Market Segmentation Analysis of Electric Vehicles Market in India

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Problem Statement:

The Task is to Perform segmentation analysis on the Electric Vehicle (EV) market in India to identify distinct customer segments based on geographic, demographic, psychographic, and behavioral factors. The objective is to determine the most viable segments for EV adoption and develop targeted strategies for market entry. By understanding customer preferences, charging infrastructure availability, and regional variations, this study aims to help stakeholders tailor their marketing efforts and product offerings to accelerate the adoption of EVs in India, contributing to sustainable transportation and reducing the country's carbon footprint.

Fermi Estimation:

Fermi estimation, also known as back-of-the-envelope calculation, is a quick and rough method to estimate a quantity using simple and reasonable assumptions. Let's perform a Fermi estimation for Electric Vehicle (EV) market segmentation to get an approximate understanding of the market size for different segments.

Problem: Estimate the number of potential customers for each segment in the Indian EV market.

Assumptions:

1. India's total population ≈ 1.4 billion.

2. Percentage of the population interested in EVs: 5% (psychographic assumption).

3. Percentage of urban population in India: 35% (geographic assumption).

4. Percentage of urban population with access to charging facilities: 50% (behavioral assumption).

5. Percentage of urban population willing to purchase a 4-wheeler EV: 30% (demographic assumption).

6. Percentage of urban population willing to purchase a 2-wheeler EV: 25% (demographic assumption).

Equations:

- Total population in India = 1.4 billion
- Urban population in India = 35% of 1.4 billion
- Potential EV customers = 5% of urban population
- Urban population with access to charging facilities = 50% of urban population
- Potential 4-wheeler EV customers = 30% of urban population with charging facilities
- Potential 2-wheeler EV customers = 25% of urban population with charging facilities

Fermi Estimation:

1. Urban Population ≈ 0.35 * 1.4 billion ≈ 490 million.

2. Potential EV Customers ≈ 5% of 490 million ≈ 24.5 million.

3. Urban Population with Access to Charging Facilities ≈ 50% of 490 million ≈ 245 million.

4. Potential 4-wheeler EV Customers ≈ 30% of 245 million ≈ 73.5 million.

5. Potential 2-wheeler EV Customers ≈ 25% of 245 million ≈ 61.25 million.

Conclusion:

Based on the Fermi estimation, there are approximately 73.5 million potential customers for 4-wheeler EVs and 61.25 million potential customers for 2-wheeler EVs in the Indian market. These rough estimates provide an initial understanding of the potential market size for different EV segments and can help guide further in-depth analysis and decision-making in the EV industry. Keep in mind that Fermi estimation is an approximate method, and the actual figures may differ due to complex market dynamics and actual data variations.

Data Collection:

Raw data is generated from

- https://drive.google.com/file/d/10EtybEhNg_TzhaDclnIo8T2sJYD8fPdS/view?usp=drive_link
- https://drive.google.com/file/d/1GIdb0-ciOmCn1Pv-ErH_94s2WPM-lR_x/view?usp=drive_link

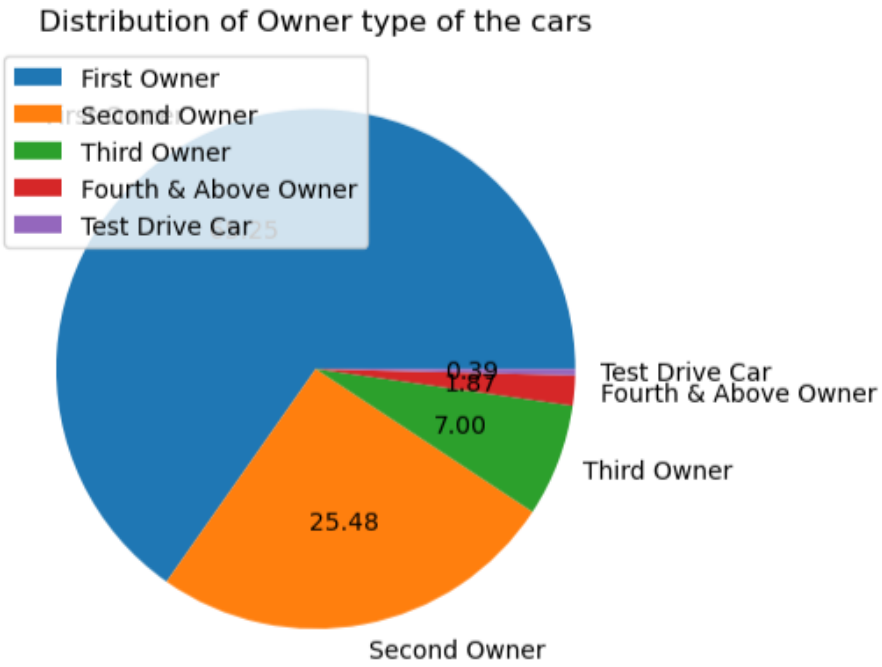
Data Preprocessing:

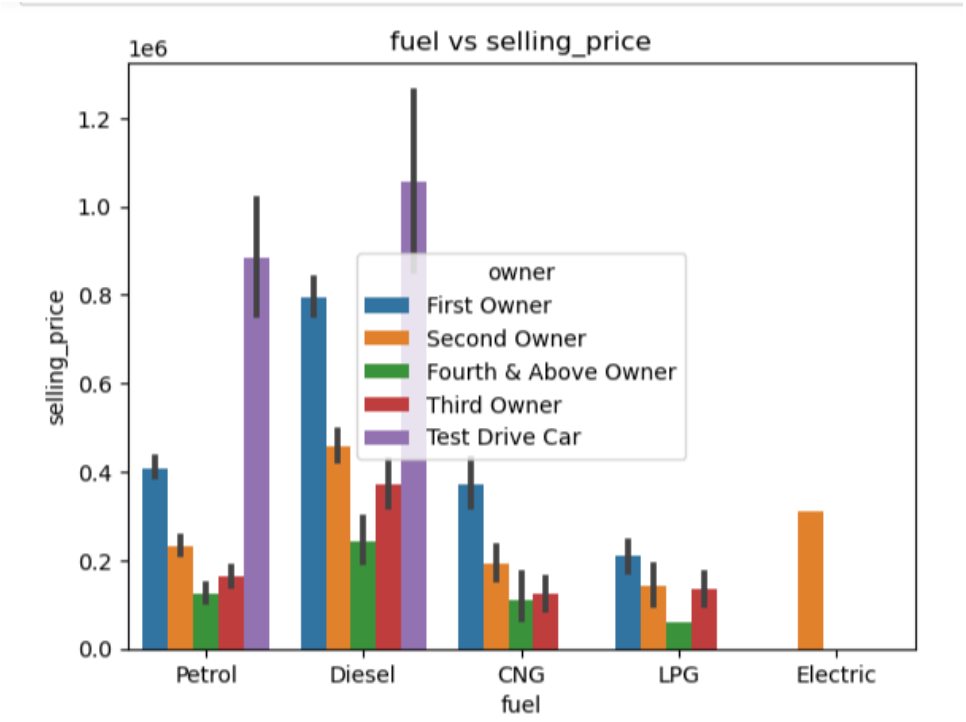
Some of the preprocessing methods involved in this CSV file are:

→ Importing the various libraries
→ To Clean the Data
→ Missing Values
→ Encoding Categorical Variables
→ Data Visualization

Exploratory Data Analysis:

Exploratory Data Analysis (EDA) in Electric Vehicle (EV) segmentation in India involves visualizing and summarizing data to gain insights and patterns. It includes using charts, graphs, and statistical measures to understand the distribution of variables, identify correlations, and detect outliers. EDA helps in uncovering key characteristics of customer segments, their geographic distribution, charging behaviour, and vehicle preferences. This analysis aids in formulating effective market segmentation strategies and promoting sustainable EV adoption in India.





Segment Extraction:

1. Data Preparation:
   - Load the car dataset.
   - Explore the dataset to understand its structure and features.
2. Feature Selection:
   - Choose relevant features for clustering. In this case, consider features like selling_price, km_driven, etc.
3. Data Preprocessing:
   - Handle missing values and outliers.
   - Convert categorical variables into numerical format using techniques like one-hot encoding.
4. Feature Scaling:
   - Normalize or standardize the numerical features so that they have the same scale.
5. Choosing the Number of Clusters (k):
   - Use methods like the Elbow Method or Silhouette Score to determine the optimal number of clusters.
6. Applying K-Means:
   - Initialize the K-Means algorithm with the chosen number of clusters (k).
   - Fit the algorithm to the scaled data.
7. Clustering Results:
   - Get the cluster assignments for each data point.

- Add the cluster labels to the original dataset.

8. Visualization:

- Plot the clusters on a scatter plot using two relevant features (e.g., selling_price vs. km_driven).

- Colour the points by cluster labels.

9. Cluster Analysis:

- Interpret the characteristics of each cluster by analysing the mean values of features within each cluster.

10. Interpretation:

- Assign meaningful names to clusters based on the characteristics of the data points within them.

- Analyse and discuss the insights obtained from the clusters.

11. Additional Steps:

- You can perform further analysis within each cluster to understand customer segments or patterns.

Potential Segments:

1.Luxury Cars:

- High selling_price.
- Low km_driven.
- Fuel-efficient or premium fuel type.
- Premium seller type and transmission.
- Low number of owners.

2. Low Mileage Cars:

Moderate to high selling_price.

- Low km_driven.
- Regular or premium fuel type.
- Premium seller type and transmission.
- Low number of owners.

3. Newer Cars:

- Moderate to high selling_price.
- Low km_driven.
- Regular or premium fuel type.
- Premium seller type and transmission.
- Low number of owners.
- Newer model years.

GitHub Link:

https://github.com/Srikrithika05/EV_dataset.git