

**Report on**

**Market Segmentation and Analysis**

**Of**

**EV Market in India**



**Solo Submission by**

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# INTRODUCTION


The **Electric Vehicle (EV)** market in India is undergoing a rapid transformation, driven by a confluence of factors such as environmental consciousness, government incentives, and advancements in EV technology. As this industry continues to evolve, market segmentation and analysis play a pivotal role in understanding the dynamics of this burgeoning sector.

This report is dedicated to exploring the intricacies of the Indian EV market, specifically focusing on market segmentation and user reviews, with a keen eye on discerning the target customer base.


In recent years, EVs have gained significant traction in India as more consumers seek eco-friendly and cost-efficient alternatives to traditional internal combustion engine vehicles. With the aim of providing valuable insights to industry stakeholders and enthusiasts, this report delves into the market segmentation, drawing on data analysis, to identify key customer segments and their preferences within the Indian EV market. Additionally, I examine user reviews to gauge the sentiment, satisfaction levels, and key concerns of EV owners, shedding light on the evolving landscape of this sector. Through a comprehensive analysis of these aspects, this report aims to offer a comprehensive understanding of the Indian EV market and provide valuable recommendations for industry players and policymakers alike.

## MARKET OVERVIEW

- **Government Initiatives:** The Electric Vehicle (EV) market in India is witnessing a significant transformation, driven in large part by the Indian government's proactive measures. The "**Faster Adoption and Manufacturing of Hybrid and Electric Vehicles**" (FAME) scheme is at the forefront of these initiatives, offering incentives and subsidies to both manufacturers and consumers. This has effectively reduced the upfront costs of electric vehicles, making them more appealing to a broader customer base.



MINISTRY OF  
HEAVY INDUSTRIES &  
PUBLIC ENTERPRISES  
GOVERNMENT OF INDIA





मेरी सरकार

## A Big Push Towards PM's Vision of Sustainable Transportation under FAME Scheme (2/2)

### FAME Phase II

- ◆ Being implemented for 3 years w.e.f. 1st April'19, with a budgetary support of ₹10,000 crore
- ◆ To support approx. 7000 e-Buses, 5 lakh e-3 Wheelers, 55000 e-4 Wheeler Passenger Cars, 10 lakh e-2 Wheelers & creation of charging infrastructure
- ◆ 670 new Electric buses sanctioned for Maharashtra, Goa, Gujarat & Chandigarh
- ◆ 241 new Charging Stations sanctioned for Madhya Pradesh, Tamil Nadu, Kerala, Gujarat & Port Blair

- **State-Level Incentives:** Beyond the FAME scheme, various state governments have introduced additional benefits, including exemptions from road taxes and registration fees for EVs. These state-level incentives further sweeten the deal for potential buyers and encourage the adoption of electric mobility.
- **Charging Infrastructure Growth:** The expansion of the EV charging infrastructure is another noteworthy development. . As of 2023, India has witnessed a substantial increase in the number of public charging stations, with a total of 8029 stations across 777 cities. Efforts are underway to further expand this network, with plans to install a total of 1.32 million charging stations by 2030.

# DATASET

This report bases it's analysis on 2 datasets:

## 1. Electric Vehicles User Reviews India

Electric Vehicles User Reviews for two-wheeler and four-wheeler in India

<https://www.kaggle.com/datasets/deadprstkriish/ev-cars-user-reviews-india>

## 2. Gov owned Vahan Sewa Dashboard

<https://vahan.parivahan.gov.in/vahan4dashboard/>

# FERMI ESTIMATION

These Fermi estimations provide a broad perspective on the various aspects of the Indian EV market, offering rough quantitative values to better understand its current state and potential.

- **Total Indian EV Market Size:**

The EV Market in India is estimated at USD 5.61 billion in 2023, and is expected to reach USD 37.70 billion by 2028, growing at a CAGR of 46.38% during the forecast period (2023-2028).

- **Demographic Factors:**

- **Urban vs. Rural Divide:** Approximately 35% of India's population lives in urban areas. EV adoption is more prominent in urban centers due to better infrastructure and awareness.

- **Income Levels:** A significant percentage of EV buyers belong to the middle-income group, with disposable incomes between INR 5-10 lakh per annum.
- **Age Group:** Young professionals aged 25-40 are more likely to adopt EVs due to environmental concerns and tech-savviness.

- **Geographical Factors:**

- **Regional Variation:** EV adoption in India varies significantly by region. Let's break down the market into three main regions:

Northern Region (Delhi, Uttar Pradesh, etc.)

Southern Region (Tamil Nadu, Karnataka, etc.)

Western Region (Maharashtra, Gujarat, etc.)

- **Market share by region:** Assuming that the northern region has a higher adoption rate of EVs due to stricter pollution norms and greater awareness, it might account for 40% of the total market. The southern and western regions could each represent 30% of the market.

- **Government Incentives Impact:**

FAME scheme incentives reduce the cost of an EV by about 20%.

If an average EV cost is around INR 10 lakh (1 million), the incentive could save consumers INR 2 lakh.

Considering the incentives, we can estimate that around 500,000 EVs have been sold due to this scheme.

# MARKET SEGMENTATION ANALYSIS:

## Dataset-1: Electric Vehicles User Reviews India

### Dataset:

```
[ ] df=pd.read_csv('4-wheeler-EV-carwale.csv')
df.head()
```

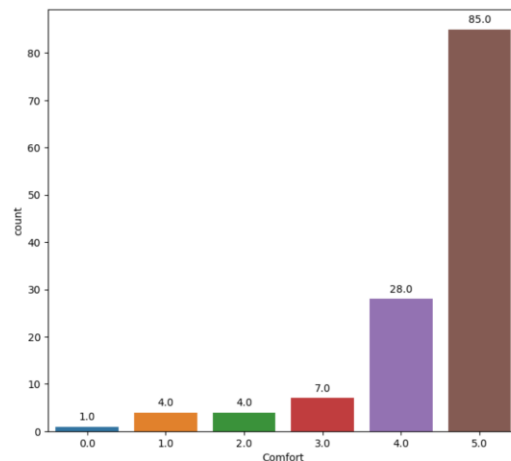
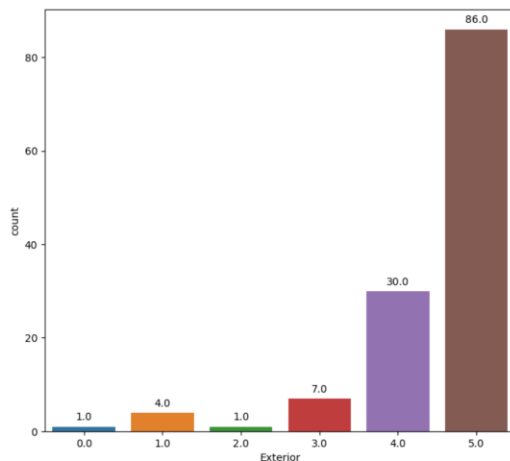
	review	Exterior	Comfort	Performance	Fuel Economy	Value for Money	Condition	driven	rating	model_name
0	Superb car like as fantastic as petroleum car....	5.0	4.0	5.0	5.0	5.0	New	Few hundred kilometers	5.0	hyundai kona
1	Anti national, worst service, worst customer c...	1.0	1.0	1.0	1.0	1.0	New	Haven't driven it	0.0	hyundai kona
2	Super happy with it. The car is too good	4.0	5.0	5.0	5.0	4.0	New	Few thousand kilometers	5.0	hyundai kona
3	Pretty good car, smooth as a glider fast car, ...	5.0	5.0	5.0	5.0	5.0	New	Few thousand kilometers	5.0	hyundai kona
4	Price difference between petrol and electronic...	4.0	4.0	5.0	3.0	2.0	Not Purchased	Haven't driven it	3.0	hyundai kona

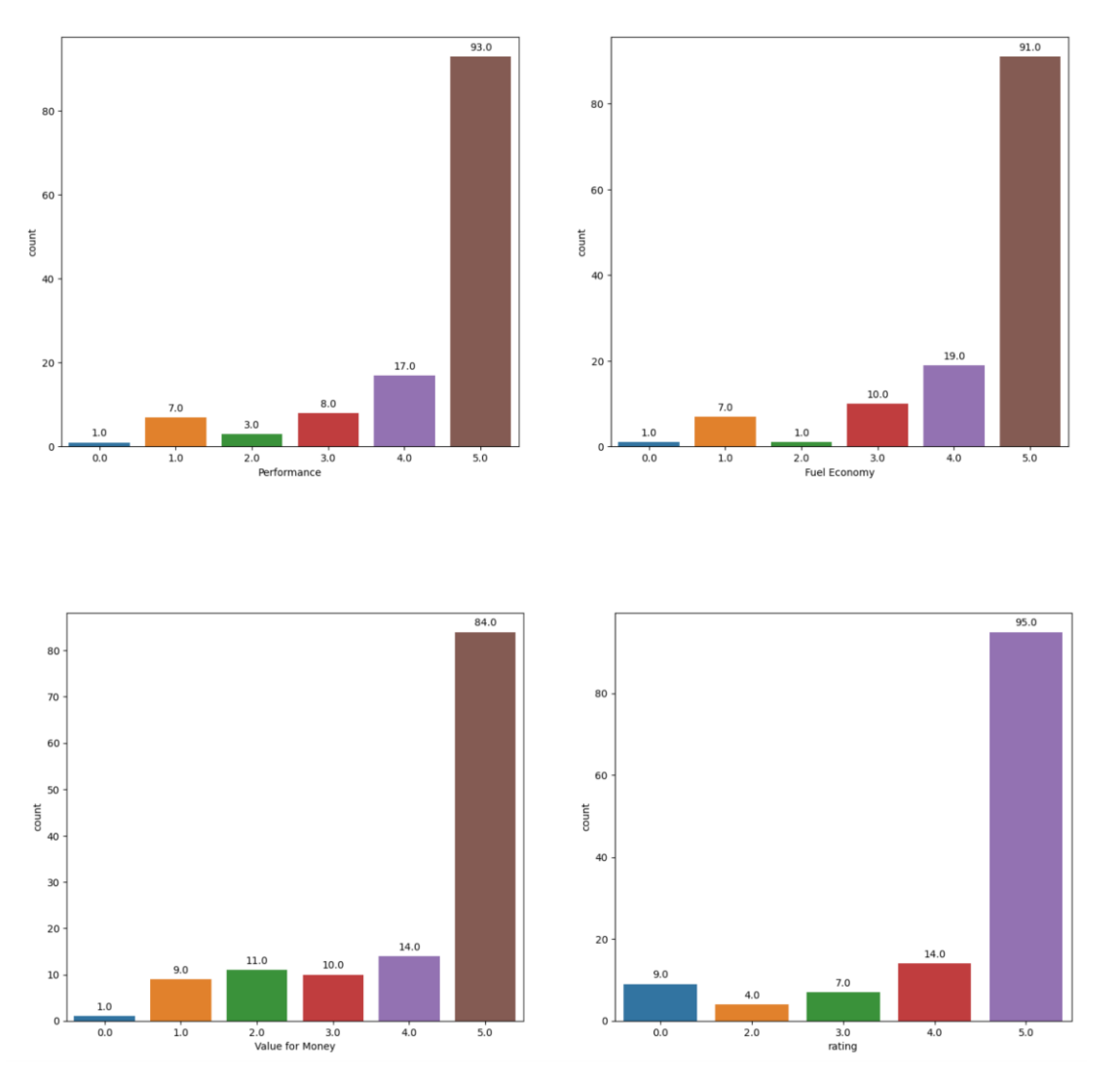
### Data Pre-processing (Libraries used)

```
[1] import pandas as pd
import warnings
import numpy as np
import re
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.decomposition import PCA
from sklearn.preprocessing import StandardScaler
import plotly.express as px
from sklearn.cluster import KMeans
```

### Exploratory Data Analysis:

#### Plots on Index:



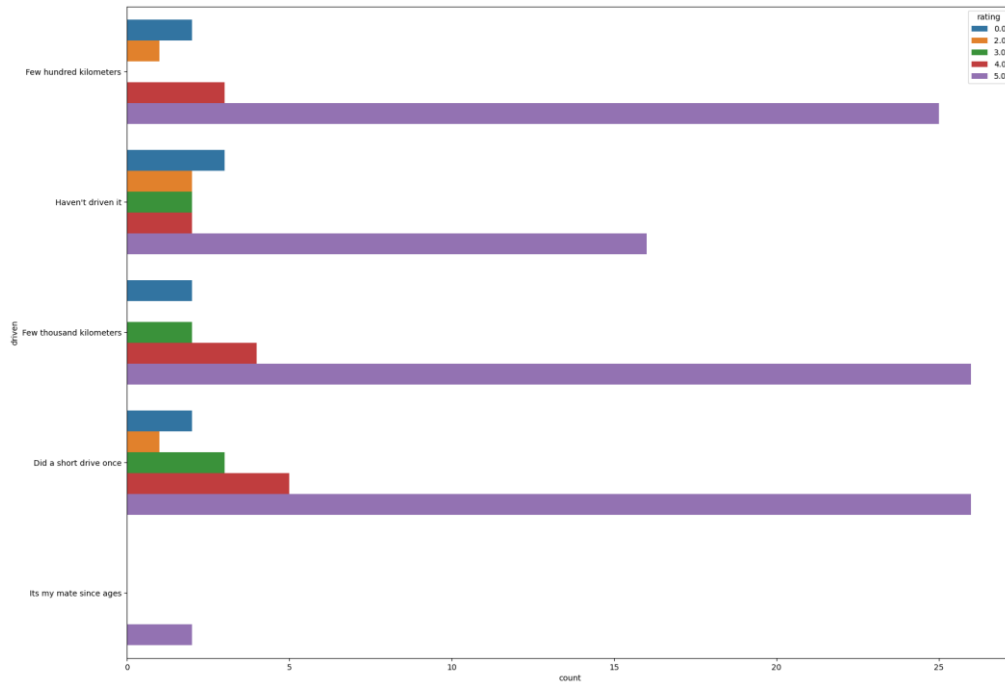


## Specifying Target Segments

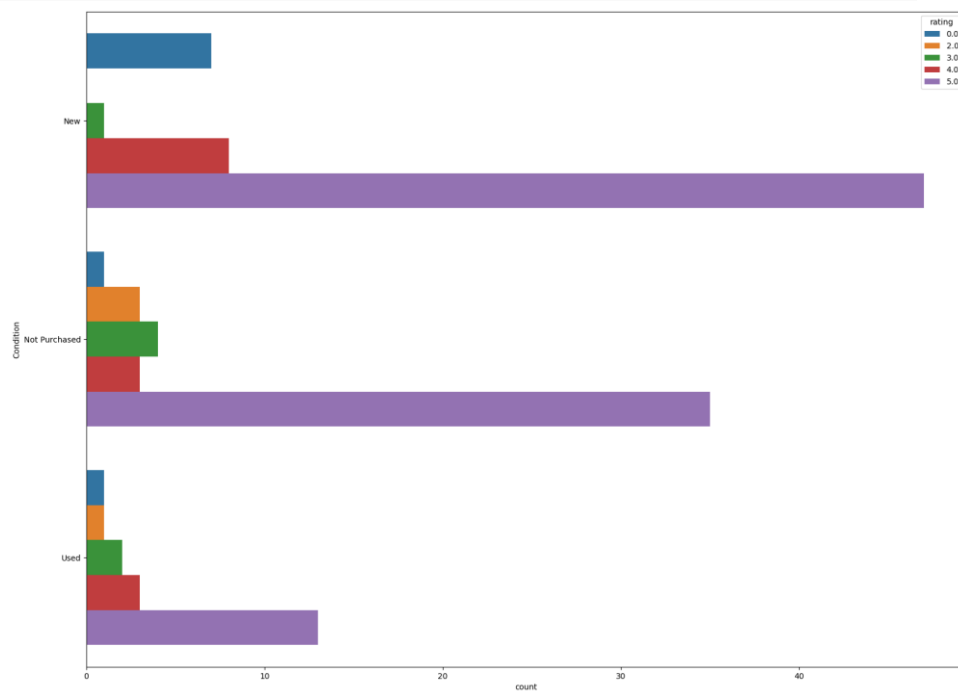
From above analysis, it can be concluded that the optimum customer base or the ideal target segments “Driven” and “Condition”



```
plt.figure(figsize=(20, 15))  
sns.countplot(y='driven', data = df, hue='rating')
```



```
[15] plt.figure(figsize=(20, 15))
      sns.countplot(y='Condition', data = df, hue='rating')
```





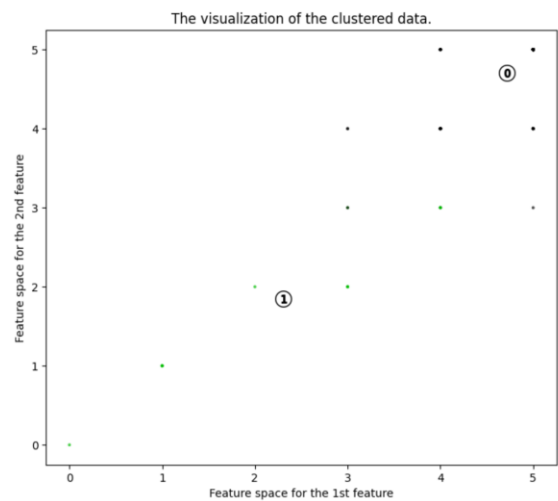
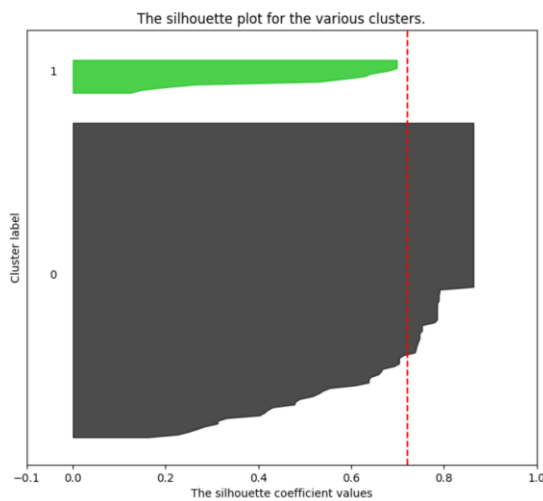
## Segmentation

### Using K Means

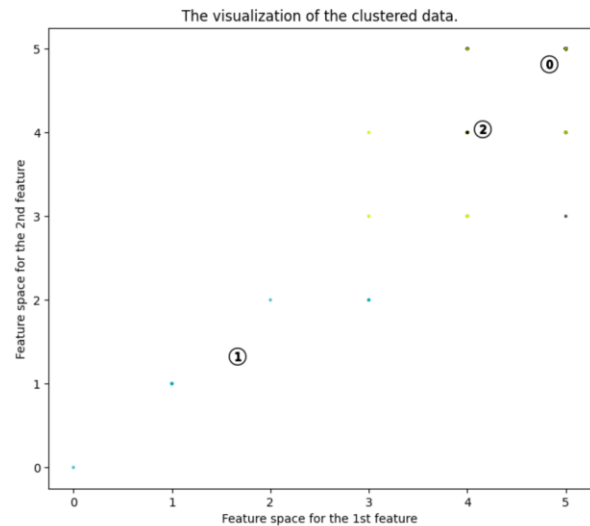
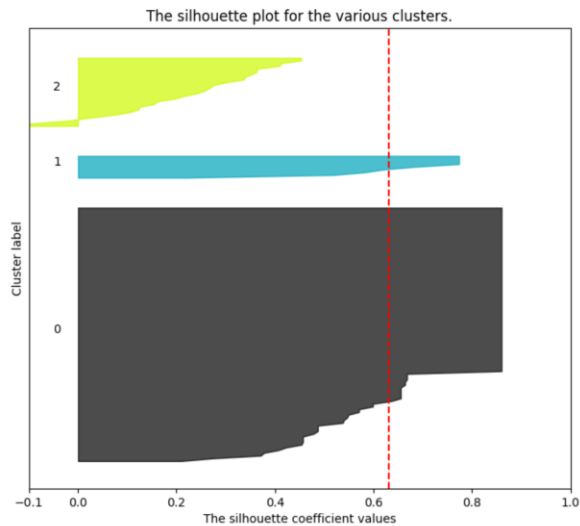
K-Means Clustering is an Unsupervised Learning algorithm, which groups the unlabeled dataset into different clusters. Here K defines the number of pre-defined clusters that need to be created in the process, as if  $K=2$ , there will be two clusters

### Clustering:

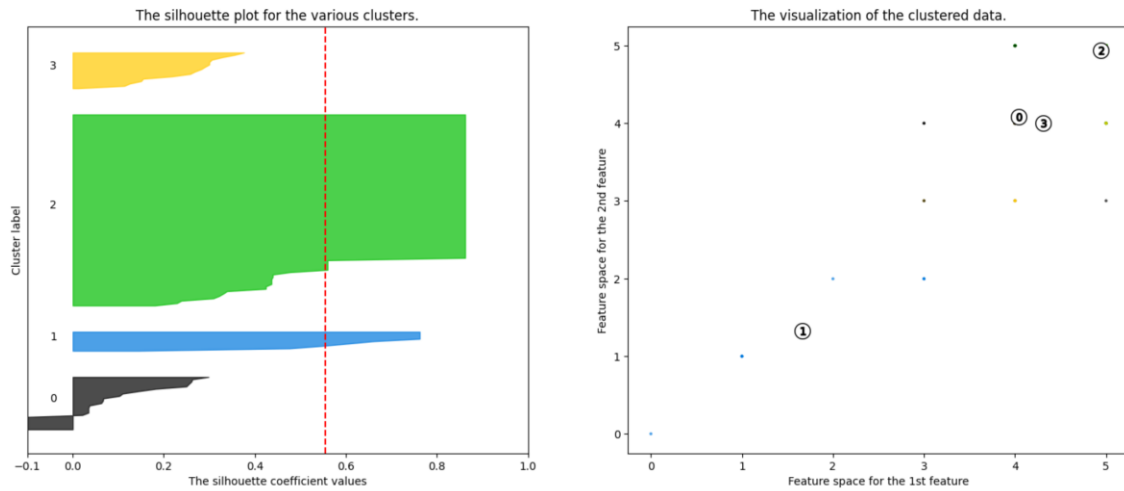
**Silhouette analysis for KMeans clustering on sample data with  $n\_clusters = 2$**



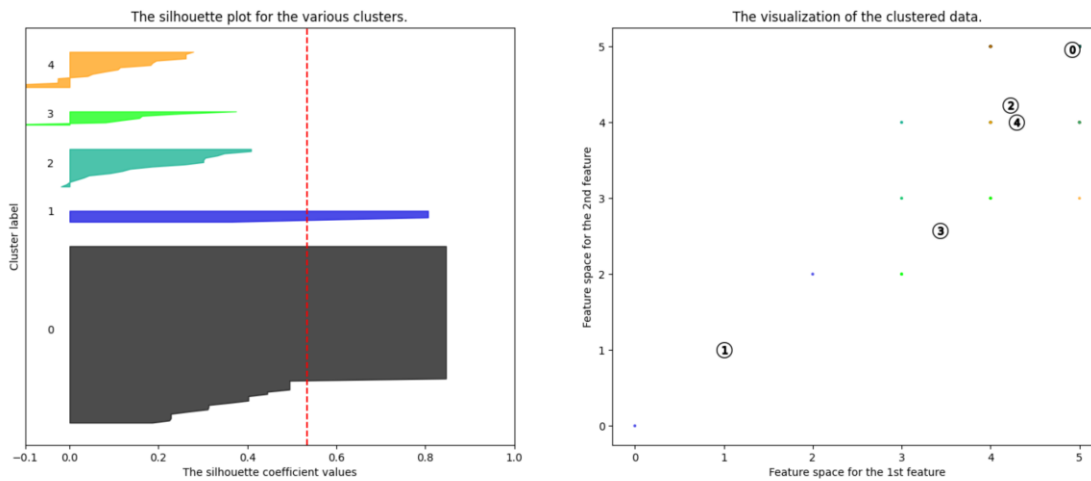
**Silhouette analysis for KMeans clustering on sample data with  $n\_clusters = 3$**



### Silhouette analysis for KMeans clustering on sample data with $n\_clusters = 4$



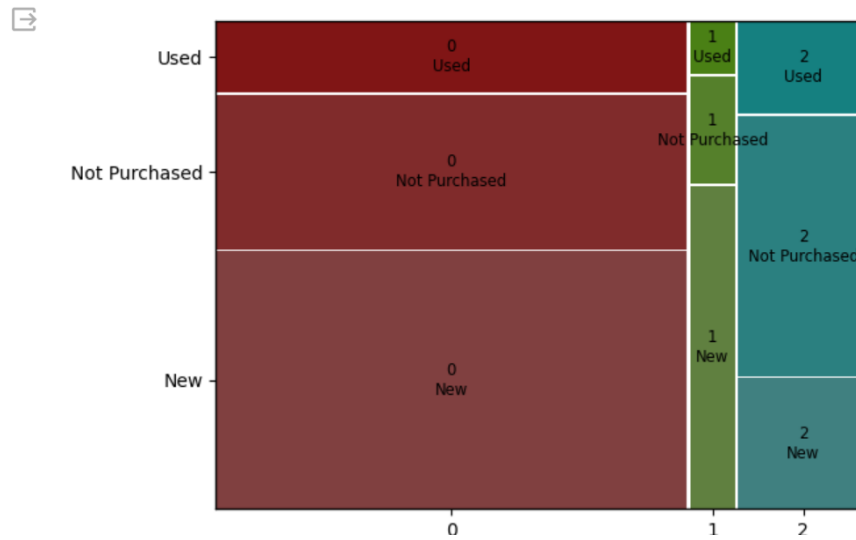
### Silhouette analysis for KMeans clustering on sample data with $n\_clusters = 5$



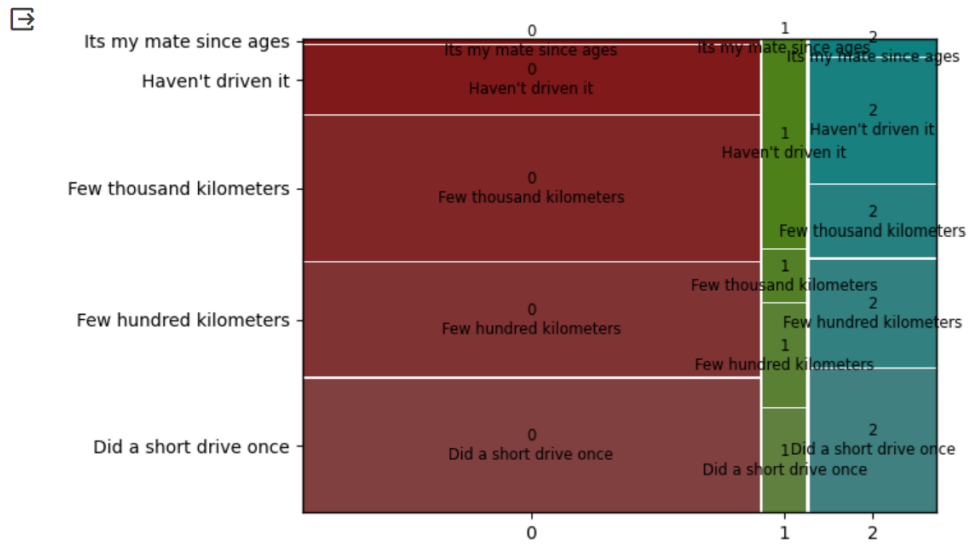
## Describing Segments:

1. Condition
2. Distance Driven

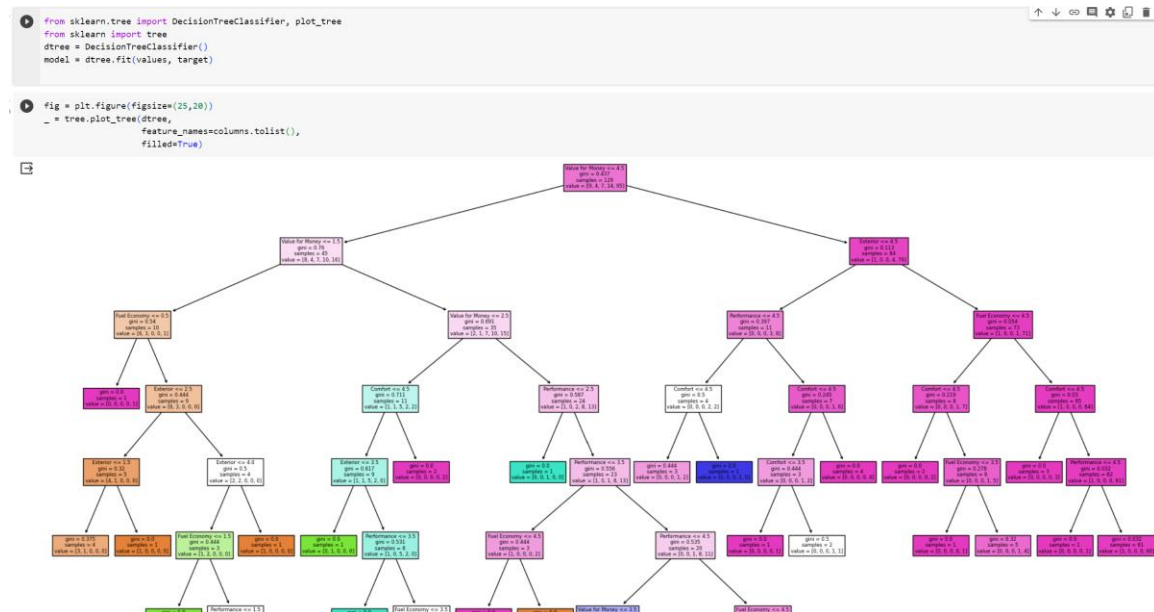
```
# Condition
crosstabCondition = pd.crosstab(kmeans.labels_, df['Condition'])
mosaic(crosstabCondition.stack())
plt.show()
```



```
# Distance Driven
crosstabDriven = pd.crosstab(kmeans.labels_, df['driven'])
mosaic(crosstabDriven.stack())
plt.show()
```



## Selecting the Target Segments



## Interpret the Clusters:

### 1st Cluster:

- Customers with positive reviews for all the properties
- Most of them own new EVs and haven't driven them much

### 2nd Cluster:

- Customers with negative reviews for all the properties.
- Customers who purchased new EVs but haven't driven them much.

### 3rd Cluster:

- Customers who are satisfied with the Exterior and the Comfort but have mixed reviews for the remaining properties
- Most of them haven't purchased an EV.

## INFERENCE AND CONCLUSION

The 3rd Cluster is chosen to be the target as it has the most impact on customer's perception.

## Dataset-2: Target Customer Demographic, Behavioral, Psychographic and Geographic Analysis

### Dataset:

```
[4] data= pd.read_csv('statewise_details.csv')  
data.head()
```

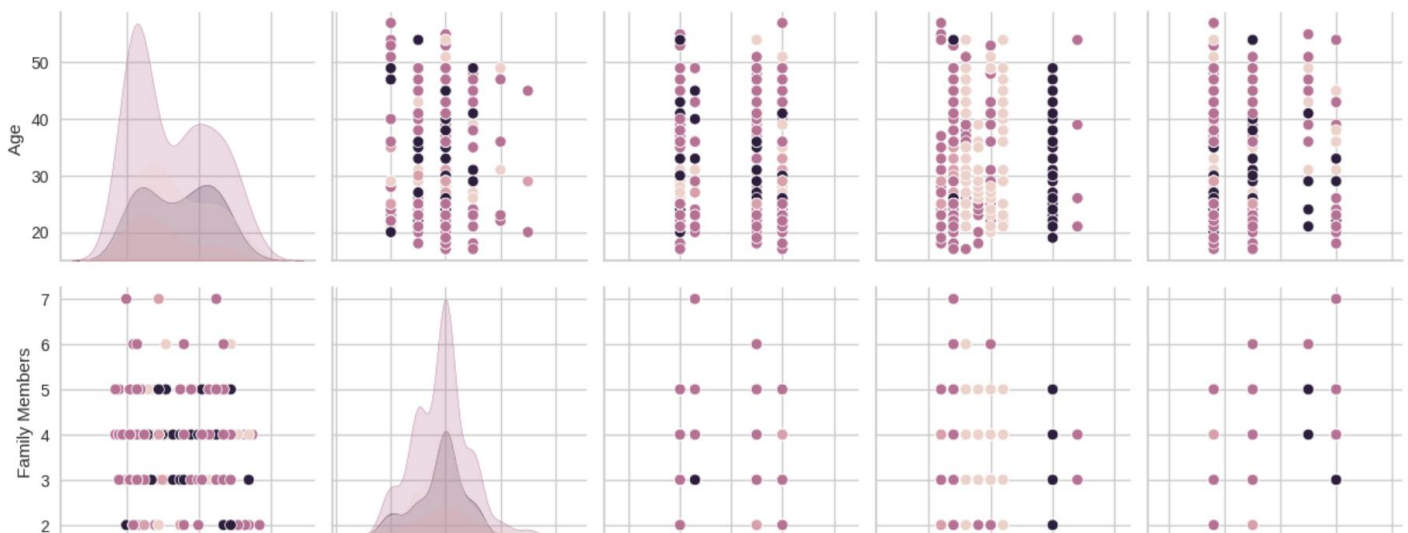
	Age	City	Gender	Education Level	Occupation	Family Members	Annual Income	Charging Hours	Electric Cars are economical	Charging stations	Convert your car to all electric	Hybrid or Both	Next car will be electric car?
0	29	Kolkata	Male	Postgraduate	Working Professional	5	150000	1	Yes	15	Yes	Hybrid car	5
1	29	Mumbai	Male	Graduate	Working Professional	4	1000000	1	Yes	8	Yes	Electric car	5
2	25	Mumbai	Male	Graduate	Working Professional	4	5000	5	Yes	15	Didn't think about it	Hybrid car	5
3	25	Bangalore	Male	Graduate	Working Professional	4	750000	1	Don't know	8	Didn't think about it	Hybrid car	5
4	21	Mumbai	Male	Postgraduate	Student	4	5000	12	Don't know	15	Didn't think about it	Hybrid car	5

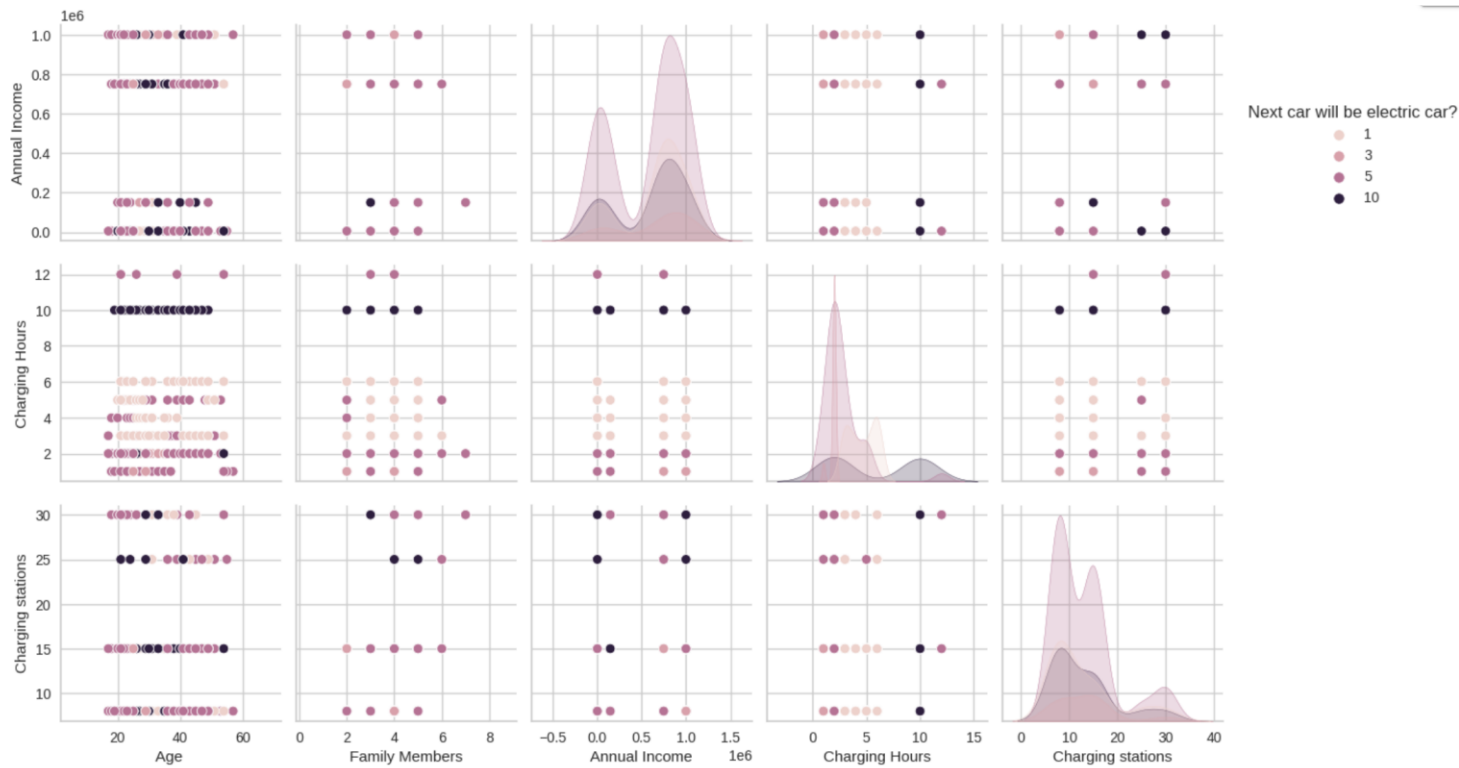
### Data Pre-processing (Libraries used)

```
[1] import pandas as pd  
import numpy as np  
import matplotlib.pyplot as plt  
import seaborn as sns  
from sklearn.preprocessing import StandardScaler  
from sklearn.decomposition import PCA  
from sklearn.cluster import KMeans  
from yellowbrick.cluster import KElbowVisualizer  
from sklearn.metrics import silhouette_score
```

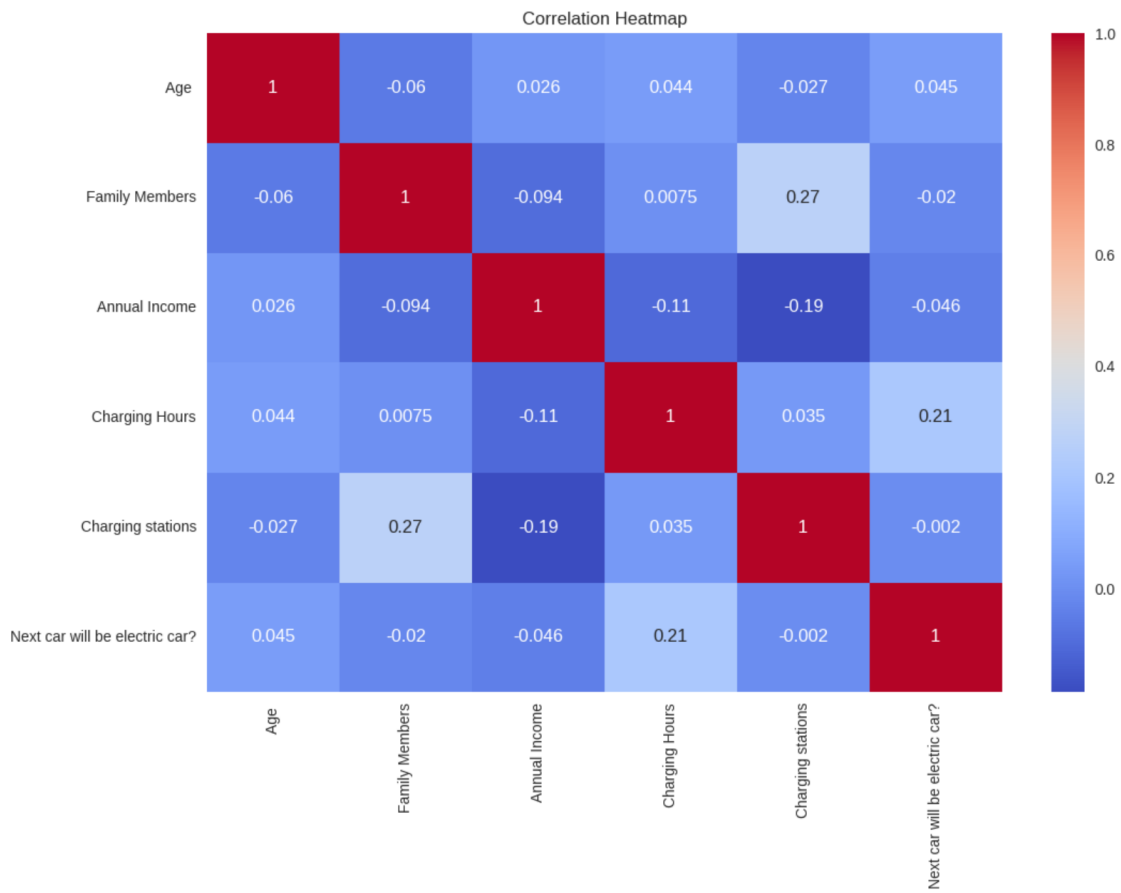
### Exploratory Data Analysis(EDA)

# Pairplot to visualize relationships between numerical variables

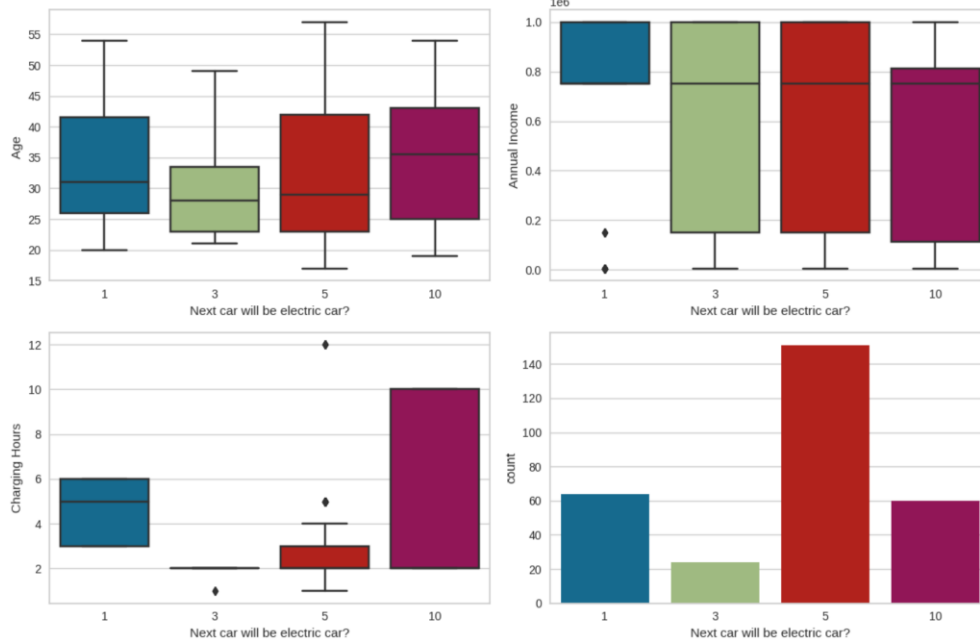




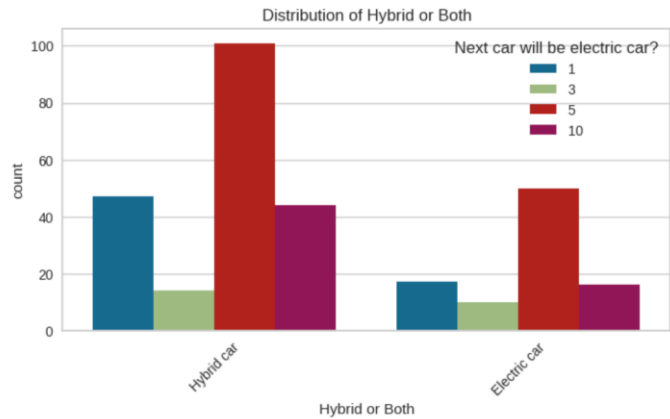
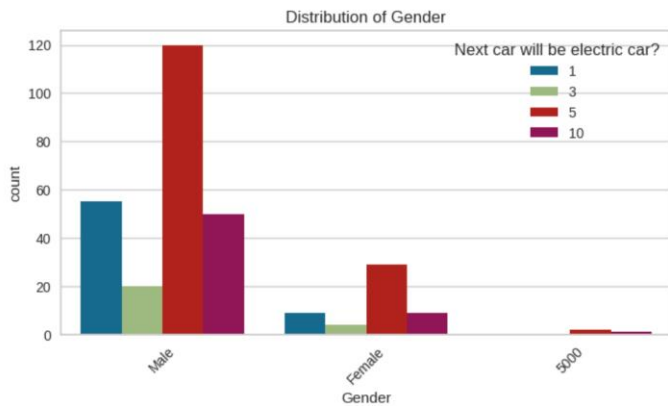
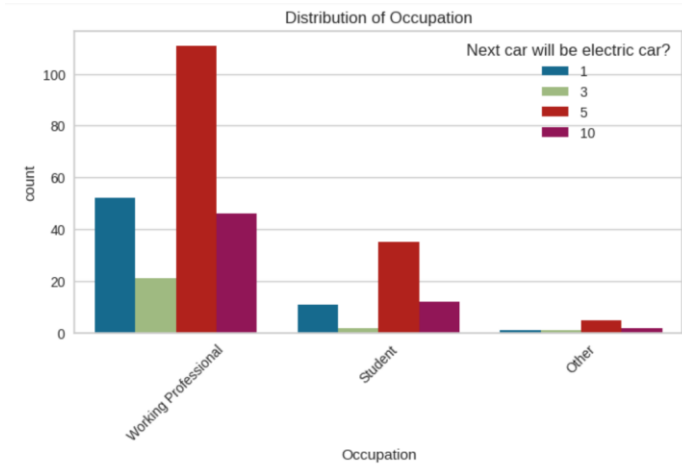
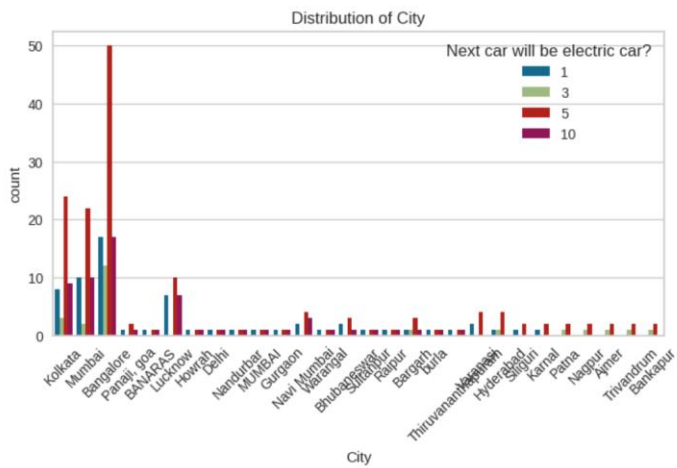
# Correlation Heatmap to examine correlations between variables



## # Boxplots to identify potential differences between target groups



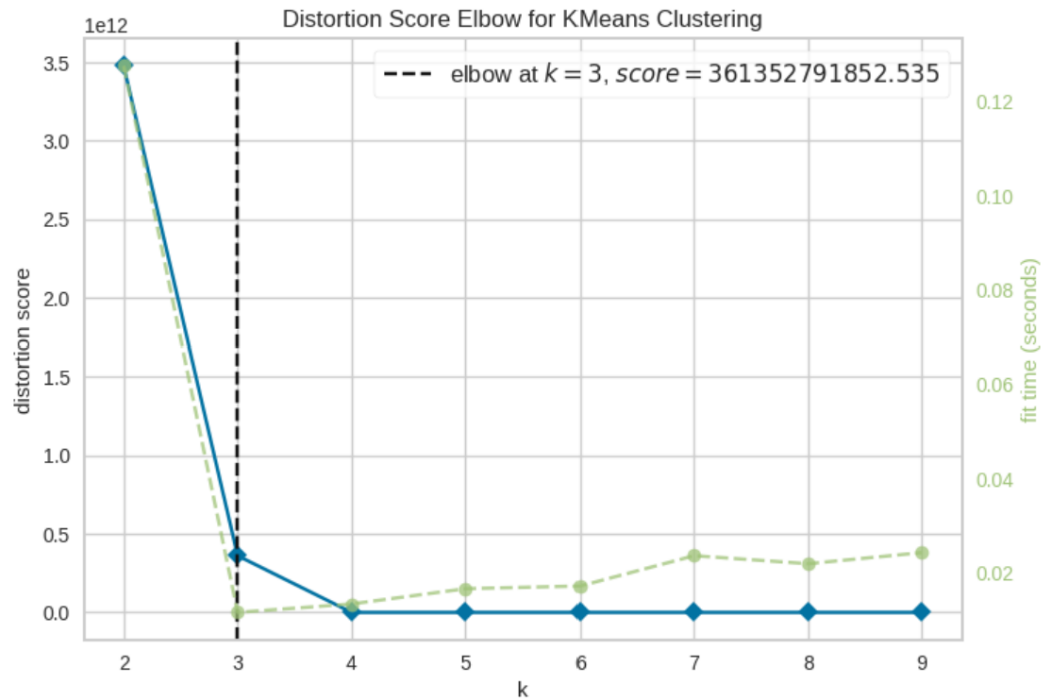
## # Distribution of categorical variables



## Segmentation

### Using K Means

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



### Selecting the Target Segments:

- Assumption 1: We will prioritize segments with higher annual income as they are more likely to afford electric vehicles.
- Assumption 2: Segments with positive attitudes toward electric cars (e.g., "Electric Cars are economical") will be considered.
- Assumption 3: Segments located in urban areas (cities) may have better access to charging infrastructure.



## INSIGHTS:

- The selected target segments primarily consist of high-income individuals in urban areas who express positive attitudes toward electric cars. This indicates a strong potential for EV adoption within this group.
- Based on the PCA analysis, these segments are not densely concentrated in a specific region, suggesting a nationwide marketing approach may be effective.
- It is essential to further investigate specific factors influencing these segments' decisions, such as the availability of charging infrastructure, government incentives, and awareness of environmental benefits.

## Marketing Mix in the Indian EV Market:

In the Indian Electric Vehicle (EV) market, the marketing mix, often referred to as the **4Ps (Product, Price, Place, and Promotion)**, plays a pivotal role in shaping consumer perceptions and influencing purchase decisions.

**1. Product:** In the EV market, product differentiation is key. Manufacturers are introducing a variety of EV models to cater to diverse customer needs, including electric two-wheelers, cars, and e-rickshaws. Features like battery range, charging capabilities, and technological innovations are vital in attracting different customer segments.

**2. Price:** Pricing strategies are multifaceted. Government incentives and subsidies significantly impact the final price, making EVs more affordable. However, consumers still evaluate the total cost of ownership, including savings on fuel and maintenance, which makes the pricing structure critical for market penetration.

**3. Place:** Accessibility to charging infrastructure and dealership networks is essential. The placement of charging stations in urban and semi-urban areas is crucial for customer convenience. Moreover, expanding the reach of dealerships and service centers enhances market penetration.

**4. Promotion:** Marketing and communication strategies should emphasize the environmental benefits, cost savings, and technological advancements of EVs. Collaborations with celebrities, social media campaigns, and educational programs can create awareness and drive interest among potential customers.

In conclusion, a well-balanced marketing mix tailored to the diverse needs and preferences of Indian consumers is essential for the continued growth and success of the EV market in India. By effectively addressing the 4Ps, stakeholders can better engage with their target audience and contribute to the sustainable evolution of the Indian EV industry.

## RECOMMENDATIONS

Through this report, one can analyze and come up with the following recommendations:

1. Develop targeted marketing campaigns that highlight the cost-efficiency and environmental advantages of electric vehicles to appeal to the high-income urban population.
2. Collaborate with urban planning authorities to improve and expand charging infrastructure in urban areas to enhance convenience for potential customers.
3. Offer personalized financing options and leverage government incentives to make EVs more accessible and attractive to the target segments.

## CONCLUSION

In conclusion, the analysis of the Indian EV market has revealed promising opportunities for growth and adoption. The selected target segments, comprising high-income urban individuals with positive attitudes toward electric vehicles, present a compelling market for EV manufacturers and stakeholders. To capitalize on this potential, it is imperative to develop tailored marketing campaigns emphasizing the cost-efficiency and environmental benefits of EVs. Collaborating with urban planning authorities to enhance charging infrastructure accessibility in cities can significantly improve the convenience factor, further stimulating adoption.

Moreover, offering personalized financing options and leveraging government incentives will make EVs more accessible and appealing to the identified target segments. The absence of regional concentration among these segments suggests that a nationwide marketing approach could be effective. To fully unlock this potential, it is essential to delve deeper into the specific factors influencing their decisions, including charging infrastructure, government policies, and environmental awareness.

**This report highlights the significant prospects for the EV market in India and provides a strategic direction for market players to drive sustainable growth and contribute to a greener future.**

## GITHUB LINK

Both notebooks containing the 2 datasets are compiled to 1 GitHub Repo.  
Link: [github.com/simxr/EV\\_Market\\_Segmentation\\_Simar\\_Ahuja\\_Solo](https://github.com/simxr/EV_Market_Segmentation_Simar_Ahuja_Solo)

Report by  
**Simar Ahuja**  
(Performed Solo)