

Market Segmentation

Analysing the Electric Vehicle market in India using Segmentation analysis for an Electric Vehicles Startup and coming up with a feasible strategy to enter the market, targeting the segments most likely to use Electric vehicles.

GitHub Link:

<https://github.com/Aditi-Verma-1709/EV-Market-Segmentation-Analysis-Geographic->

Submitted By:

Aditi Verma

Overview

More than 90% of vehicles all over the world run on oil, there is a noticeable trend of desire to power vehicles with alternative energy sources. As a result, the subject of electric vehicles (EVs) is gaining popularity. An electric vehicle is one that operates on an electric motor instead of an internal combustion engine, which generates power by burning a mix of fuel and gases. Therefore, an electric vehicle is seen as a possible replacement for the current-generation automobile in the near future. As the problem of rising levels of global air pollution is serious, the use of electric cars can be a response to the achievement of sustainable development goals. With a pressing need for smarter infrastructure and friendlier government policy, electric vehicles have an important role to play in India's energy and mobility markets. In India the current market share of EV/HEV/PHEV is around 0.1%. At present almost all vehicles rely on fossil fuel-based transportation. This pollutes the atmosphere by the emission of greenhouse gases & causes global warming. The Indian transportation sector is growing very fast. The gap between domestic crude oil production and consumption is widening. India is a country which imports around 70% of oil required per year. Hence, there is an urgent need to investigate factors and challenges for the development of sustainable and clean alternatives for transportation systems. Electrified vehicles are one of the promising, clean and sustainable forms of transportation.

The recent scenario of the road transportation sector can be highlighted as:

- Energy consumption: 524 million tons of oil equivalent
- Vehicle to people ratio: 1:56.3
- Per capita energy: 442 kg of oil equivalent
- GHG emissions: 1730 million tons of CO₂ equivalent

- Electric Vehicles sold (2016): 25000 (all) and 2000 (cars)

Unlike other countries the vehicle to people ratio is very high, however, the population is more and emission is high. India stands third with the CO₂ emission of 1.726 billion Metric ton. Hence, there is an urgent need to focus towards EV technology which has the capability towards zero emission for sustainable transportation.

Market Overview

The Indian Electric Vehicle Market is segmented by Vehicle Type and Power Source.

- By Vehicle Type, the market is segmented into Passenger Cars, Commercial Vehicles, and Two- and Three-wheelers.
- By Power Source Type, the market is segmented into Battery Electric Vehicle, Plug-in Electric Vehicle, and Hybrid Electric Vehicle.

Our report mainly focuses on the Indian Electric Vehicle Market segmented by Vehicle Type. However, accessibility to Power Sources for Electric Vehicles affects the market and would be slightly discussed in the report. Page 3 The Indian Electric Vehicle Market was valued at USD 5 billion in 2020, and it is expected to reach USD 47 billion by 2026, registering a compound annual growth rate (CAGR) of above 44% during the forecast period (2021-2026). The Indian Electric Vehicle Market has been impacted by the outbreak of the COVID-19 pandemic due to supply chain disruptions and halt of manufacturing units due to continuous lockdowns and travel restrictions across the country. However, the electric vehicle (EV) market is still in its nascent stage in India. It is expected to grow at a much faster rate during the forecast period due to various government initiatives and policies. E-commerce companies (Amazon, for example) are launching initiatives to use e-Mobility for last-mile deliveries to reduce carbon footprint. India is experimenting with e-Mobility for public transport, and the country has deployed electric intercity buses across some major cities. In addition, state governments are also playing an active role in the deployment of policies encouraging the usage of EVs. For instance,

- Kerala aims to put one million EV units on the road by 2023 and 6,000 e-buses in public transport by 2025.

- Telangana aims to have EV sales targets for 2025 to achieve 80% 2- and 3-wheelers (motorcycles, scooters, auto-rickshaws), 70% commercial cars (ride-hailing companies, such as Ola and Uber), 40% buses, 30% private cars, and 15% electrification of all vehicles.

The EV market in India has gained significant momentum after the implementation of the (Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India) FAME India scheme with its aim of shifting toward e-mobility in the wake of growing international policy commitments and environmental challenges. Moreover, India offers the world's largest untapped market, especially in the electric two-wheeler segment. As 100% foreign direct investment is allowed in this sector, the automatic route market is expected to gain momentum during the forecast period.

GOVERNMENT INITIATIVES AND POLICIES SUPPORTING THE EV INDUSTRY

The Indian government has also taken initiatives, like FAME, which will contribute towards the boom in the EV market. The Indian government announced its National Electric Mobility Mission Plan (NEMMP), to support the manufacturing capabilities of local automakers. With this roadmap, the government plans to make electric vehicles economically viable and self-sustaining, by 2020. The government also announced investments of over INR 13,000 crore for demand incentives, INR 1,800 crore for R&D investments, INR 5,000 crore for power infrastructure, and INR 1,200 crore for charging infrastructure. This plan aims at encouraging reliable, affordable, and efficient EVs that can meet the consumers' performance and price expectations. Additionally, it involves a collaboration between the government and the industry for the promotion and development of indigenous manufacturing capabilities, consumer awareness, technology, and required infrastructure, thereby, helping the country emerge as a global leader in the global two-wheeler and four-wheeler electric vehicles market.

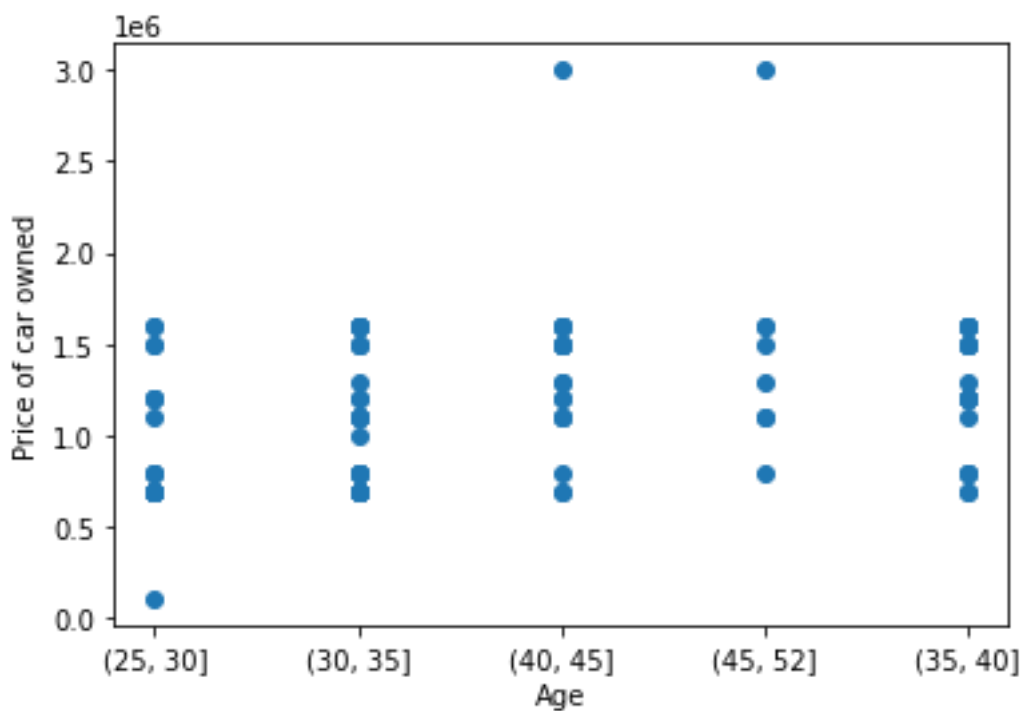
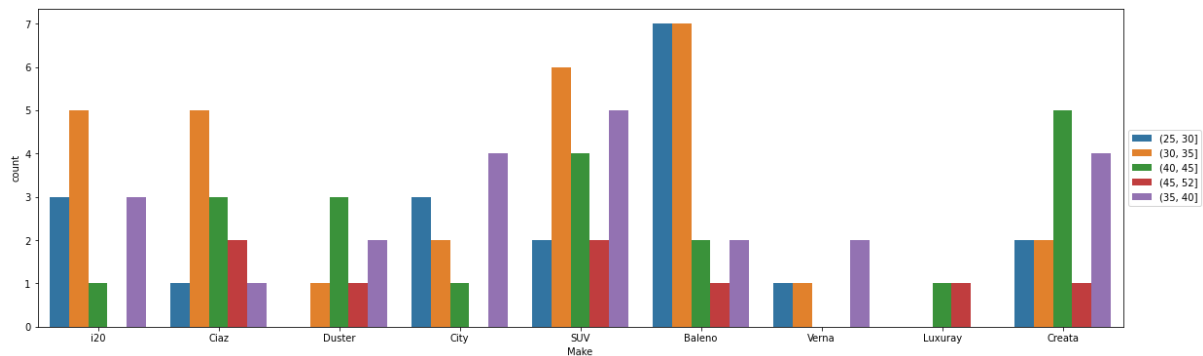
COMPETITIVE LANDSCAPE

The Indian EV market is consolidated with the presence of major players in the market, owing to cheap and readily available manpower. However, established players in the market are introducing new models to gain a competitive edge over other players. For instance,

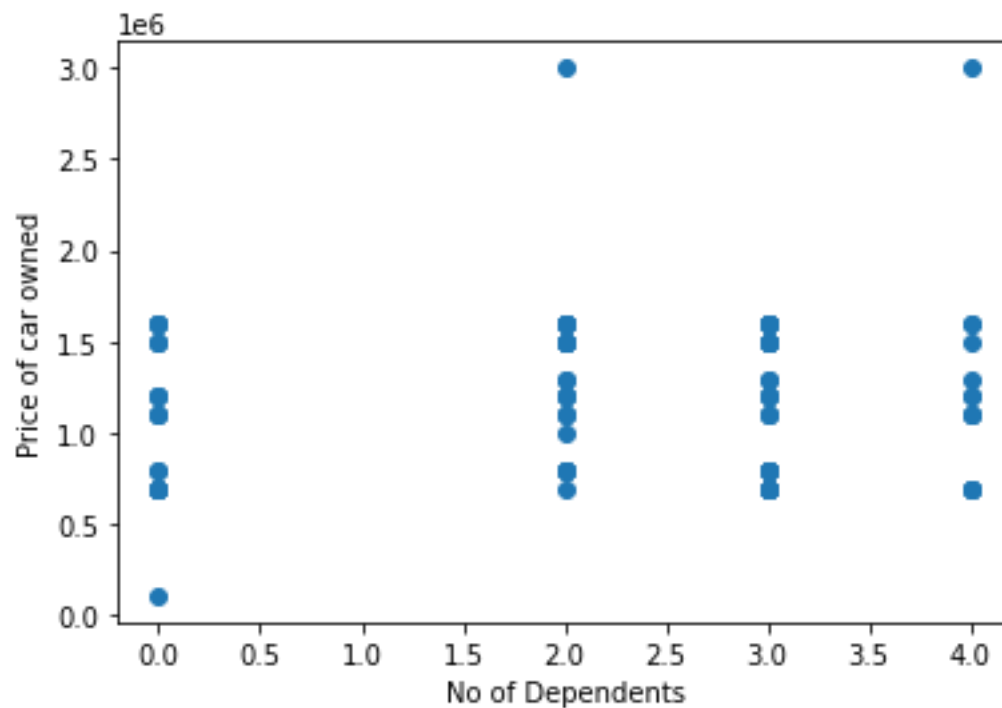
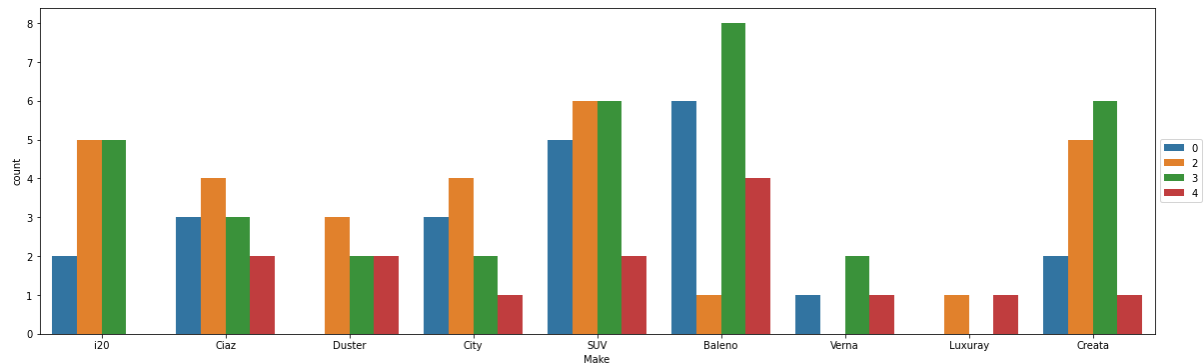
- In 2019, Tata Motors announced its EV technology ZIPTRON, which will power all future Tata electric cars. It consists of a highly efficient permanent magnet AC motor, providing excellent performance. It will also offer a dust and waterproof battery system.
- In January 2020, Morris Garages Motor India launched its first electric internet SUV, and the car has a driving range of 340 km on a full charge. The startups are expanding their presence by raising funds from investors and tapping into new and unexplored cities. Companies are investing a tremendous amount in R&D and launching new models to mark their presence in the market

Observations

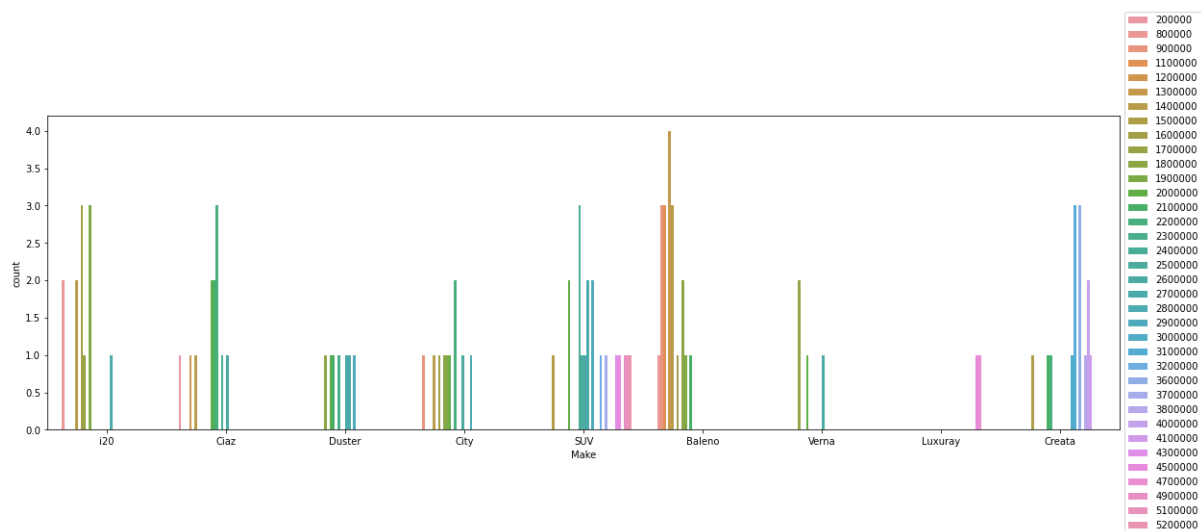
- Age: Younger consumers purchase less expensive vehicles. This can be explained simply as they have lesser dependents, lesser income and are single, and so they don't have both the option and the need to buy more expensive vehicles.



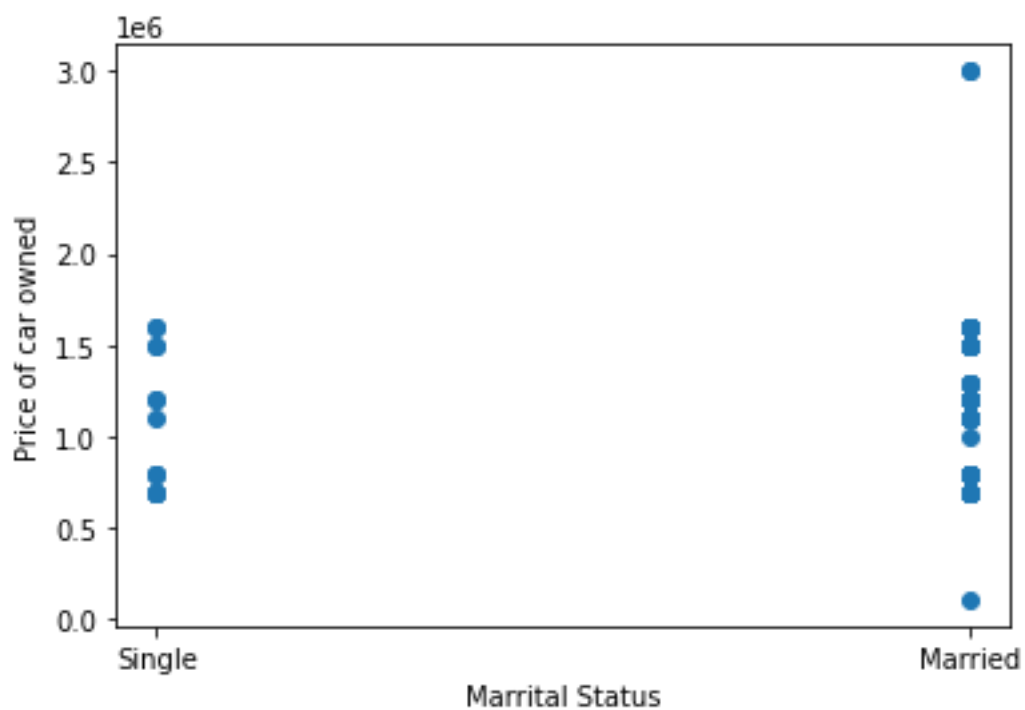
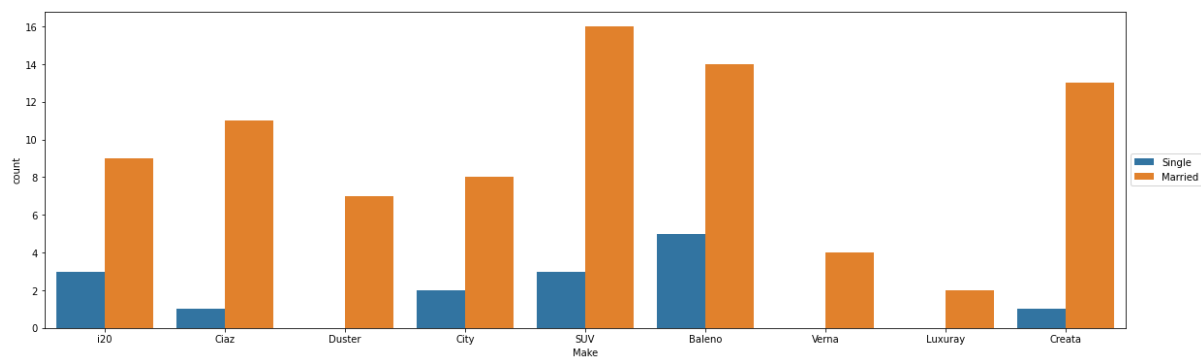
- Number of Dependents: Greater number of dependents makes the consumer buy a vehicle with more seats and so they tend to prefer SUVs.



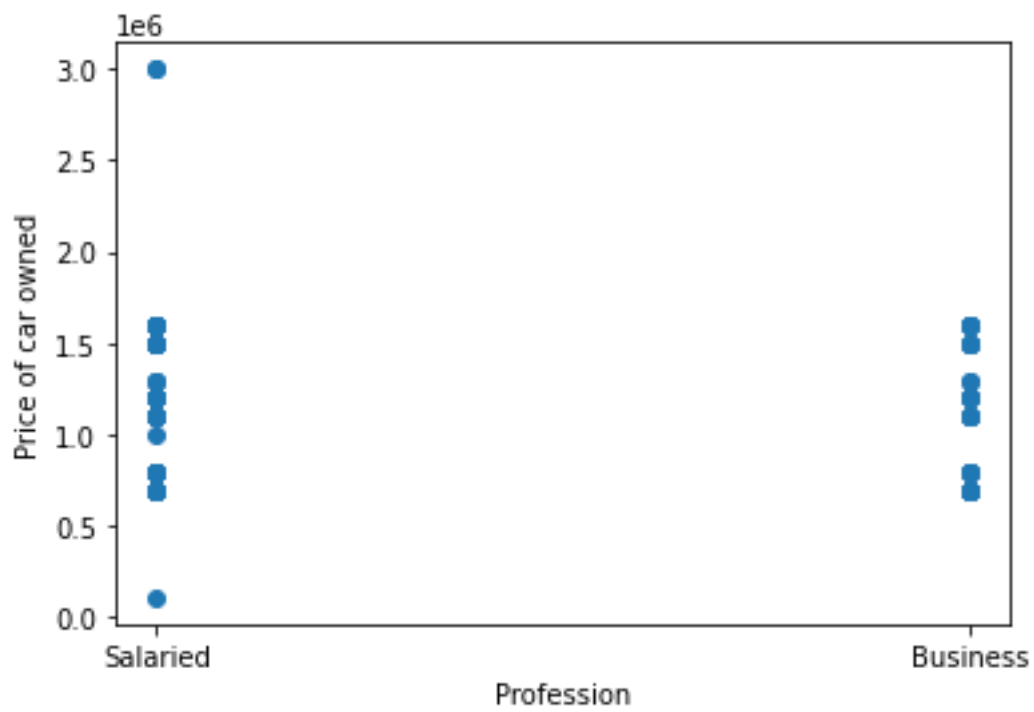
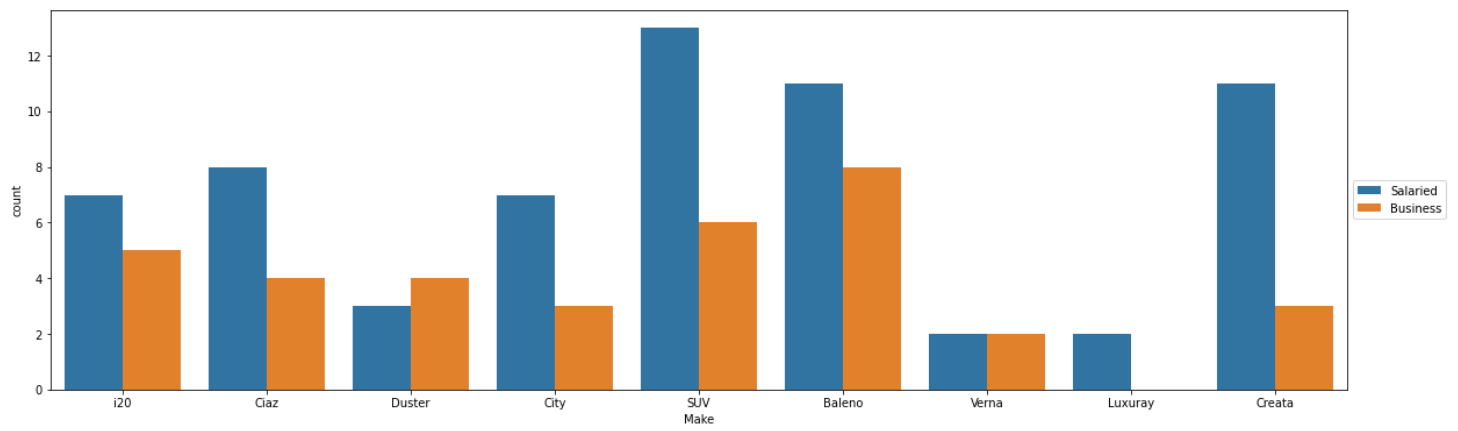
- Salary: If you overlap the normalised salary plots with price plot, you would observe the median of salary violin plot matches that of the price of the vehicle indicating a very direct relationship, which makes sense as most people would buy vehicles they can afford.



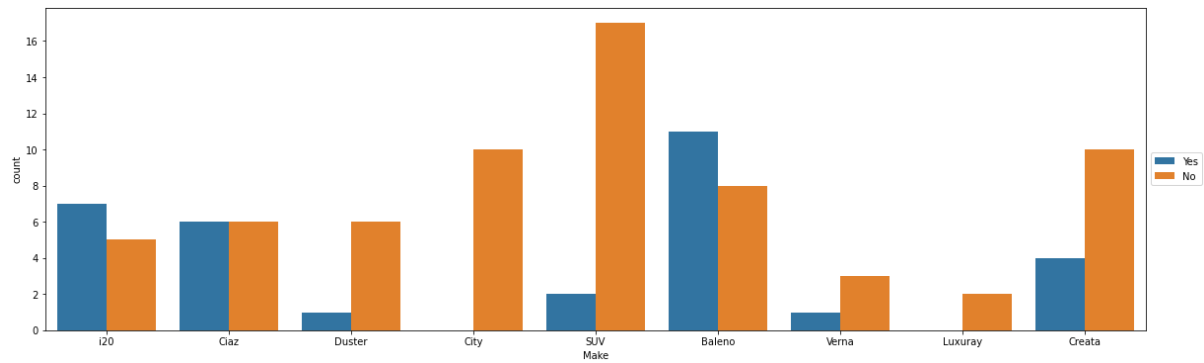
- Marital Status: Make of vehicles they tend to purchase:



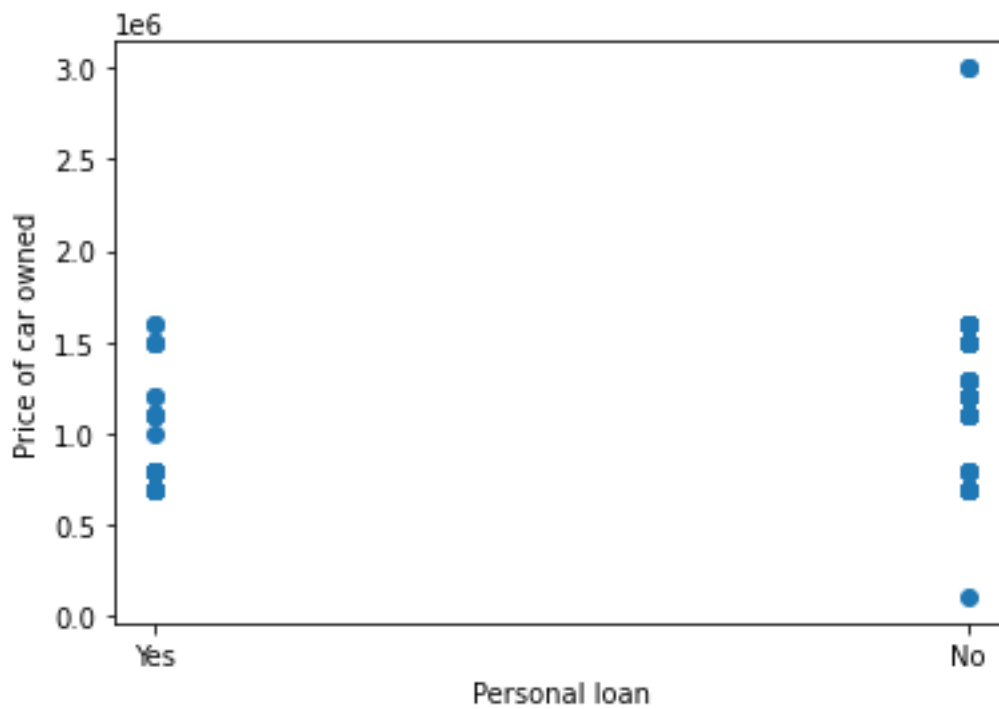
- Profession



- Relation between consumers education and the vehicles they tend to purchase

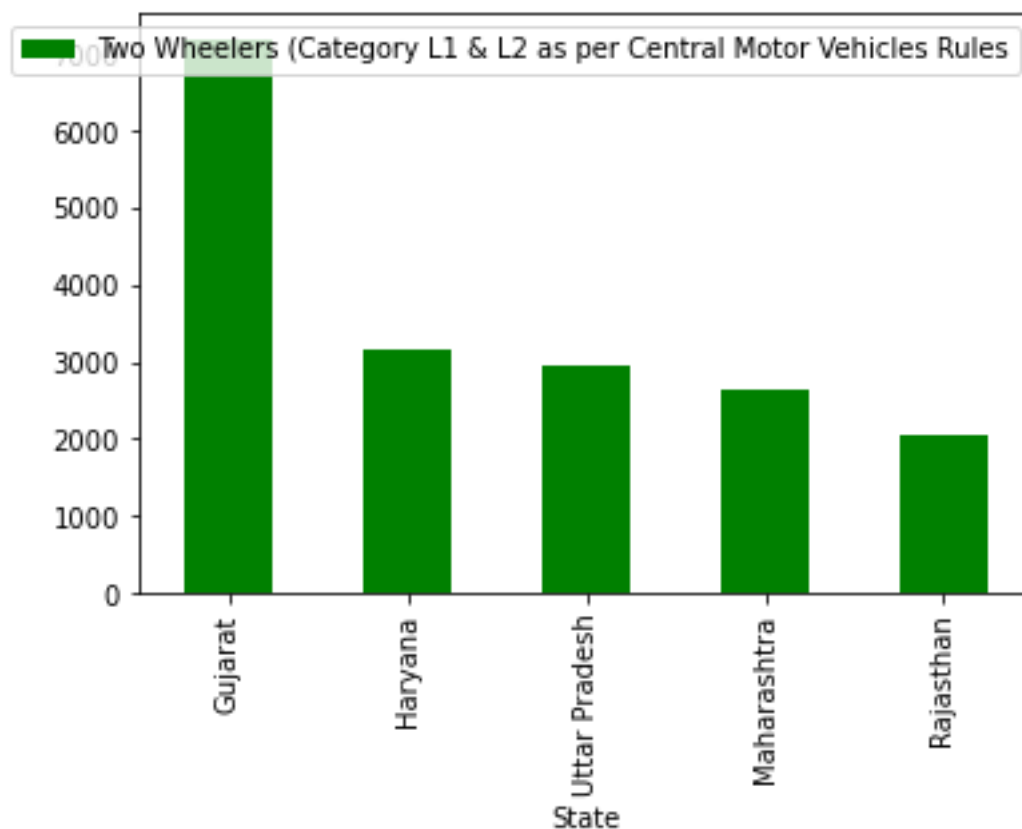


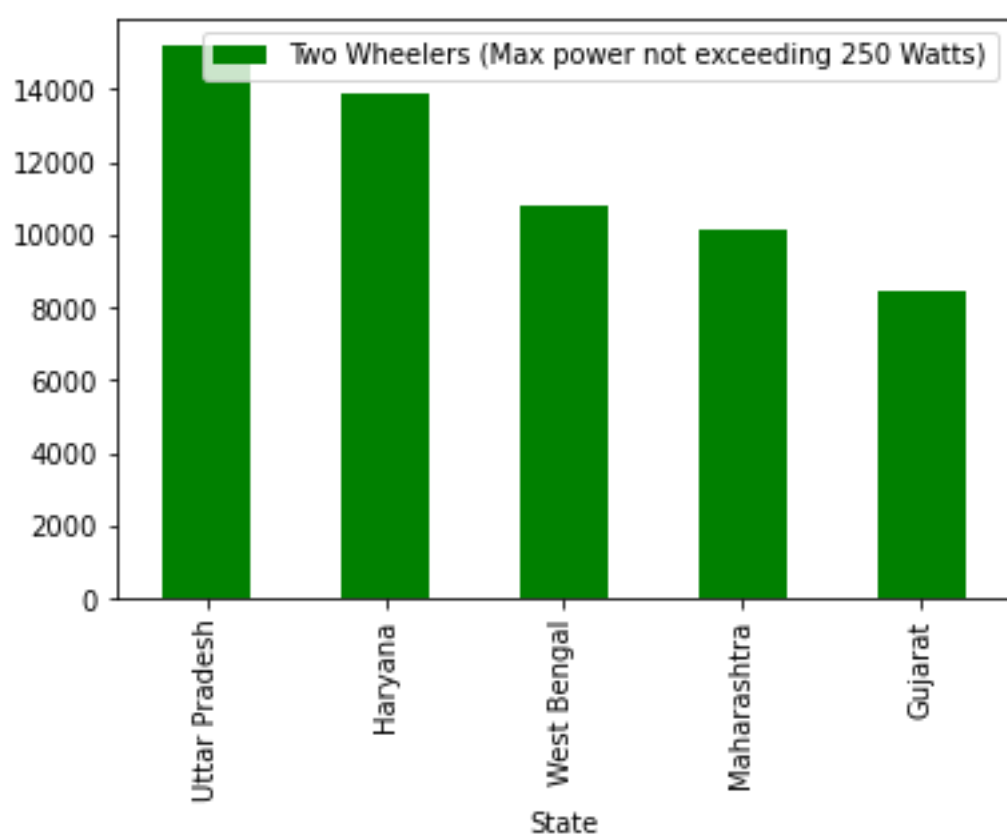
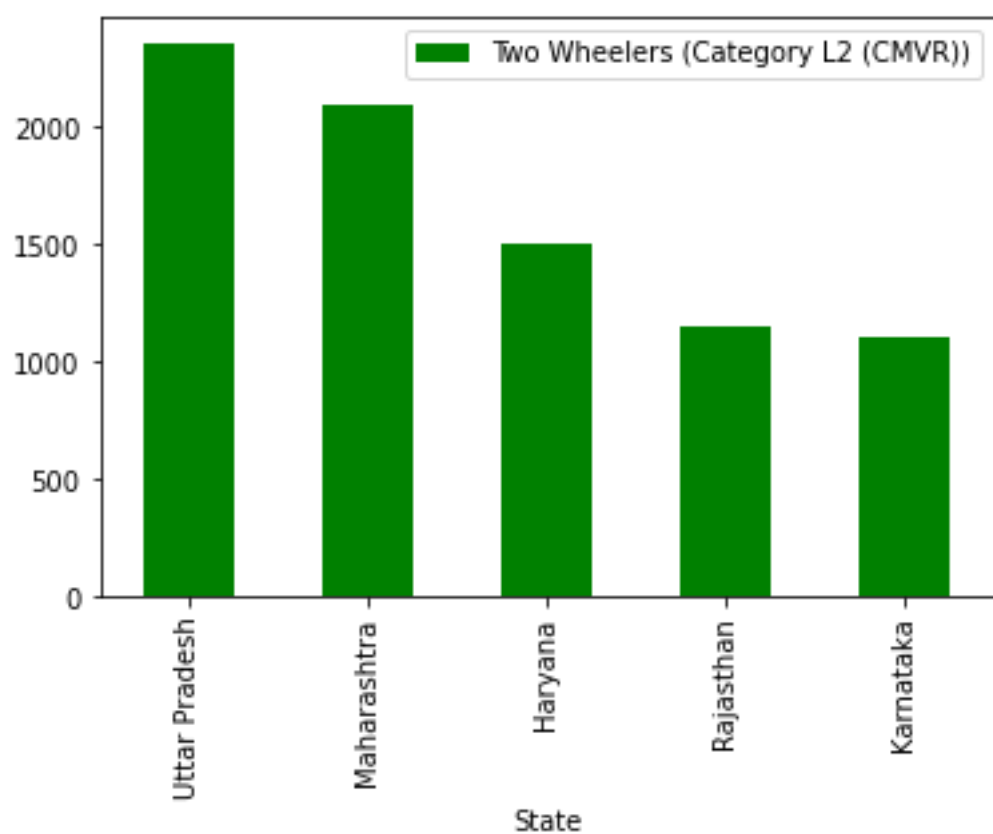
Price

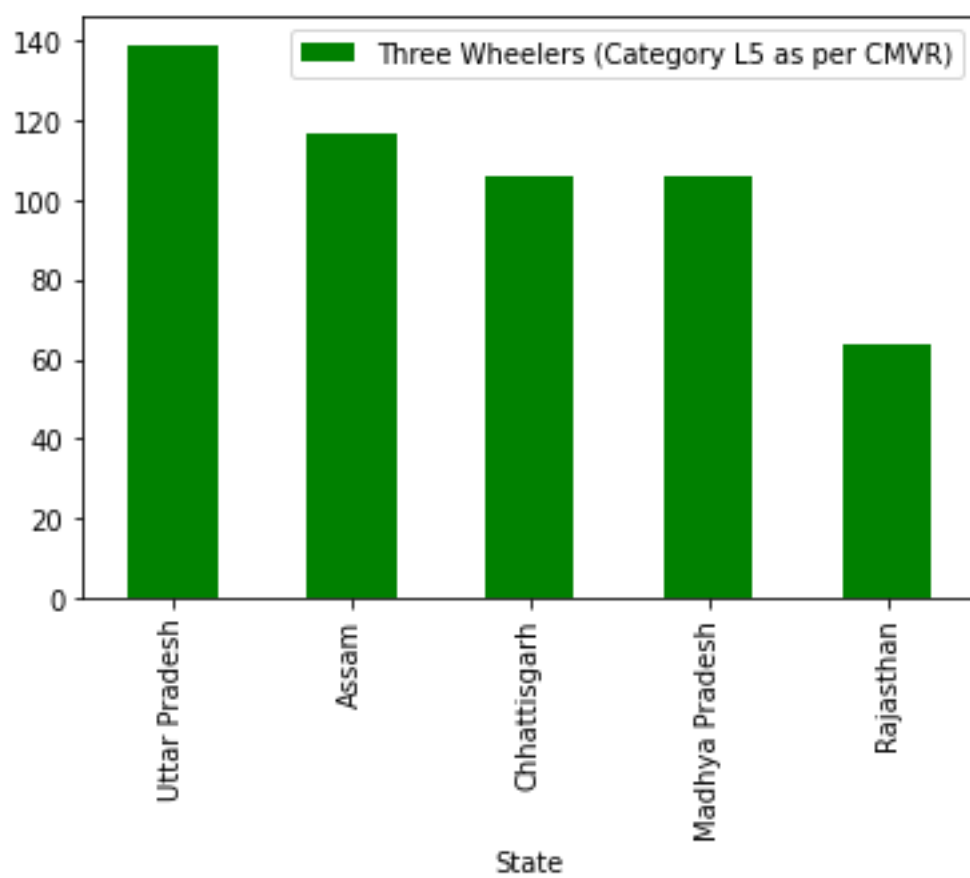
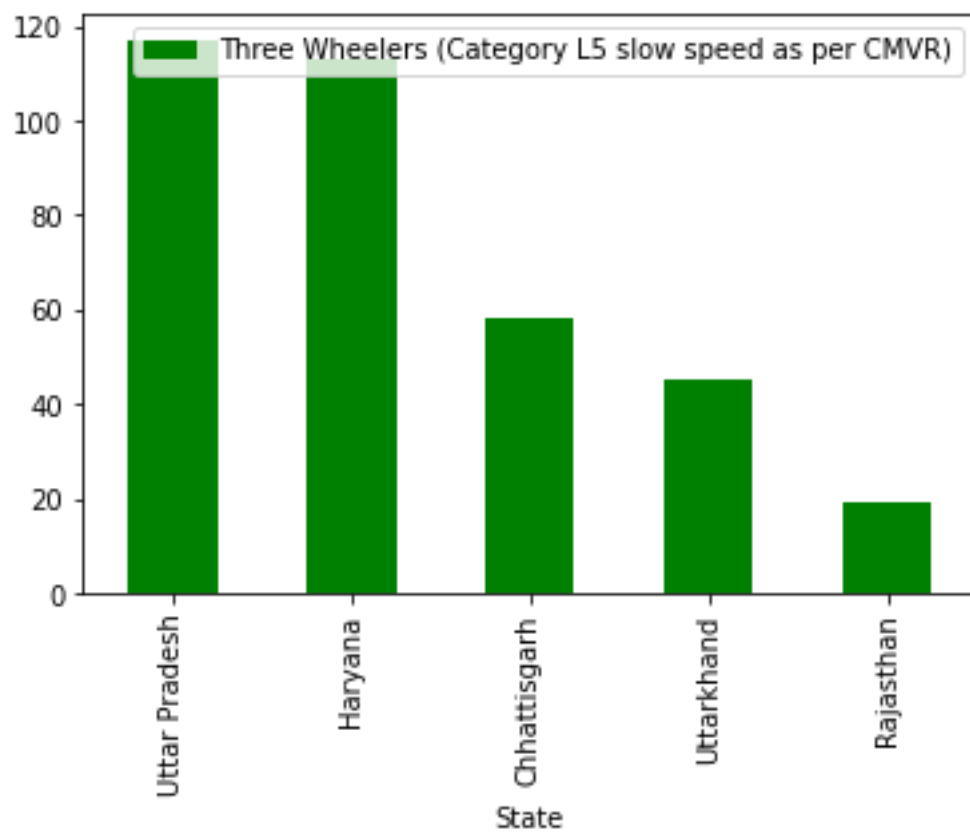


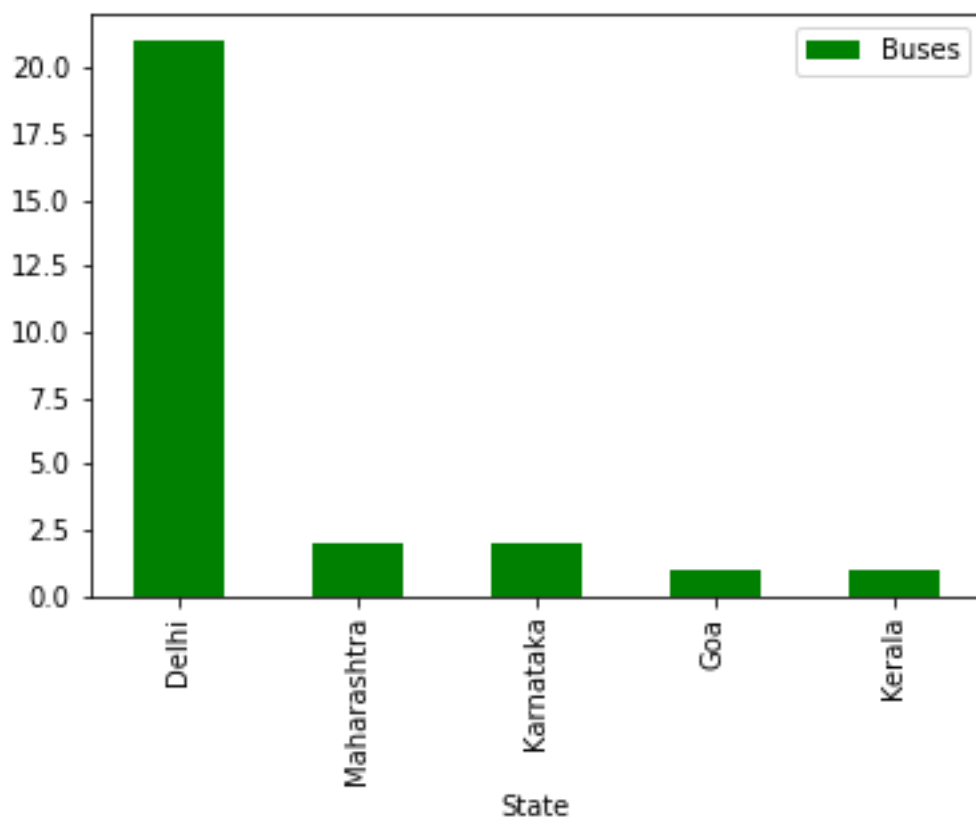
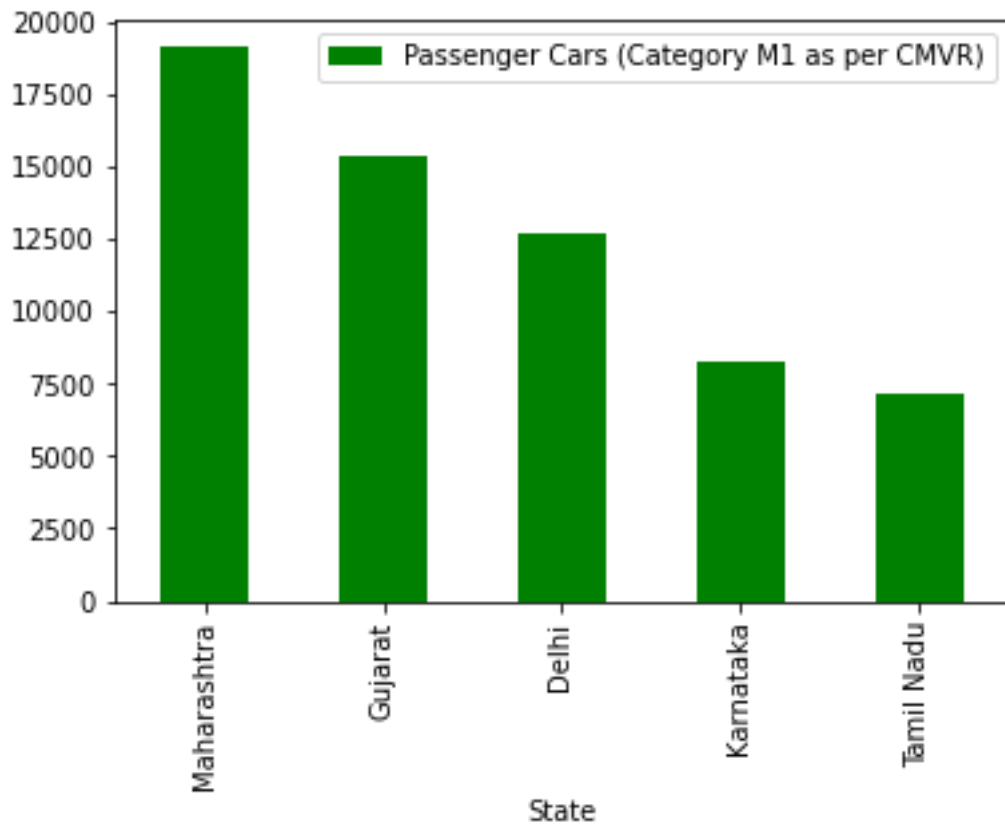
GEOGRAPHIC ANALYSIS

It is a component that competently complements a marketing strategy to target products or services on the basis of where their consumers reside. Division in terms of countries, states, regions, cities, colleges or areas is done to understand the audience and market a product/service accordingly. Here we have made divisions in terms of states and union territories in India. For geographic analysis we used state-wise sales of different types of Electric Vehicles dataset which would help us understand our target region. Based on the type of electric vehicle, states with higher numbers of electric vehicles can be targeted as people in these states are more likely to purchase them. Given below are bar charts showing the top 5 states in sales of a particular EV type:









Observations regarding Electric Vehicles of Different types in various states:

1.Two wheelers of Category L1 and L2 are sold most in Gujarat.

2.Two wheelers of Category L2(CMVR) are sold most in Uttar Pradesh.

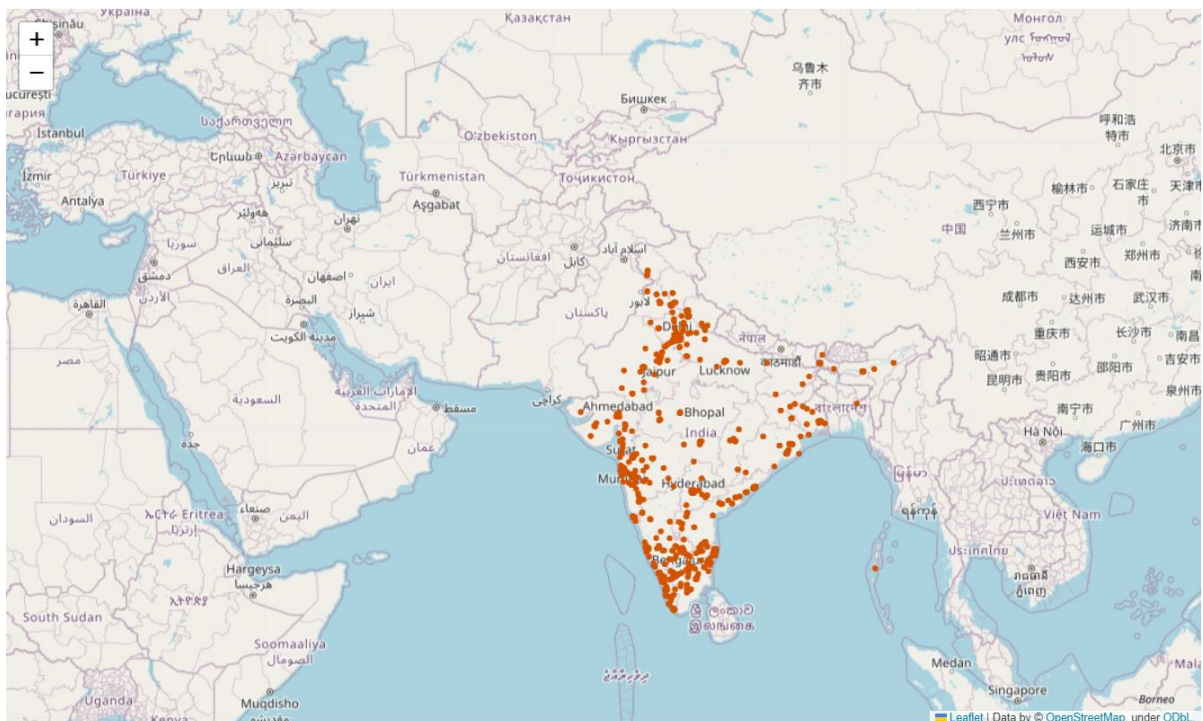
3.Three wheelers of Category L5(CMVR) are sold most in Uttar Pradesh.

4.Passenger Cars are sold most in Maharashtra.

5.Buses are sold most in Delhi.

6.Overall, Maharashtra is the Largest user of Electric Vehicles.

- Plot Of EV Charging Stations on India Map built using Folium Library



Approaches Used for Segmentation

To perform market segmentation, we are using the population behavioural study where 100 people out of the entire population are selected and data relevant to our goal which is to know about the automobile purchase capability is noted. Since we are trying to find the ideal target segment for market penetration, we will classify the market into various segments. There are 2 general ways for classification: common sense classification and data-driven classification. Here we will be implementing one of the data-driven classification (i.e., K-Means Clustering).

ALGORITHM: K-MEANS CLUSTERING K-means clustering is a type of unsupervised learning, which is used when you have unlabelled data (i.e., data without defined categories or groups). The goal of this algorithm is to find groups in the data, with the number of groups represented by the variable K. The algorithm works iteratively to assign each data point to one of K groups based on the features that are provided. Data points are clustered based on feature similarity. The results of the K-means clustering algorithm are:

1. The centroids of the K clusters, which can be used to label new data.
2. Labels for the training data (each data point is assigned to a single cluster) The 'means' in the K-means refers to averaging of the data; that is, finding the centroid. The steps followed by the K-Means Clustering are :

1. Specify the desired number of segments k .
2. Randomly select k observations (consumers) from data set X and use them as the initial set of cluster centroids $C = \{c_1, \dots, c_k\}$.
3. Assign each observation x_i to the closest cluster centroid to form a partition of the data, that is, k market segments S_1, \dots, S_k

This means that each consumer in the data set is assigned to one of the initial segment representatives. This is achieved by calculating the distance between each consumer and each segment representative, and then assigning the consumer to the market segment with the most similar representative.

4. Recompute the cluster centroids (segment representatives) by holding cluster membership fixed, and minimising the distance from each consumer to the corresponding cluster centroid.

5. Repeat from step 3 until convergence or a pre-specified maximum number of iterations is reached.

This is when the stepwise process of the partitioning algorithm stops and the segmentation solution is declared to be the final one.

LIBRARIES USED

- NumPy: Scientific Computing Library
- Pandas: Data Analysis Library (mainly used to manage data frames)
- Matplotlib: Data Visualization Library
- seaborn: Data Visualization Library
- scikit-learn: Machine Learning Library

Datasets:

1. <https://github.com/Aditi-Verma-1709/EV-Market-Segmentation-Analysis-Geographic/blob/main/EVStats.csv>
2. <https://github.com/Aditi-Verma-1709/EV-Market-Segmentation-Analysis-Geographic/blob/main/EVStats2.csv>
3. <https://github.com/Aditi-Verma-1709/EV-Market-Segmentation-Analysis-Geographic/blob/main/EVStats3.csv>
4. https://github.com/Aditi-Verma-1709/EV-Market-Segmentation-Analysis-Geographic/blob/main/EV_India.csv