
EV MARKET SEGMENTATION

Report Work Submitted By:

Pradeep Agrahari

(Machine Learning Intern, Feynn Labs)

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PROBLEM STATEMENT

The electric vehicle (EV) market in India is expanding rapidly due to rising fuel prices, growing environmental concerns, and increasing consumer interest in sustainable mobility solutions. With numerous manufacturers entering the EV space, companies must make strategic decisions regarding which type of products to develop and which customer segments to target.

The key challenge for any EV company is twofold. First, the company needs to determine what type of four wheeler electric vehicle it should manufacture whether to focus on compact cars, sedans, SUVs, or luxury models. Second, it must identify the ideal customer segment for its product. This includes understanding customer demographics such as age, income, education level, lifestyle, preferences, and geographic location. Addressing this challenge is essential for optimizing product development, marketing strategies, and overall business performance.

Approach

This report aims to analyze the Indian four-wheeler electric vehicle (EV) market using segmentation techniques to identify suitable customer groups for targeted marketing and product development. The study considers geographic, demographic, psychographic, and behavioral factors. Principal Component Analysis (PCA), K-Means clustering, and hierarchical clustering methods are applied to group customers based on their preferences and income. These segments are then evaluated to determine which customer profiles are most likely to adopt EVs, helping companies develop effective entry and growth strategies in the Indian EV market.

GitHub Link to the Analysis:

<https://github.com/arindam1399/feynn-lab-project>

DATA COLLECTION

Demographic dataset and EV bikes dataset are collected from <https://www.kaggle.com/>. The bikes dataset needed to be modified to add some missing values like products from popular brands.

PSYCHOLOGICAL AND BEHAVIOURAL SEGMENTATION

In this section, I outline the methods used to perform demographic segmentation on the dataset. Initially, an Exploratory Data Analysis (EDA) is conducted. EDA is a comprehensive examination that reveals the underlying structure of a dataset, making it crucial for a company. It helps uncover trends, patterns, and relationships that are not immediately obvious.

Exploratory Data Analysis (EDA)

The datasets:

<https://www.kaggle.com/>

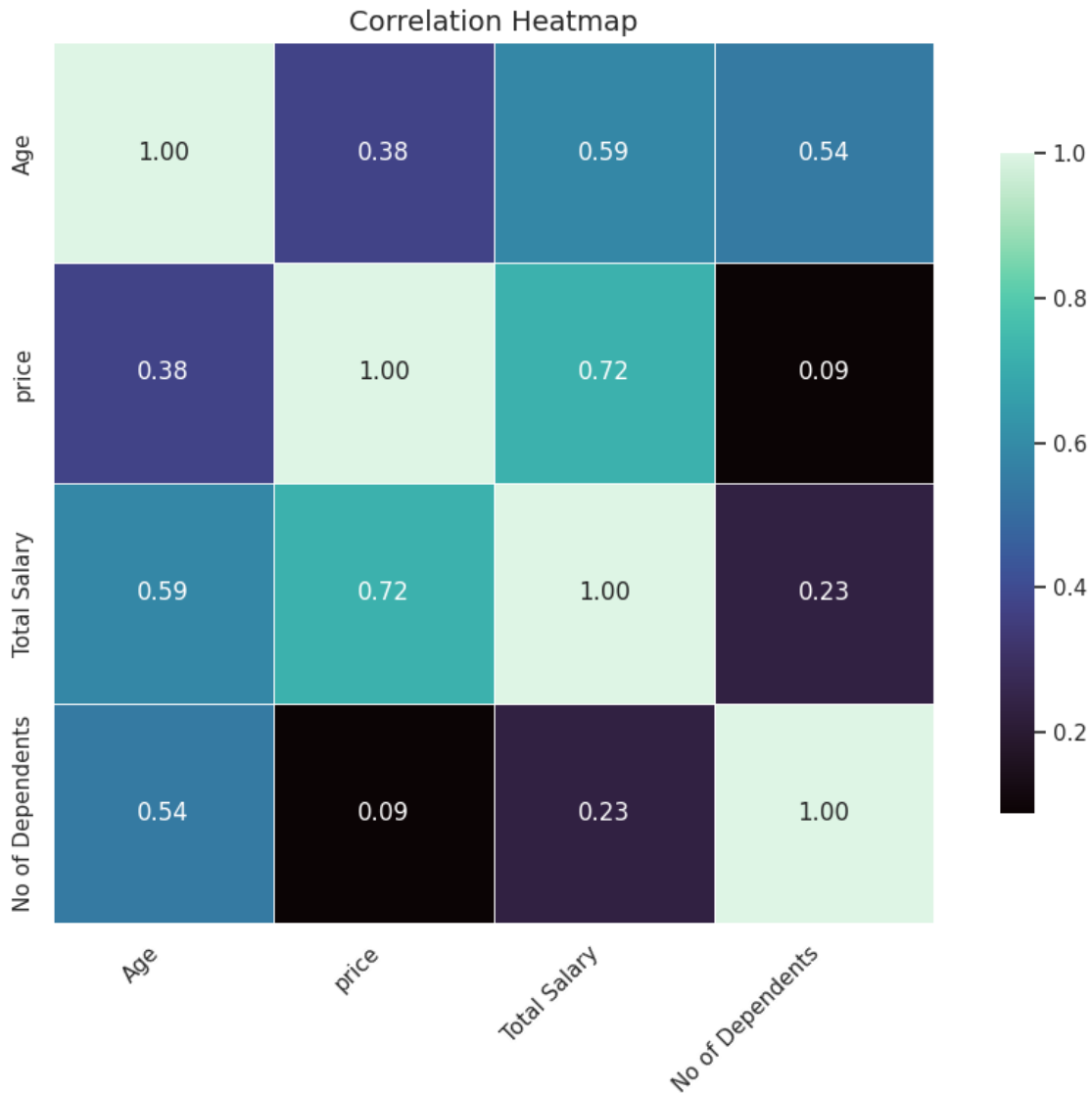
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df.head()
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	Age	price	Profession	Marrital Status	Education	Personal loan	Total Salary	No of Dependents
94	27	1600000	Business	Single	Graduate	No	2400000	0
95	50	1600000	Salaried	Married	Post Graduate	No	5100000	3
96	51	1100000	Business	Married	Graduate	Yes	2200000	2
97	51	1500000	Salaried	Married	Post Graduate	No	4000000	2
98	51	1100000	Salaried	Married	Post Graduate	Yes	2200000	2

- The dataset includes features like Exterior, Comfort, Performance, Fuel Economy, Value for Money, and Rating. Consumers are generally satisfied with all attributes, but show the highest satisfaction with vehicle appearance, highlighting the importance of aesthetics in EV preference.
- There is a high correlation between vehicle appearance and comfort. Consumer ratings are not related to fuel economy; instead, higher ratings are linked to vehicles that offer better value for money. Performance and value for money are critical to consumer satisfaction.
- The Kernel Density Estimate (KDE) plot confirms a strong relationship between appearance and comfort. It also shows no link between ratings and fuel economy. Vehicles perceived to provide good value for money receive higher ratings. Performance and value for money significantly impact customer satisfaction.
- The boxplot further validates the strong correlation between appearance and comfort. Ratings remain unaffected by fuel economy. Again, strong performance and good value for money are essential for higher customer satisfaction.

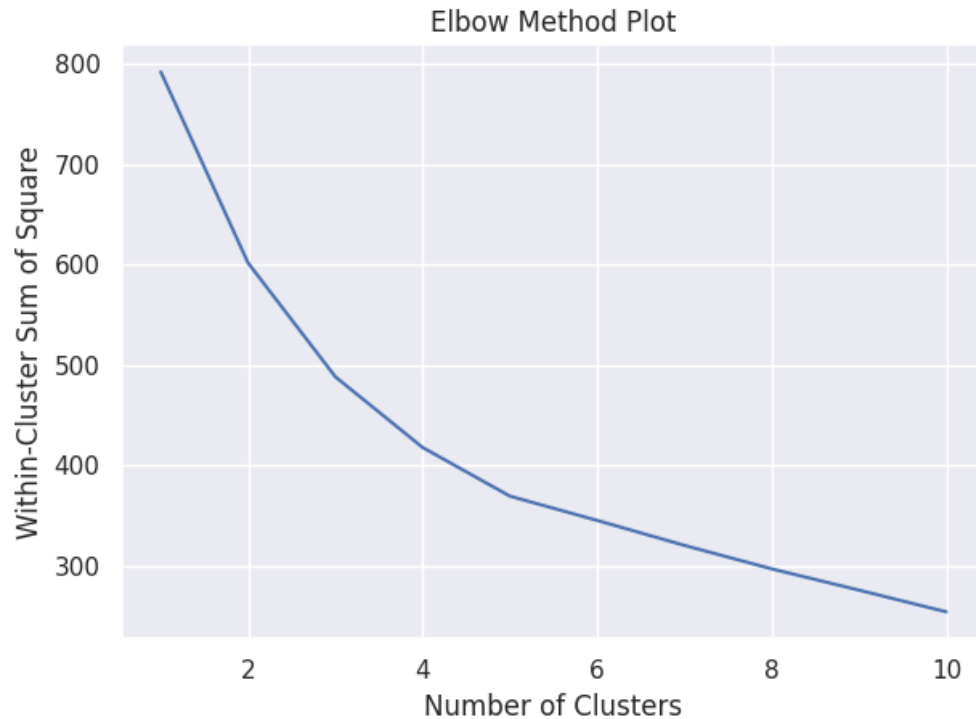
	Age	price	Total Salary	No of Dependents
count	99.000000	9.900000e+01	9.900000e+01	99.000000
mean	36.313131	1.194040e+06	2.270707e+06	2.181818
std	6.246054	4.376955e+05	1.050777e+06	1.335265
min	26.000000	1.100000e+05	2.000000e+05	0.000000
25%	31.000000	8.000000e+05	1.550000e+06	2.000000
50%	36.000000	1.200000e+06	2.100000e+06	2.000000
75%	41.000000	1.500000e+06	2.700000e+06	3.000000
max	51.000000	3.000000e+06	5.200000e+06	4.000000

- Data reveals the percentage of users based on travel usage patterns: 28.7% use EVs for short to mid-distance travel, 26.4% for long-distance, and 35.7% have not purchased an EV but have driven one and are willing to adopt based on satisfaction ratings.
- Among EV options, the Tata Nexon EV holds the largest market share and has the highest ratings, indicating strong performance. Tata Tigor EV has the smallest market presence and lowest customer satisfaction. Hyundai Kona is competitive but has limited market penetration.



K-Means Clustering

I applied K-means clustering with different cluster counts and used the Elbow method to find the optimal number of clusters. The "k-means++" initialization technique was used to ensure smarter and more efficient cluster center selection, avoiding random initialization. This approach improves the accuracy and consistency of the clustering results compared to the traditional K-means method.



Hierarchical Clustering

Hierarchical clustering was performed to explore customer segmentation further. The resulting Dendrogram revealed two distinct clusters, indicating natural groupings among customers based on their characteristics. This method helps visualize relationships between data points and supports deeper insights into customer behavior, preferences, and potential target segments for electric vehicle marketing strategies.

EXTRACTING SEGMENT

- Segment 0: High satisfaction on every aspect, indicates higher willingness to adopt EV, forms most of the population - 72.9%; Most desired EV is Tata Nexon; These are Early majority.
- Segment 1: Unsatisfied on all aspects, didn't find EV to be value for money; forms 7% of population; Found Tata Tigor EV to be most likeable; can be considered Late adopters.
- Segment 2: They liked Exterior and Comfort of EVs but didn't find it Value for money much; form 20.2% population; Found each EV equally likeable; can be considered Early adopters.

Data Exploration on Buying Behaviour

- On average Consumer is 36 years old Salaried professional, Married, having higher education with 2 dependents, no ongoing loans, having a working wife, earning household income of 22 Lacs, Opting for SUV pricing up to 12 lacs

Findings:

1. Price of car purchased is highly correlated with Total salary
2. No. of dependents play no role in deciding the price of a car to purchase or even make.
3. Age is somewhat related to Salary earned but not so much to the caprice.

Additional Findings:

1. Younger people mostly opt for Hatchbacks like Baleno or i20 and some go for Sedans; small population of youngsters also go for SUV but none go for Luxury.
2. Higher age people mostly opt for Luxury Premium Sedans like Ciaz.
3. People who earn higher salary go for SUVs or Luxury.
4. i20 and Baleno (Hatchbacks) are the most popular vehicles of Lower income group.
5. When Wife's salary is also high and resultantly Total salary also hikes up, choice of vehicles becomes Luxury and SUVs.
6. Luxury segment has the highest market price and Baleno has the lowest.

Notable Findings:

1. SUVs hold most of the market capital with their primary Customers being Post Graduate, High Income Married, Salaried Professionals with Working wife.
2. Second Fav Vehicle in this segment is Creta.
3. Highly Educated Married Businessmen Prefer Hatchback & sedan whereas Single of this category also prefer SUV.
4. Postgraduates Salaried Professionals prefer SUV and Businessmen prefer Baleno.
5. Graduates Salaried Professionals prefer Ciaz and Businessmen prefer SUV.
6. Overall, Most Popular vehicle segments in decreasing order: SUV > Baleno (Hatchback) > Ciaz (Premium Sedan).

DEMOGRAPHIC SEGMENTATION

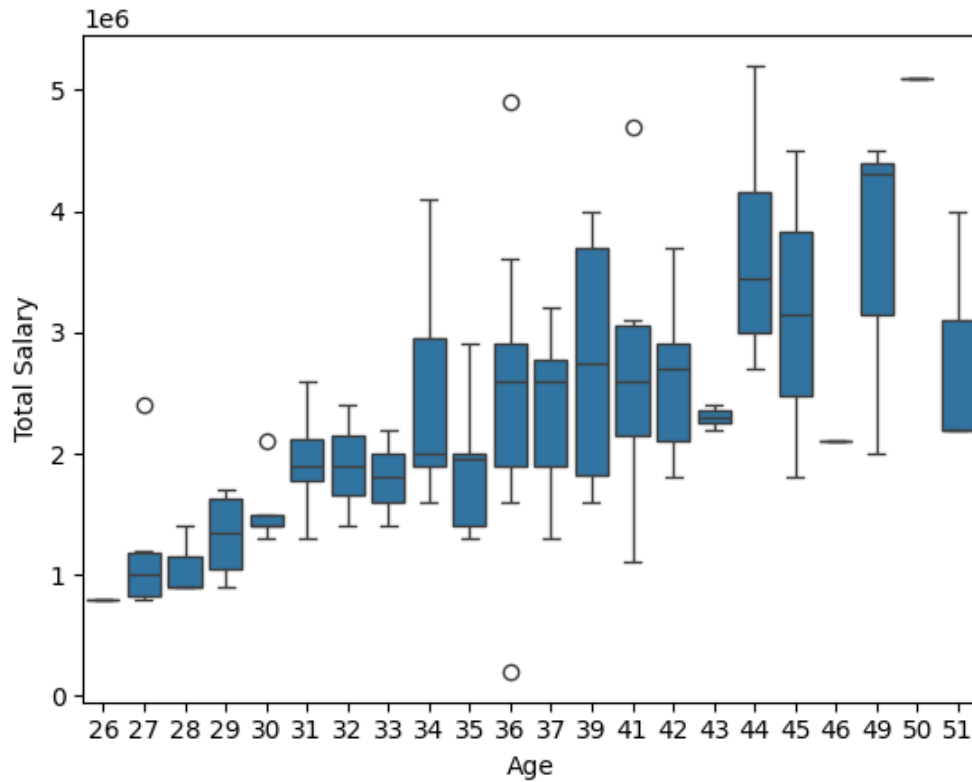
Loan:

Although Personal and home loans do not seem to have any significant impact on EV purchasing patterns.

Salary:

Regardless of even high salaries, average to low price-ranged cars are preferred.

We see people buying over a range of prices when it comes to Verna, whereas in the case of other brands, probably some specific models are preferred.



Clusters:

- **Cluster 1 (Orange):** Prefer low to moderately priced EVs, Age 20–30, Moderate salary, Wife's salary Low
- **Cluster 2 (Green):** Prefer low to moderately priced EVs, Age 30–45, Average to high salary, Wife's salary Low
- **Cluster 3 (Blue):** Prefer moderately to high-priced EVs, Age 30–45, Average to very high salary, Wife's salary High

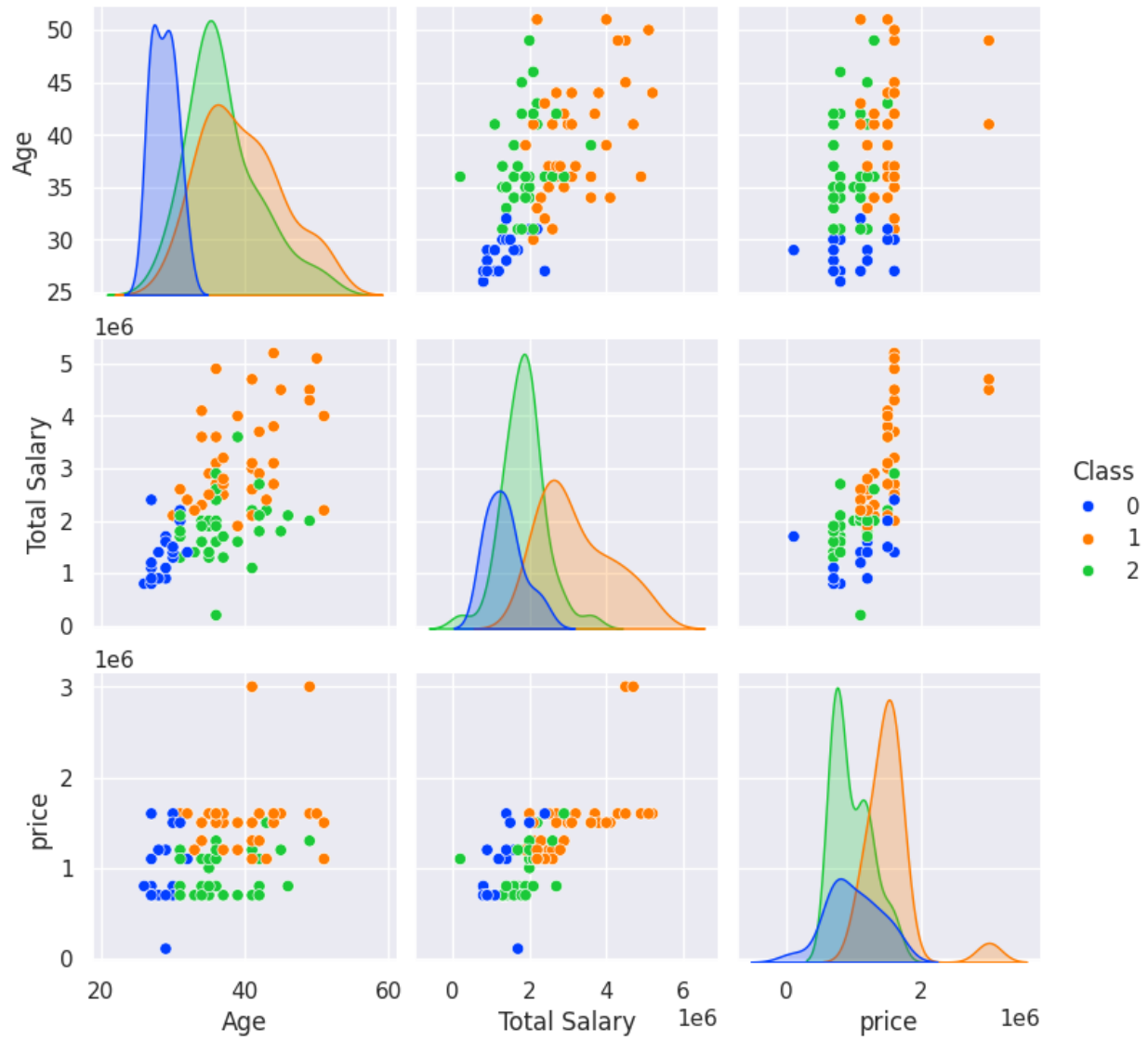


Figure 1: Caption

Key Conclusions

- Moderately priced EVs are the most preferred across all the clusters.
- Most purchasing activity is seen in the age range of 26–38.
- Personal and home loans do not significantly impact EV purchases.
- High correlation between total salary and price.

Optimal Target Profile

Demographic Profile:

- Cluster 0: Young Age, No Business, Graduate, Single
- Cluster 1: Young age, Working Professional, Graduate, Married
- Cluster 2: Middle aged (30+), Businessmen, Post Graduate
- Cluster 3: Middle aged, Salaried professional, Married

Geographic Profile:

- **High EV Adoption, High Infrastructure:** Karnataka, Delhi
- **High EV Adoption, Moderate Infrastructure:** Tamil Nadu, Chhattisgarh
- **Moderate EV Adoption, Moderate Infrastructure:** Maharashtra, Rajasthan, West Bengal, Gujarat, Kerala
- **High EV Adoption, Low Infrastructure:** Uttar Pradesh
- **Low EV Adoption, Low Infrastructure:** Odisha, Punjab, Bihar, Assam, Haryana, Ladakh, Sikkim, Jharkhand, Puducherry, Goa, Jammu Kashmir

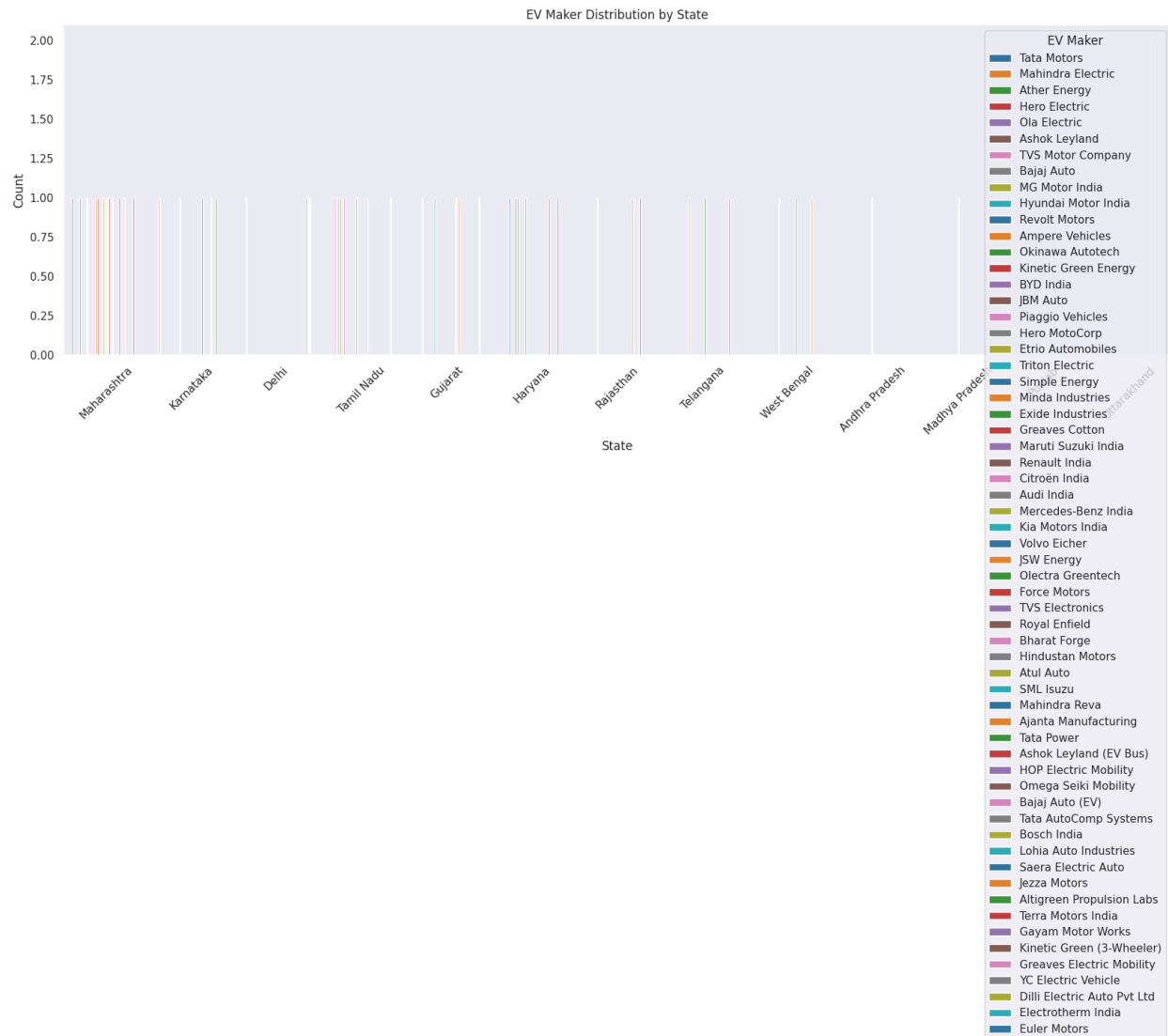


Figure 2: Caption

POSSIBLE IMPROVEMENTS

- Consider DBSCAN or Gaussian models for additional insights.
- Collect clearer, more comprehensive data through surveys or scraping.

MARKET MIX

Innovation:

- Advanced batteries
- Autonomous driving
- Smart integration

Infrastructure:

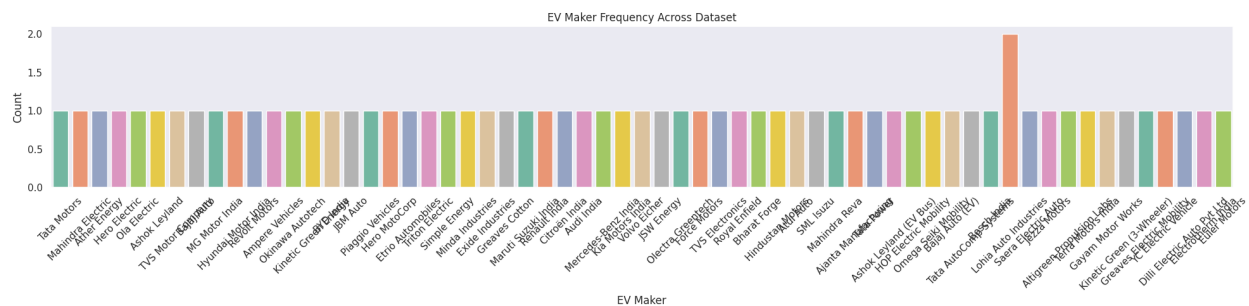
- Charging station availability
- Service and maintenance
- Smart grid integration

Customer Experience:

- After-sales service
- Apps, support, and education

Sustainability:

- Eco-friendly materials
- Battery recycling
- Lower production carbon footprint



CONCLUSION

This report shows that electric vehicles, especially 4-wheelers, are becoming more popular in India. People prefer them for their modern features and savings on fuel. Using data analysis and clustering methods, we identified key customer segments. This helps companies understand who to target. EVs are a good business opportunity because they are both eco-friendly and cost-effective for consumers in the long run.

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