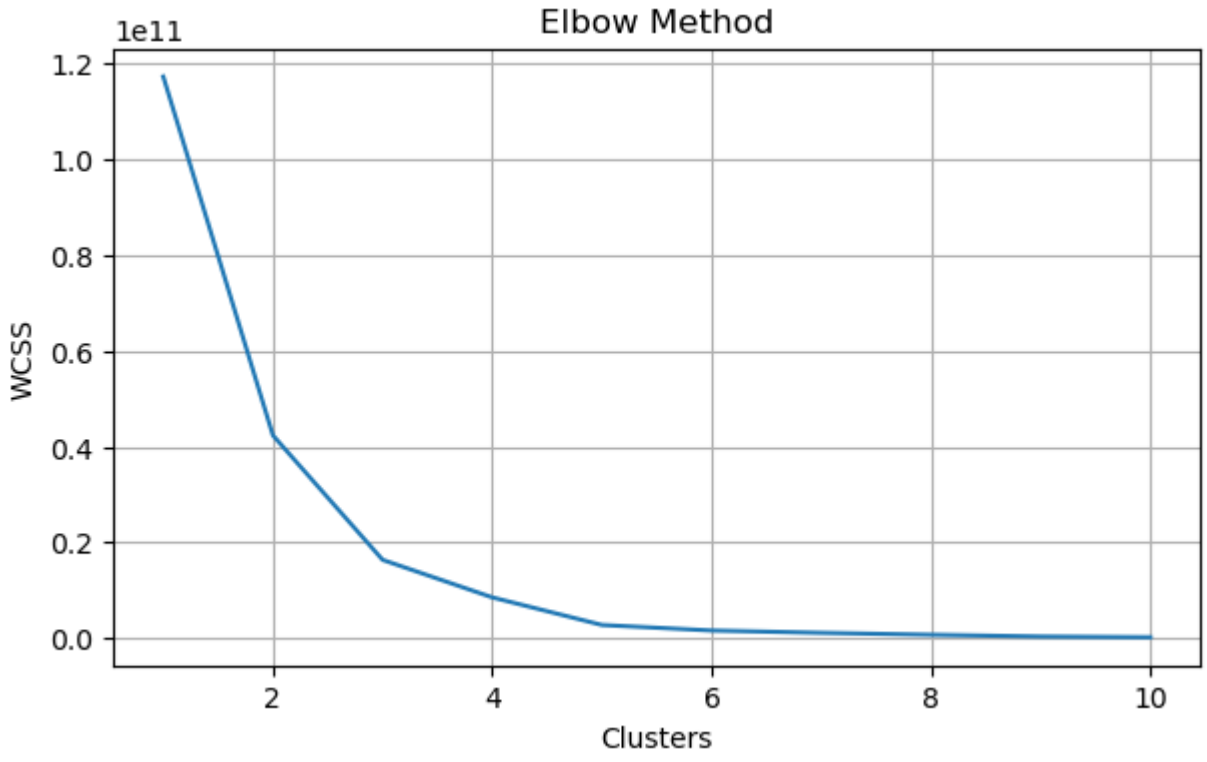
C. Market Segmentation for Electric Two Wheelers.

In this Case Segmentation will be Based on lot of parameters like Power,Torque, Speed ,Vehicle Category(Bike/Scooter),Range per Charge etc.

Feature Selection: Below is the list of features Selected and their Correlationship.

Top Speed (km/h)	**0.838972**
Charging Time	**0.826697**
Range per Charge (km)	**0.823016**
Battery Capacity (kWh)	**0.811086**
Power (HP or kW)	**0.784330**
Year of Manufacture	**0.348236**

K-Means Cluster for Electric Two Wheeler.

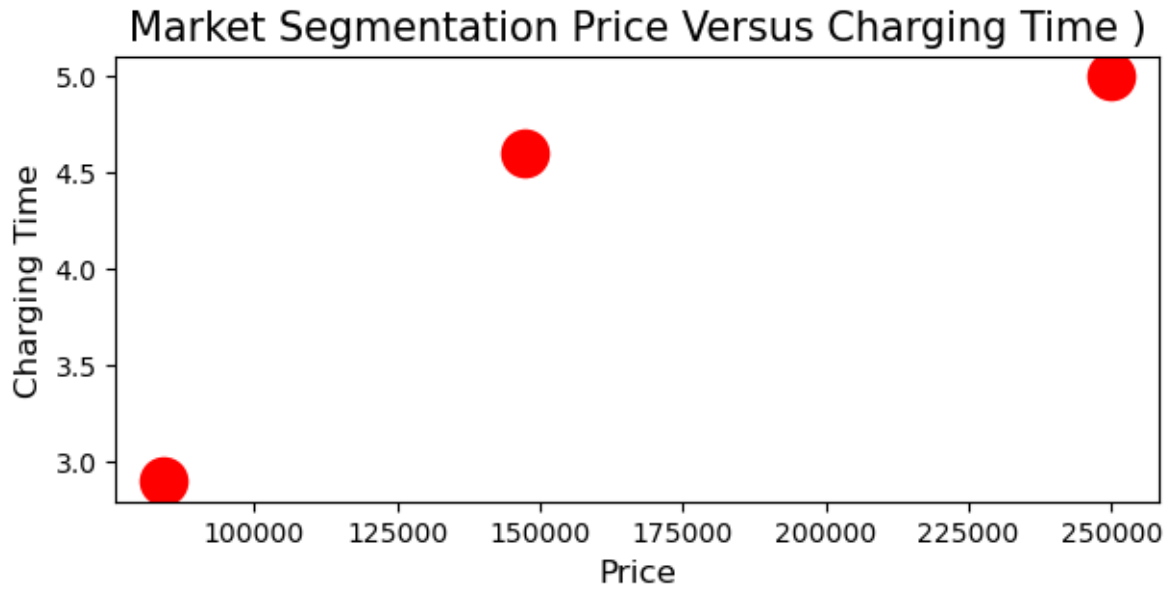


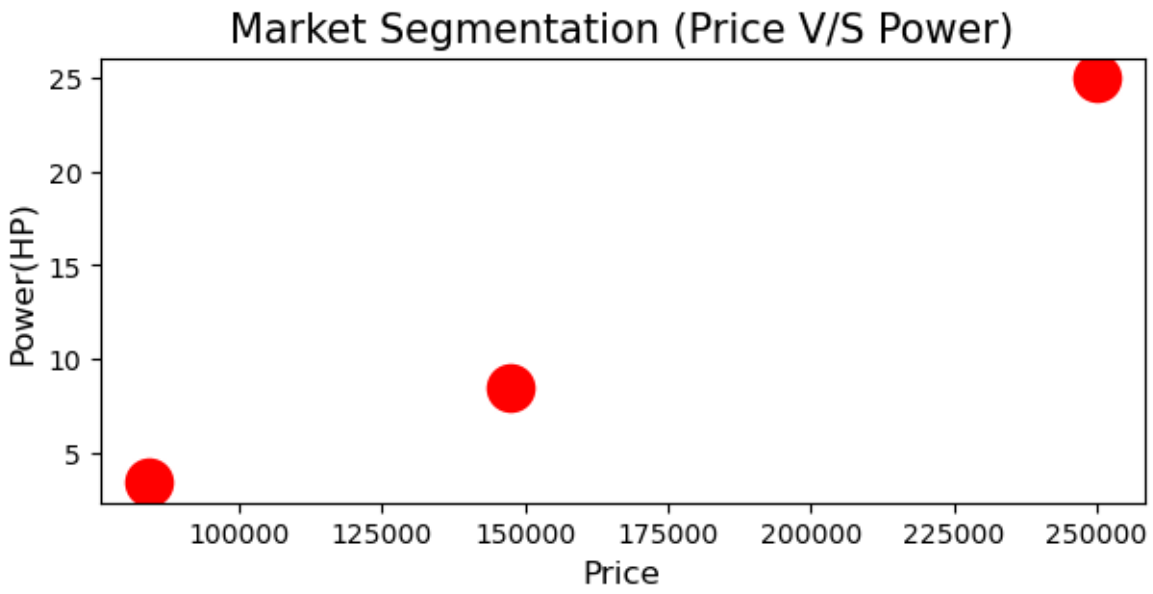
\
From above diagram Number of clusters=3

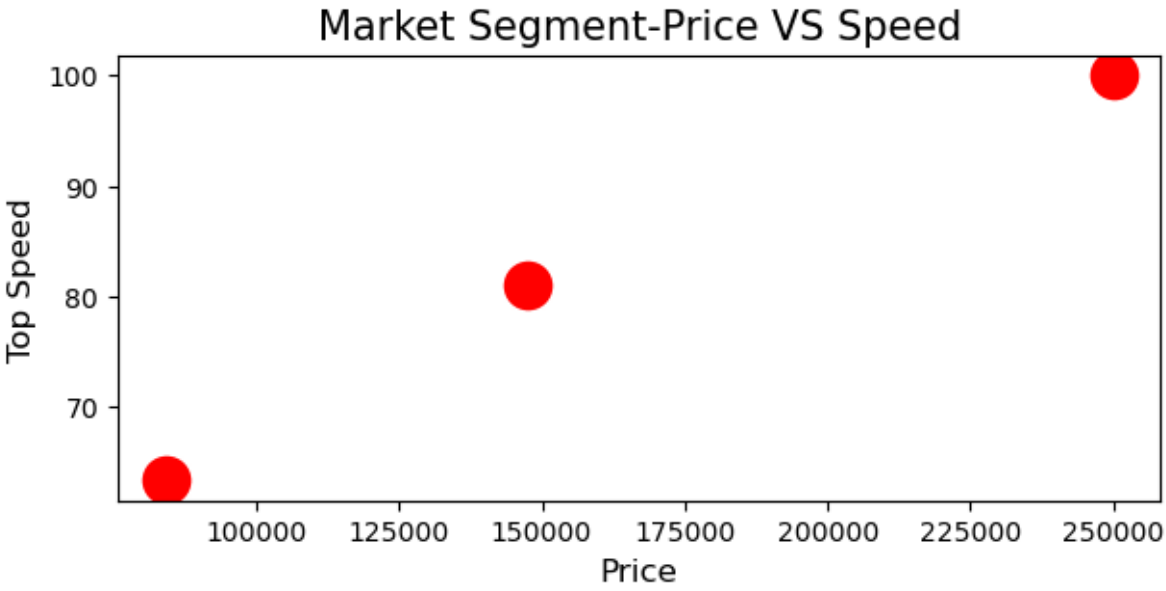
Attached is the Value Count for Each Segment.

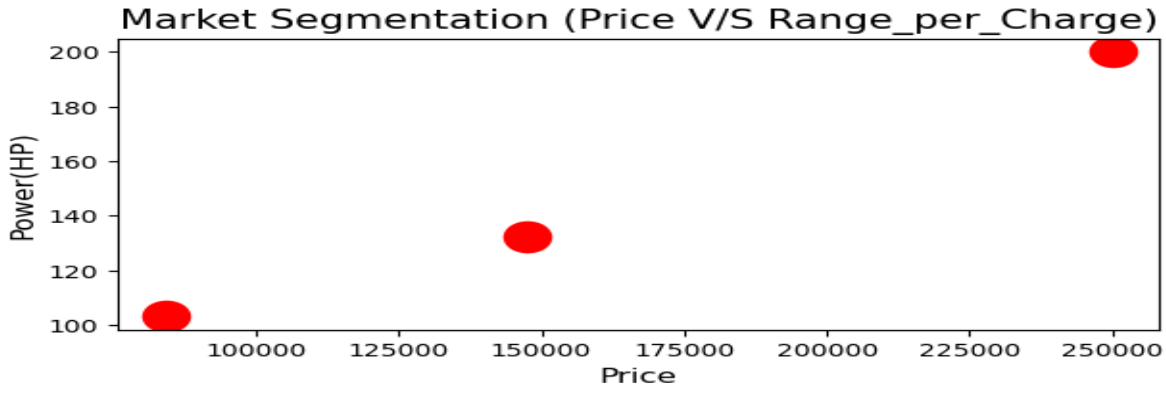
Cluster	count
1	28
0	19
2	3

Below are Segments Extracted Based on Features.




Market Segmentation (Price V/S Power)
Power(HP)
25
20
15
10
5
100000
125000
150000
175000
200000
225000
250000
Price


Market Segment-Price VS Speed
Top Speed
100
90
80
70
100000
125000
150000
175000
200000
225000
250000
Price


Market Segmentation (Price V/S Range_per_Charge)
Power(HP)
200
180
160
140
120
100
100000
125000
150000
175000
200000
225000
250000
Price

Column1	id	Model	Manufacturer	Vehicle Type	Battery Capacity (kWh)	Range per Charge (km	Charging Time	Price	Power (HP or kW	Top Speed (km/h	Year of Manufactur	Cluste
5	5	Tork T6X	Tork Motors	Bike	6.2	200	5	250000	25	100	2021	2
12	12	Tork T6X	Tork Motors	Bike	6.2	200	5	250000	25	100	2021	2
18	18	Tork T6X	Tork Motors	Bike	6.2	200	5	250000	25	100	2021	2
0	0	Aura 300 Plus	Ather Energy	Scooter	2.9	116	4.5	129000	6	80	2021	1
2	2	Bajaj Chetak Electri	Bajaj Auto	Scooter	4	95	5	150000	4	60	2020	1
6	6	Revolt RV400	Revolt Motors	Bike	3.2	150	4	150000	20	85	2021	1
7	7	Bajaj Chetak Electri	Bajaj Auto	Scooter	4	95	5	150000	4	60	2020	1
8	8	Ather 450X	Ather Energy	Scooter	2.9	116	4.5	149000	6	80	2021	1
13	13	Revolt RV400	Revolt Motors	Bike	3.2	150	4	150000	20	85	2021	1
14	14	Ather 450X	Ather Energy	Scooter	2.9	116	4.5	149000	6	80	2021	1
19	19	Bajaj Chetak EV	Bajaj Auto	Scooter	4	146	5.5	145000	4	80	2021	1
23	23	Ather 450X	Ather Energy	Scooter	2.9	116	4.5	149000	6	80	2021	1
26	26	Revolt RV400	Revolt Motors	Bike	3.2	150	4	150000	20	85	2021	1
27	27	Ather 450X	Ather Energy	Scooter	2.9	116	4.5	149000	6	80	2021	1
32	32	Bajaj Chetak EV	Bajaj Auto	Scooter	4	146	5.5	145000	4	80	2021	1
34	34	Ather 450X	Ather Energy	Scooter	2.9	116	4.5	149000	6	80	2021	1
37	37	Revolt RV400	Revolt Motors	Bike	3.2	150	4	155000	21	85	2022	1
38	38	Ather 500X	Ather Energy	Scooter	4	150	5	165000	7	90	2022	1
39	39	Pure EV Epluto 8G	Pure EV	Scooter	3.5	140	3.5	120000	5	85	2022	1
43	43	Bajaj Chetak EV Plu	Bajaj Auto	Scooter	4.5	160	6	160000	5	90	2022	1
45	45	Ather 500X	Ather Energy	Scooter	4	150	5	165000	7	90	2022	1
46	46	Pure EV Epluto 8G	Pure EV	Scooter	3.5	140	3.5	120000	5	85	2022	1
1	1	Pure EV Epluto 7G	Pure EV	Scooter	2.7	120	3	109000	5	80	2021	0
3	3	Okinawa iPraise Pro	Okinawa Autotech	Scooter	2.5	100	3	85000	3	60	2021	0
4	4	Hero Electric Opto (	Hero Motocorp	Scooter	2.2	75	3	75000	3	60	2021	0
9	9	Pure EV Epluto 7G	Pure EV	Scooter	2.7	120	3	109000	5	80	2021	0
10	10	Okinawa iPraise Pro	Okinawa Autotech	Scooter	2.5	100	3	85000	3	60	2021	0
11	11	Hero Electric Opto (	Hero Motocorp	Scooter	2.2	75	3	75000	3	60	2021	0
15	15	Pure EV Epluto 7G	Pure EV	Scooter	2.7	120	3	109000	5	80	2021	0
16	16	Okinawa iPraise Pro	Okinawa Autotech	Scooter	2.5	100	3	85000	3	60	2021	0
17	17	Hero Electric Opto (	Hero Motocorp	Scooter	2.2	75	3	75000	3	60	2021	0
20	20	Ampere Reo	Ampere Vehicles	Scooter	3	100	3.5	80000	3	60	2021	0
21	21	Urbanite X1	Electric Vehicle Co.	Scooter	2.5	100	3	75000	3	60	2021	0
22	22	Joy e-Ride	Joy E-Bike	Bike	2.2	80	2.5	60000	2	50	2021	0
24	24	Pure EV Epluto 7G	Pure EV	Scooter	2.7	120	3	109000	5	80	2021	0
25	25	Okinawa iPraise Pro	Okinawa Autotech	Scooter	2.5	100	3	85000	3	60	2021	0
28	28	Pure EV Epluto 7G	Pure EV	Scooter	2.7	120	3	109000	5	80	2021	0
29	29	Okinawa iPraise Pro	Okinawa Autotech	Scooter	2.5	100	3	85000	3	60	2021	0
30	30	Joy E-Bike Urbanite	Electric Vehicle Co.	Bike	2.2	80	2.5	60000	2	50	2021	0
31	31	Ampere Reo	Ampere Vehicles	Scooter	3	100	3.5	80000	3	60	2021	0
33	33	Urbanite X1	Electric Vehicle Co.	Scooter	2.5	100	3	75000	3	60	2021	0
35	35	Pure EV Epluto 7G	Pure EV	Scooter	2.7	120	3	109000	5	80	2021	0
36	36	Okinawa iPraise Pro	Okinawa Autotech	Scooter	2.5	100	3	85000	3	60	2021	0
40	40	Okinawa iPraise Pro	Okinawa Autotech	Scooter	3	120	3	95000	4	70	2022	0
41	41	Joy E-Bike Urbanite	Electric Vehicle Co.	Bike	2.8	90	2.5	70000	3	60	2022	0
42	42	Ampere Zeo	Ampere Vehicles	Scooter	3.5	120	4	90000	4	70	2022	0
44	44	Urbanite X2	Electric Vehicle Co.	Scooter	3.2	130	4	110000	5	80	2022	0
47	47	Okinawa iPraise Pro	Okinawa Autotech	Scooter	3	120	3	95000	4	70	2022	0
48	48	Joy E-Bike Urbanite	Electric Vehicle Co.	Bike	2.9	85	2.5	75000	3	65	2022	0
49	49	Ampere Zeo	Ampere Vehicles	Scooter	3.5	120	0	0	0	0	0	0

Cluster for segmentation of Two Wheeler Data Set

Conclusion.

Following Conclusions are obtained from the above Analysis.

State Wise EV Distribution Data Set

A)Two Wheelers and Three Wheelers contribute to 99 percent of Market segment and there is a Huge scope for expansion in all other segments.

B)There is a Huge Potential for Development of EV Market in Northeast India as North east has poor Contribution to EV'S from Above Data Set

3)3 Wheelers operate in few Regions North East India and North India.

4)Huge Potential for Heavy Vehicles and Buses provided Conditions are studied carefully and designed for Indian conditions and weather

5)EV Market Segmentation Based on geography effectively segments market and suitable strategies for each segment can be taken based on the Segment observations.

Customer Behaviour Data Set.

A)Most of the Customers are in the Range of 30 to 40 years and Significantly contribute for Driving 4 Wheeler Market(Car Sales)

B)65 Percent of customers are of salaried. Hence Corporate Employees needs to be targeted having a fixed salary and stable Income

C)There is a relation Between Wife Salary and Price of Car Purchased. Hence luxury Brands can target working couples

D)Further referring to Clusters help significantly in identifying segments. And trends of each segment.
E)Based on Data in each segment specific groups can be targeted.

Electric Two Wheeler Data Set
A) There is scope for Bike Segment in india as Majority of Two Wheelers are Scooters.
B) From Market Segment Analysis for Vehicle segment we observed that 59% of all EV'S were Two Wheelers. Hence Demand for Two wheelers seemed high. Further Analysis of current Market demand, customer preferences etc can be further analyzed to check feasibility to capture this Market.
c)Lot of technicalities need to be analysed to meet or exceed current market demands for technicality. As observed as technical features improve cost also increases. Cost reduction for same features may increase demand for vehicle in specific segment

Scope for Further Improvements.

A)It is not clearly understood as to why in few states EV Market is not well developed or not developed in specific segment. Analysis needs to be carried out to check constrains for the same.
B)Public Transport seems less developed in EV Segment. Further analysis needs to be made on the same with additional data and analysis.
C)Two wheeler Data set is limited in terms of number of vehicles. Need larger Data set for analysis

Libraries and Algorithms Used in Market Segmentation.

A)Pandas for Data loading, cleaning and Transformation
B)Matplotlib for Data Visualisation
c)Pandas for EDA
D)K-Means Clustering for Segmentation.