

“

ELECTRIC VEHICLE MARKET
SEGMENTATION

”

Team Sanjay

Vedant Bhatkar

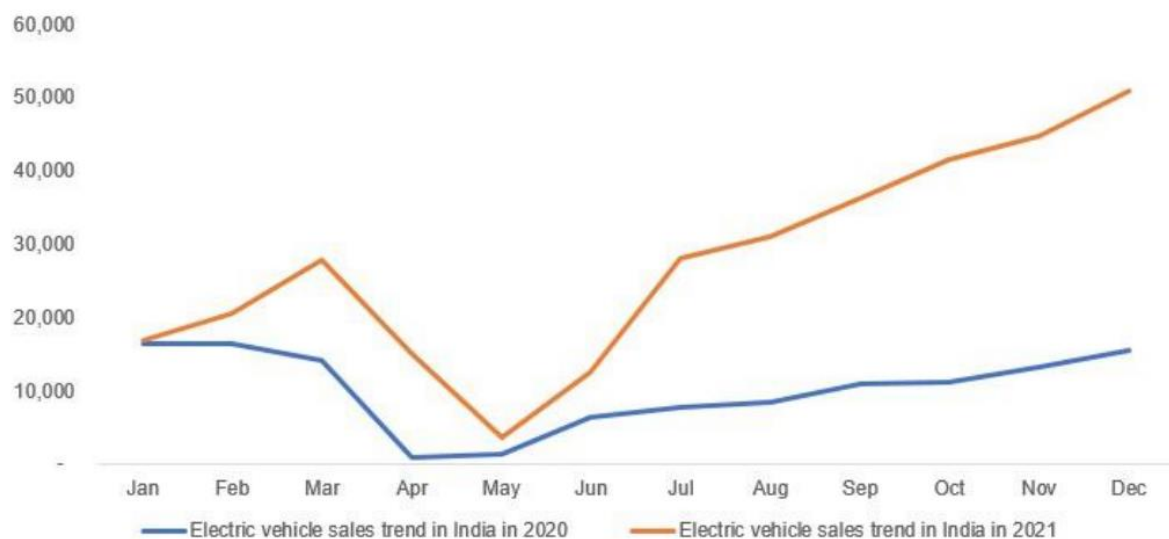
1.0 PROBLEM STATEMENT

This is a team task where the job is 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.

2.0 INTRODUCTION

The global electric vehicle (EV) market is developing at a rapid pace. According to EV volumes, overall electric vehicle reached a global share of 8.3% (including battery electric vehicles [BEVs] and Plug- in hybrid electric vehicles [PHEVs]) in 2021 from 4.2% in 2020 with 6.75 million vehicles on the road. This is an increase of 108% as of 2020. EVs are gaining attention across the globe as they help reduce emissions and depletion of natural resources. The Indian EV market is also evolving fast as close to 0.32 million vehicles were sold in 2021, up 168% YoY. Ongoing electric vehicle adoption in India is based on the Paris agreement to reduce carbon emissions, to improve the air quality in urban areas and reduce oil imports.

2.0.1 Electric Vehicle Sales Trend in India (2020-21)

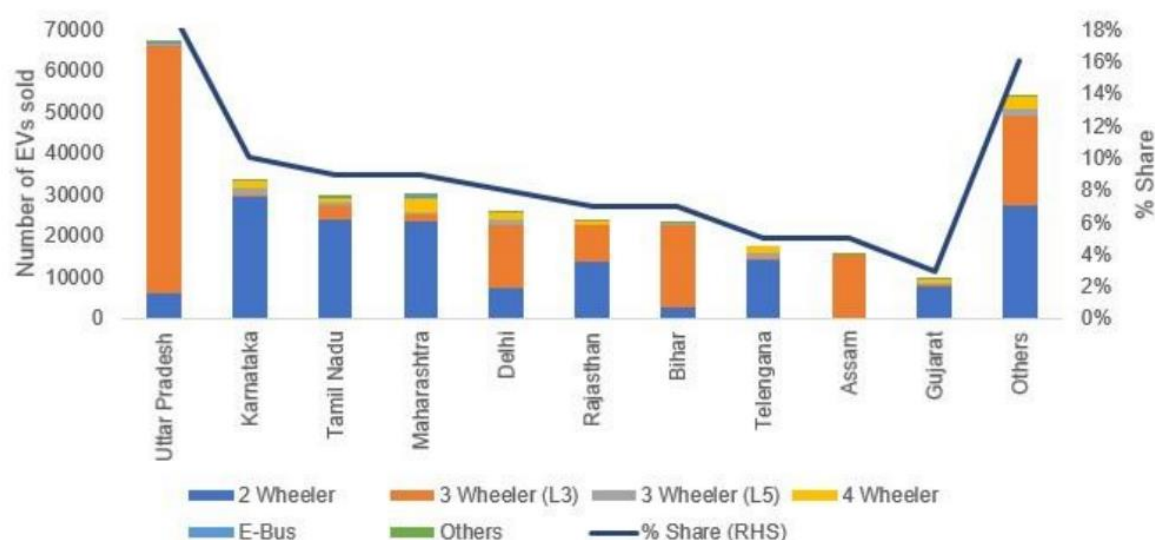


Source: EV reporter

2.0.2 EV Market in India

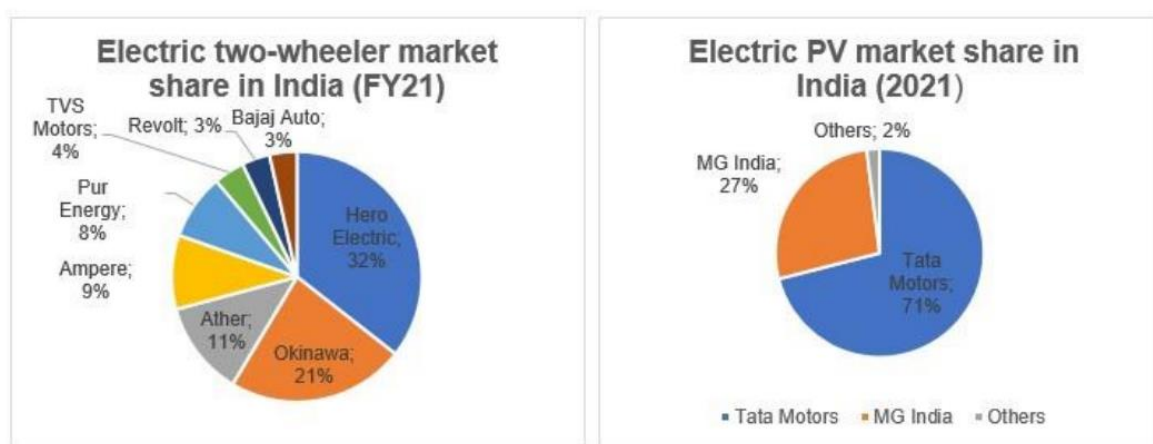
The Indian automobile industry is the fifth largest in the world and is expected to become the third largest by 2030. As per India Energy Storage Alliance (IESA), the Indian EV industry is expected to expand at a CAGR of 36%. As population rises and demand for vehicles grow, dependence on conventional energy resources is not a sustainable option as India imports close to 80% of its crude oil requirements. NITI Aayog aims to achieve EV sales penetration of 70% for all commercial cars, 30% for private cars, 40% for buses and 80% for two and three-wheelers by 2030. This is in line with the goal to achieve net zero carbon emission by 2070. Over the last three years, 0.52 million EVs were registered in India, according to the Ministry of Heavy Industries. EVs recorded robust growth in 2021, supported by the implementation of favourable policies and programmes by the government. In India, Uttar Pradesh held the highest share in EV sales in 2021, with the number of units sold across all segments reaching 66,704, followed by Karnataka with 33,302 units and Tamil Nadu with 30,036 units. Uttar Pradesh dominated the three-wheeler segment, while Karnataka and Maharashtra led the two-wheeler segment and four-wheeler segment, respectively.

2.0.3 State -Wise-EV Sales Trend in 2021



Source: EV Reporter

Hero Electric, Okinawa and Ather Energy controls the electric two-wheeler market in India with a combined market share of 64%. Hero Electric has a market share of 36% followed by Okinawa with 21%. Ather Energy with an 11.1% market share is slowly gaining market share, as the company is currently expanding its distribution network across India. In the passenger vehicle segment, Tata Motors enjoys a commanding position in electric vehicle space with a market share of 71%, led by their two key models, Nexon and Tigor EV. MG Motors India enjoys the second position and offers the longest-range EV (MG EZS provides 439 KM range on a single charge). Other Indian manufacturers have announced their models and is expected to be launched in the future.



Source- Cardekho, gaadiwaadi, e-vehicle info.,Rushlane.

The reason of this is higher flexibility and practicality that they offer with hybrid vehicles. This has led automobile manufacturers to develop vehicles that offer the benefits of both conventional and electric vehicles. This is the hybrid electric vehicles category. These vehicles come with an internal combustion engine and rechargeable batteries to drive the vehicle. Apart from this, additional benefits associated with hybrid electric vehicles is the significant reason behind the tremendous growth of hybrid electric vehicles. The batteries of hybrid vehicles can be recharged through an internal combustion engine. Due to this, it has been witnessed that there is growth in the sales of hybrid vehicles which is much higher than pure and plug in hybrid vehicles. "In 2015, the government of India introduced a scheme – Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) – to promote clean fuel technology cars. This scheme was introduced under the National Electric Mobility Mission Plan (NEMMP) to mobilize a fleet of six million electric vehicles on Indian roads by 2020. For achieving their targets, the Indian government is planning to replace petrol and diesel variants being used by its agencies with electric vehicles.

3.0 DATA SOURCES

For the EV segmentation, I have collected all the dataset from Kaggle.

<https://www.kaggle.com>

4.0 DATA PRE-PROCESSING

Data pre-processing is a stage that helps us identify the measurement levels of variables, and the relationship between the variables drives hidden insights from the raw data and guides us on the suitable algorithms to use for market segmentation. To derive insights from the raw data we have used data visualization as a step to create multiple plots:-

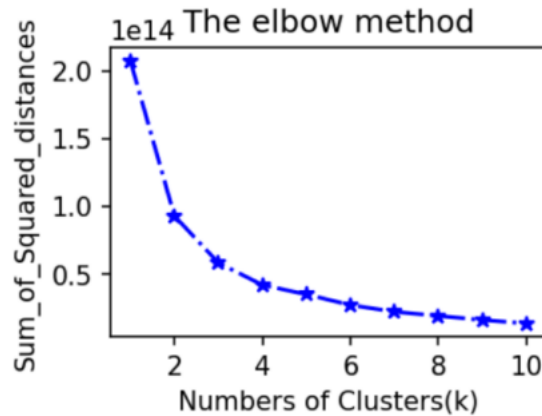
- For numerical variables, we have used histogram, and kernel density plot.
- For categorical variables, we have used bar plots, count plots, and pie charts.
- To understand the relationship between two numeric variables, we have used pairs plot, scatter plot and heatmap.

Libraries used in the project

- Pandas
- Numpy
- Matplotlib
- Seaborn
- Sklearn

5.0 SEGMENT EXTRACTION (ML TECHNIQUE USED)

K-Means clustering was used on the dataset to form clusters of the different electric vehicles models based on the other attributes. K-Means Clustering is an unsupervised learning algorithm that is used to solve the clustering problems in machine learning or data science. In this topic, we will learn what is K-means clustering algorithm, how the algorithm works, along with the Python implementation of k-means clustering.



6.0 PROFILING AND DESCRIBING POTENTIAL SEGMENTS

6.0.1 Segmentation by platform analysis

There are namely 3 types into which the vehicles are classified as: two-wheeler, three-wheeler and four wheelers. The four-wheeler segment has dominated the market in 2021 and is expected to dominate Electric vehicles in India in the coming years. It is also expected to dominate during the forecast period with a maximum market share. In comparison to the two wheelers, four wheelers have larger space for batteries which results in a higher range on a single charge. This makes the segment dominant compared to the other two segments. Two wheelers are sued by the majority crowd in India because of the great benefits its offers. Rising traffic congestions is forcing people to shift towards two wheelers from four wheelers. The rising fuel prices and increasing awareness and availability of electric two wheelers are expected to accelerate the penetration of electric two wheelers in the India market.

6.0.2 By vehicle Type analysis:

By vehicle type market is categorized into passenger cars and commercial vehicles. Passenger cars accounted highest electric vehicle market in India in 2021. These are in immense demand due to the availability of varied options, comfort, and luxury they provide with clean emissions. 7.0.3 By propulsion type analysis. Based on the propulsion type the market is classified as battery electric vehicles and hybrid electric vehicles. Battery electric vehicles are completely electric vehicles with rechargeable batteries and no conventional gasoline engine. All energy propels the vehicle is received from the battery pack which is recharged from the grid. The battery electric vehicles use electricity stored in a

battery pack to power an electric motor and rotate the wheels. When batteries are depleted, they are recharged using grid electricity from a dedicated charging unit.

7.0 CUSTOMIZING THE MARKET MIX

Today marketing is based on the fundamental 4Ps: - Product, Price, Promotion, and Place.



The above figure the target segment decision which has to be integrated with other strategic areas like competition and positioning for the best results. The organization also has the option to structure the entire market segmentation around the fundamental 4Ps. However, most of the time, market segmentation analysis is not conducted with the 4Ps specifically. Rather insights are gained from the detailed descriptions of the target segment obtained from describing segments and developing a complete picture of marketing segments which guides the organization on how to develop and adjust the marketing features to obtain the best target segment.

8. Benefits of Market Segmentation

Marketing segmentation takes effort and resources to implement. However, successful marketing segmentation campaigns can increase the long-term profitability and health of a company. Several benefits of market segmentation include;

1. Increased resource efficiency. Marketing segmentation allows management to focus on certain demographics or customers. Instead of trying to promote products to the entire market, marketing segmentation allows a focused, precise approach that often costs less compared to a broad reach approach.
2. Stronger brand image. Marketing segment forces management to consider how it wants to be perceived by a specific group of people. Once the market segment is identified, management must then consider what message to craft. Because this message is directed at a target audience, a company's branding and messaging is more likely to be very intentional. This may also have an indirect effect of causing better customer experiences with the company.
3. Greater potential for brand loyalty. Marketing segmentation increases the opportunity for consumers to build long-term relationships with a company. More direct, personal marketing approaches may resonate with customers and foster a sense of inclusion, community, and a sense of belonging. In addition, market segmentation increases the probability that you land the right client that fits your product line and demographic.
4. Stronger market differentiation. Market segmentation gives a company the opportunity to pinpoint the exact message the way to convey to the market and to competitors. This can also help create product differentiation by communicating specifically how a company is different from its competitors. Instead of a broad approach to marketing, management crafts a specific image that is more likely to be memorable and specific.
5. Better targeted digital advertising. Marketing segmentation enables a company to perform better targeted advertising strategies. This includes marketing plans that direct effort towards specific ages, locations, or habits via social media.

9: Code & Output:

```
In [1]: #Importing Libraries
import pandas as pd
import numpy as np
%matplotlib inline
import matplotlib.pyplot as plt
import seaborn as sns
```

```
In [2]: import warnings
warnings.filterwarnings('ignore')
```

```
In [3]: #Reading dataset
df = pd.read_csv('EV_dataset.csv')
df
```

```
Out[3]:
```

	Age	Profession	Marrital Status	Education	No of Dependents	Personal loan	House Loan	Wife Working	Salary	Wife Salary	Total Salary	Make	Price
0	27	Salaried	Single	Post Graduate	0	Yes	No	No	800000	0	800000	i20	800000
1	35	Salaried	Married	Post Graduate	2	Yes	Yes	Yes	1400000	600000	2000000	Ciaz	1000000
2	45	Business	Married	Graduate	4	Yes	Yes	No	1800000	0	1800000	Duster	1200000
3	41	Business	Married	Post Graduate	3	No	No	Yes	1600000	600000	2200000	City	1200000
4	31	Salaried	Married	Post Graduate	2	Yes	No	Yes	1800000	800000	2600000	SUV	1600000
...
94	27	Business	Single	Graduate	0	No	No	No	2400000	0	2400000	SUV	1600000

```
In [4]: df.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 99 entries, 0 to 98
Data columns (total 13 columns):
#   Column                Non-Null Count  Dtype  
---  -
0   Age                    99 non-null    int64  
1   Profession              99 non-null    object  
2   Marrital Status        99 non-null    object  
3   Education               99 non-null    object  
4   No of Dependents       99 non-null    int64  
5   Personal loan           99 non-null    object  
6   House Loan              99 non-null    object  
7   Wife Working            99 non-null    object  
8   Salary                  99 non-null    int64  
9   Wife Salary             99 non-null    int64  
10  Total Salary            99 non-null    int64  
11  Make                    99 non-null    object  
12  Price                   99 non-null    int64  
dtypes: int64(6), object(7)
memory usage: 10.2+ KB
```

```
In [7]: #check the no of columns and its name
df.columns
```

```
Out[7]: Index(['Age', 'Profession', 'Marrital Status', 'Education', 'No of Dependents',
              'Personal loan', 'House Loan', 'Wife Working', 'Salary', 'Wife Salary',
              'Total Salary', 'Make', 'Price'],
              dtype='object')
```

```
In [8]: #to print unique values of each column
for col in ['Profession','Marrital Status','Education','Personal loan','House Loan','Wife Working','Make']:
    print(col,':',df[col].unique())

Profession : ['Salaried' 'Business']
Marrital Status : ['Single' 'Married']
Education : ['Post Graduate' 'Graduate']
Personal loan : ['Yes' 'No']
House Loan : ['No' 'Yes']
Wife Working : ['No' 'Yes' 'm']
Make : ['i20' 'Ciaz' 'Duster' 'City' 'SUV' 'Baleno' 'Verna' 'Luxuray' 'Creatia']
```

```
In [9]: #wife working 'm' is incorrect so finding rows with wife working=m
df.loc[df['Wife Working']=='m']
```

```
Out[9]:
```

	Age	Profession	Marrital Status	Education	No of Dependents	Personal loan	House Loan	Wife Working	Salary	Wife Salary	Total Salary	Make	Price
11	35	Salaried	Married	Graduate	4	Yes	Yes	m	1400000	0	1400000	Baleno	700000

Behavioural Analysis

In [12]:

```
correlations = df.corr()
print(correlations)
```

```

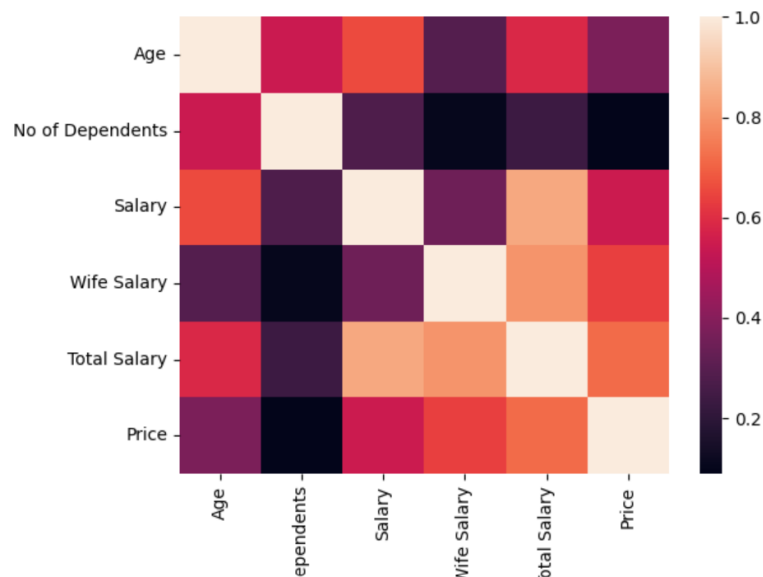
           Age  No of Dependents  Salary  Wife Salary  \
Age          1.000000          0.543675  0.656442  0.288546
No of Dependents 0.543675          1.000000  0.273921  0.102010
Salary          0.656442          0.273921  1.000000  0.347934
Wife Salary      0.288546          0.102010  0.347934  1.000000
Total Salary     0.587082          0.234379  0.841545  0.799238
Price           0.376661          0.088822  0.547630  0.635858

           Total Salary  Price
Age          0.587082  0.376661
No of Dependents 0.234379  0.088822
Salary        0.841545  0.547630
Wife Salary    0.799238  0.635858
Total Salary   1.000000  0.717442
Price          0.717442  1.000000

```

In [13]:

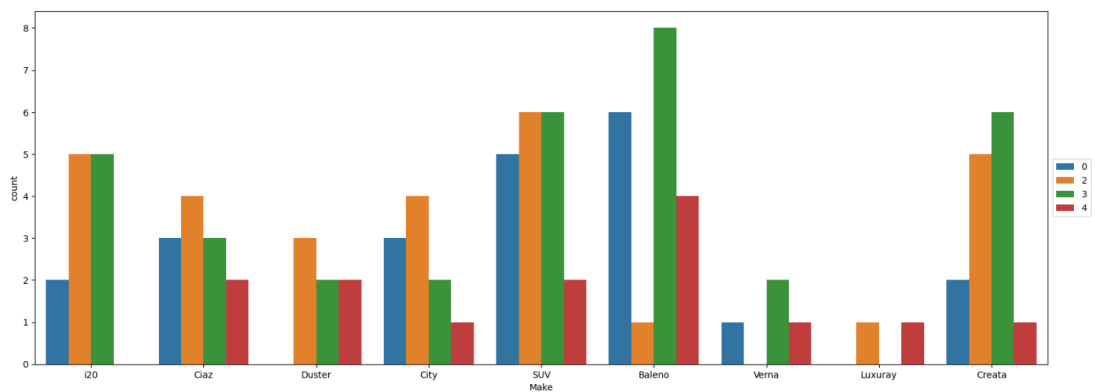
```
sns.heatmap(correlations)
plt.show()
```



In [16]:

```
plt.figure(figsize=(20,7))
sns.countplot(data=df, x="Make", hue="No of Dependents")
plt.legend(loc="center left", bbox_to_anchor=(1,0.5))
```

Out[16]: <matplotlib.legend.Legend at 0x1d9b2231690>



Building ML model

```
In [33]: #Converting all data into numerical format
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()
df['Profession'] = le.fit_transform(df['Profession'])
df['Marrital Status'] = le.fit_transform(df['Marrital Status'])
df['Education'] = le.fit_transform(df['Education'])
df['Profession'] = le.fit_transform(df['Profession'])
df['Personal loan'] = le.fit_transform(df['Personal loan'])
df['House Loan'] = le.fit_transform(df['House Loan'])
df['Wife Working'] = le.fit_transform(df['Wife Working'])
```

```
In [34]: df
```

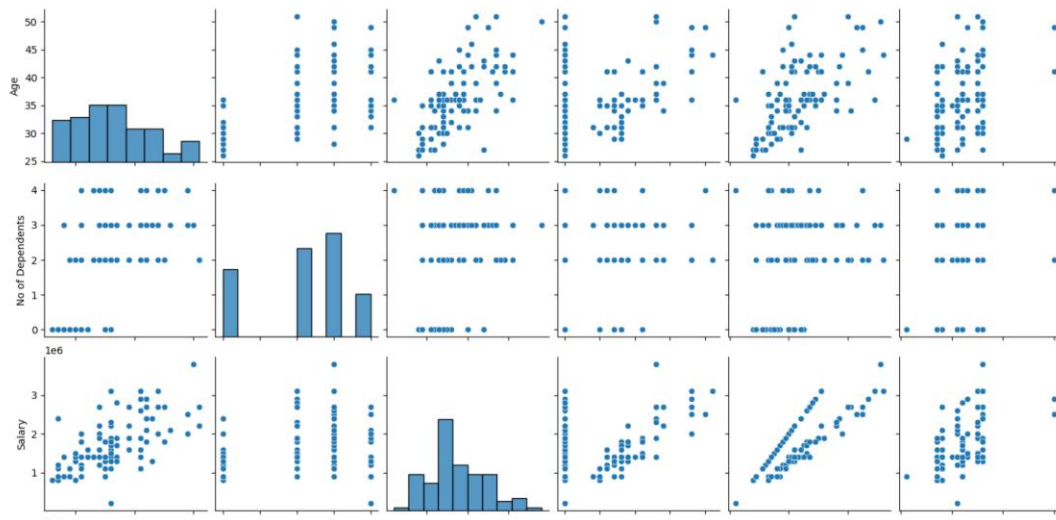
```
In [37]: from sklearn.cluster import KMeans
Sum_of_Squared_distances = []

for k in range(1, 11):
    kmeans = KMeans(n_clusters=k)
    kmeans = kmeans.fit(df)
    Sum_of_Squared_distances.append(kmeans.inertia_)

plt.figure(figsize=(3,2), dpi=150)
plt.plot(range(1, 11), Sum_of_Squared_distances, 'b*-.')
plt.title('The elbow method')
plt.xlabel('Numbers of Clusters(k)')
plt.ylabel('Sum_of_Squared_distances')
plt.show()
```

```
In [21]: sns.pairplot(df)
```

```
Out[21]: <seaborn.axisgrid.PairGrid at 0x1d9b4fe1c30>
```



Thank You

Report by Vedant Bhatkar