ELECTRICAL VEHICLE (EV)
MARKET SEGMENTATION

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GitHub Link :

https://github.com/SrinidhiKavuluru/FeynnLabs_Projects/tree/main/EV_Market_Segmentation(Project-2)

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1.0 Introduction

The electric vehicle (EV) market has experienced significant growth over the past decade, driven by advancements in technology, increased environmental awareness, and supportive governmental policies. Understanding the factors that influence consumer preferences and market dynamics is crucial for stakeholders to make informed decisions. This report aims to analyze and segment the EV market based on various features such as acceleration, top speed, range, efficiency, fast charging capabilities, seating capacity, and price.
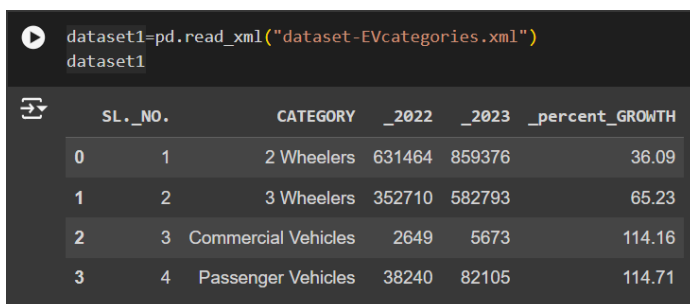
2.0 Problem Statement

The task is to analyse the Electric Vehicles market using clustering techniques to uncover significant patterns and insights within the data. The goal is to segment the market effectively, targeting clusters that reveal trends in user behaviour, vehicle performance, and infrastructure needs. The report aims to provide insights that can drive better decision-making in the Electric Vehicles market, improve user satisfaction, and enhance overall vehicle and infrastructure efficiency.

3.0 Data Collection

The data was collected from the website - data.gov.in and from the link provided.

The links to the datasets are as follows –

1. https://www.data.gov.in/resource/stateuts-wise-current-sales-electric-vehicles-ev-country-various-segments-reply-unstarred


```
dataset1=pd.read_xml("dataset-EVcategories.xml")
dataset1
```

	SL._NO.	CATEGORY	_2022	_2023	_percent_GROWTH
0	1	2 Wheelers	631464	859376	36.09
1	2	3 Wheelers	352710	582793	65.23
2	3	Commercial Vehicles	2649	5673	114.16
3	4	Passenger Vehicles	38240	82105	114.71

2. https://www.data.gov.in/resource/category-wise-details-electric-vehicles-ev-information-received-federation-automobile

```
dataset2=pd.read_xml("dataset_EV_typeNstate.xml")
dataset2.head()
```

	STATE_NAME	TWO_WHEELER	THREE_WHEELER	FOUR_WHEELER	GOODS_VEHICLES	PUBLIC_SERVICE_VEHICLE	SPECIAL_CATEGORY_VEHICLES	AMBULAI
0	Andaman and Nicobar Island	1	30.0	81	NaN	40.0	NaN	
1	Arunachal Pradesh	14	NaN	5	NaN	NaN	NaN	
2	Assam	721	47041.0	161	7.0	15.0	NaN	
3	Bihar	5003	59079.0	114	11.0	26.0	NaN	
4	Chandigarh	298	1410.0	182	NaN	40.0	NaN	

3. https://drive.google.com/drive/folders/1Yn_0KpPUvPjdNjJe8emy-QsKzqt7aexb

```
dataset3=pd.read_csv("ElectricCarData_Norm.csv")
dataset3.head()
```

|	Brand	Model	Accel	TopSpeed	Range	Efficiency	FastCharge	RapidCharge	PowerTrain	PlugType	BodyStyle	Segment	Seats
0	Tesla	Model 3 Long Range Dual Motor	4.6 sec	233 km/h	450 km	161 Wh/km	940 km/h	Rapid charging possible	All Wheel Drive	Type 2 CCS	Sedan	D	5
1	Volkswagen	ID.3 Pure	10.0 sec	160 km/h	270 km	167 Wh/km	250 km/h	Rapid charging possible	Rear Wheel Drive	Type 2 CCS	Hatchback	C	5
2	Polestar	2	4.7 sec	210 km/h	400 km	181 Wh/km	620 km/h	Rapid charging possible	All Wheel Drive	Type 2 CCS	Liftback	D	5
3	BMW	iX3	6.8 sec	180 km/h	360 km	206 Wh/km	560 km/h	Rapid charging possible	Rear Wheel Drive	Type 2 CCS	SUV	D	5

4.0   Exploratory Data Analysis (EDA)

To achieve our objective, we performed an extensive exploratory data analysis on a dataset comprising various attributes of electric vehicles.
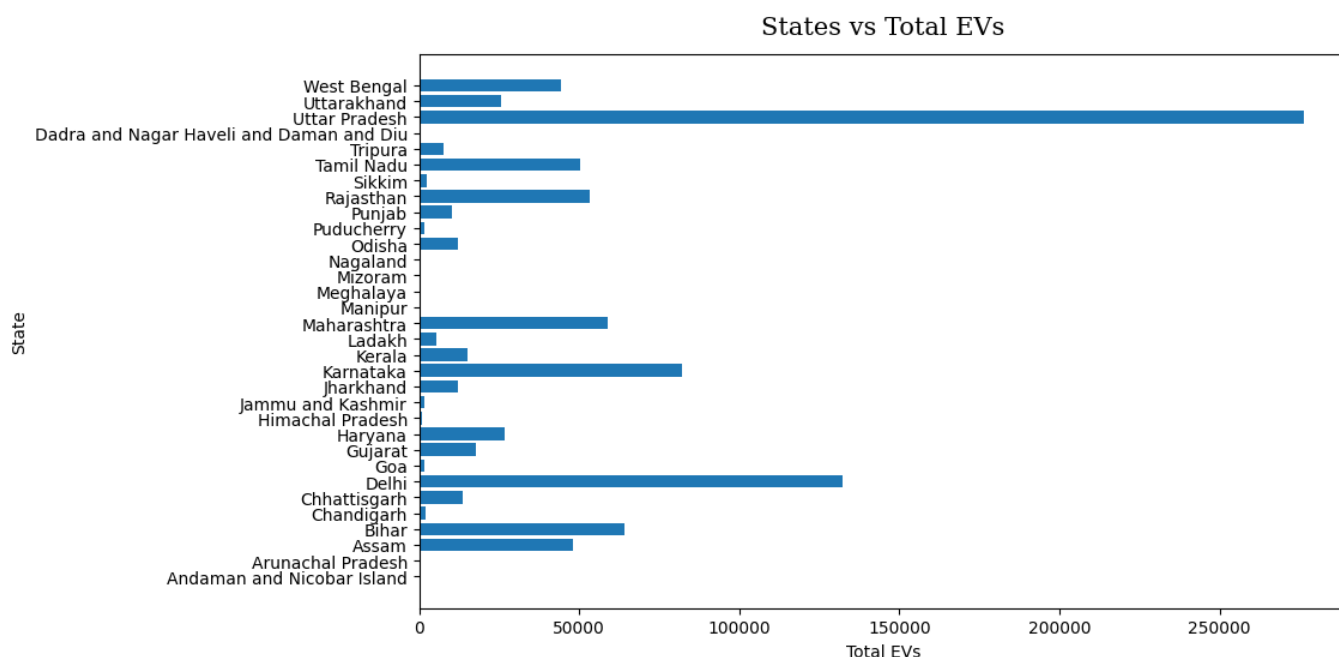
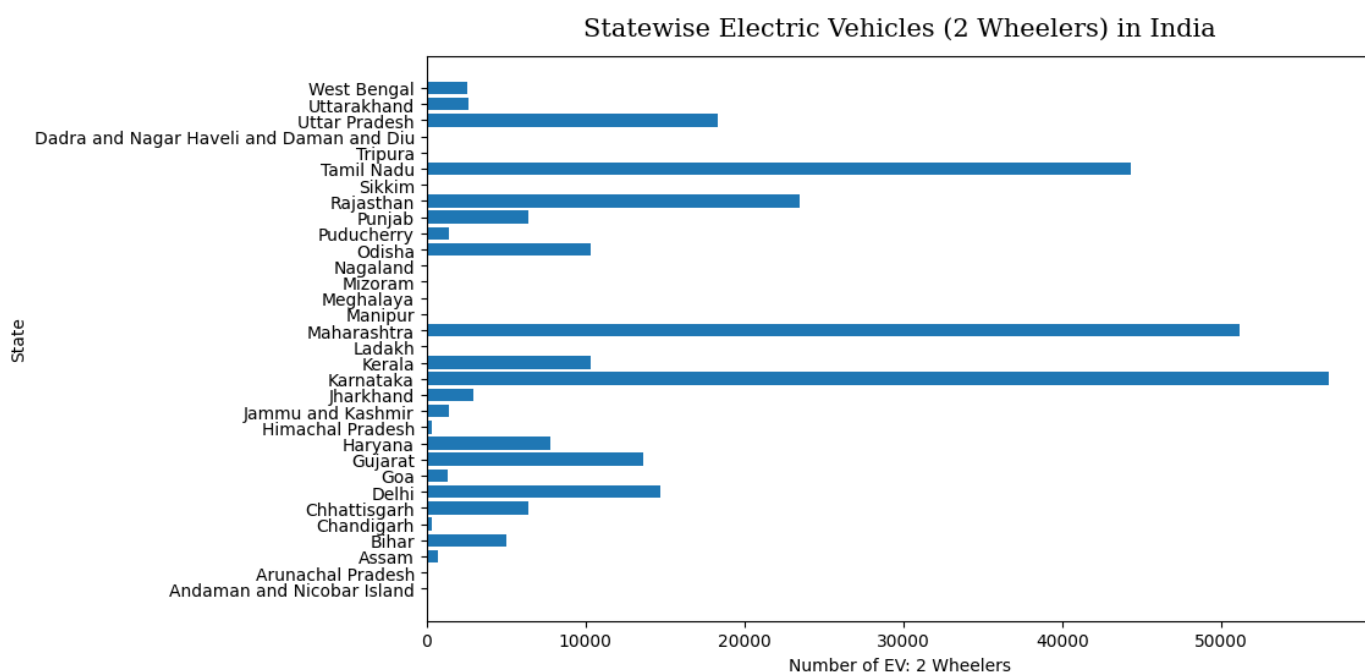## 4.1   Total Vehicles Sold in Past Two Years (2022&2023) vs Categories
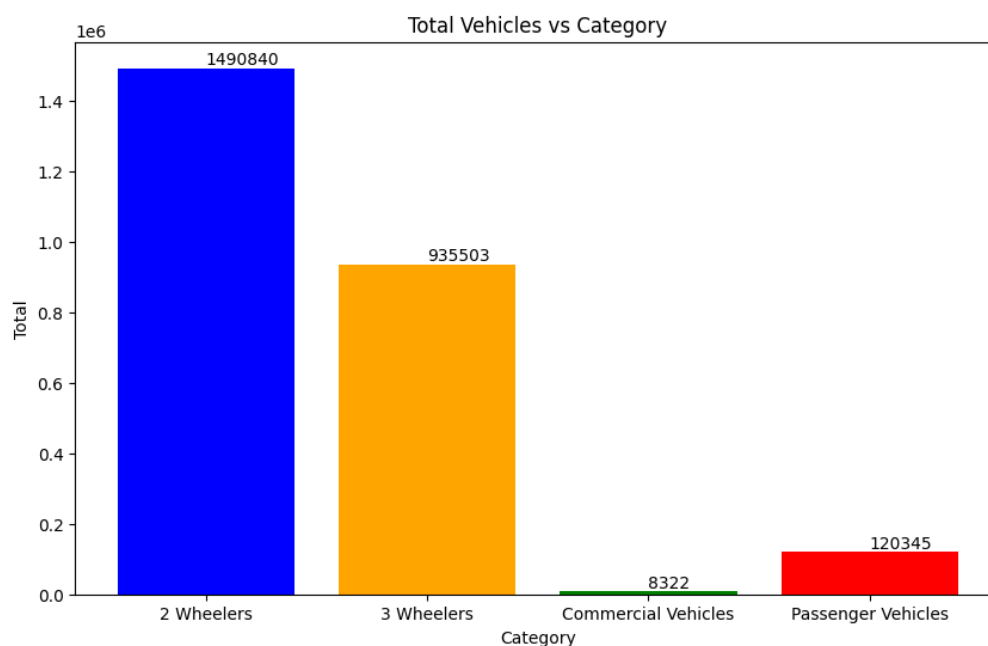
4.2   Vehicles sold in years 2022&2023 vs Categories
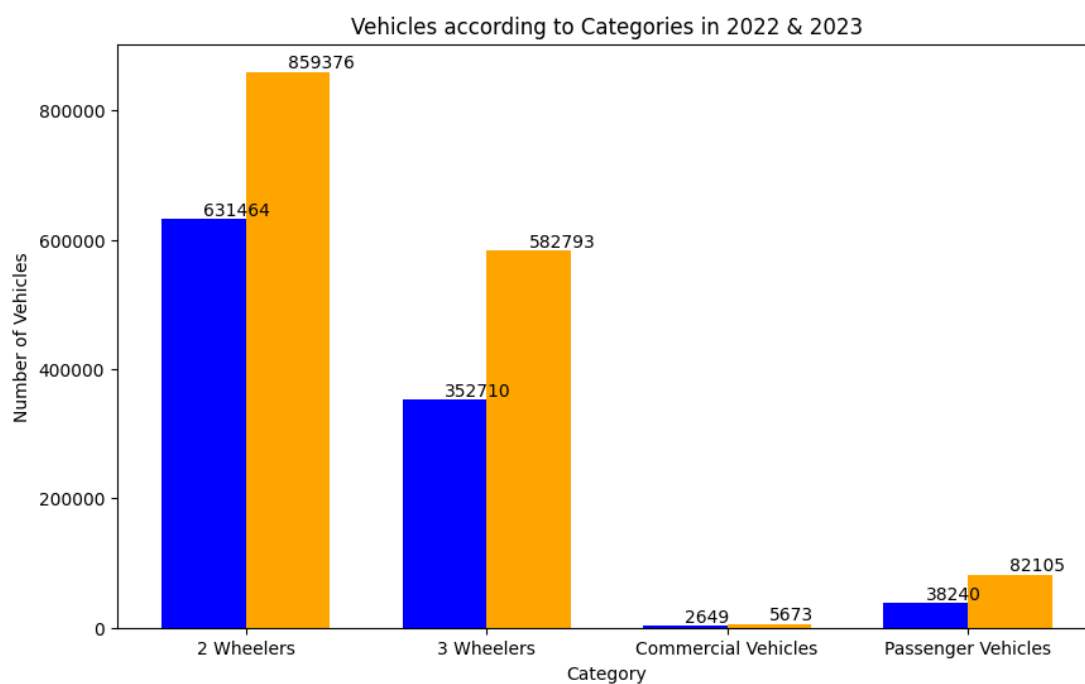
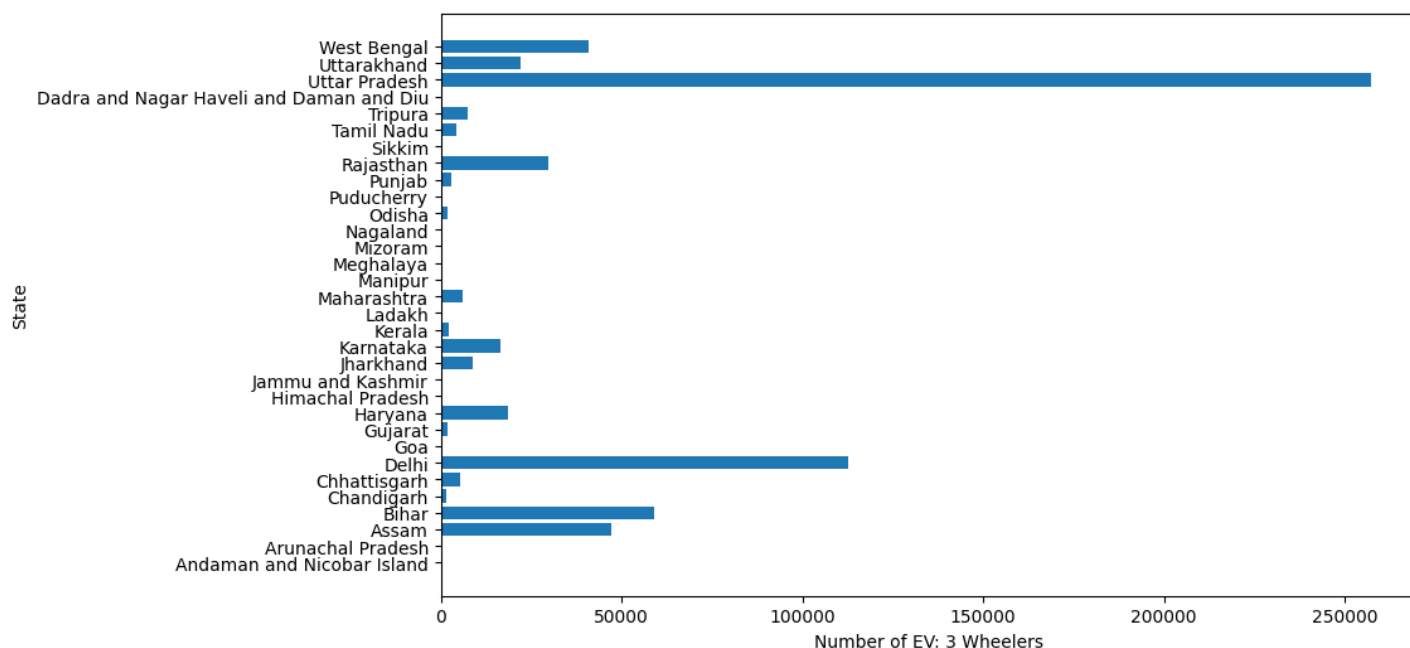## 4.3 States vs EV Vehicles of all categories sold in that state

States vs Total EVs

4.4 States vs 2 Wheeler EV Vehicles sold in that state

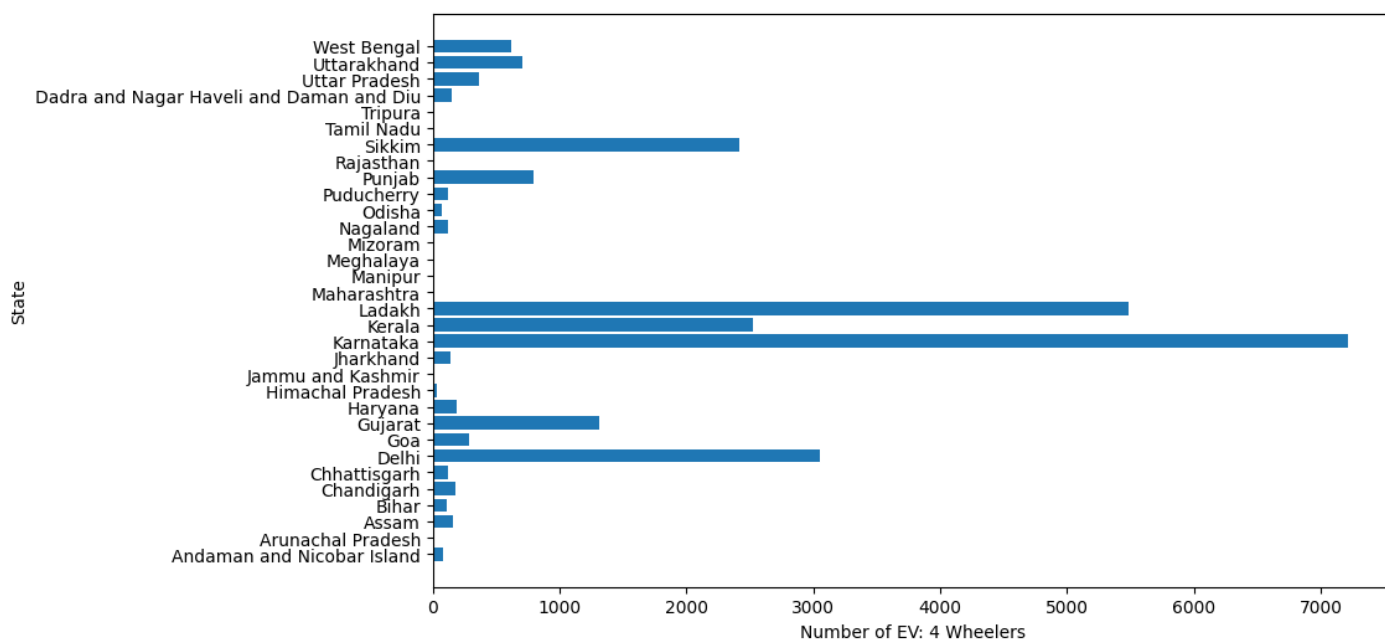### Statewise Electric Vehicles (2 Wheelers) in India

4.5   States vs 3 Wheeler EV Vehicles sold in that state

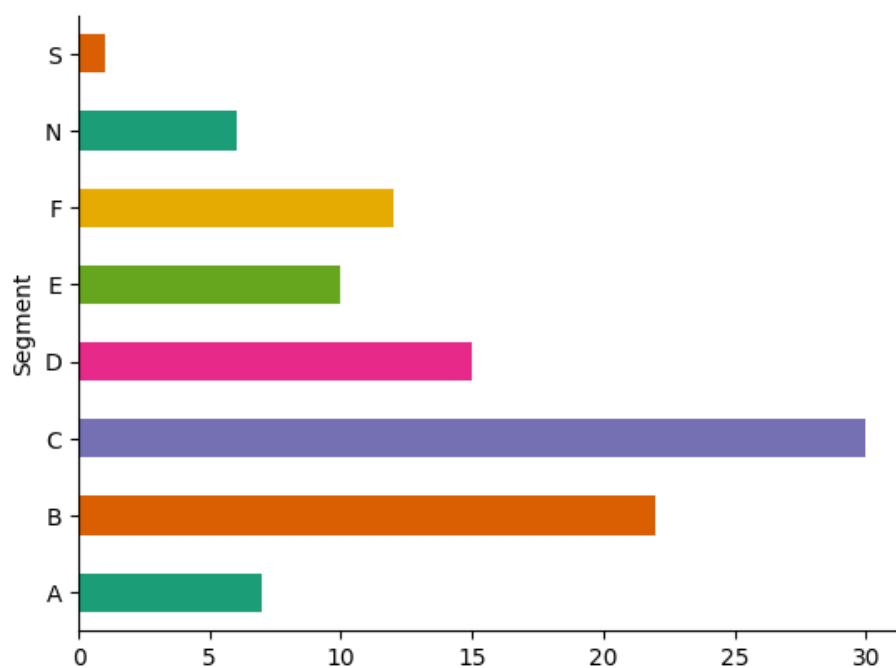Statewise Electric Vehicles (3 Wheelers) in India

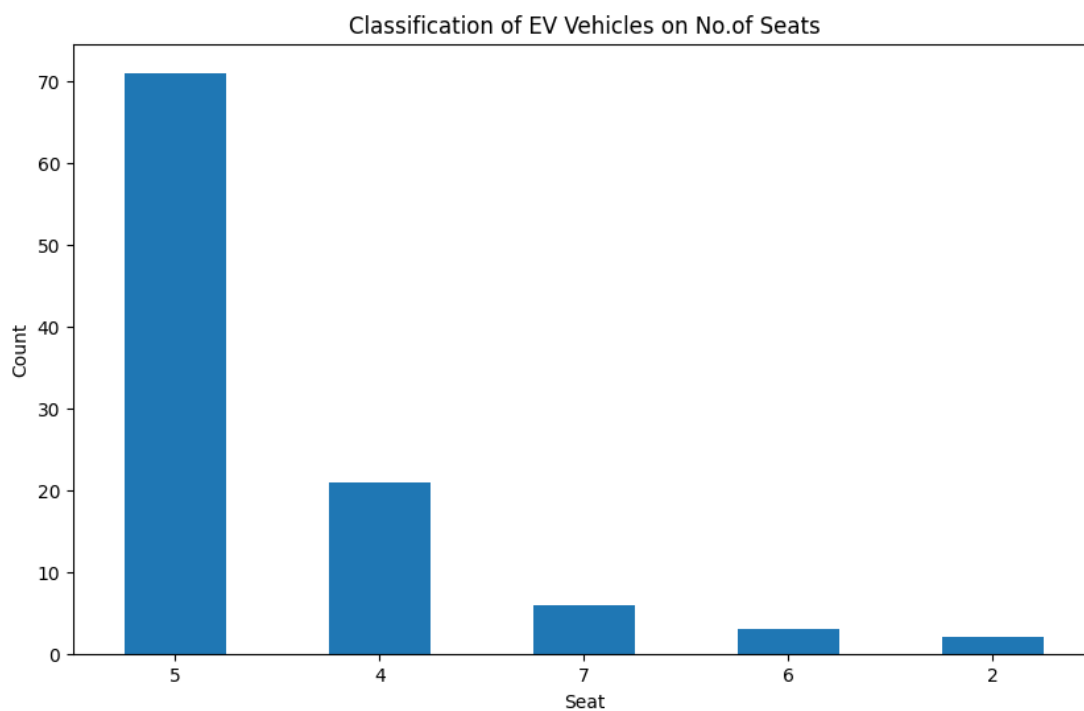## 4.6   States vs 4 Wheeler EV Vehicles sold in that state

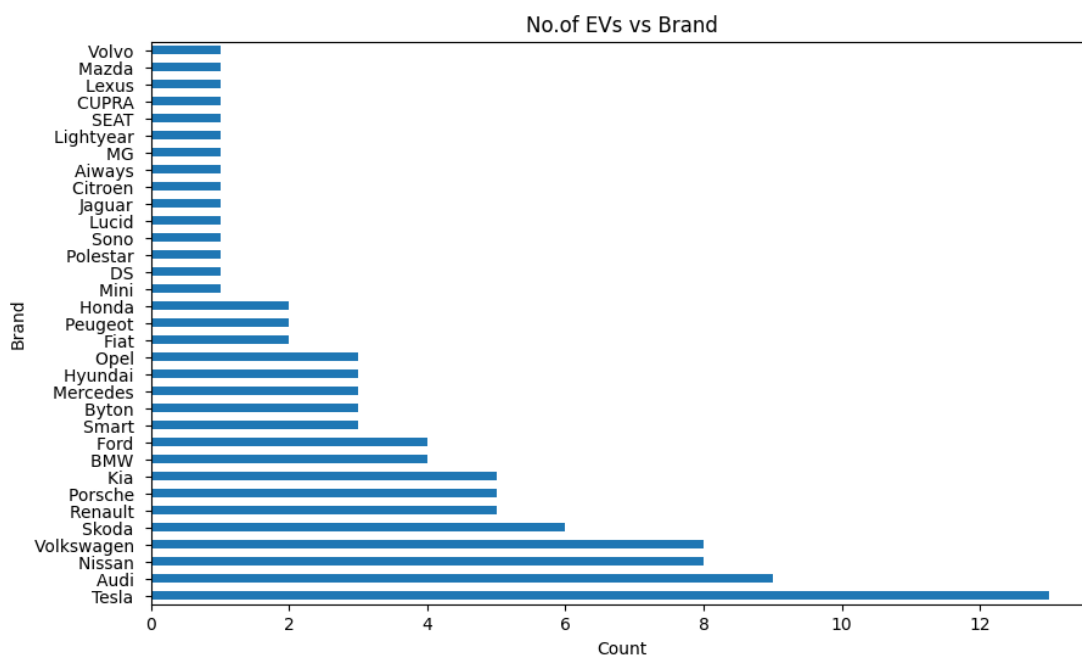Statewise Electric Vehicles (4 Wheelers) in India

4.7 Classification of EV Vehicles based on Segments Feature

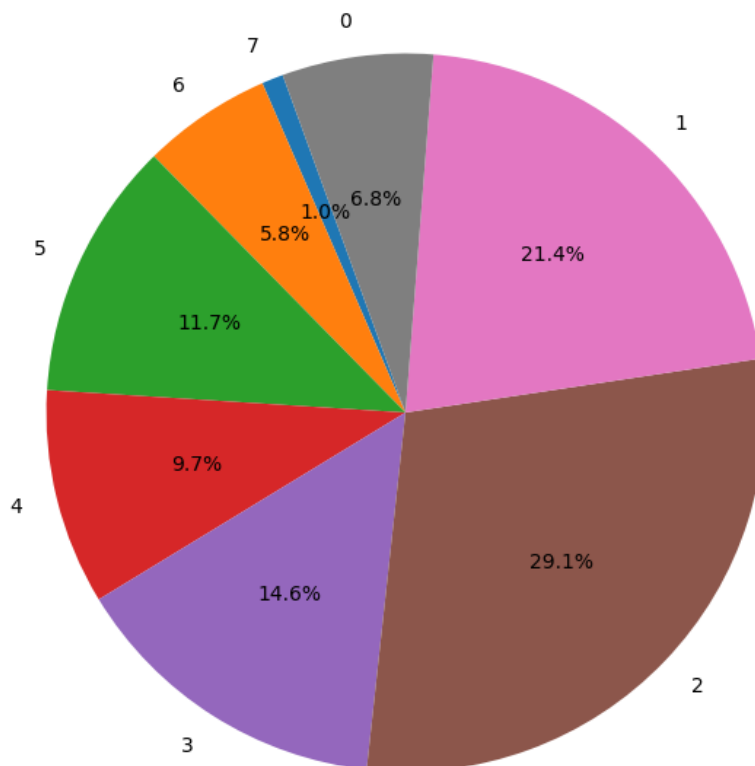## 4.8 Classification of EV Vehicles based on Number of Seats

4.9   Classification of EV Vehicles based on Brand

No.of EVs vs Brand

4.10   Classification of EV Vehicles based on Segment Feature - (%)

Distribution of EV Vehicles(%) by Segment

5.0   Dataset Preprocessing

The Data needs to be preprocessed for classification. The categorical data also needs to be label encoded before utilizing.

1. The features – Accel, TopSpeed, Range, Efficiency, FastCharge were converted to float/int data types.
2. The features - BodyStyle, Segment, RapidCharge, PowerTrain, PlugType were label encoded as they are categorical variables.

6.0   K-Means Clustering Analysis

K-Means clustering was used to segment the EV Vehicle Data. The Elbow Method gave an optimum value of K=3. Thus, the Data is segmented to get 3 clusters.
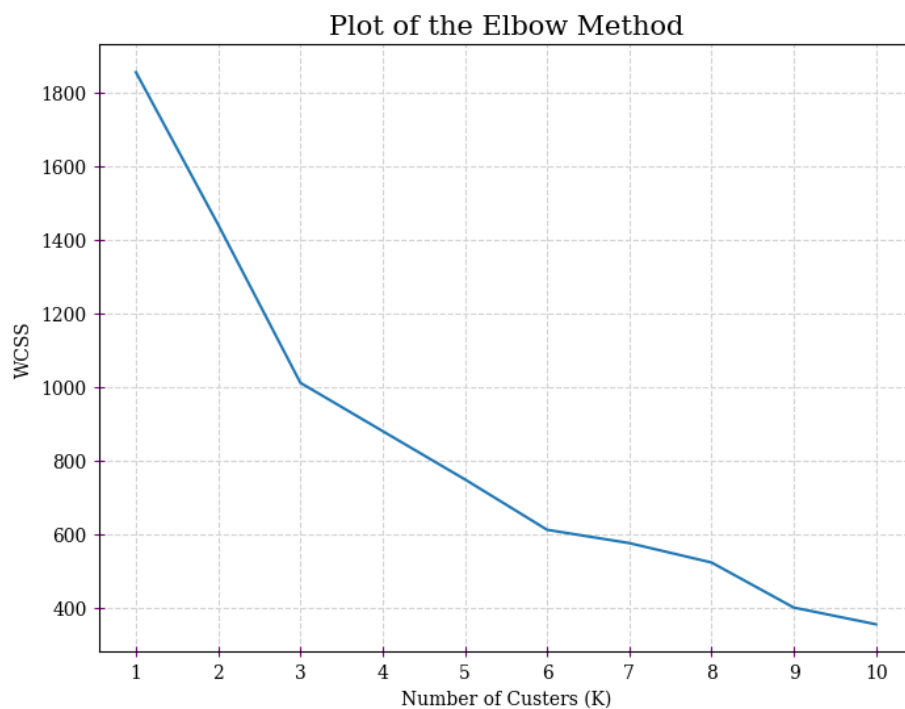
6.1   K-Means Clustering for K=3
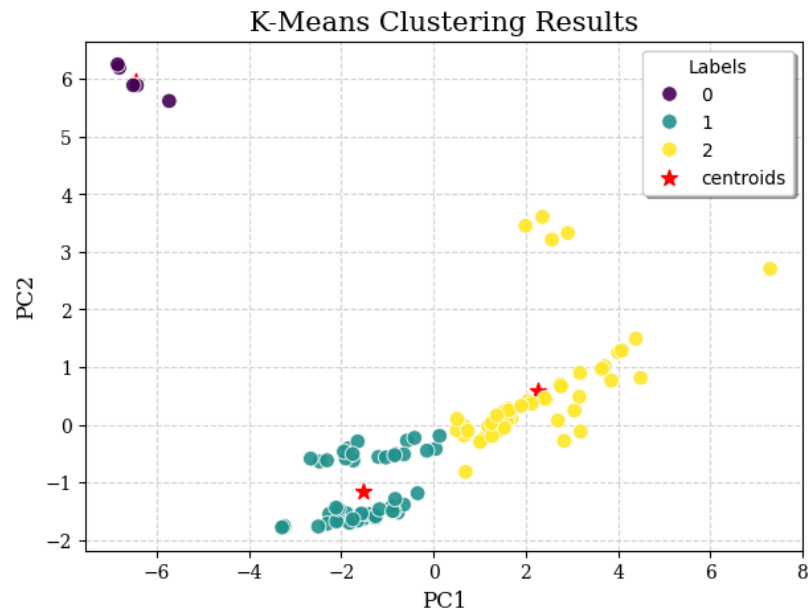
6.2   K-Means Clustering for K=4

7.0   Conclusion

Through comprehensive exploratory data analysis and segmentation, key patterns and trends can be identified. The EV Market Segmentation will help the manufacturers and suppliers to know the customers and the market better. This will inturn help in EV Sales.

In conclusion, this study underscores the importance of a data-driven approach to understanding the EV market. By identifying key correlations and segmenting the market based on vehicle attributes, stakeholders can make informed decisions that enhance product offerings, marketing strategies, and policy initiatives. These efforts collectively contribute to the growth and sustainability of the electric vehicle industry, driving the transition towards a greener and more efficient transportation future.