

Market Segmentation Analysis of Indian Electric Vehicle Customers: Insights and Strategic Recommendations

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Abstract:

This report presents a comprehensive market segmentation analysis of the Indian electric vehicle (EV) industry using the K-Means clustering algorithm. The project aims to identify distinct customer segments based on demographic, psychographic, and behavioral factors, such as age group, income level, technology adoption, and environmental consciousness. Four unique market segments were identified, providing insights into customer preferences and purchasing intentions. The results offer actionable recommendations for targeted marketing and product strategies tailored to each segment. Future improvements, including the use of advanced machine learning models and additional data acquisition, are proposed to refine the segmentation. This research highlights the growing potential of the Indian EV market and its diverse customer base, estimated to reach USD 20 billion by 2026.

1. Problem Statement:

As the electric vehicle (EV) market in India continues to expand, businesses face the challenge of identifying and understanding diverse customer groups to effectively target their products and marketing efforts. With the rapid growth of the industry, there is a need to segment the market based on consumer behavior, demographics, and preferences. The goal of this project is to use machine learning techniques to develop a data-driven approach to market segmentation. By clustering customers into meaningful groups, this analysis aims to provide insights that will enable companies to tailor their offerings, optimize marketing strategies, and maximize adoption of electric vehicles across different customer segments.

2. ML model (algorithm) used in this Project?

The **K-Means clustering algorithm** was used for market segmentation. K-Means is an unsupervised learning algorithm ideal for grouping data into distinct clusters based on similarity. It helped in this project by:

- Dividing the customer base into **4 distinct segments** based on their demographic and psychographic attributes.
- It grouped customers by minimizing the variance within each cluster, effectively categorizing individuals with similar behaviors or characteristics.

Why **K-Means** was chosen:

- **Scalability:** K-Means is computationally efficient for large datasets.
- **Easy Interpretation:** Each customer is assigned to a segment, allowing clear identification of market groups.

This approach helped identify underlying patterns in customer preferences (e.g., preferred EV type, environmental consciousness), which can inform targeted marketing strategies.

3. Conclusion and insights gained from the analysis.

From the analysis, several insights were gained:

- **Distinct Customer Segments:** Four segments were identified, showing variations in customer preferences, age groups, income levels, and purchasing intentions.
 - **Segment 1:** Young professionals, tech-savvy, high intention to purchase EVs.
 - **Segment 2:** Middle-aged customers, moderate income, more environmentally conscious, but hesitant to adopt technology.
 - **Segment 3:** Older customers with low purchase intent, mainly located in rural areas.
 - **Segment 4:** High-income urban customers with a strong inclination towards EVs and green technology.
- **Key Features for Segmentation:**
 - **Income Group** and **Age Group** were strong determinants for segmentation.
 - **Environment Consciousness** and **Technology Adoption** further refined the segments, providing a deeper understanding of the motivation behind EV purchases.

4. Improving upon the Market Segmentation Project given additional time and some budget to purchase data.

With more time and a budget for acquiring data, the following improvements could be made:

Additional Datasets:

- **Geolocation Data:** Detailed city and state-level data to understand regional trends in EV adoption.
- **Consumer Behavior Data:** Data on customers' past purchases, brand preferences, and frequency of vehicle usage.
- **Psychographic Data:** Information on lifestyle choices, brand loyalty, and environmental concerns.
- **Vehicle-Specific Data:** Data on preferences for specific EV brands and models, financing options, and subsidies awareness.

New Columns/Features to add:

- **EV Brand Preference:** Understanding which brands are preferred and how this aligns with the segment's demographics.
- **Purchase Timing:** Information on whether the customer plans to buy an EV soon or later.
- **Transportation Needs:** How frequently and for what purpose the vehicle will be used (e.g., daily commute vs. occasional travel).

Advanced ML Models to Try:

- **Hierarchical Clustering:** Could provide a more detailed breakdown of segments, especially for smaller subgroups within the market.
- **Gaussian Mixture Models (GMM):** To capture soft clustering, where customers may belong to multiple segments with varying degrees of membership.
- **PCA (Principal Component Analysis):** For dimensionality reduction and feature importance analysis, ensuring the most relevant features are emphasized in the segmentation.

5. Estimated Market Size for the Market Domain in Numbers.

The Indian electric vehicle market is growing rapidly. According to recent reports:

- **Market Size in 2024:** The Indian EV market is estimated to reach **USD 20 billion by 2026**, with a compound annual growth rate (CAGR) of around 44.5%.
- **Vehicle Sales:** Around **1.75 million EVs** were sold in India in 2023, with electric two-wheelers and cars making up the largest segments.

This growth is driven by increasing fuel prices, government initiatives (like FAME II), and heightened environmental awareness among consumers.

6. Top 4 Variables/features that have been used to create most optimal Market Segments for the Market Domain.

The top 4 variables that can optimally define market segments for the Indian EV market are:

1. **Income Group:** Critical for determining purchasing power and likelihood of EV adoption, as higher income groups tend to buy premium EVs.
2. **Age Group:** Younger individuals are more likely to adopt new technologies like EVs, whereas older generations may need more incentives.
3. **Technology Adoption:** EV customers are often early adopters of new technology, making this a key feature for segmentation.
4. **Intention to Purchase:** A direct measure of how ready a customer is to buy an EV, this feature can help focus marketing efforts on high-potential buyers.

7. Overall Inferences

- The analysis provides valuable insights into different customer segments based on their characteristics related to environmental consciousness, technology adoption, purchasing intentions, demographics, profession, etc.
- We can see which segment has a higher level of environmental consciousness, technology adoption, or intention to purchase.
- We can identify the demographic and profession characteristics common to each segment.
- These insights can be used for targeted marketing strategies, product development, and customer relationship management.
- The segments can help EV companies focus their marketing efforts on specific groups with different needs and preferences.

