EV Market Segmentation

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Problem Statement

The electric vehicle (EV) market in India is at a pivotal stage, driven by increasing environmental concerns, government policies promoting sustainable transportation, and technological advancements in battery and vehicle design. Economic Impact: The growing EV industry is not only contributing to a cleaner environment but also generating employment opportunities. The manufacturing of EV components, battery assembly, and research and development activities are creating jobs, and boosting the country's economy.

This dataset provides information on various 4-wheeler electric vehicles (EVs) available in the Indian market as of 2023. The dataset contains information such as car name, price range, battery capacity, driving range, power, charge time, transmission, boot space, and top speed. The dataset is useful for EV enthusiasts, researchers, and analysts who want to compare different EVs based on their specifications and features.

Data Collection

To effectively perform a market segmentation analysis of the Indian Electric Vehicle (EV) market, you need to gather comprehensive data from multiple sources.

Data Preprocessing

Data Cleaning:

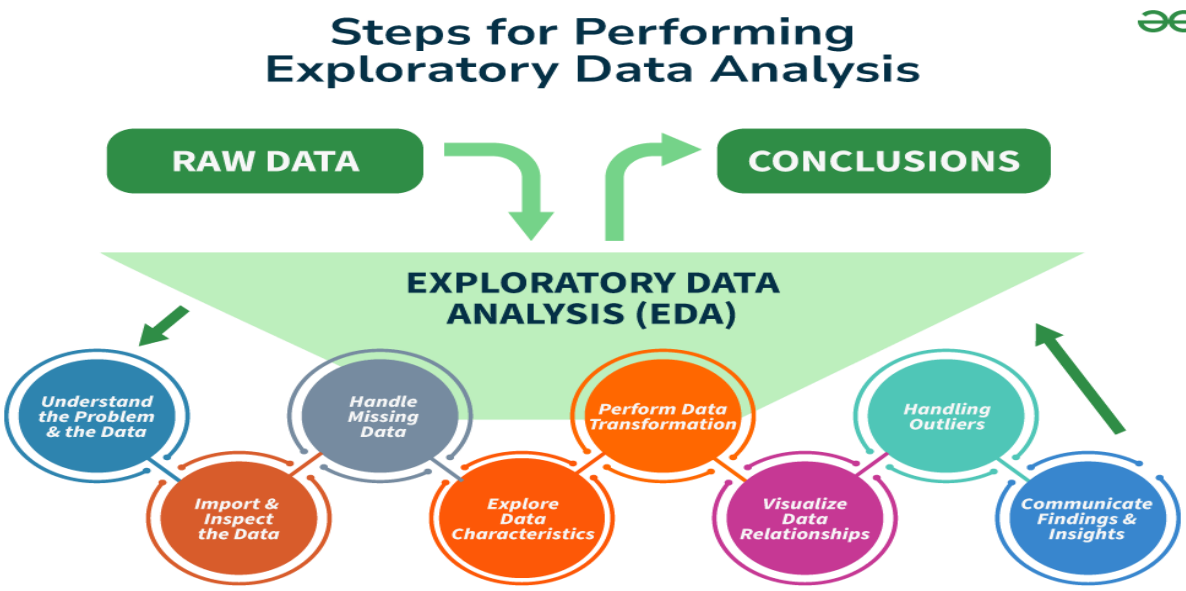
- Handle missing values, duplicates, and outliers.
- Normalize or standardize numerical data if necessary.
- Normalize or scale numerical features to ensure they contribute equally to the analysis.

Libraries:

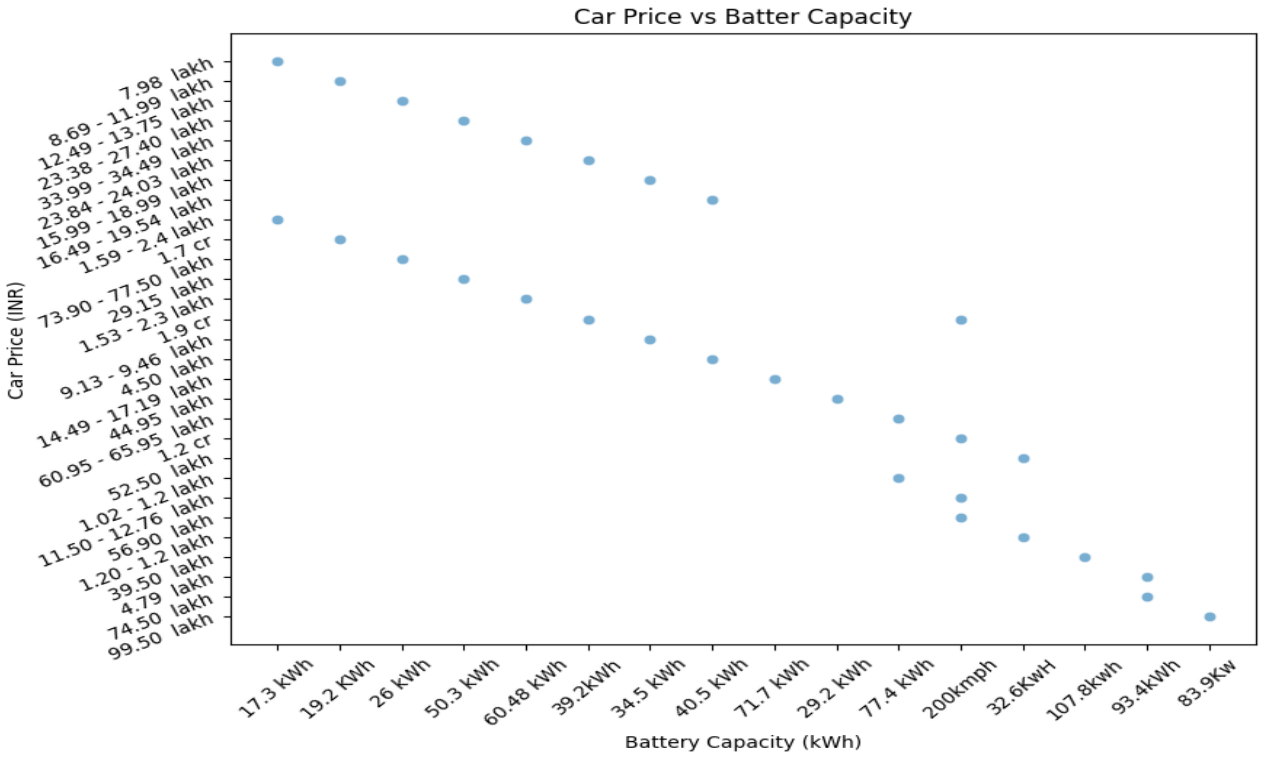
- **Pandas**: for data manipulation and cleaning.
- **NumPy**: for numerical operations.
- **Scikit-learn**: for machine learning and clustering.
- **Matplotlib/Seaborn**: For data visualization.

Exploratory Data Analysis (EDA)

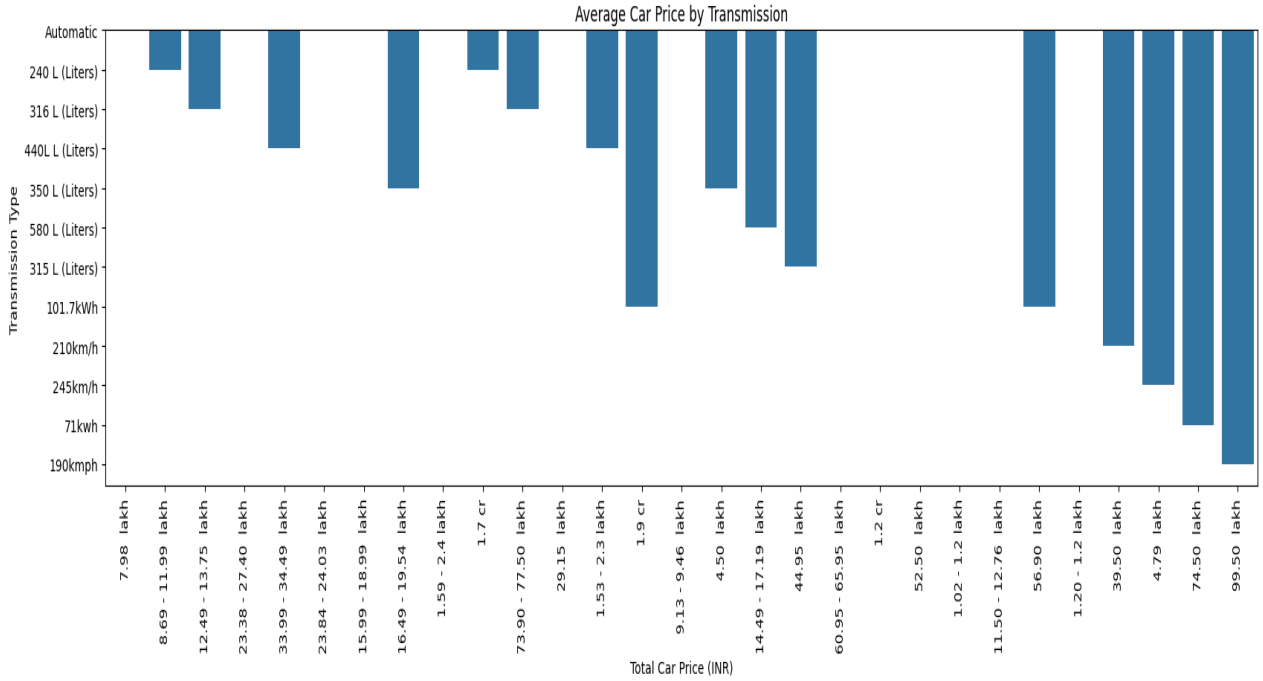
Exploratory Data Analysis (EDA) involves summarizing and visualizing data to understand its structure, identify patterns and anomalies, and inform further analysis and modeling decisions for better insights.Keys features of this technique are presented in the below image.



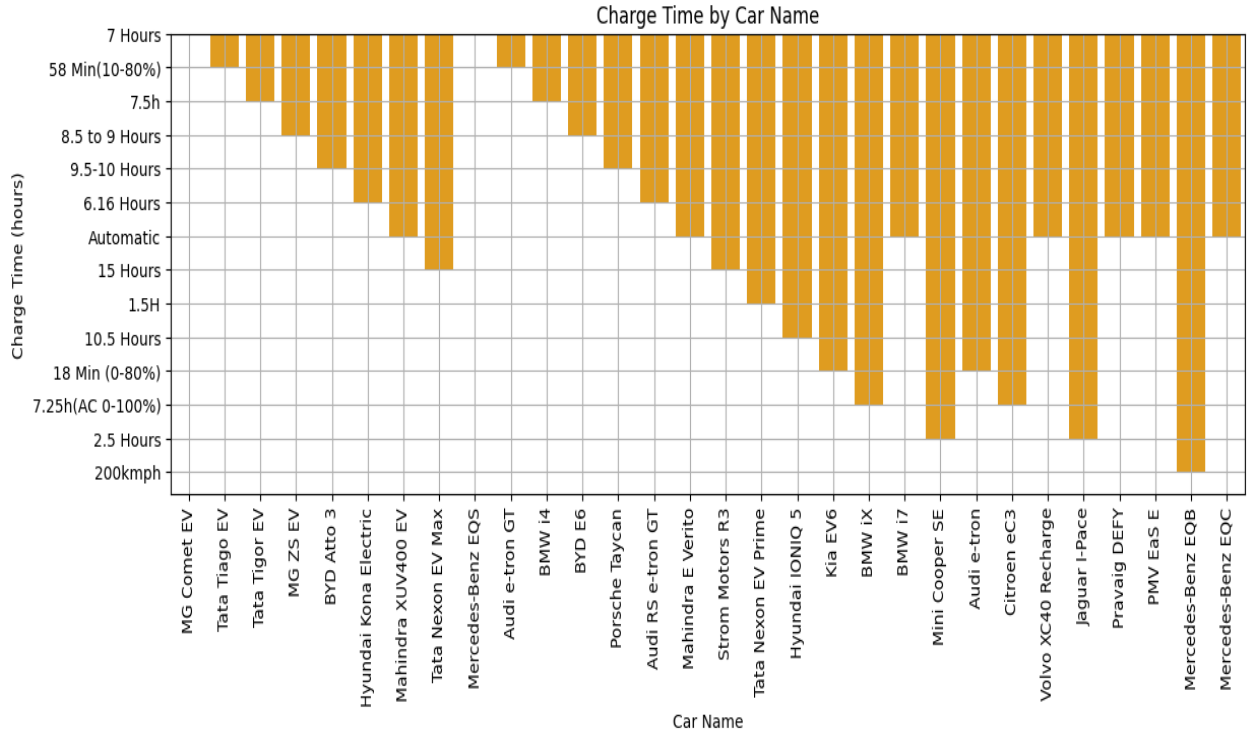
Car price vs Batter capacity



Average Car price by Transmission



Charge time by Car name

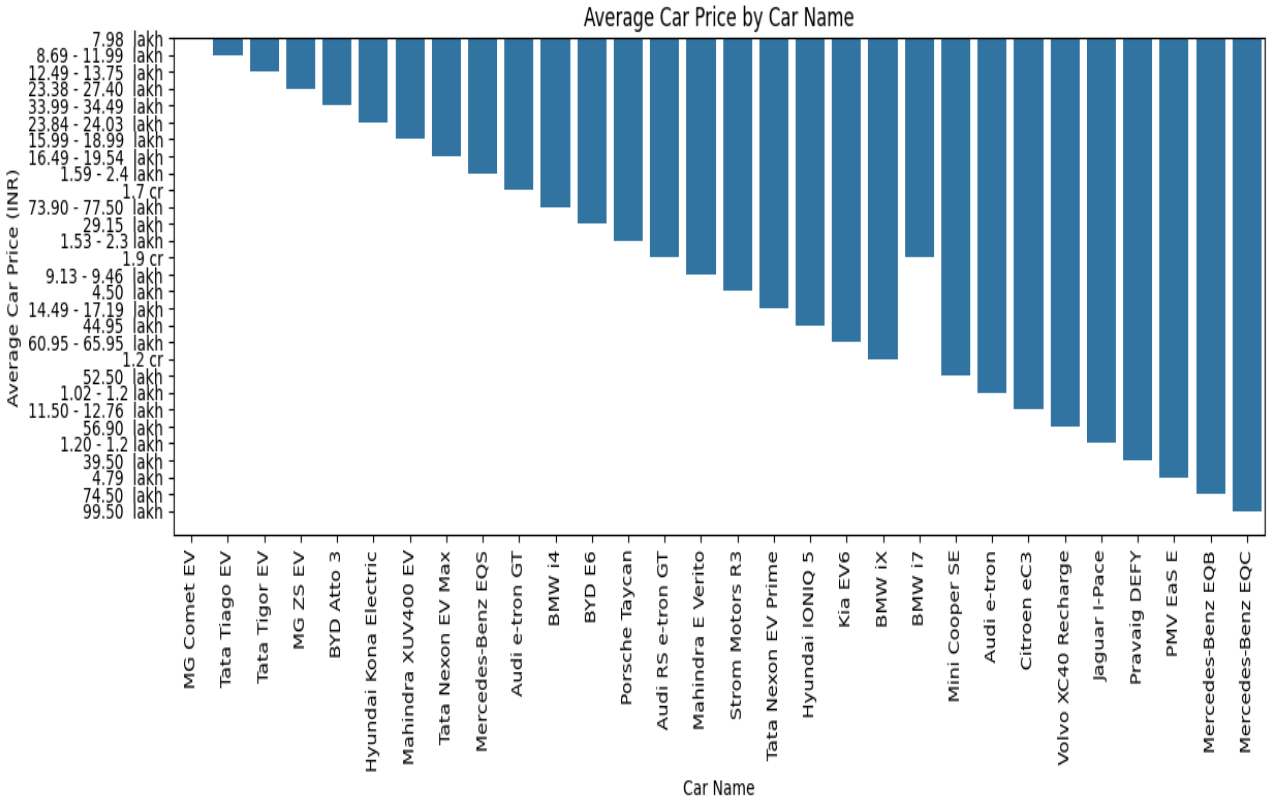


Key insights regarding battery charging times based on the bar graph:

- Rapid Charging Models Lead the Market: The Audi e-tron, Kia EV6, and Audi e-tron GT stand out with their shorter charging times, making them more appealing to consumers who value convenience and quick turnaround for daily use. This positions them favorably in the competitive EV market.

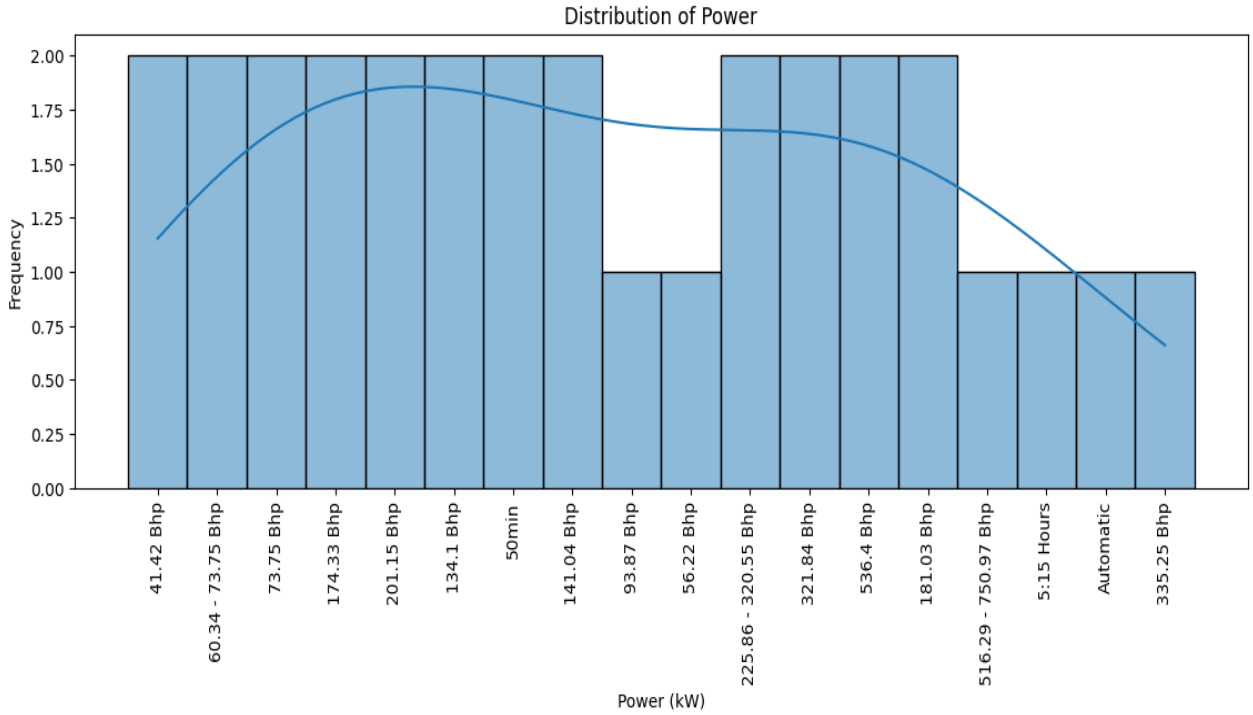
- Impact of Charging Times on Consumer Choice: Vehicles with longer charging times, may struggle to attract buyers who prioritize efficiency and convenience. As the market evolves, manufacturers must innovate to reduce charging times to stay competitive.
- Future Developments in Battery Technology: Ongoing advancements in battery technology and charging infrastructure are likely to lead to reduced charging times across the board, enhancing overall consumer confidence in electric vehicles and encouraging broader adoption.

Average Car price by Car name



This plot shows that average price of electric vehicles (EVs) significantly influences consumer purchasing decisions in India, where price sensitivity is high. Vehicles priced like (Tata car models)within the budget range are more likely to attract middle-class consumers, which is a significant demographic in India. Further, expanding the range of electric vehicles at various price points will cater to diverse consumer needs. This includes introducing more affordable models without compromising on quality, thereby increasing market penetration.

Distribution of Power



Segment Extraction

K-Means Clustering is a widely used unsupervised machine learning algorithm that groups unlabeled multivariate datasets into clusters based on similar features or patterns. Here's a concise overview:

1. **Purpose of Clustering**:

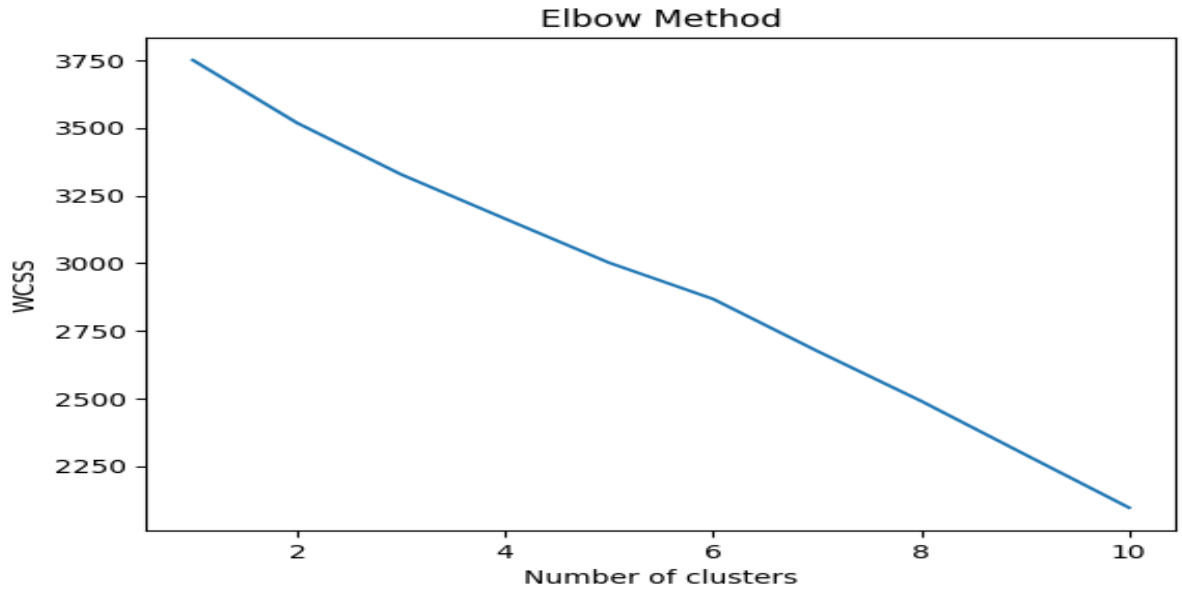
   Clustering segregates data into groups (clusters) with similar characteristics, such as water availability, price, and city. This helps in discovering hidden patterns in the data without any prior labelling.

2. **K-Means Algorithm**:

   The algorithm partitions data into k clusters, where each cluster is represented by its centroid. The data points are assigned to the nearest centroid based on their features.

3. **Elbow Method**:

   The Elbow method is a way of determining the optimal number of clusters (k) in K-Means Clustering. It is based on calculating the Within Cluster Sum of Squared Errors (WCSS) for a different number of clusters (k) and selecting the k for which change in WCSS first starts to diminish.



Conclusions

The following are the key insights of the project:

Develop an EV for the Indian market: The Indian market has unique needs and requirements. Developing an EV that is specifically designed for the Indian market could be a successful business venture.

Focus on the low-cost segment: The average Indian consumer is price-sensitive. Focusing on the low-cost segment of the EV market could be a way to reach a large number of potential customers.

Partner with a government agency: The Indian government is promoting the adoption of EVs. Partnering with a government agency could help you to get access to funding and other resources.

The market size and growth potential: The EV market in India is still small, but it is growing rapidly. This means that there is a lot of potential for growth in the market.

The Indian EV market is expected to grow significantly in the coming years.

GITHUB Link: