Market Segmentation Analysis of Electric Vehicles Market in India

Team Members :-

1] Suyog Pawar

2] Saurav Rakshit

3] Gayatri Padmani

4] Akshay Kumar

1]Suyog Pawar

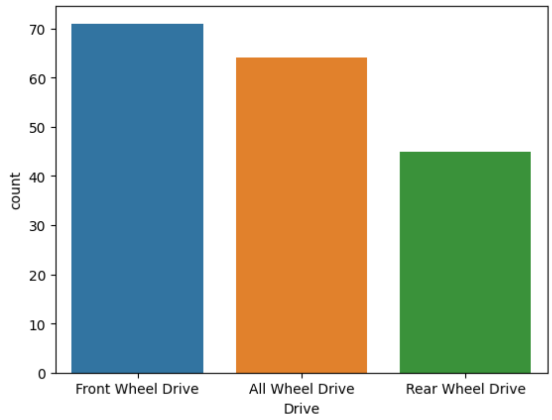
Market Segmentation Analysis of Electric Vehicles Market in India

Fast charging in Electric Vehicle

Plug-in Electric Vehicles (PEVs) are considered one solution to reducing GHG emissions from private transport. Additionally, PEV adopters often have free access to public charging facilities. Through a pattern analysis, this study identifies five distinct clusters of daily PEV charging profiles observed at the public charging stations. Empirically observed patterns indicate a significant amount of operational inefficiency, where 54% of the total parking duration PEVs do not consume electricity, preventing other users from charging. This study identifies the opportunity cost in terms of GHG emissions savings if gasoline vehicles are replaced with potential PEV adopters. The time spent in parking without charging by current PEV users can be used by these potential PEV users to charge their PEVs and replace the use of gasoline. The results suggest that reducing inefficient station use leads to significant reductions in emissions. Overall, there is significant variability in outcomes depending on the specific cluster membership.

Infrastructure Performance and Evaluation

PEV adoption will also impact the electric grid and shift environmental impact from point-source vehicle to electricity generator emissions due to increasing electricity demand. The literature has produced work on network optimization models that quantify and assess infrastructure and environmental impacts at the network level. These studies consider developing public charging infrastructure [9, 10] by optimizing social welfare relative to impacts on the electrical grid. Other studies assess the electric grid impacts from widespread charging through conventional travel surveys, where travel logs of PEV drivers [11] from the NHTS are used to predict electricity consumption and load profiles. Other studies further expand on these by applying network charging scheduling [12] and time-of-use rates [13] to optimize and assess electrical loads on the infrastructure. In another study, large-scale vehicle survey data [14] are used to model charging location decisions by maximizing PEV driving miles to jointly maximum environmental benefit. An activity-based modeling approach [15] was used in another study to assess PEV environmental impacts, suggesting that public charging facilities allow charging during the daytime and can potentially reduce emissions. Although observed travel data is used in these studies, the effects of individual charging behaviors at the stations themselves have not been examined and operational inefficiencies in station turnaround are not considered.

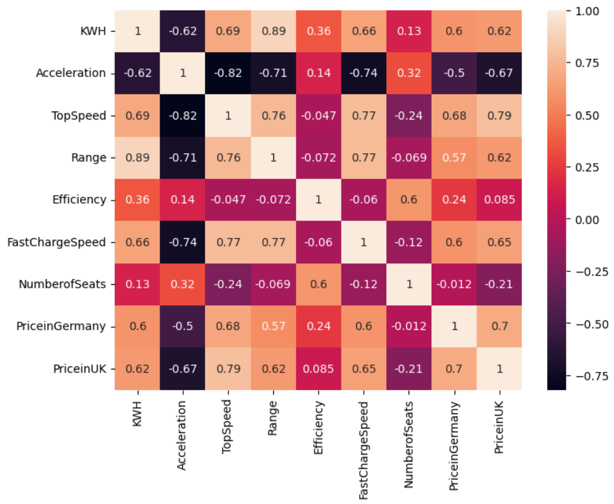


Tyres for Electric Cars

Electric vehicles and traditional internal combustion engines (ICE) might look the same, they can sometimes even be fitted with the same tyres! Still, to maximise the benefits of electric cars, Michelin has developed tyres to fit them exclusively. Keep in mind that any of our tyre line is suitable for electric vehicles, even if **MICHELIN Pilot Sport EV** and **MICHELIN primacy**, are specifically designed for.

With an electric vehicle fitted with tyres that are designed for it, the battery range, the preservation of silence in the interior are what strikes the most. In addition, as soon as you press the accelerator, you're immediately at 100% of the vehicle's power. Whereas, with a combustion-powered vehicle, the engine is powered gradually. This means the weight transfers are a lot more intense than with a combustion-powered vehicle.

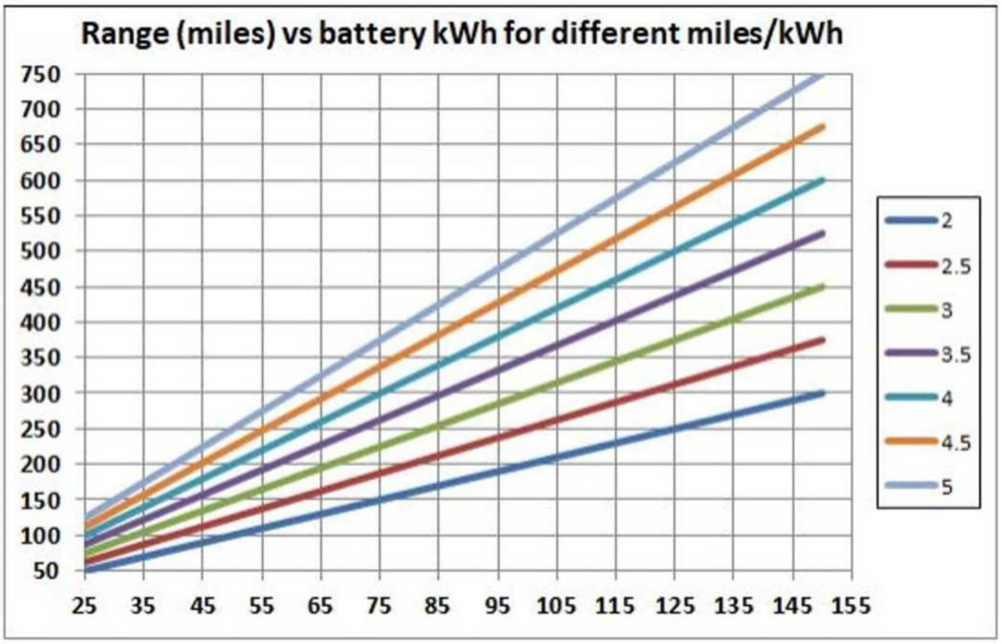
These differences between an electric and an ICE-powered car have consequences on tyre design. At Michelin we design our electric car tyres differently to optimize the performances of the electric vehicles. The battery range, the silence in the cabin, and tyre longevity are optimized while maintaining a high level of safety and driving pleasure of your electric vehicle.



Electric Cars Battery Capacity andd Efficiency

The value of kWh/100-miles is useful to calculate how much energy in kWh is required to travel a specific distance in miles. The value of MPGe is useful to compare the efficiency of a BEV to a gasoline car's MPG. MPGe is calculated using the EPA number that one gallon of unleaded regular gasoline when fully combusted producs 33.7 kWh of heat.

The following graph shows how range varies with bateery capacity for seven values of miles/kWh.



Github link :- https://github.com/suyogpawar00/Market-Segmentation-Analysis

PROJECT - 3

EV MARKET ANALYSIS

FEYNN LABS

Problem Statement

Our team has to work under an Electric Vehicle Start-up. The Start-up is still deciding in which vehicle/customer space it will be develop its EVs. We have to analyse the Electric Vehicle market in India using Segmentation analysis and come up with a feasible strategy to enter the market, targeting the segments most likely to use Electric vehicles.

What is an Electric Vehicle?

An EV is a shortened acronym for an electric vehicle. EVs are vehicles that are either partially or fully powered on electric power. Electric vehicles have low running costs as they have less moving parts for maintaining and also very environmentally friendly as they use little or no fossil fuels (petrol or diesel). While some EVs used lead acid or nickel metal hydride batteries, the standard for modern battery electric vehicles is now considered to be lithium ion batteries as they have a greater longevity and are excellent at retaining energy, with a selfdischarge rate of just 5% per month. Despite this improved efficiency, there are still challenges with these batteries as they can experience thermal runaway, which have, for example, caused fires or explosions in the Tesla model S, although efforts have been made to improve the safety of these batteries.

Working principle

An electric vehicle works on a basic principle of science: conversion of energy. Electrical energy is converted into mechanical energy. There is a motor used in the electrical system to carry on this duty of conversion. Motors can be of various types.

Market study

The question arises that will electric vehicle replace the normal vehicles? And the answer to this question is YES!. Because of the ample advantages and the growing market it is likely that EV's will replace normal vehicle . The market for EV's is increasing at 3X speed. Currently 30% of the market supply is of EV's. People would prefer electric vehicles over normal vehicle in future because of the following reasons:

Lower running costs

The running cost of an electric vehicle is much lower than an equivalent petrol or diesel vehicle. Electric vehicles use electricity to charge their batteries instead of using fossil fuels like petrol or diesel. Electric vehicles are more efficient, and that combined with the electricity cost means that charging an electric vehicle is cheaper than filling petrol or diesel for your travel requirements. Using renewable energy sources can make the use of electric vehicles more eco-friendly. The electricity cost can be reduced further if charging is done with the help of renewable energy sources installed at home, such as solar panels.

Low maintenance cost

Electric vehicles have very low maintenance costs because they don't have as many moving parts as an internal combustion vehicle. The servicing requirements for electric vehicles are lesser than the conventional petrol or diesel vehicles. Therefore, the yearly cost of running an electric vehicle is significantly low.

Zero Tailpipe Emissions

Driving an electric vehicle can help you reduce your carbon footprint because there will be zero tailpipe emissions. You can reduce the environmental impact of charging your vehicle further by choosing renewable energy options for home electricity.

Tax and financial benefits

Registration fees and road tax on purchasing electric vehicles are lesser than petrol or diesel vehicles. There are multiple policies and incentives offered by the government depending on which state you are in.

Creates very little noise

The electric vehicles run at almost no noise hence decreasing the sound pollution and are environmentally friendly.

No exhaust, spark plugs

No exhaust, hence no air, sound pollution; as it runs on electrical energy, there is no need of any spark plug.

Project Code

EV Market Analysis

In [26]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

In [27]:
```
data = pd.read_excel('ev_dataset.xlsx')
data
```

Out[27]:

	Brand	Model	AccelSec	TopSpeed_KmH	Range_Km	Battery_Pack Kwh	Efficiency_WhKm	FastCharge_KmH	RapidCharge	PowerTrain	PlugType
0	Tesla	Model 3 Long Range Dual Motor	4.6	233	460	70.0	161	940	Yes	AWD	Type 2 CCS
1	Volkswagen	ID.3 Pure	10.0	160	270	45.0	167	250	Yes	RWD	Type 2 CCS
2	Polestar	2	4.7	210	400	75.0	181	620	Yes	AWD	Type 2 CCS
3	BMW	iX3	6.8	180	360	74.0	206	560	Yes	RWD	Type 2 CCS
4	Honda	e	9.5	145	170	28.5	168	190	Yes	RWD	Type 2 CCS
...	...	...	...	...	...	...	...	...	...	...	...
97	Nissan	Ariya 63kWh	7.5	160	330	63.0	191	440	Yes	FWD	Type 2 CCS

Data Preprocessing

In [28]:
```
data.head()
```

Out[28]:

	Brand	Model	AccelSec	TopSpeed_KmH	Range_Km	Battery_Pack Kwh	Efficiency_WhKm	FastCharge_KmH	RapidCharge	PowerTrain	PlugType	BodyStyle
0	Tesla	Model 3 Long Range Dual Motor	4.6	233	460	70.0	161	940	Yes	AWD	Type 2 CCS	Sedan
1	Volkswagen	ID.3 Pure	10.0	160	270	45.0	167	250	Yes	RWD	Type 2 CCS	Hatchback
2	Polestar	2	4.7	210	400	75.0	181	620	Yes	AWD	Type 2 CCS	Liftback
3	BMW	iX3	6.8	180	360	74.0	206	560	Yes	RWD	Type 2 CCS	SUV
4	Honda	e	9.5	145	170	28.5	168	190	Yes	RWD	Type 2 CCS	Hatchback

In [29]:
```
data.tail()
```

Out[29]:

	Brand	Model	AccelSec	TopSpeed_KmH	Range_Km	Battery_Pack Kwh	Efficiency_WhKm	FastCharge_KmH	RapidCharge	PowerTrain	PlugType	BodyS
97	Nissan	Ariya 63kWh	7.5	160	330	63.0	191	440	Yes	FWD	Type 2 CCS	Hatchb
98	Audi	e-tron S Sportback 55 quattro	4.5	210	335	86.5	258	540	Yes	AWD	Type 2 CCS	

In [31]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 102 entries, 0 to 101
Data columns (total 16 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   Brand            102 non-null    object
 1   Model            102 non-null    object
 2   AccelSec         102 non-null    float64
 3   TopSpeed_KmH     102 non-null    int64
 4   Range_Km         102 non-null    int64
 5   Battery_Pack Kwh 102 non-null    float64
 6   Efficiency_WhKm  102 non-null    int64
 7   FastCharge_KmH   102 non-null    int64
 8   RapidCharge      102 non-null    object
 9   PowerTrain       102 non-null    object
 10  PlugType         102 non-null    object
 11  BodyStyle        102 non-null    object
 12  Segment          102 non-null    object
 13  Seats            102 non-null    int64
 14  PriceEuro        102 non-null    int64
 15  INR              102 non-null    float64
dtypes: float64(3), int64(6), object(7)
memory usage: 12.9+ KB
```

In [32]:
```
data.isnull().sum()
```

Out[32]:
```
Brand           0
Model           0
AccelSec        0
TopSpeed_KmH    0
Range_Km        0
```

In [33]:
```
data.describe().T
```
Out[33]:

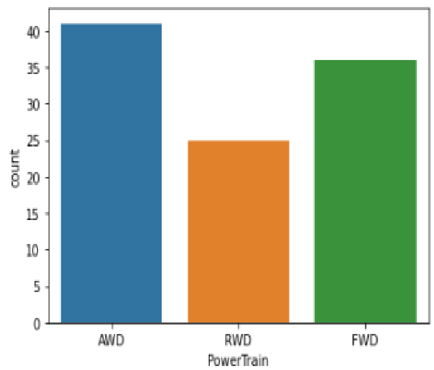
	count	mean	std	min	25%	50%	75%	max
AccelSec	102.0	7.391176e+00	3.031913e+00	2.100	5.100000e+00	7.30	9.0	22.4
TopSpeed_KmH	102.0	1.793137e+02	4.377123e+01	123.000	1.500000e+02	160.00	200.0	410.0
Range_Km	102.0	3.386275e+02	1.267006e+02	95.000	2.500000e+02	340.00	400.0	970.0
Battery_Pack Kwh	102.0	6.541569e+01	2.995578e+01	16.700	4.312500e+01	64.35	83.7	200.0
Efficiency_WhKm	102.0	1.893039e+02	2.967907e+01	104.000	1.680000e+02	180.50	204.5	273.0
FastCharge_KmH	102.0	4.356863e+02	2.204474e+02	0.000	2.600000e+02	440.00	557.5	940.0
Seats	102.0	4.882353e+00	7.996796e-01	2.000	5.000000e+00	5.00	5.0	7.0
PriceEuro	102.0	5.599759e+04	3.425072e+04	20129.000	3.441475e+04	45000.00	65000.0	215000.0
INR	102.0	4.583352e+06	2.803391e+06	1647540.534	2.816816e+06	3683209.50	5320191.5	17597556.5

In [34]:
```
data['Brand'].unique()
```
Out[34]:
```
array(['Tesla', 'Volkswagen', 'Polestar', 'BMW', 'Honda', 'Lucid',
       'Peugeot', 'Audi', 'Mercedes', 'Nissan', 'Hyundai', 'Porsche',
       'MG', 'Mini', 'Opel', 'Skoda', 'Volvo', 'Kia', 'Renault', 'Mazda',
       'Lexus', 'CUPRA', 'SEAT', 'Lightyear', 'Aiways', 'DS', 'Citroen',
       'Jaguar', 'Ford', 'Byton', 'Sono', 'Smart', 'Fiat'], dtype=object)
```

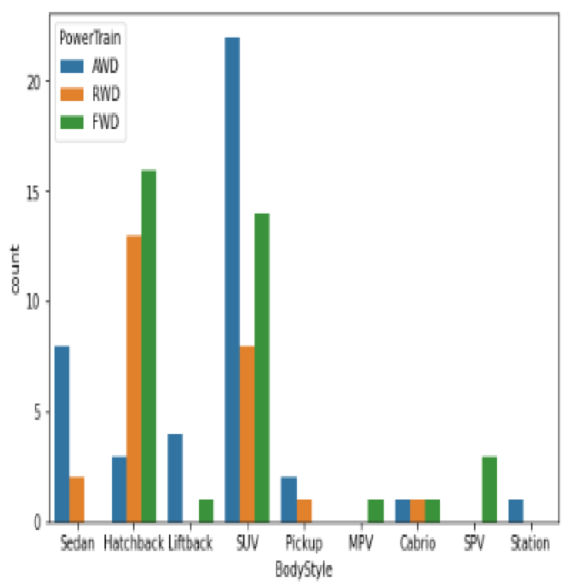
Data Visualization

In [39]:
```
sns.countplot(data['PowerTrain'])
plt.show()
```

```
C:\Users\MY-PC\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variable as a keyword a
rg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit ke
yword will result in an error or misinterpretation.
  warnings.warn(
```

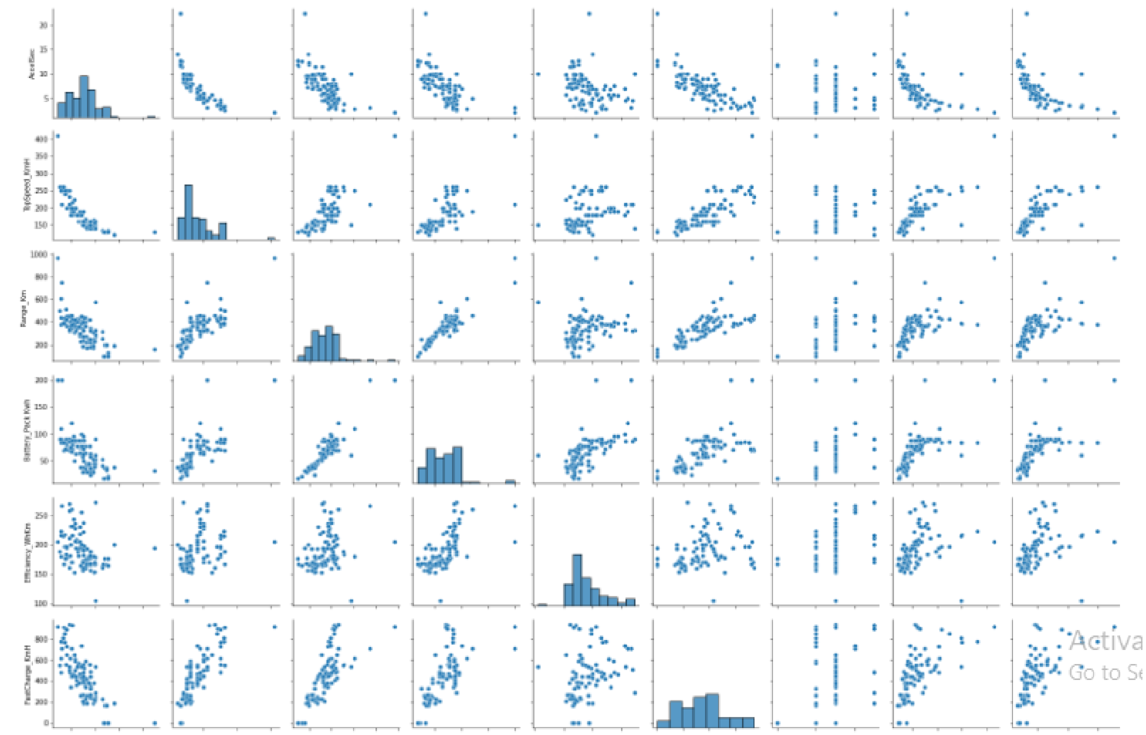


In [53]:
```
plt.figure(figsize = (8,5))
sns.countplot(data['BodyStyle'], data = data, hue='PowerTrain')
plt.show()
```



In [42]:

```
sns.pairplot(data)
plt.show()
```

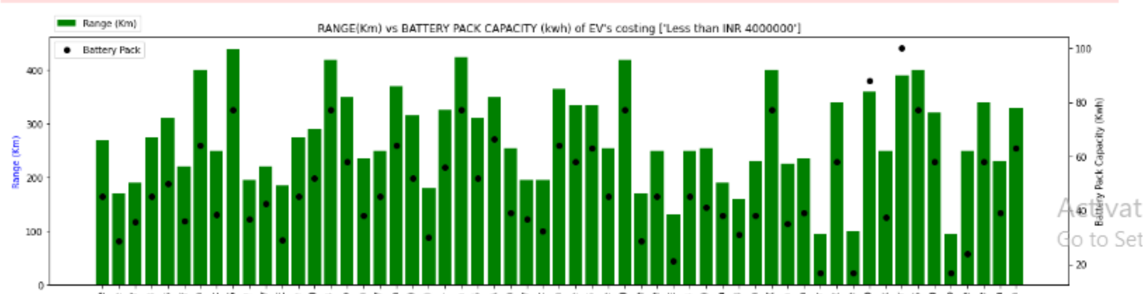


Range - Battery Pack

In [72]:

```
#range-batterypack
def range_batterypack(data, text):
    fig = plt.figure(figsize=(20,5))
    a1= plt.subplot()
    a1.bar(data["C_name"], data["Range_Km"], label='Range (Km)', color='green')
    plt.legend(loc= "upper left", bbox_to_anchor=(0,1.105))
    a2 = a1.twinx()
    a2.scatter(data["C_name"], data["Battery_Pack Kwh"], label= "Battery Pack", color= 'black')
    plt.title('''RANGE(Km) vs BATTERY PACK CAPACITY (kwh) of EV's costing {}'''.format(text), fontsize=12)
    a1.set_xlabel('Models', size= 16)
    a1.set_ylabel('Range (Km)', color = 'blue')
    a2.set_ylabel('Battery Pack Capacity (Kwh)', color='black')
    plt.legend(loc='upper left', bbox_to_anchor=(0,1))
    a1.set_xticklabels(df_1['C_name'], rotation = 'vertical')
    plt.show()

range_batterypack(df_1, t1)
range_batterypack(df_2, t2)
```

```
C:\Users\MY-PC\AppData\Local\Temp/ipykernel_664/1523676411.py:14: UserWarning: FixedFormatter should only be used together with FixedLocator
  a1.set_xticklabels(df_1['C_name'], rotation = 'vertical')
```

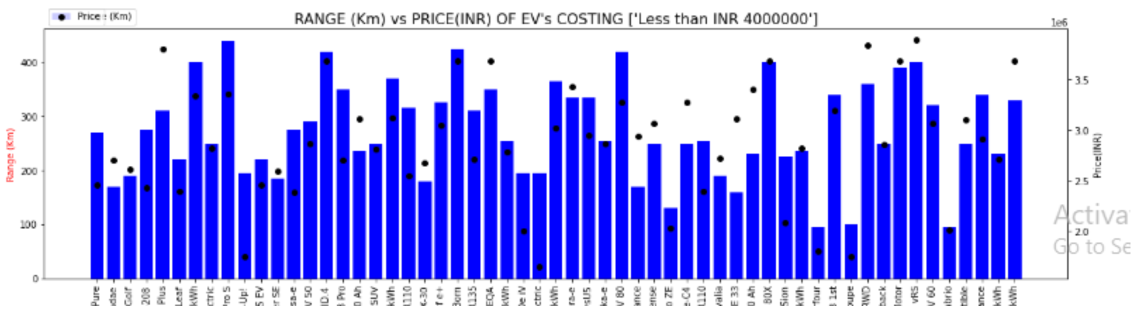


Range - Vehicle Price

In [73]:

```python
#Range - Price
def range_price(data, text):
    fig = plt.figure(figsize=(20, 5))
    a1 = plt.subplot()
    a1.bar(data['C_name'], data['Range_Km'], label='Range (Km)', color='blue')
    plt.legend(loc='upper left', bbox_to_anchor = (0, 1.1))
    a2= a1.twinx()
    a2.scatter(data['C_name'], data['INR'], label = 'Price', color = 'black')
    plt.title('''RANGE (Km) vs PRICE(INR) OF EV's COSTING {}'''.format(text), fontsize=16)
    a1.set_xlabel('Models', size=16)
    a1.set_ylabel('Range (Km)', color = 'red')
    a2.set_ylabel('Price(INR)', color= 'black')
    plt.legend(loc = 'upper left', bbox_to_anchor = (0,1.1))
    a1.set_xticklabels(df_1['C_name'], rotation = 'vertical')
    plt.show()

range_price(df_1, t1)
range_price(df_2, t2)
```

```
C:\Users\MY-PC\AppData\Local\Temp/ipykernel_664/739021973.py:14: UserWarning: FixedFormatter should only be used together with FixedLocator
  a1.set_xticklabels(df_1['C_name'], rotation = 'vertical')
```



Vehicles with Maximum Efficiency

In [83]:

```python
pd.set_option('display.max_columns', None)
efficiency = data.sort_values(by = 'Efficiency_WhKm')
print(efficiency[['C_name', 'Efficiency_WhKm', 'Range_Km', 'PowerTrain', 'Battery_Pack Kwh', 'INR']])
```

```
                           C_name  Efficiency_WhKm  Range_Km PowerTrain  \
48                   LightyearOne              104       575        AWD
14          HyundaiIONIQ Electric              153       250        FWD
8     TeslaModel 3 Standard Range Plus         153       310        RWD
41        HyundaiKona Electric 39 kWh          154       255        FWD
74                      SonoSion              156       225        FWD
..                            ...              ...       ...        ...
98  Audie-tron S Sportback 55 quattro          258       335        AWD
67       TeslaCybertruck Dual Motor            261       460        AWD
33        TeslaCybertruck Tri Motor            267       750        AWD
90          Audie-tron S 55 quattro            270       320        AWD
84           MercedesEQV 300 Long              273       330        FWD

    Battery_Pack Kwh           INR
48              60.0  1.219552e+07
14              38.3  2.820438e+06
8               50.0  3.796161e+06
41              39.0  2.780496e+06
74              35.0  2.087152e+06
..               ...           ...
98              86.5  7.861606e+06
67             120.0  4.501700e+06
33             200.0  6.138682e+06
90              86.5  7.677446e+06
84              90.0  5.781084e+06

[102 rows x 6 columns]
```

Github link : https://github.com/akshaytestgithub/Feynn-Labs-Projects

Thank you

Market Segmentation Analysis of

Electric Vehicles Market in India

Data Collection:

Data was extracted from the various websites mentioned below for EV market segmentation.

Link for data extraction:

- Press Information Bureau (pib.gov.in)
- The Electric Vehicle Ecosystem in India: A Look at the Progress So Far (india-briefing.com)
- Market-Segmentation-for-Electric-Vehicles-in-India/Market_Segmentation.ipynb at main · Marisha18/Market-Segmentation-for-Electric-Vehicles-in-India · GitHub

Data from those links are extracted by Google play scraper available on libraries package. There are multiple datasets get extracted from those websites in CSV and Excel formats. There are some pdfs also which contains valuable information regarding the EV market. We have extracted data from those pdfs as well.

Raw data generated:

- https://github.com/gayatripadmani/Feynn-Labs-Intership/tree/main/Task%203%20-%20Market%20Segmentation%20of%20Electric%20Vehicles%20in%20In

Columns explanations :

1. 'Brand' and tells the manufacturers of electric vehicles.
2. 'model' tells the various of electric vehicles.
3. 'AccelSec', 'Top Speed', 'Power Train' tellsspecification about the vehicles.
4. 'Range_km', 'Fast_Charge', 'Plug_type' and 'Bodystyle' tells us about rangeof vehicle per full charge,fast charging is provided or not, type of charging plug and body style of vehicle respectively.
5. 'Seats' and 'Price' tells about the number of seats available on vehicle and theirprice.
6. 'Region' and 'State/UT' tells about the states of India.
7. 'EV Charging Facility' and 'Chargers' tells about the facility of charging in the respectivestates.
8. '2V', '3V', '4V', 'Bus' tells about the type of vehicles in the market

Data Preprocessing:

Steps taken to preprocess the scraped raw data:

1. Ordinal encoded 'PowerTrain'

```
# PowerTrain feature

df3['PowerTrain'] = df3['PowerTrain'].replace({'RWD' : 0, 'FWD' : 1, 'AWD' : 2})
```

2. Label encoded 'RapidCharge’

```
# RapidCharge feature

le = LabelEncoder()

df3['RapidCharge'] = le.fit_transform(df3['RapidCharge'])
```

3. Used Label Encoder and Standard Scaler package for preprocessing of the dataset.

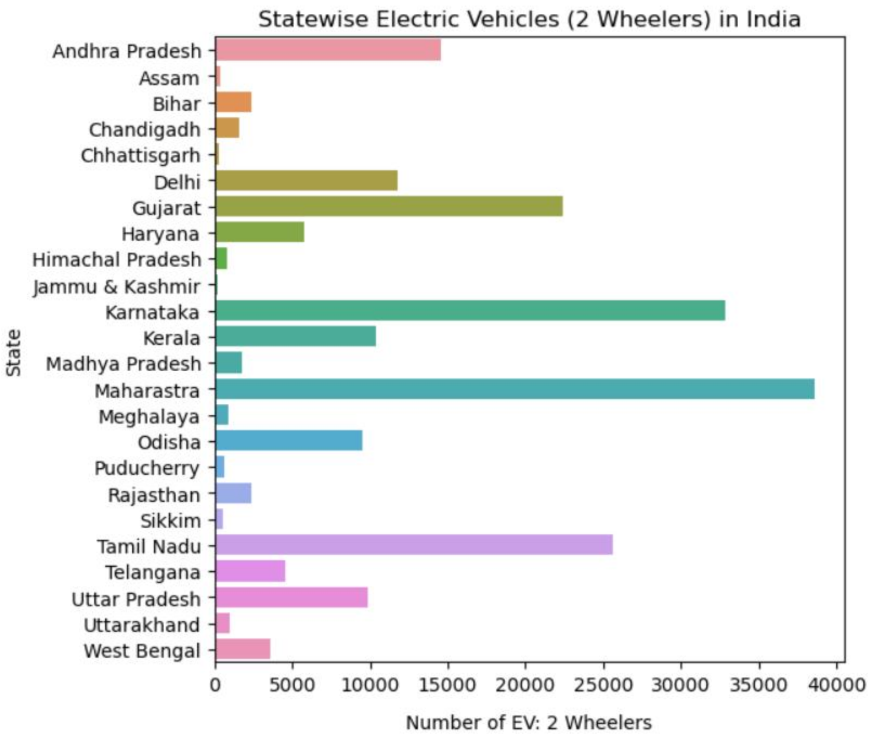
```
X = df3[['AccelSec', 'TopSpeed_KmH', 'Efficiency_WhKm', 'FastCharge_KmH', 'Range_Km', 'RapidCharge', 'Seats',
         'PriceEuro','PowerTrain']]

scaler = StandardScaler()

X_scaled = scaler.fit_transform(X)
```

Exploratory Data Analysis:

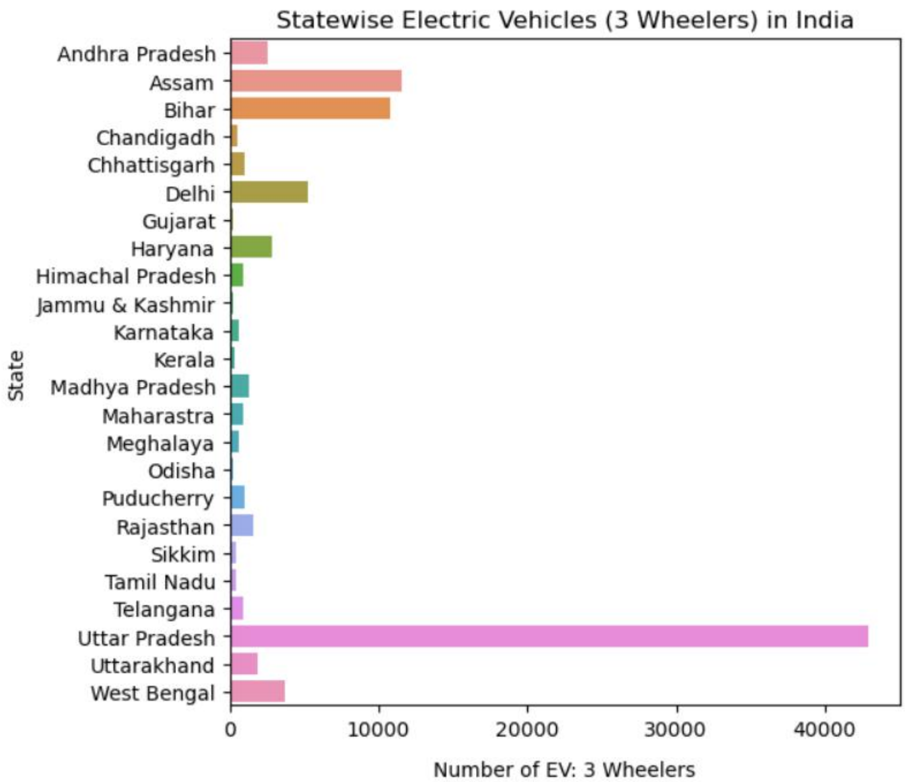
An Exploratory Data Analysis or EDA is a thorough examination meant to uncover the underlying structure of a data set and is important for a company because it exposes trends, patterns, and relationships that are not readily apparent.

We analyzed our dataset using univariate (analyze data over a single variable/column from a dataset), bivariate (analyze data by taking two variables/columns into consideration from a dataset) and multivariate (analyze data by taking more than two variables/columns into consideration from a dataset) analysis.

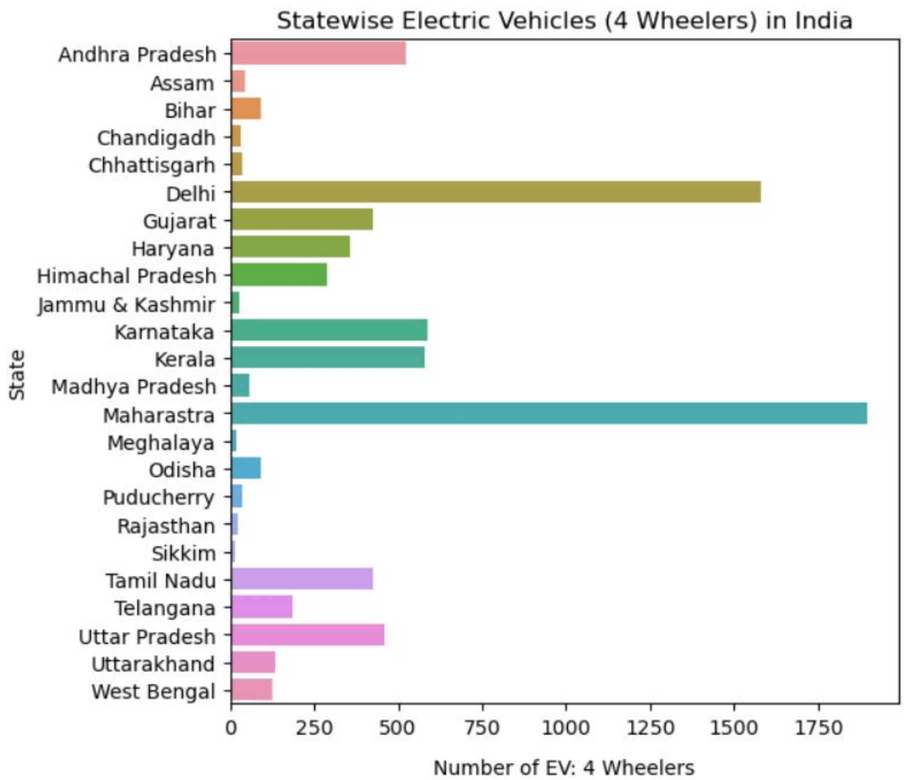
The bar graph below shows the diversity of the data geographically. We can see that we have the maximum amount of data of states Karnataka and Maharashtra; and minimum amount of data for Sikkim, Meghalaya, Lakshadweep, Ladakh, and Dadra and Nagar Haveli and Daman and Diu. There are a total of 1536 rows of data distributed amongthe cities shown in the graph.

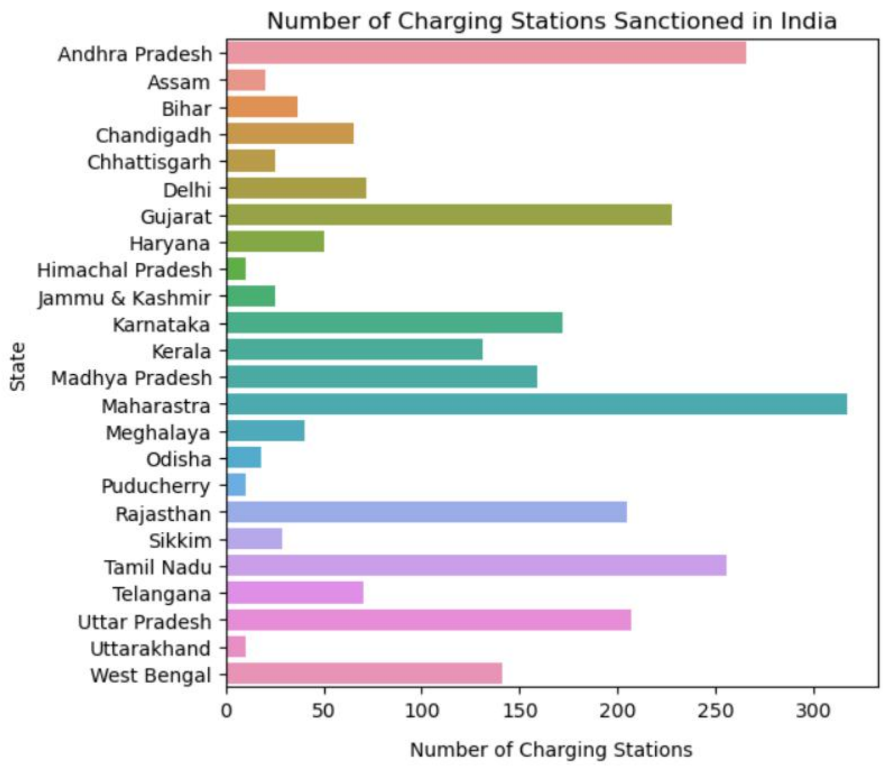


Statewise Electric Vehicles (2 Wheelers) in India
Andhra Pradesh
Assam
Bihar
Chandigadh
Chhattisgarh
Delhi
Gujarat
Haryana
Himachal Pradesh
Jammu & Kashmir
Karnataka
Kerala
Madhya Pradesh
Maharastra
Meghalaya
Odisha
Puducherry
Rajasthan
Sikkim
Tamil Nadu
Telangana
Uttar Pradesh
Uttarakhand
West Bengal
State
0
5000
10000
15000
20000
25000
30000
35000
40000
Number of EV: 2 Wheelers

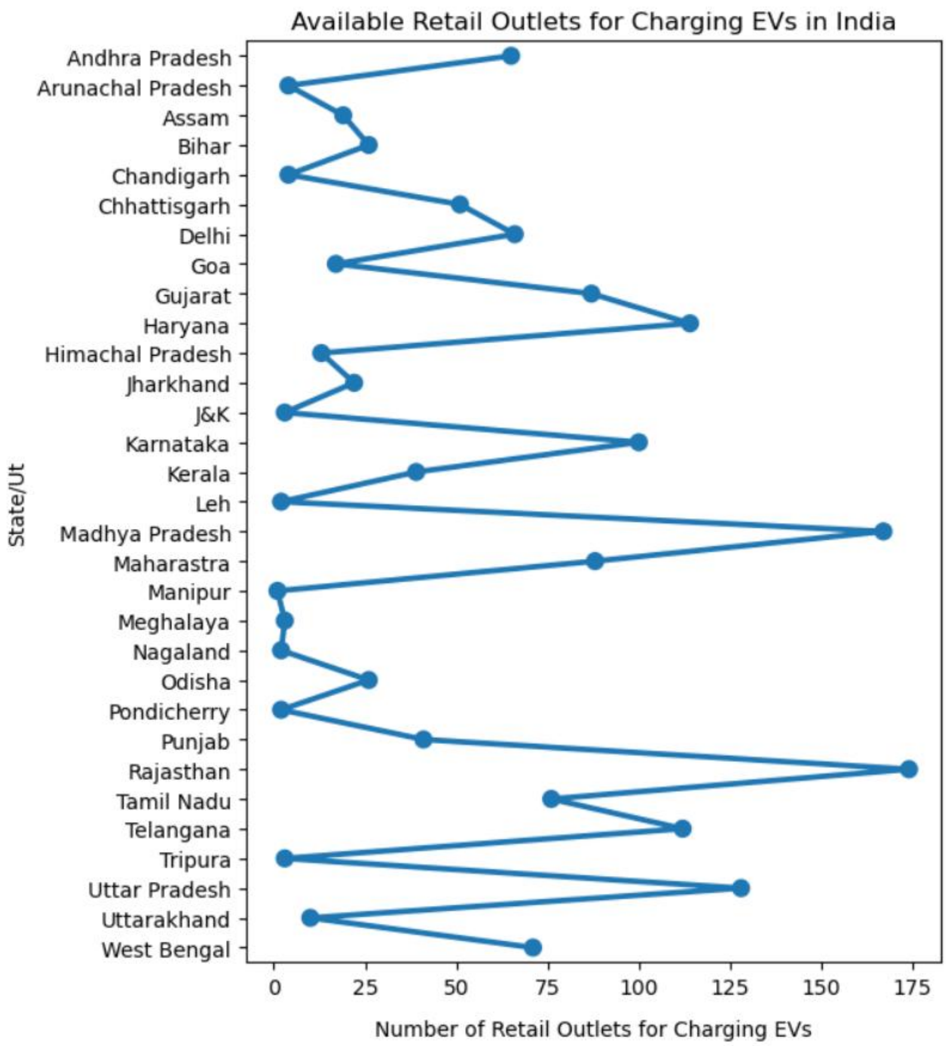


Statewise Electric Vehicles (3 Wheelers) in India
Andhra Pradesh
Assam
Bihar
Chandigadh
Chhattisgarh
Delhi
Gujarat
Haryana
Himachal Pradesh
Jammu & Kashmir
Karnataka
Kerala
Madhya Pradesh
Maharastra
Meghalaya
Odisha
Puducherry
Rajasthan
Sikkim
Tamil Nadu
Telangana
Uttar Pradesh
Uttarakhand
West Bengal
State
0
10000
20000
30000
40000
Number of EV: 3 Wheelers



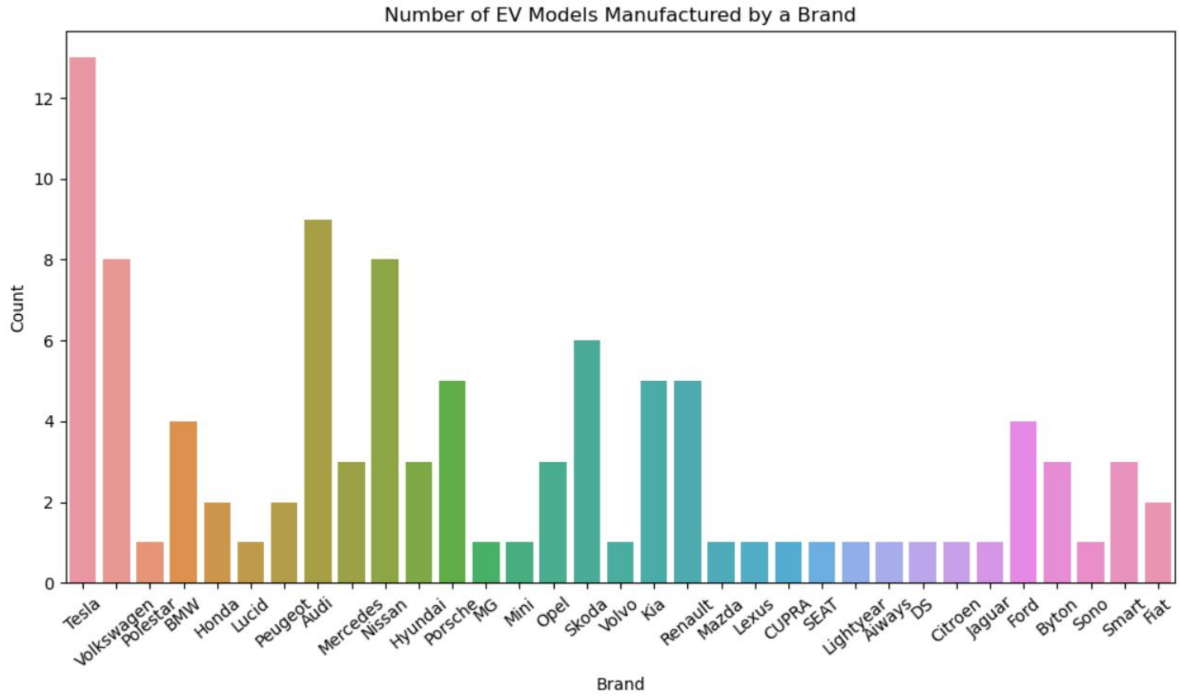


This Bar Chart shows the type of vehicles used in various states from the dataset after removing meaningless outliers. It also shows the Number of Charging Stations sanctioned in India state wise. Quick look at the graphs tells us that Maharashtra, Karnataka, Andhra Pradesh, Tamilnadu and Gujrat have the most number of electric vehicles and least number of electric vehicles are from Sikkim, Meghalaya, Lakshadweep, Ladakh, and Assam states.

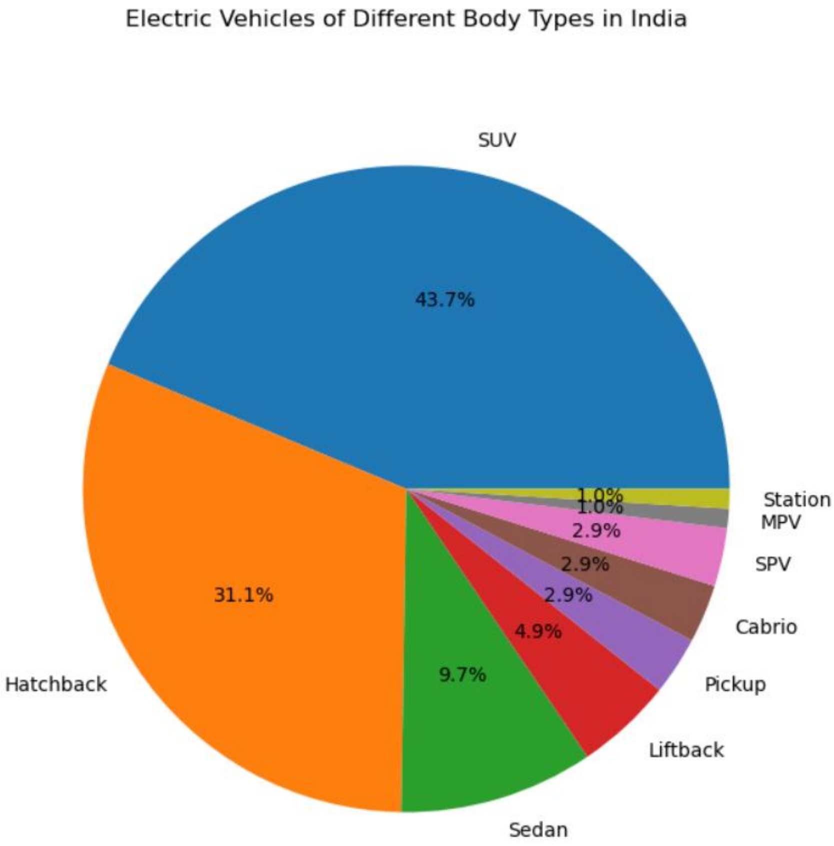


This point plot shows the number of retail outlets for charging EVs in various states fromthe dataset. Graphs shows us that Maharashtra, Karnataka, Andhra Pradesh, Tamilnadu and Gujrat have the most number of retail outlets for charging EVs and least number of retail outlets for charging EVs are from Sikkim, Meghalaya, Lakshadweep, Ladakh, and Assam states.

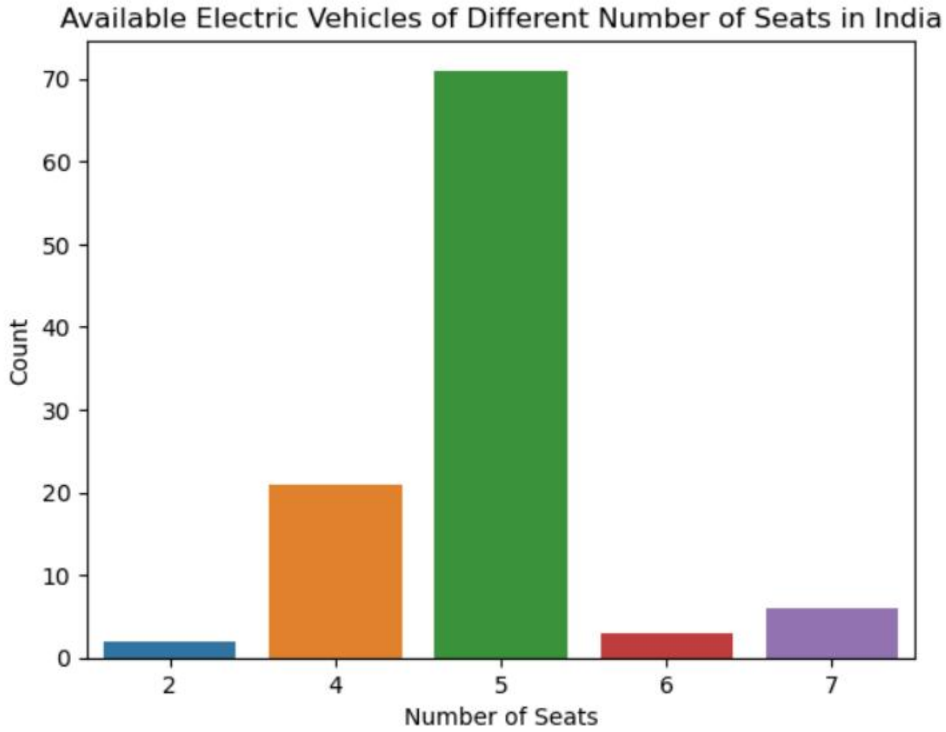
This bar graphs shows the manufacturers of Electric Vehicles.



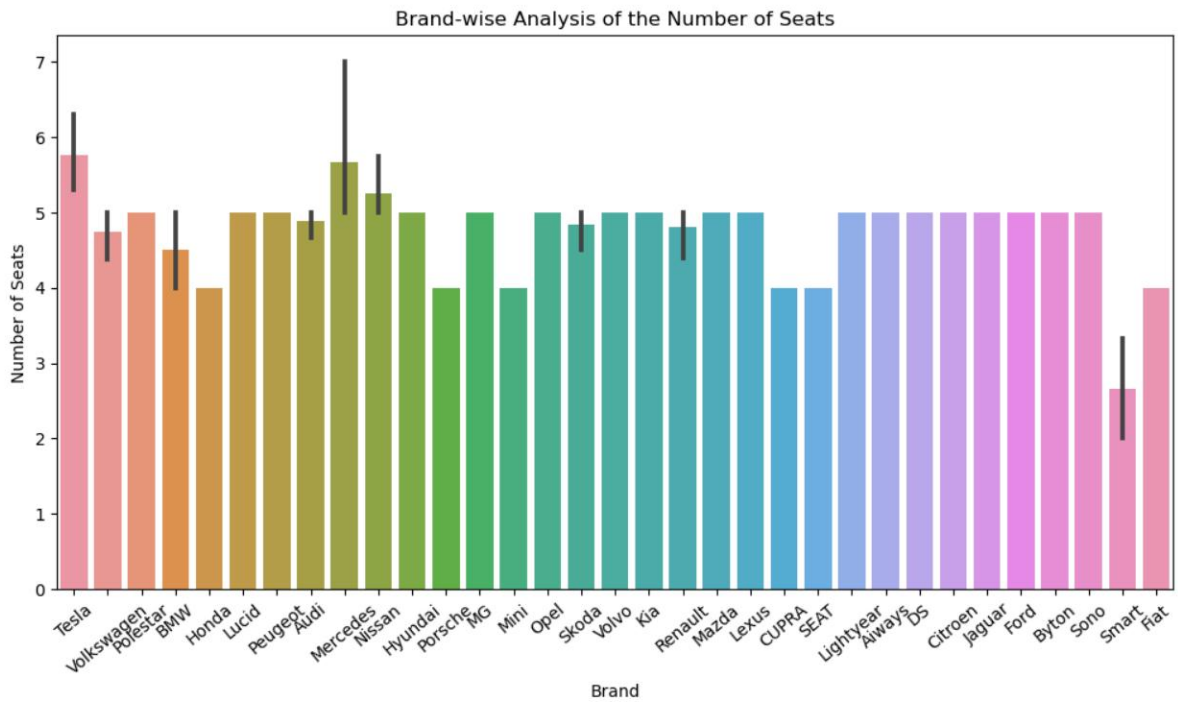
This pie chart shows the different types of Electric Vehicles.



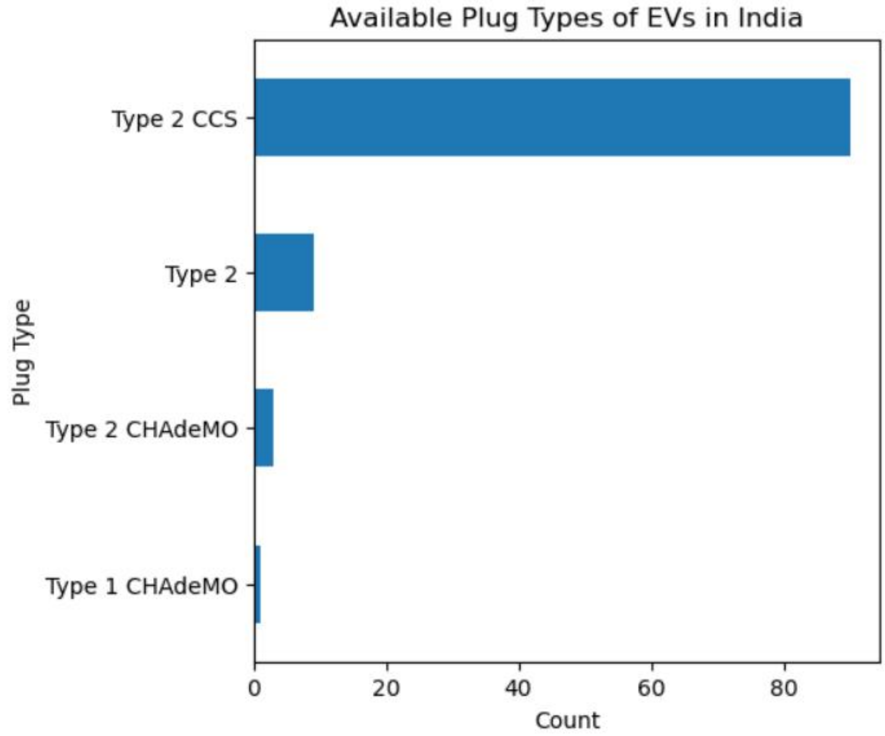
This bar graph shows the number of seats available in Electric Vehicles.



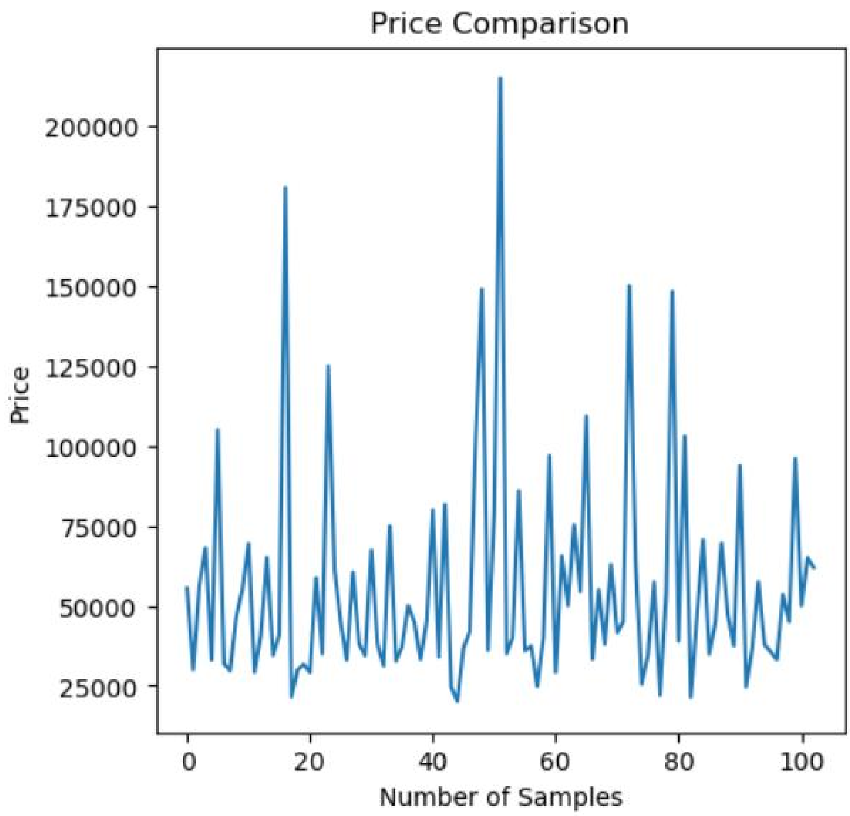
This bar graph shows the number of seats available in Electric Vehicles available in India.

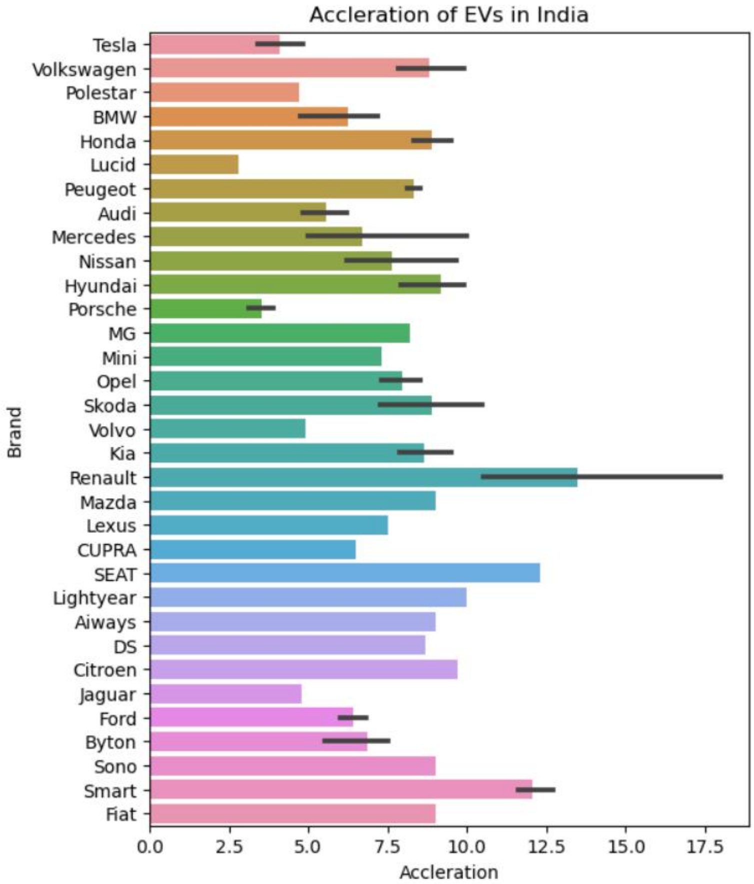


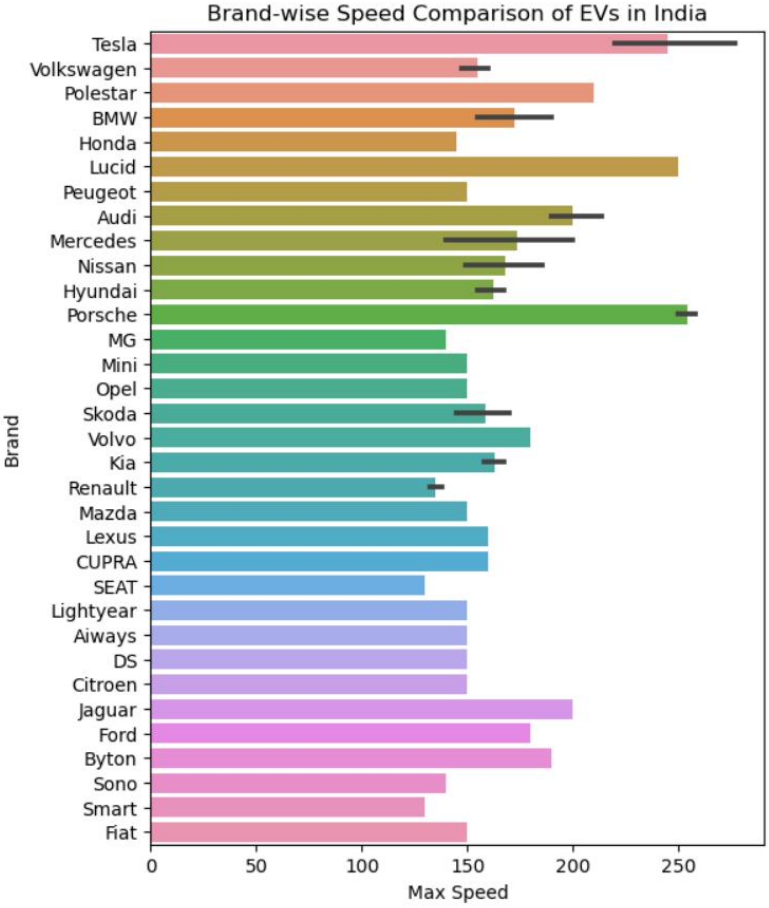
This bar graph shows the available plug types in Electric Vehicles.

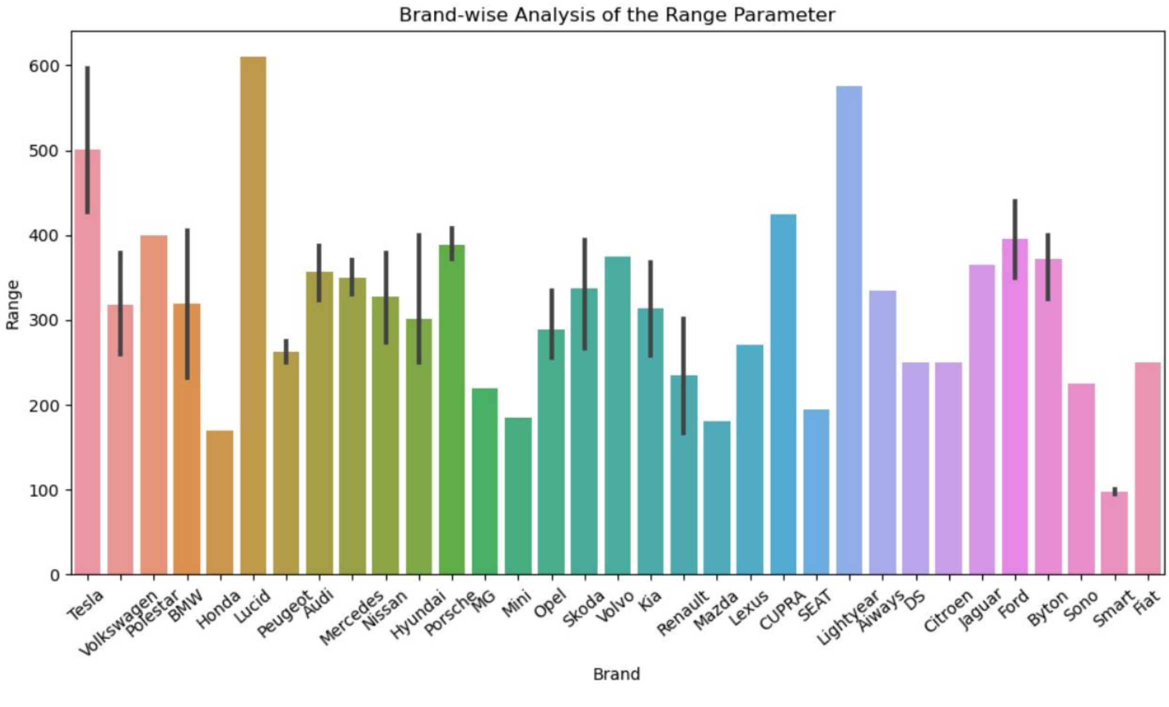


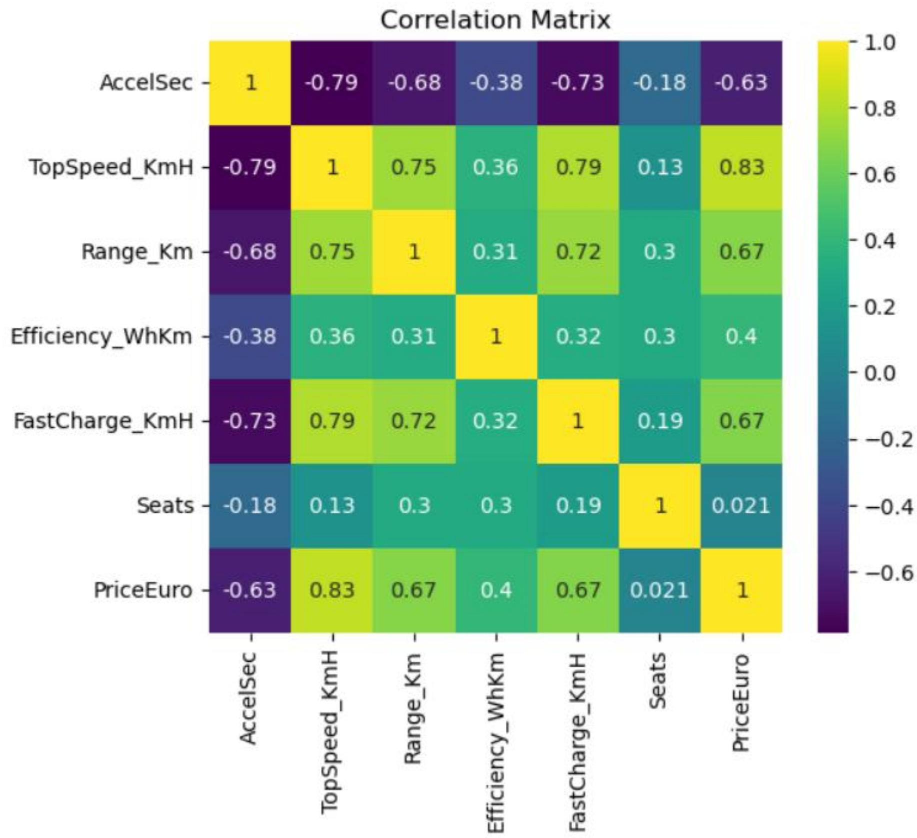
This line graph shows the price comparisons in Electric Vehicles.




Accleration of EVs in India
Tesla
Volkswagen
Polestar
BMW
Honda
Lucid
Peugeot
Audi
Mercedes
Nissan
Hyundai
Porsche
MG
Mini
Opel
Skoda
Volvo
Kia
Renault
Mazda
Lexus
CUPRA
SEAT
Lightyear
Aiways
DS
Citroen
Jaguar
Ford
Byton
Sono
Smart
Fiat
Brand
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
Accleration


Brand-wise Speed Comparison of EVs in India
Brand
Max Speed
Tesla
Volkswagen
Polestar
BMW
Honda
Lucid
Peugeot
Audi
Mercedes
Nissan
Hyundai
Porsche
MG
Mini
Opel
Skoda
Volvo
Kia
Renault
Mazda
Lexus
CUPRA
SEAT
Lightyear
Aiways
DS
Citroen
Jaguar
Ford
Byton
Sono
Smart
Fiat
0
50
100
150
200
250


Brand-wise Analysis of the Range Parameter
Range
Brand
0
100
200
300
400
500
600
Tesla
Volkswagen
Polestar
BMW
Honda
Lucid
Peugeot
Audi
Mercedes
Nissan
Hyundai
Porsche
MG
Mini
Opel
Skoda
Volvo
Kia
Renault
Mazda
Lexus
CUPRA
SEAT
Lightyear
Aiways
DS
Citroen
Jaguar
Ford
Byton
Sono
Smart
Fiat



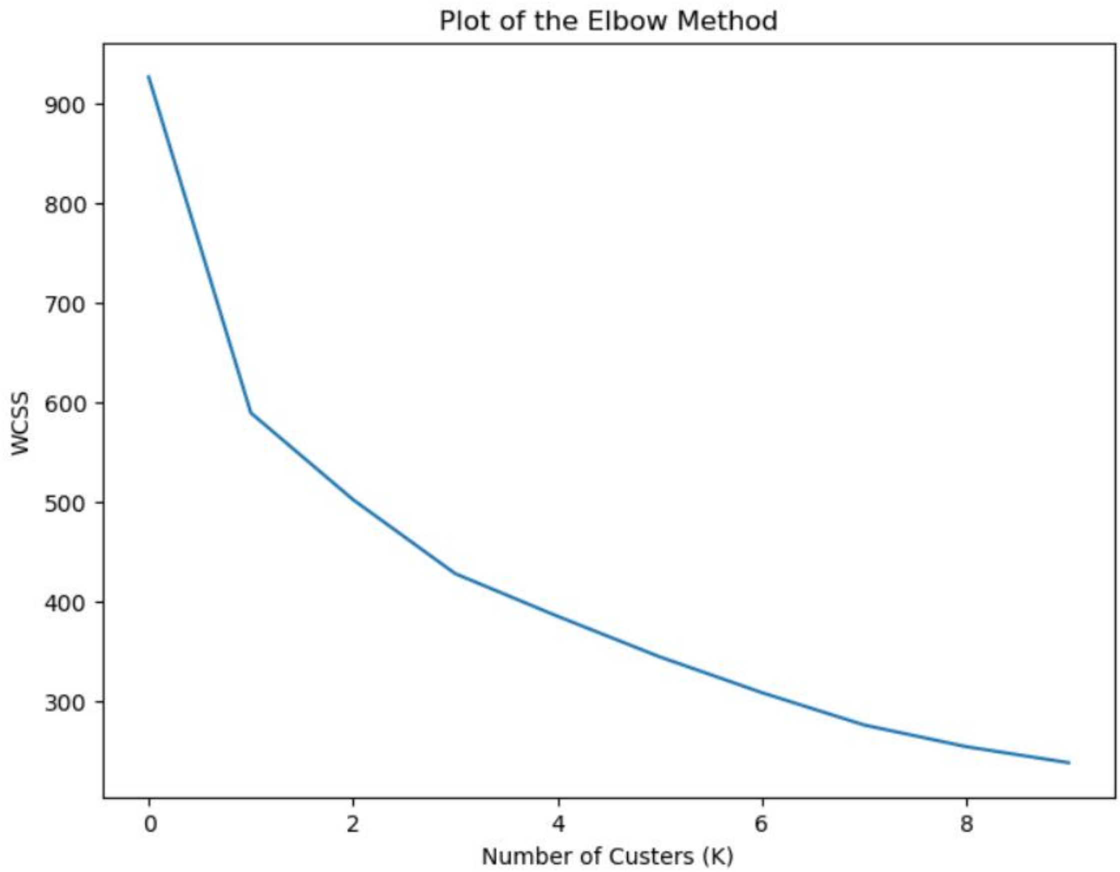
Segment Extraction:

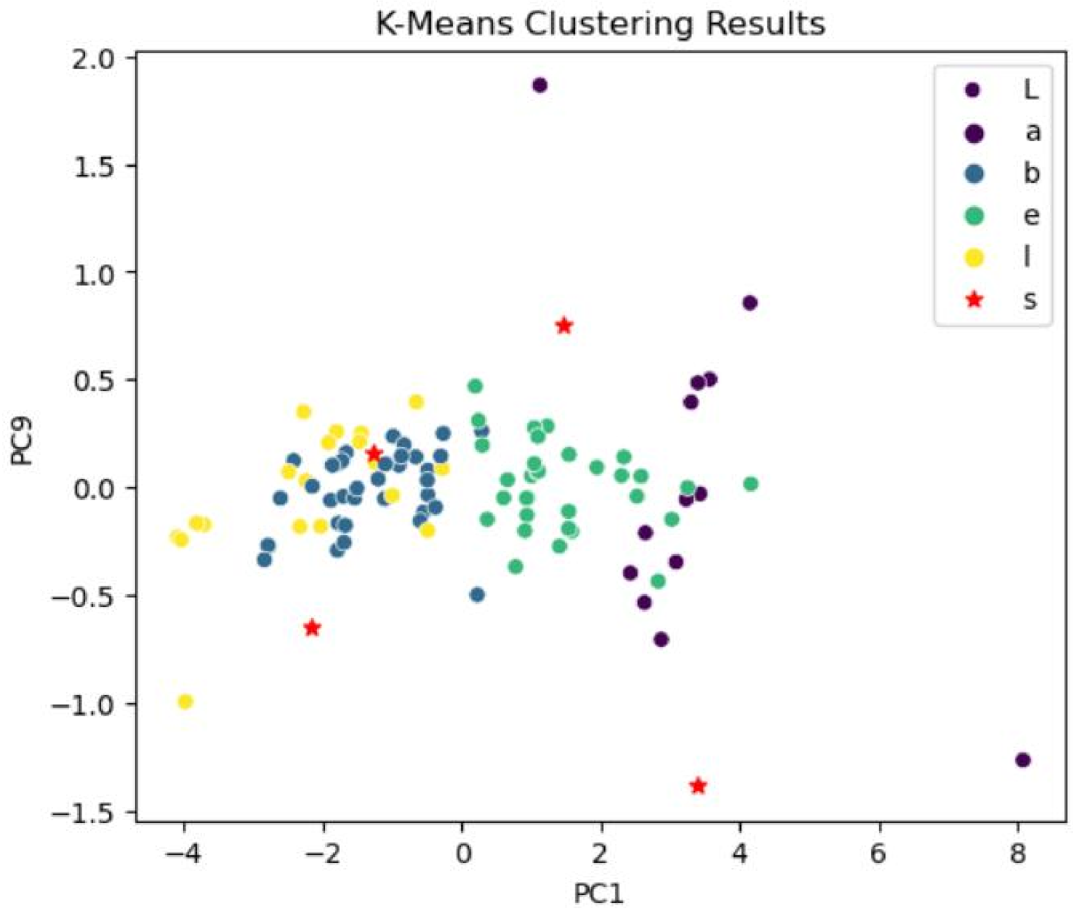
K-Means Clustering is one of the most popular Unsupervised Machine Learning Algorithms Used for Solving Classification Problems. K Means segregates the unlabeled data into various groups, called clusters, based on having similar features, common patterns.

Suppose we have N number of Unlabeled Multivariate Datasets of various features like water-availability, price, city etc. from our dataset. The technique to segregate Datasets into various groups, on the basis of having similar features and characteristics, is called Clustering. The groups being Formed are known as Clusters. Clustering is being used in Unsupervised Learning Algorithms in Machine Learning as it can segregate multivariate data into various groups, without any supervisor, on the basis of a common pattern hidden inside the datasets.

In the Elbow method, we are actually varying the number of clusters (K) from 1 – 10. For each value of K, 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. Whenwe plot the WCSS with the K value, the plot looks like an Elbow.

As the number of clusters increases, the WCSS value will start to decrease. WCSS value is largest when K = 1. When we analyze the graph, we can see that the graph will rapidly change at a point and thus creating an elbow shape. From this point, the graph starts to move almost parallel to the X-axis. The K value corresponding to this point is the optimal K value or an optimal number of clusters.





Github Link:

https://github.com/gayatripadmani/Feynn-Labs-Intership/tree/main/Task%203%20-%20Market%20Segmentation%20of%20Electric%20Vehicles%20in%20India

EV - Market Geographic Segmentation

Abstract:

This article provides a succinct introduction to the marketing tactic known as market segmentation (MS). Market segmentation is a key tactic that enables companies to recognise and target particular consumer segments with targeted advertising and product offerings. This case study looks at how a retailer increased sales and profitability by using market segmentation. This case study exemplifies how crucial market segmentation is to boosting revenue and profitability. Businesses can maintain their competitiveness and cater to the specific wants and preferences of their customers by recognising and targeting particular consumer groups with customised marketing messages and product offerings. Additionally, it emphasises important MS-related concepts together with their theoretical underpinnings and Python-based applications. One of the economies with the quickest growth is India.

Market Segmentation

What is Market Segmentation?

The division of a bigger market into smaller groups of consumers with comparable wants, traits, or behaviours is known as market segmentation. Market segmentation is to recognise and target these particular customer groups with customised advertising messages and product proposals that would better suit their tastes and needs. This enables companies to develop marketing efforts that are more successful and raises the possibility of bringing in and keeping customers. Numerous variables, including demographics, psychographics, location, behavioural patterns, and more, can be used to segment the market.

Why is it important?

Market Segmentation is necessary as:

1. Gaining a deeper understanding of clients: By recognising their unique demands, preferences, and behaviours, market segmentation enables firms to better understand their customers. Due to their ability to better address these needs, firms are able to personalise their marketing messaging and product offerings, which eventually results in more satisfied and devoted customers.
2. Marketing campaigns can be made to be more effective by targeting particular consumer segments with messaging and product offerings that are more appropriate for them. Better engagement, higher response rates, and higher sales result from this.
3. Competitive advantage: By developing products and marketing messages that are more suited to the requirements and preferences of particular consumer groups, firms can set themselves apart from their rivals. This gives firms a competitive edge and allows them to stand out in a crowded market.
4. Targeting particular consumer groups allows businesses to make more effective use of their marketing resources. Businesses can concentrate their resources on marketing strategies that are more likely to resonate with particular customer groups rather than investing money on campaigns that target a broad audience.

Types of Market Segmentation

There are different types of market segments that you can create. The four major types of Market Segmentation are given below.

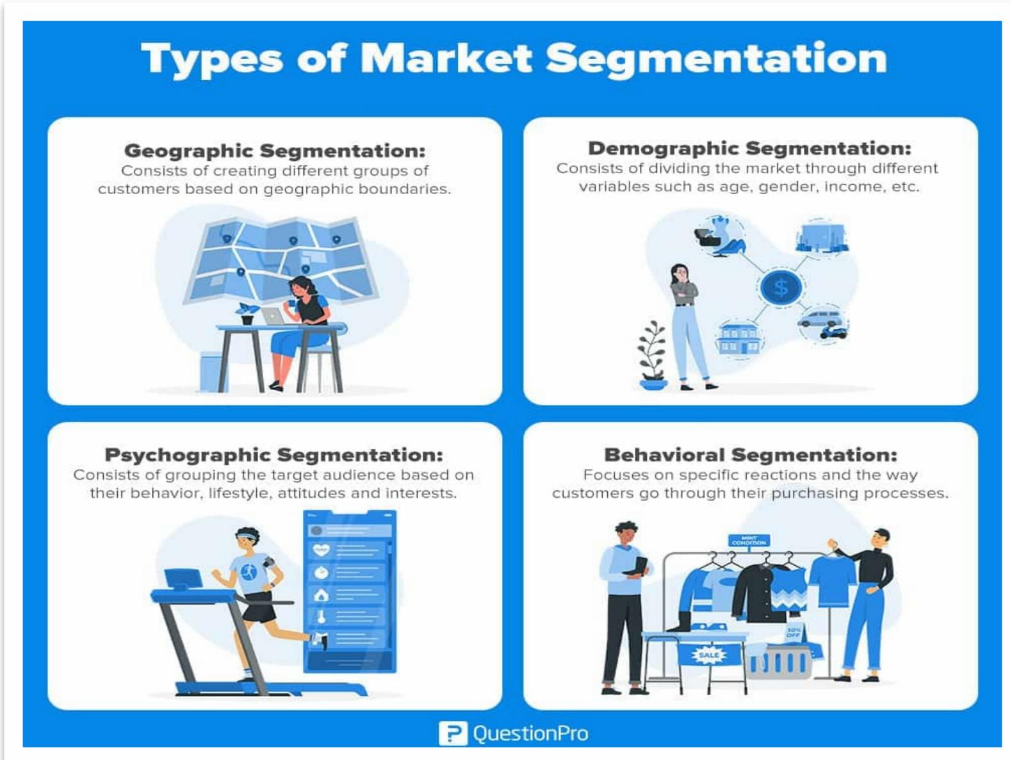


Fig: Methods of Market Segmentation

Geographic Segmentation

Segmenting the market according to a given geographic area, such as a nation, region, city, or climate. Your target segment is divided up using geographic segmentation based on places like a country, state, etc. Customers can also be located by taking into account their location's features, such as their language and if they live in an urban, suburban, or rural environment.

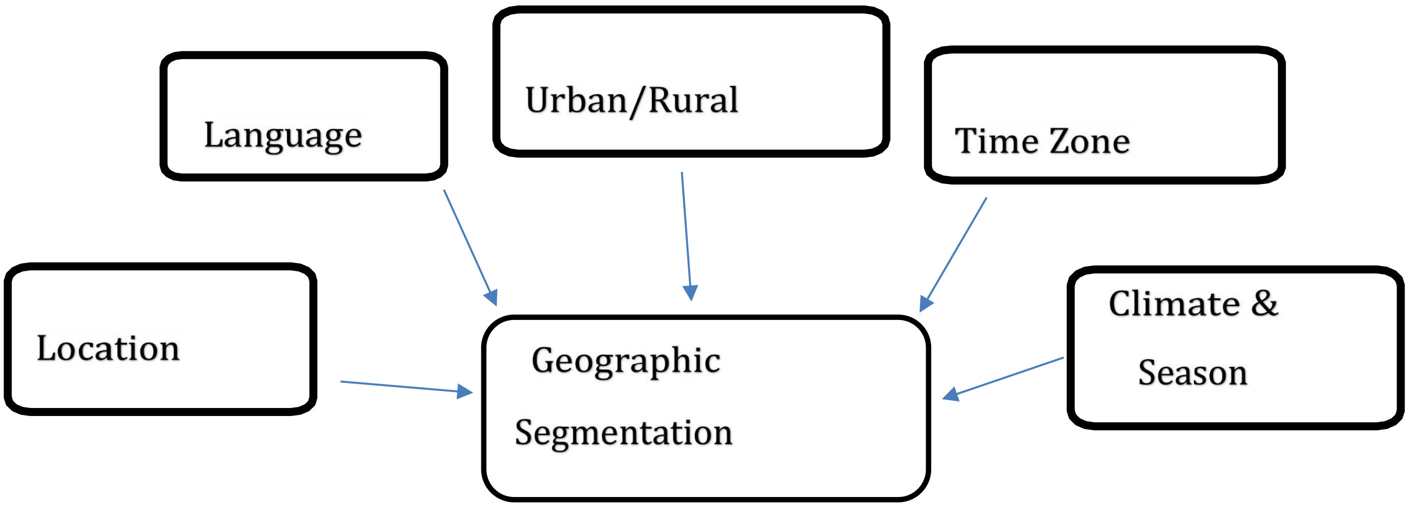


Fig: Geographic Segmentation.

Market Segmentation:

The EV market in India can be segmented based on geography into North India, South India, East India, and West India.

North India: Major cities like Delhi, Noida, and Gurgaon are at the forefront of the adoption of electric vehicles, making North India one of the top regions in the Indian EV industry. Due to rising public knowledge of the advantages of electric vehicles and government incentives to support clean energy, there is a considerable demand for electric two-wheelers and three-wheelers in the region. The Delhi government has unveiled a thorough electric car strategy, providing incentives like road tax and registration fee deductions for electric vehicles.

South India: With cities like Bangalore, Hyderabad, and Chennai spearheading the adoption of electric vehicles, South India is another important market for electric vehicles. Because there are many IT companies in the area and a developing middle class, there is a significant demand for electric vehicles. The Karnataka state government has unveiled a comprehensive electric vehicle strategy that includes incentives for electric vehicles, including exemptions from road tax, registration fees, and electricity rates.

East India: Although the industry for electric vehicles in East India is still relatively young, it has a lot of growth potential in the years to come. Due to government attempts to support clean energy and growing knowledge of the advantages of electric vehicles, cities like Kolkata and Bhubaneswar have seen an increase in demand for them. A complete electric vehicle strategy has been unveiled by the West Bengali administration, offering incentives like a road tax, registration fee, and electricity tariff exemption for electric vehicles.

West India: With cities like Mumbai, Pune, and Ahmedabad spearheading the adoption of electric vehicles, West India is another important market for electric vehicles. Due to the presence of major auto manufacturing enterprises and a growing middle class, the area has a significant demand for electric vehicles. A comprehensive electric vehicle strategy has been unveiled by the Maharashtra government, including incentives like reduced electricity rates, road tax exemptions, and registration fees.

Algorithm used in this project:

K-means clustering: is an unsupervised machine learning algorithm that is used to group data into K clusters based on their similarity. It is a simple and efficient algorithm that is widely used in various applications such as market segmentation, image segmentation, and data mining.

The basic idea behind the K-means algorithm is to minimize the distance between the data points and their respective cluster centroids. The algorithm starts by randomly selecting K initial cluster centroids from the data set. Then, each data point is assigned to the closest centroid based on the Euclidean distance between the data point and the centroid. Once all data points are assigned to their respective clusters, the centroid of each cluster is updated as the mean of all the data points in that cluster. The process of assigning data points to clusters and updating the centroids is repeated until the centroids no longer move or the maximum number of iterations is reached.

The K-means algorithm has a few key parameters:

1. K: The number of clusters to be formed. This is typically chosen based on prior knowledge or experimentation.
2. Distance Metric: The distance metric used to measure the similarity between the data points and centroids. Euclidean distance is the most commonly used distance metric, but other distance metrics such as Manhattan distance and cosine similarity can also be used.
3. Initialization Method: The method used to select the initial K centroids. Random initialization is commonly used, but other methods such as k-means++ initialization can also be used to improve the quality of the clustering.

The K-means algorithm has a few advantages:

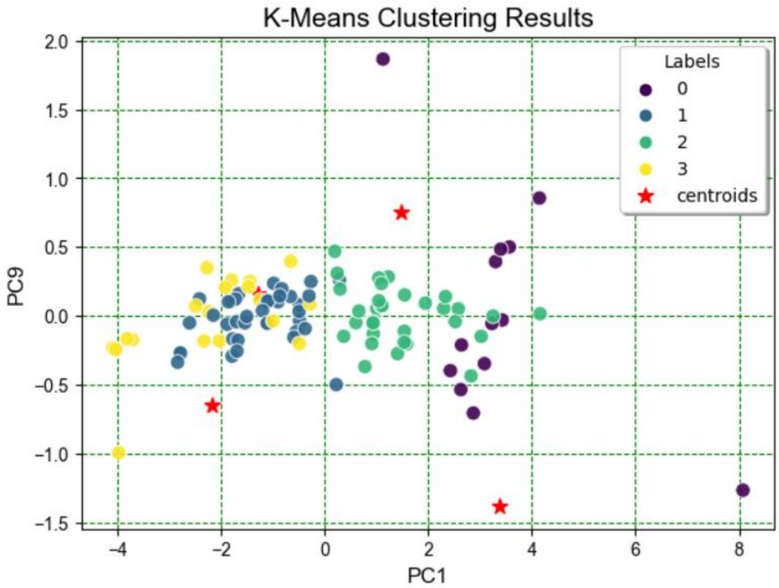
1. Simple and easy to implement.
2. Fast and efficient for large data sets.
3. Can handle high-dimensional data.

However, it also has some limitations:

1. The algorithm is sensitive to the initial centroid selection.

2. The algorithm may converge to a local optimum, rather than the global optimum.

3. The algorithm may not work well with non-linear data.



Conclusion:

In conclusion, India's market for electric vehicles is expanding significantly as a result of growing government support and increased public understanding of the advantages of electric vehicles. Geographically speaking, the market is divided into North India, South India, East India, and West India. East India is a relatively new market with significant development potential in the years to come, in contrast to North and South India, which are the country's two largest markets for electric vehicles. The industry is anticipated to develop across all areas as a result of rising consumer awareness, disposable income, and government backing. However, issues like a lack of infrastructure, expensive costs, and range anxiety are likely to slow down the market's growth in the near future. These issues are anticipated to be resolved by the government's actions to support sustainable energy and incentives for the use of electric vehicles, which will also fuel the expansion of the EV industry in India.