EV MARKET SEGMENTATION

TEAM MEMBERS	TASKS ASSIGNED	GITHUB Links
Jay Soni	Data Collection, Primary Analysis, Strategy Development, Report Writing	Link
Sumit Tabhane	Data Collection, Vehicle Specifications Analysis	Link
Adi Antulay	Data Collection, Geographical Analysis	Link
Kajal Gaikwad	Data Collection, Behavioural Analysis	LINK

PROBLEM STATEMENT:

You are a team working under an Electric Vehicle Startup. The Startup is still deciding in which vehicle/customer space it will be develop its EVs.

You have to analyse the Electric Vehicle market in India using Segmentation analysis and come up with a feasible strategy to enter the market, targeting the segments most likely to use Electric vehicles.

(CUSTOMER/VEHICLE/B2B) SEGMENTS: Apart from Geographic, Demographic, Psychographic, Behavioral segments, teams can consider different CATEGORY of Segments for the Segmentation Tasks, based on AVAILABILITY OF DATA. Market Segmentation comes with wide scope of possibility and Segments created can change based on different datasets collected.

DATA SOURCES USED & PRE-PROCESSING:

The team decided to elect the project statement based on the availability of dataset, and so the two statements were initially divided into two groups of two team members.

After 24 hours of search work, the team came to a decision of proceeding with the EV Market Segmentation project, however, there was no specific dataset to be followed. To eliminate the hassle of sourcing dataset from the internet, I took over the data collection part.

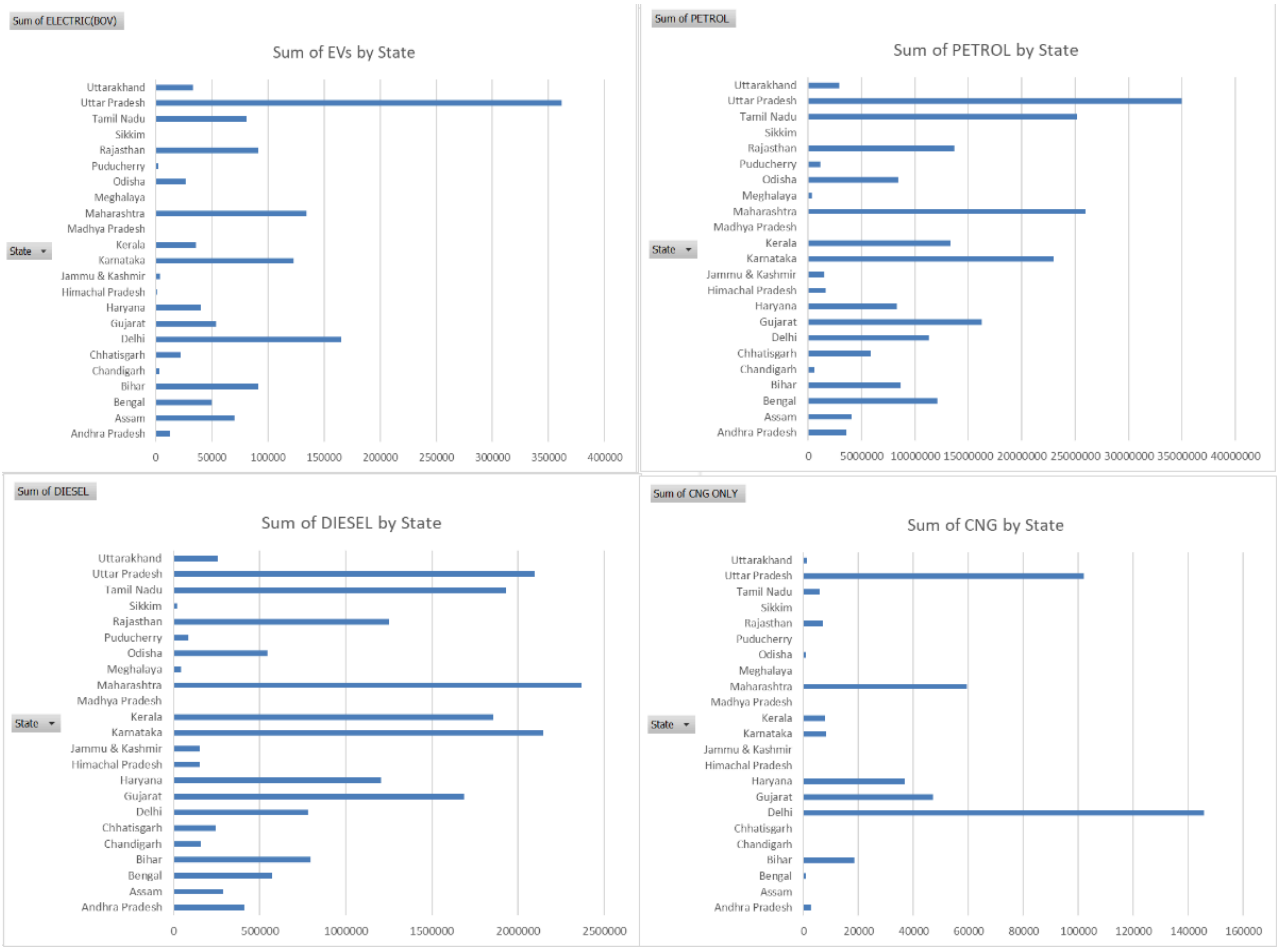
1. **Geographical Dataset:** Acquired from data.gov.in, the raw dataset consisted of state wise count of different fuel type vehicles and state sanctioned EV charging stations. Every state had a different file and required it to be processed and finally combined.
2. **Vehicle Specification Dataset:** Acquired from Kaggle, this dataset featured a variety of vehicles and their specifications. The dataset was pretty much cleaned but needed to be toned as per the project requirements.
3. **Customer Behavioural Dataset:** Acquired from Kaggle, the dataset featured client data, like education, loan history, family member, salary range etc. The dataset was mostly clean and required no such pre-processing.

SEGMENT EXTRACTION

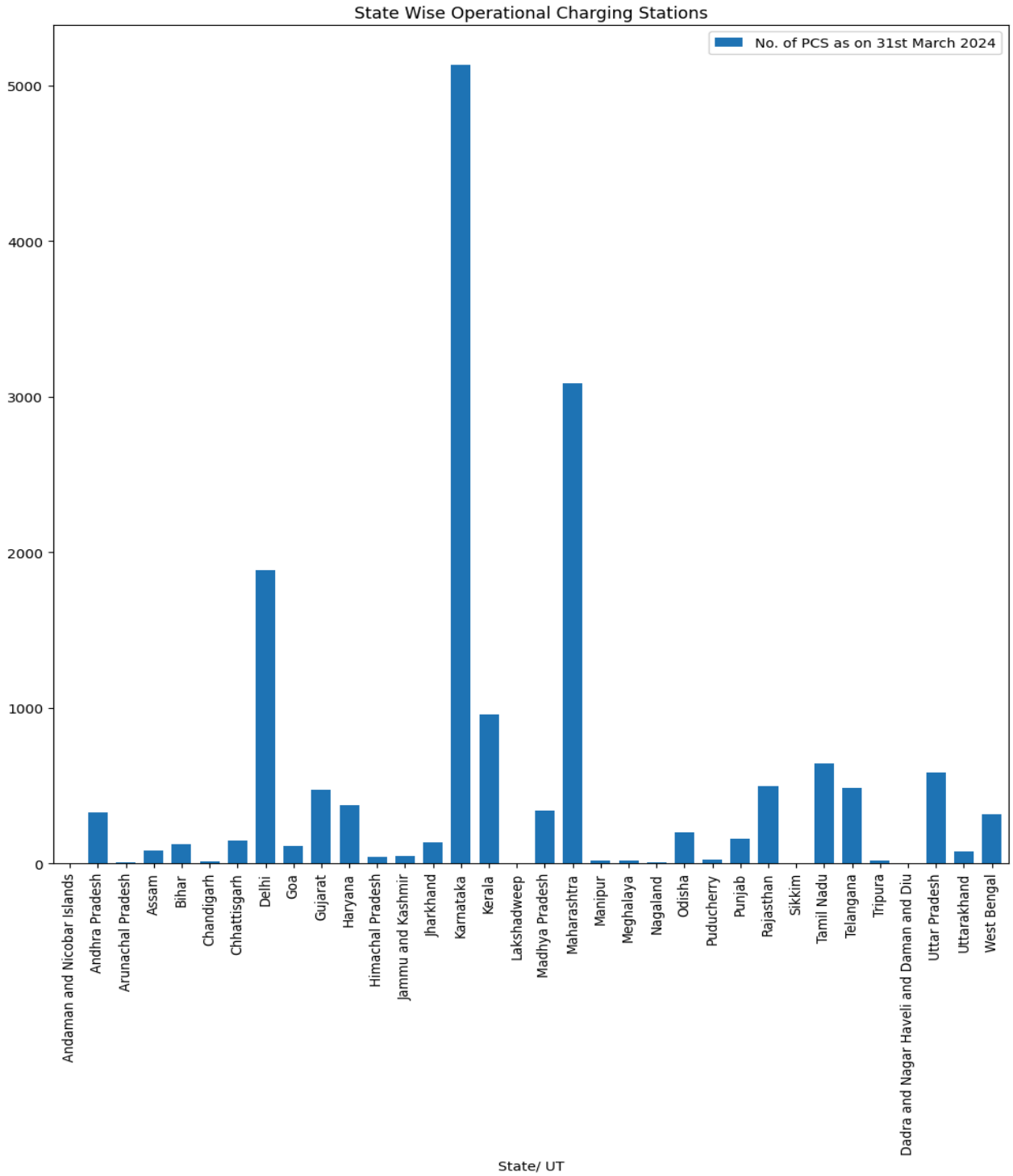
Geographic Segmentation

India is one of the fastest growing markets for Electric Vehicles. With a population of 1.4 billion, India becomes a target market for global industries. Following the adaptation of electric vehicles, even the Indian government is encouraging the public as well as the industries to enter the EV market.

The following chart displays 4 major fuel categories and their adaptation across different states and Union Territories:



To study the EV market in India, we have used government data extracted from data.gov.in which provides an insight on the EV infrastructure across India. The following chart shows the number of Public Electric Charging Stations across different states in India(Total: 16348)



Market Segmentation and Investment Priority Summary based on Geographical Spread:

1. State-level analysis identified regions with high growth potential and significant infrastructure gaps.
    - Growth rates and EV station density were used to rank states.
    - KMeans clustering categorized states into three priority groups for investment.
2. Highway analysis highlighted key expressways requiring improved EV charging infrastructure.
3. Visualizations and ranked data provide actionable insights for strategic planning.
    - Bar charts for growth and gaps.
    - Scatter plot for investment priority clustering.
    - Highway analysis for targeted infrastructure upgrades.
4. Processed data and visual outputs have been saved for reporting and further analysis.

Recommendations:

- Focus investments on high-priority clusters and underserved highways
- Leverage growth metrics to anticipate future infrastructure demands.

Vehicle Specifications based Segmentation

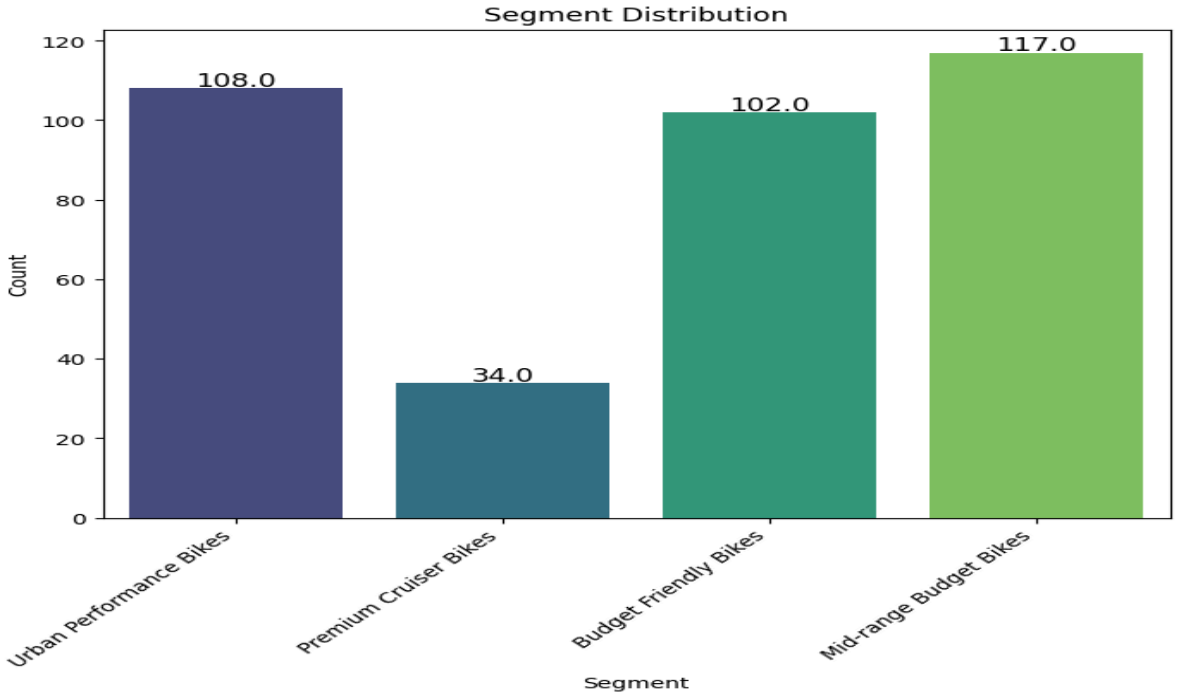
Over 55% of the Indian population owns a two-wheeler bike, while only 7.5% of the Indian households own a car. This variation in demand provides us a clear sense of what market segment we should target first and foremost.

To get a better insight on this subject, we have considered 3 datasets to study what vehicle specs are widely recognized across India. Following are the 3 datasets and their analysis

1. **BIKE DATASET**

   Columns: 'model_name', 'price', 'CC', 'mileage', 'type_of_bike', 'weight_in_kg', 'links', 'acceleration_speed', 'top_speed'

   The market segmentation analysis was conducted using clustering techniques to group motorcycles into distinct categories based on key attributes such as price, engine displacement (CC), mileage, weight, acceleration speed, and top speed. This analysis aims to identify actionable insights to guide marketing and product strategies.



Segment Profiles:

- **Segment 0: Urban Performance Bikes**
  Price: ₹222,250 (affordable)
  CC: 261 cc (low engine displacement)
  Mileage: 38.01 km/l (moderate fuel efficiency)
  Weight: 157.4 kg (lightweight)
  Acceleration Speed: 2.91 seconds (fastest)
  Top Speed: 127.85 km/h (highest speed)
  Customer Profile: Urban commuters seeking affordable bikes with high speed and acceleration.
  Marketing Strategy: Highlight affordability and superior speed in urban environments.

- **Segment 1: Premium Cruiser Bikes**
  Price: ₹2,904,260 (luxury)
  CC: 1747 cc (high engine displacement)
  Mileage: 15.82 km/l (low fuel efficiency)
  Weight: 338.6 kg (heaviest)
  Acceleration Speed: 4.19 seconds
  Top Speed: 99.34 km/h
  Customer Profile: Premium customers who value power and luxury.
  Marketing Strategy: Position these bikes as aspirational lifestyle products, targeting affluent buyers.

- **Segment 2: Budget-Friendly Commuter Bikes (Recommended Target Segment)**
  Price: ₹85,502 (most affordable)
  CC: 431 cc (moderate engine displacement)
  Mileage: 91.10 km/l (highest fuel efficiency)
  Weight: 103.6 kg (lightest bikes)
  Acceleration Speed: 5.56 seconds (slower acceleration)
  Top Speed: 69.15 km/h (lowest speed)
  Customer Profile: Budget-conscious buyers, daily commuters, and first-time bike owners.
  Marketing Strategy: Promote as the most economical and environmentally friendly option.
  Target students, entry-level professionals, and urban dwellers.

- **Segment 3: Mid-Range Balanced Bikes**
  Price: ₹1,467,843 (mid-range to premium)

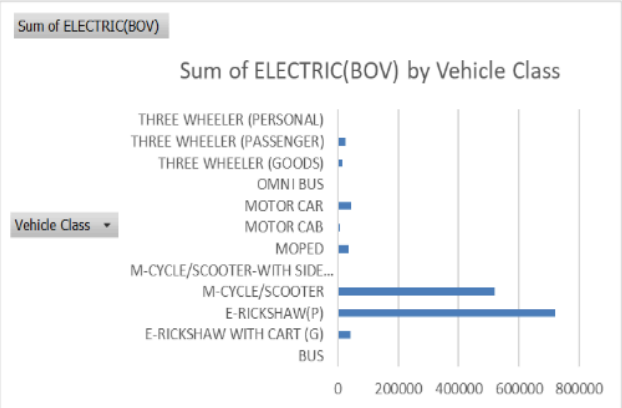
CC: 976 cc (medium engine displacement)
Mileage: 18.76 km/l (moderate fuel efficiency)
Weight: 217.8 kg
Acceleration Speed: 4.19 seconds
Top Speed: 99.34 km/h
Customer Profile: Riders seeking a balance between performance and cost.
Marketing Strategy: Emphasize versatility and performance for regular use.

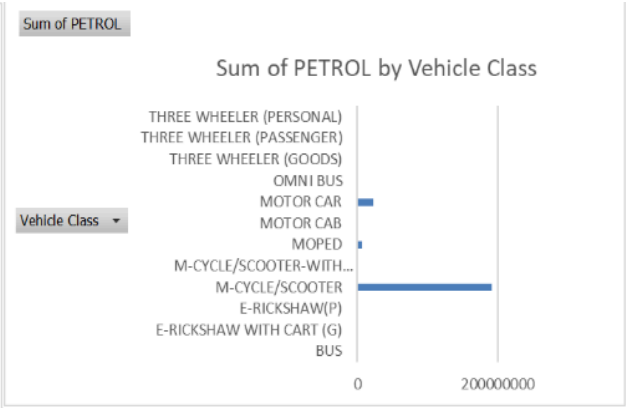
This segmentation analysis identifies Segment 2 as the most promising target due to its affordability and high mileage, which are crucial for budget-conscious and environmentally aware customers. Strategic marketing efforts focusing on these aspects will likely yield the best results. Meanwhile, other segments provide opportunities for premium and performance-oriented markets.

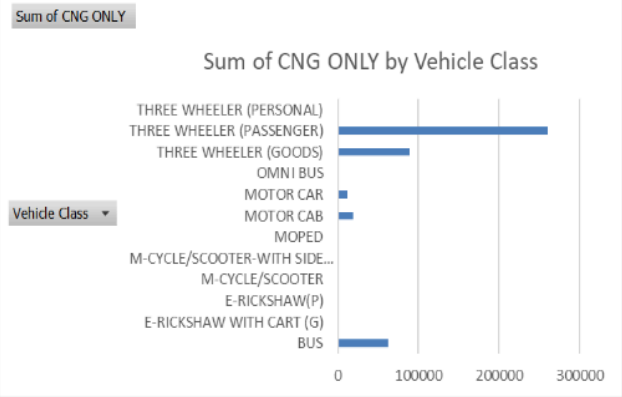
2. **Cars Dataset**
   Columns: 'Model', 'Maker', 'Type', 'Seats', 'Displacement', 'Length', 'Width', 'Height', 'Wheelbase', 'No_of_Cylinders', 'Fuel', 'Engine Type', 'Transmission', 'Front Brake', 'Rear Brake', 'Drive', 'Turning Radius', 'Fuel Tank Capacity', 'Boot Space', 'Fuel Efficiency', 'Emission Type', 'Tyre Size', 'Variants', 'NCAP Rating'

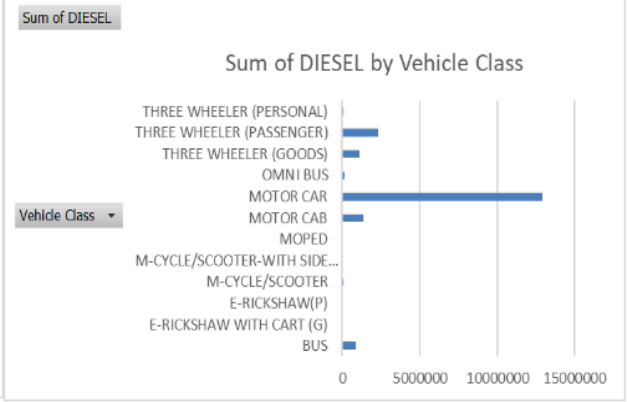
   General Insights:
   - **Segment 0:**
     Key Characteristics:
     Average engine displacement: 1193 cc.
     Moderate boot space: 370.5 liters.
     High fuel efficiency: 20.06 km/l.
     Interpretation: Represents economy cars or compact vehicles for budget-conscious buyers.
     Suitable for urban commuting and small families.

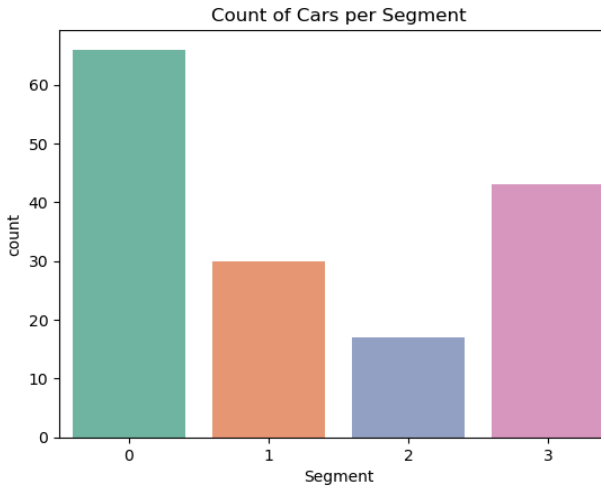
   - **Segment 1:**
     High engine displacement: 2243 cc.
     Large boot space: 411.2 liters.
     Lower fuel efficiency: 15.96 km/l.
     Interpretation: Represents premium cars or SUVs for buyers seeking performance and spaciousness.
     Appeals to larger families or luxury-oriented buyers.

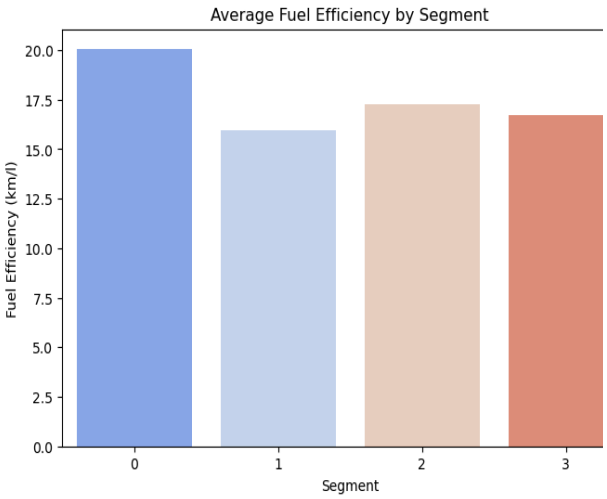












- **Segment 2:**
  Moderate engine displacement: 1579 cc.
  Compact boot space: 197.5 liters.
  Moderate fuel efficiency: 17.26 km/l.
  Interpretation: Represents mid-range vehicles, possibly compact SUVs or crossovers.

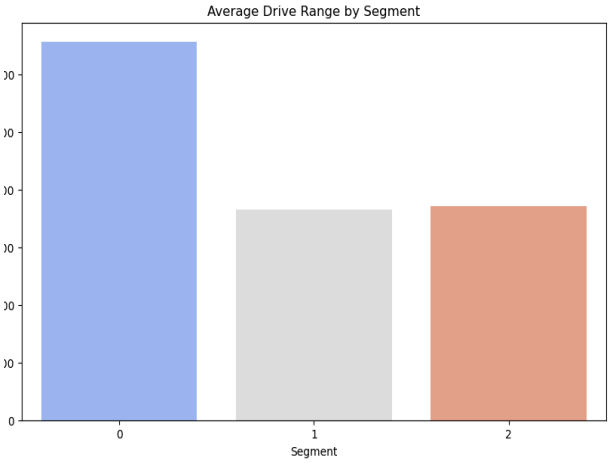
Appeals to younger demographics or small households.

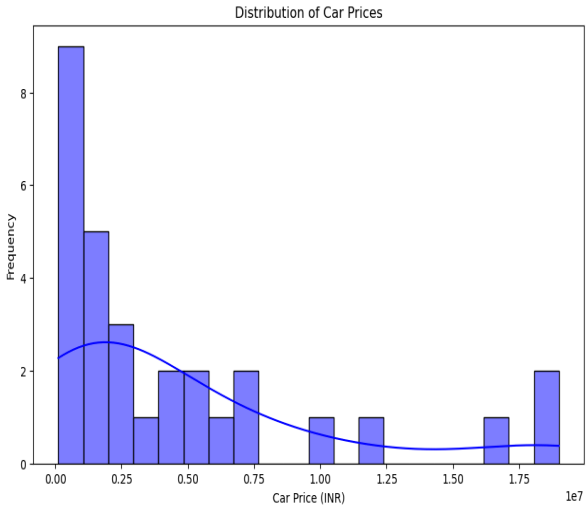
- **Segment 3:**
  Engine displacement: 1773 cc.
  Large boot space: 441.5 liters.
  Moderate fuel efficiency: 16.7 km/l.
  Interpretation: Represents well-rounded cars balancing performance, space, & efficiency.
  Appeals to families or buyers seeking a balance of utility and comfort.

Target Segment (Segment 0):
Why Target Segment 0?
Highest fuel efficiency (20.06 km/l) appeals to cost-conscious buyers.
Moderate boot space (370.5 liters) is suitable for urban families.
Represents the largest market segment (42% of cars in this category).
Potential Marketing Strategy:
Focus on affordability and practicality.
Highlight fuel savings and suitability for city commuting.

Recommendations:
- Primary Target: Segment 0 (Economy cars) for immediate market penetration due to size and efficiency focus.
- Secondary Focus: Segment 3 (Balanced performance and utility) for families or buyers seeking mid-tier cars.
- Premium Segment (Segment 1): Niche market for luxury buyers; emphasize power and spaciousness.
- Monitor Segment 2: Appeals to younger or first-time buyers, with moderate fuel efficiency and compact design.

3. EV Cars in INDIA





Target Segments and Insights: Three customer segments were identified using K-Means clustering:

1. Segment 0: Price-Sensitive Buyers
    - Average Car Price: ₹2.57M
    - Battery Capacity: 45 kWh
    - Driving Range: 124 km
    - Cluster Size: 22 (Largest segment, ~73% of the data)
    - Characteristics:
        - Majority of the market; focus on affordability.
        - Customers prefer economical options for shorter commutes.

2. Segment 1: Mid-Range Buyers
    - Average Car Price: ₹5.87M
    - Battery Capacity: 144 kWh
    - Driving Range: 443 km
    - Cluster Size: 5 (~17% of the data)
    - Characteristics:
        - Balance between cost, range, and battery performance.
        - Urban professionals or families prioritizing value.

3. Segment 2: Premium Buyers
    - Average Car Price: ₹18.33M
    - Battery Capacity: 29 kWh

- Driving Range: 197 km
- Cluster Size: 3 (~10% of the data)
- Characteristics:
    - Focused on luxury EVs with premium features.
    - Affluent individuals who value eco-friendly status symbols.

Insights from Visualizations

- Car Price Distribution: Majority of vehicles in the lower price range; outliers indicate demand for premium EVs.
- Correlation Analysis:
    - Car Price vs. Drive Range: Strong positive correlation; higher-priced EVs offer better range.
    - Battery Capacity vs. Drive Range: High correlation indicates driving range improvement depends on battery capacity.
    - Battery Capacity vs. Car Price: Weak correlation suggests battery efficiency can reduce costs.

Recommended Strategy

- Primary Target (Segment 0):
- Focus on affordable EVs (₹2–3M), 45 kWh battery, 100–150 km range.
- Marketing: Highlight affordability, low running costs, and eco-benefits.
- Secondary Target (Segment 1):
- Develop mid-range EVs (₹5–7M), ~140 kWh battery, 400+ km range.
- Marketing: Highlight convenience for families and professionals with long commutes.
- Niche Target (Segment 2):
- Luxury EVs (₹15M+), with cutting-edge features and design.
- Marketing: Position as eco-friendly status symbols for high-income buyers.

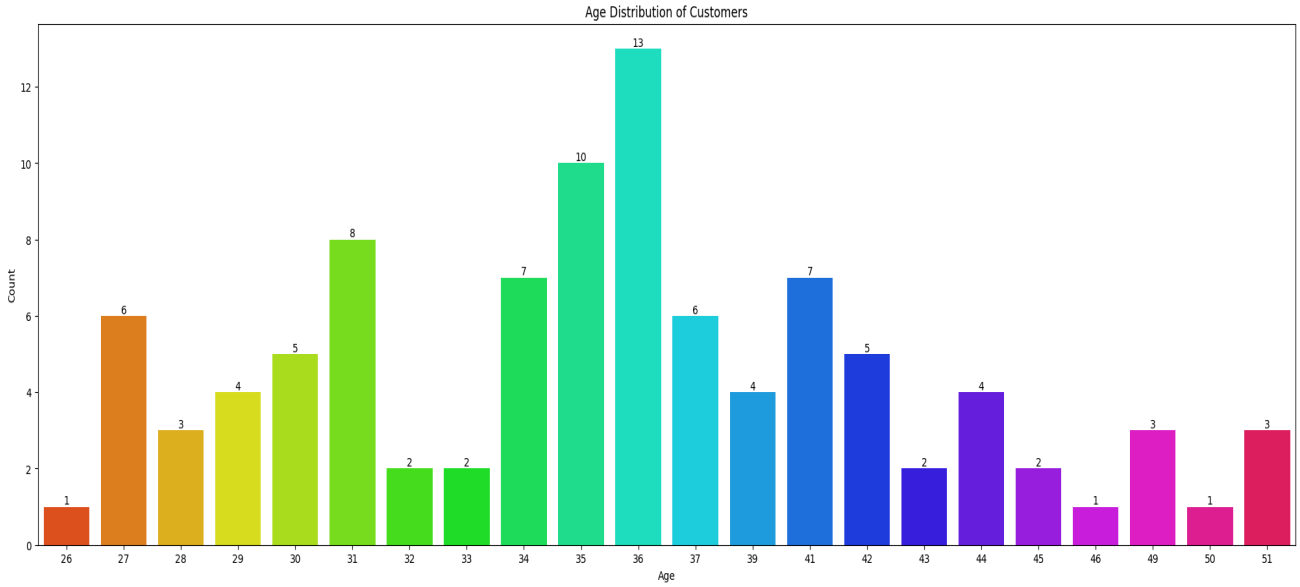
Business Implications

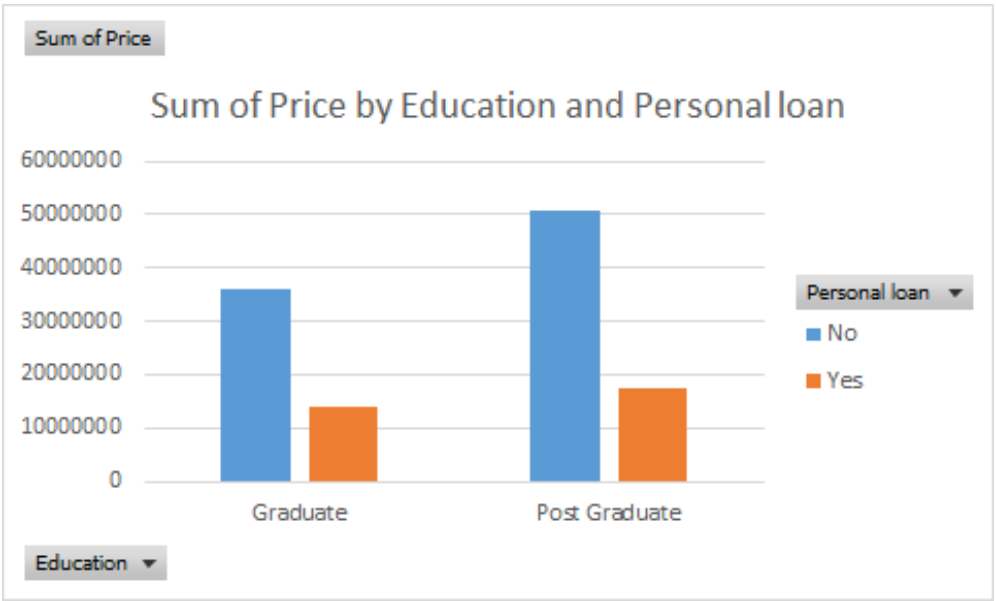
- Battery Optimization: Focus on efficient batteries for cost and range.
- Infrastructure Support: Expand charging network for longer-range users.
- Customization: Offer flexible features for mid-range and premium buyers.

BEHAVIORAL SEGMENTATION

In order to study the behaviour of clients, we have a set of client data from kaggle as our source. The dataset contains features like age, profession, existing loan, number of dependents in family, education and salary information. Based on this information, the following segments were identified:

Based on the variables, we can hypothesize a few customer segments for the EV market:





1. **High-Income, Tech-Savvy Professionals**:
    - Age: 25-45
    - Profession: IT professionals, executives, entrepreneurs, managers
    - Education: Higher education (Masters, Doctorate, etc.)
    - Total Salary: High income (₹10,00,000+ per year)
    - Marital Status: Mixed (single or married)
    - Personal Loan: Low or no personal loans
    - Number of Dependents: Few or none
    - Profile: This group is likely to adopt electric vehicles due to their high income, environmental awareness, and affinity for technology. They may prefer premium EVs with advanced features and sustainability credentials
2. **Middle-Income, Family-Oriented Consumers**:
    - Age: 30-50
    - Profession: Mid-level professionals, teachers, government employees
    - Education: Bachelor's degree or higher
    - Total Salary: Moderate income (₹5,00,000 - ₹10,00,000)
    - Marital Status: Married with dependents
    - Personal Loan: Likely to have personal loans or financial obligations
    - Number of Dependents: 1-2 children
    - Profile: They are likely to be interested in electric cars due to long-term savings on fuel costs and a desire to provide eco-friendly transportation for their families. They might be more price-sensitive and look for affordable EV options with family-friendly features.
3. **Eco-Conscious, Lower-Income Consumers**:
    - Age: 20-40
    - Profession: Students, part-time workers, NGO employees, early-career professionals
    - Education: College graduates or higher
    - Total Salary: Lower income (₹2,00,000 - ₹5,00,000)
    - Marital Status: Single or newly married
    - Personal Loan: High likelihood of personal loans
    - Number of Dependents: None or one
    - Profile: This segment may be interested in more affordable electric vehicles, particularly two-wheelers or compact cars. Their decision to buy may be driven by environmental concerns and fuel savings.
4. **Affluent, Eco-Conscious Retirees**:
    - Age: 55+
    - Profession: Retired, senior-level professionals, business owners
    - Education: Higher education, experienced in eco-friendly living
    - Total Salary: High income, pension-based or wealthier retirees

- Marital Status: Likely married, but could be widowed
- Personal Loan: No loans or low debt
- Number of Dependents: Few or none
- Profile: Older, financially stable consumers who may have an interest in EVs for eco-conscious reasons, as well as to reduce overall cost of living. They might be more likely to choose premium EV models if they prioritize comfort, safety, and reliability.

Target Audience:

Segment 0: High Income, Family Oriented People:
This group is tech-savvy, environmentally conscious, and has the financial capacity to afford premium EVs with advanced features.

The strategy for targeting high-income, family-oriented consumers, who are both tech-savvy and environmentally conscious, focuses on positioning the electric vehicle (EV) as the ideal combination of premium technology, family comfort, and sustainability. This segment values cutting-edge tech features, eco-friendly solutions, and products that align with both their lifestyle and family needs.

The EV will be offered at a premium price point, with flexible EMI plans to make the purchase accessible. Emphasis will be placed on the long-term savings from lower fuel and maintenance costs, making the investment more attractive. Additionally, lease and subscription models will be introduced to provide flexibility for tech-savvy customers who appreciate frequent upgrades.

Market Entry Strategy Recommendations

Geographical Recommendation:

1. **States with Pro-EV Policies**: These states have introduced state-specific EV policies that provide incentives like subsidies, tax rebates, free registration, and road tax waivers. They often have a well-established vision for the adoption of EVs and infrastructure development. Examples: Delhi, Maharashtra, Uttar Pradesh, Tamil Nadu, and Andhra Pradesh.
2. **States with Less EV Support**: Some northeastern states and rural regions may have limited EV-specific policies and infrastructure. The government may need to introduce more targeted incentives to boost adoption in these regions.
3. **Well-developed Road Networks**: These cities with well-maintained roads are better suited for long-range EVs and have a greater likelihood of adopting electric vehicles. The availability of fast-charging networks and less road congestion further accelerates adoption. Examples: Delhi NCR, Mumbai, Bangalore, Chennai.
4. **Congested Cities and Smaller Towns**: In these cities, EV adoption may focus on two-wheelers (e-scooters, e-bikes) or three-wheelers for better maneuverability in traffic. Infrastructure improvements like dedicated charging stations and traffic management solutions could further help EV uptake in these regions. For example: Kolkata, Mumbai, Pune, Jaipur.

Vehicle Specification Recommendation:

1. **Budget-Friendly Commuter Bikes:** This is the most promising target due to its affordability and high mileage, which are crucial for budget-conscious and environmentally aware customers. Strategic marketing efforts focusing on these aspects will likely yield the best results. Meanwhile, other segments provide opportunities for premium and performance-oriented markets.
2. **Economical Vehicle:** Vehicles that offer highest fuel efficiency (20.06 km/l) appeals to cost-conscious buyers. They also choose moderate boot space (370.5 liters) suitable for urban families. Based on our analysis we have found that they represent the largest market segment (42% of cars in this category). Additionally, to target these customers, our marketing strategy can include focus on affordability and practicality while also providing highest fuel savings and suitability for city commuting. This also includes price sensitive buyers who can be targeted by focusing on affordable EVs (₹2–3M), 45 kWh battery, 100–150 km range.

Behavioral Recommendation

Here our target is people in the age group of 30-50, with an income around ₹10,00,000 or more per year. As this category of people are more family oriented and are likely to have children. Additionally, they are more inclined toward adopting advanced technologies and eco-friendly solutions due to both personal and family priorities.

Key Drivers:

- **Tech-driven lifestyle:** They value the latest innovations in both technology and automobiles.
- **Family-focused values:** Prioritize family safety, comfort, and overall well-being.
- **Eco-consciousness:** Interested in sustainability and the long-term environmental impact.
- **Willingness to invest in quality:** They have the financial resources to pay for premium features, high performance, and a top-tier experience.