CAR PRICE PREDICTION PROJECT

Prepared by
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SME Name:

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Acknowledgement

It is my deepest pleasure and gratification to present this report. Working on this project was an incredible experience that has given me a very informative knowledge regarding the data analysis process.
All the required information and dataset are provided by **Flip Robo Technologies** (Bangalore) that helped me to complete the project.
I want to thank my SME **Sristi Maan** for giving the dataset and instructions to perform the complete case study process.

INTRODUCTION

Problem Statement:

With the covid 19 impact in the market, we have seen lot of changes in the car market. Now some cars are in demand hence making them costly and some are not in demand hence cheaper. One of our clients works with small traders, who sell used cars. With the change in market due to covid 19 impact, our client is facing problems with their previous car price valuation machine learning models. So, they are looking for new machine learning models from new data. We have to make car price valuation model.
This project contains two phases:

Data Collection Phase
We need to scrape approx. 5000 used cars data.
In this section we need to scrape the data of used cars from websites. We need webscraping for this. we have to fetch data for different locations. The number of columns for data doesn't have limit. Generally, these columns are Brand, model, variant, manufacturing year, driven kilometers, fuel, number of owners, location and at last target variable Price of the car. This data is to give you a hint about important variables in used car model.

Model Building Phase
After collecting the data, you need to build a machine learning model. Before model building do all data pre-processing steps. Try different models with different hyper parameters and select the best model.

Analytical Problem Framing

With the help of Selenium I have scrapped data from different websites like cartrade, Olx and carwale and used Pandas library to save the data in excel file and csv file. Just taking a glace on basic code for scrapping from different websites.

```
#import all the required libraries
import pandas as pd
import selenium
from selenium import webdriver
import time
from selenium.webdriver.support.ui import Select
from selenium.webdriver.common.keys import Keys
from selenium.webdriver.common.action_chains import ActionChains
from selenium.common.exceptions import StaleElementReferenceException, NoSuchElementException, TimeoutException, ElementNotInteractableException, Eleme
from collections import Counter
import warnings
warnings.filterwarnings('ignore')
```

```
#webdriver
driver=webdriver.Chrome(r"D:\chromedriver\chromedriver.exe")
time.sleep(3)
```

```
#cartrade

# Opening the homepage of cartrade

url = "https://www.cartrade.com/"
driver.get(url)

time.sleep(2)
driver.find_element_by_xpath('//*[@id="ucity"]').click()
driver.find_element_by_xpath('//*[@id="ucity"]/optgroup[1]/option[1]').click()
driver.find_element_by_xpath('//*[@id="rvwtop"]/div/div[1]/div[2]/div[2]/input').click()
time.sleep(2)
bodyType = driver.find_element_by_xpath('//*[@id="selectlistarrow6"]')
Hatchback = driver.find_element_by_xpath('//*[@id="body_Hatchback"]')
Sedan = driver.find_element_by_xpath('//*[@id="body_Sedan"]')
SUV = driver.find_element_by_xpath('//*[@id="body_SUV"]')
Van_Minivan = driver.find_element_by_xpath('//*[@id="body_Van_Minivan"]')
action= ActionChains(driver)
action.move_to_element(bodytype).move_to_element(Hatchback).click().move_to_element(Sedan).click().move_to_element(SUV).click().move_to_element(Van_Min
```

```
links1=[]
driver.execute_script("window.scrollTo(0,document.body.scrollHeight)")
time.sleep(2)
try:
    for l in driver.find_elements_by_xpath('//h2[@class="h2heacing truncate"]/a'):
        links1.append(l.get_attribute('href'))
        time.sleep(1)
except NoSuchElementException:
        links1.append("-")
        time.sleep(1)
for page in range(0,10):
        nxt_button=driver.find_elements_by_xpath('//div[@class="pagination"]/ul/li[@class="next"]/a')#scraping the list of buttons from the page
        time.sleep(2)
        try:
            driver.get(nxt_button[1].get_attribute('href'))#getting the link from the list for next page
            time.sleep(2)
        except:
            driver.get(nxt_button[0].get_attribute('href'))
            time.sleep(2)
        driver.execute_script("window.scrollTo(0,document.body.scrollHeight)")
        time.sleep(2)
        try:
            for l in driver.find_elements_by_xpath('//h2[@class="h2heading truncate"]/a'):
                links1.append(l.get_attribute('href'))
                time.sleep(1)
        except NoSuchElementException:
                links1.append("-")
                time.sleep(1)
```

```
len(links1)
```

```
271
```

[9]:
```
# Opening the homepage of cartrade

url = "https://www.cartrade.com/"
driver.get(url)

time.sleep(2)
driver.find_element_by_xpath('//*[@id="ucity"]').click()
driver.find_element_by_xpath('//*[@id="ucity"]/optgroup[1]/option[3]').click()
driver.find_element_by_xpath('//*[@id="rvwtop"]/div/div[1]/div[2]/div[2]/input').click()
time.sleep(2)
bodytype = driver.find_element_by_xpath('//*[@id="selectlistarrow6"]')
Hatchback = driver.find_element_by_xpath('//*[@id="body_Hatchback"]')
Sedan = driver.find_element_by_xpath('//*[@id="body_Sedan"]')
SUV = driver.find_element_by_xpath('//*[@id="body_SUV"]')
Van_Minivan = driver.find_element_by_xpath('//*[@id="body_Van_Minivan"]')
action= ActionChains(driver)
action.move_to_element(bodytype).move_to_element(Hatchback).click().move_to_element(Sedan).click().move_to_element(SUV).click().move_to_element(Van_
```

[10]:
```
links3=[]
driver.execute_script("window.scrollTo(0,document.body.scrollHeight)")
time.sleep(2)
try:
    for l in driver.find_elements_by_xpath('//h2[@class="h2heading truncate"]/a'):
        links3.append(l.get_attribute('href'))
        time.sleep(1)
except NoSuchElementException:
        links3.append("-")
        time.sleep(1)

for page in range(0,10):
        nxt_button=driver.find_elements_by_xpath('//div[@class="pagination"]/ul/li[@class="next"]/a')#scraping the list of buttons from the page
        time.sleep(2)
        try:
            driver.get(nxt_button[1].get_attribute('href'))#getting the link from the list for next page
            time.sleep(2)
        except:
            driver.get(nxt_button[0].get_attribute('href'))
            time.sleep(2)
        driver.execute_script("window.scrollTo(0,document.body.scrollHeight)")
        time.sleep(2)
        try:
            for l in driver.find_elements_by_xpath('//h2[@class="h2heading truncate"]/a'):
                links3.append(l.get_attribute('href'))
                time.sleep(1)
        except NoSuchElementException:
                links3.append("-")
                time.sleep(1)
```

[11]:
```
len(links3)
```

[11]: 264

[12]:
```
links=links1+links2+links3
len(links)
```

[12]: 806

```
Brand=[]
Model=[]
Variant=[]
Man_year=[]
Driven_km=[]
Fuel=[]
Num_of_owners=[]
Location=[]
Price=[]
```

```
for url in links:
    driver.get(url)
    time.sleep(2)

    try:
        # Extracting Brand
        try:
            b = driver.find_element_by_xpath('//*[@id="idbybody"]/div[2]/div[1]/div/ul/li[4]/a/span')
            Brand.append(b.text)
        except NoSuchElementException:
            Brand.append('-')

        time.sleep(1)
        # Extracting Model
        try:
            m = driver.find_element_by_xpath('//*[@id="idbybody"]/div[2]/div[1]/div/ul/li[5]/a/span')
            Model.append(m.text)
        except NoSuchElementException:
            Model.append('-')

        time.sleep(1)
        # Extracting Variant
        try:
            v = driver.find_element_by_xpath('//*[@id="idbybody"]/div[2]/div[1]/div/ul/li[6]/span')
            Variant.append(v.text)
        except NoSuchElementException:
            Variant.append('-')
        # Extracting Man_year
        try:
            my = driver.find_element_by_xpath('//*[@id="idbybody"]/div[2]/div[8]/div[1]/div[2]/div[1]/div[4]/table/tbody/tr[8]/td[2]')
            Man_year.append(my.text)
        except NoSuchElementException:
            Man_year.append('-')
        # Extracting Driven_km
        try:
            dk = driver.find_element_by_xpath('//*[@id="idbybody"]/div[2]/div[8]/div[1]/div[2]/div[1]/div[4]/table/tbody/tr[3]/td[2]')
            Driven_km.append(dk.text)
        except NoSuchElementException:
            Driven_km.append('-')
        # Extracting Fuel
        try:
            f = driver.find_element_by_xpath('//*[@id="idbybody"]/div[2]/div[8]/div[1]/div[2]/div[1]/div[4]/table/tbody/tr[2]/td[2]')
            Fuel.append(f.text)
        except NoSuchElementException:
            Fuel.append('-')
        # Extracting Num_of_owners
        try:
            no = driver.find_element_by_xpath('//*[@id="idbybody"]/div[2]/div[8]/div[1]/div[2]/div[1]/div[4]/table/tbody/tr[5]/td[2]')
            Num_of_owners.append(no.text)
        except NoSuchElementException:
            Num_of_owners.append('-')
        # Extracting Location
        try:
            l = driver.find_element_by_xpath('//*[@id="idbybody"]/div[2]/div[8]/div[1]/div[2]/div/div[4]/table/tbody/tr[1]/td[2]')
            Location.append(l.text)
        except NoSuchElementException:
            Location.append('-')
        # Extracting Price
        try:
            p = driver.find_element_by_xpath('//*[@id="idbybody"]/div[2]/div[8]/div[1]/div[2]/div/div[1]/div[1]/span[2]')
            Price.append(p.text)
        except NoSuchElementException:
            Price.append('-')
    except TimeoutException:
        pass
    except NoSuchElementException:
        pass
```

```
# dictionary of lists
dict1 = {'Brand': Brand, 'Model': Model, 'Variant': Variant,'Man_year':Man_year,'Driven_km':Driven_km,'Fuel':Fuel,
         'Num_of_owners':Num_of_owners,'Location':Location,'Price':Price}

df = pd.DataFrame(dict1)

# saving the dataframe
df.to_csv('cartrade.csv')
```

```

```

```
#webdriver
driver=webdriver.Chrome(r"D:\chromedriver\chromedriver.exe")
time.sleep(3)
```

```
#olx


# Opening the homepage of olx

url = "https://www.olx.in/cars_c84"
driver.get(url)

time.sleep(2)
driver.find_element_by_xpath('//ul[@class="_3eZBP _1TJht rui-1Culj _2XSBC"]/li/a').click()
time.sleep(2)
driver.find_element_by_xpath('//ul[@class="_3eZBP _1TJht rui-1Culj _2XSBC"]/li/ul/li[1]/a').click()
time.sleep(2)
driver.find_element_by_xpath('//ul[@class="_3eZBP _1TJht rui-1Culj _2XSBC"]/li/ul/li/ul/li[1]/a').click()
```

```
links1=[]
for page in range(0,15):
    try:
        driver.execute_script("window.scrollTo(0,document.body.scrollHeight)")
        driver.find_element_by_xpath('//li[@class="_20FqS"]/div[@class="JbJAl"]').click()
        time.sleep(2)
    except NoSuchElementException:
        pass
```

```
try:
    for l in driver.find_elements_by_xpath('//*[@id="container"]/main/div/div/section/div/div/div[5]/div[2]/div/div[2]/ul/li/a'):
        links1.append(l.get_attribute('href'))
        time.sleep(1)
except NoSuchElementException:
        links1.append("-")
        time.sleep(2)
```

```
len(links1)
```

```
358
```

```
Brand=[]
Model=[]
Variant=[]
Man_year=[]
Driven_km=[]
Fuel=[]
Num_of_owners=[]
Location=[]
Price=[]
```

```
for url in links1:
    driver.get(url)
    time.sleep(2)

    try:
        # Extracting Brand
        try:
            b = driver.find_element_by_xpath('//*[@id="container"]/main/div/div/div/div[4]/section[1]/div/div/div[1]/div/div[1]/div/span[2]')
            Brand.append(b.text)
        except NoSuchElementException:
            Brand.append('-')

        time.sleep(1)
        # Extracting Model
        try:
            m = driver.find_element_by_xpath('//*[@id="container"]/main/div/div/div/div[4]/section[1]/div/div/div[1]/div/div[2]/div/span[2]')
            Model.append(m.text)
        except NoSuchElementException:
            Model.append('-')

        time.sleep(1)
        # Extracting Variant
        try:
            v = driver.find_element_by_xpath('//*[@id="container"]/main/div/div/div/div[4]/section[1]/div/div/div[1]/div/div[3]/div/span[2]')
            Variant.append(v.text)
        except NoSuchElementException:
            Variant.append('-')
        # Extracting Man_year
        try:
            my = driver.find_element_by_xpath('//*[@id="container"]/main/div/div/div/div[4]/section[1]/div/div/div[1]/div/div[4]/div/span[2]')
            Man_year.append(my.text)
        except NoSuchElementException:
            Man_year.append('-')
        # Extracting Driven_km
        try:
            dk = driver.find_element_by_xpath('//*[@id="container"]/main/div/div/div/div[4]/section[1]/div/div/div[1]/div/div[7]/div/span[2]')
            Driven_km.append(dk.text)
        except NoSuchElementException:
            Driven_km.append('-')
        # Extracting Fuel
        try:
            f = driver.find_element_by_xpath('//*[@id="container"]/main/div/div/div/div[4]/section[1]/div/div/div[1]/div/div[5]/div/span[2]')
            Fuel.append(f.text)
        except NoSuchElementException:
            Fuel.append('-')
        # Extracting Num_of_owners
        try:
            no = driver.find_element_by_xpath('//*[@id="container"]/main/div/div/div/div[4]/section[1]/div/div/div[1]/div/div[8]/div/span[2]')
            Num_of_owners.append(no.text)
        except NoSuchElementException:
            Num_of_owners.append('-')
        # Extracting Location
        try:
            l = driver.find_element_by_xpath('//*[@id="container"]/main/div/div/div/div[5]/div[1]/div/section/div/div[1]/div/span')
            Location.append(l.text)
        except NoSuchElementException:
            Location.append('-')
        # Extracting Price
        try:
            p = driver.find_element_by_xpath('//*[@id="container"]/main/div/div/div/div[5]/div[1]/div/section/span[1]')
            Price.append(p.text)
        except NoSuchElementException:
            Price.append('-')
    except TimeoutException:
        pass
    except NoSuchElementException:
        pass
```

9]:
```
#webdriver
driver=webdriver.Chrome(r"D:\chromedriver\chromedriver.exe")
time.sleep(3)
```

6]:
```
#cartrade


# Opening the homepage of cartrade

url = "https://www.cartrade.com/"
driver.get(url)

time.sleep(2)
driver.find_element_by_xpath('//*[@id="ucity"]').click()
driver.find_element_by_xpath('//*[@id="ucity"]/optgroup[1]/option[4]').click()
driver.find_element_by_xpath('//*[@id="rvwtop"]/div/div[1]/div[2]/div[2]/input').click()
time.sleep(2)
bodytype = driver.find_element_by_xpath('//*[@id="selectlistarrow6"]')
Hatchback = driver.find_element_by_xpath('//*[@id="body_Hatchback"]')
Sedan = driver.find_element_by_xpath('//*[@id="body_Sedan"]')
SUV = driver.find_element_by_xpath('//*[@id="body_SUV"]')
Van_Minivan = driver.find_element_by_xpath('//*[@id="body_Van_Minivan"]')
action= ActionChains(driver)
action.move_to_element(bodytype).move_to_element(Hatchback).click().move_to_element(Sedan).click().move_to_element(SUV).click().move_to_element(Van_Min
```

7]:
```
links1=[]
driver.execute_script("window.scrollTo(0,document.body.scrollHeight)")
time.sleep(2)
try:
    for l in driver.find_elements_by_xpath('//h2[@class="h2heading truncate"]/a'):
        links1.append(l.get_attribute('href'))
        time.sleep(1)
except NoSuchElementException:
        links1.append("-")
        time.sleep(1)
for page in range(0,10):
        nxt_button=driver.find_elements_by_xpath('//div[@class="pagination"]/ul/li[@class="next"]/a')#scraping the list of buttons from the page
        time.sleep(2)
        try:
            driver.get(nxt_button[1].get_attribute('href'))#getting the link from the list for next page
            time.sleep(2)
        except:
            driver.get(nxt_button[0].get_attribute('href'))
            time.sleep(2)
        driver.execute_script("window.scrollTo(0,document.body.scrollHeight)")
        time.sleep(2)
        try:
            for l in driver.find_elements_by_xpath('//h2[@class="h2heading truncate"]/a'):
                links1.append(l.get_attribute('href'))
                time.sleep(1)
        except NoSuchElementException:
                links1.append("-")
                time.sleep(1)
```

8]:
```
len(links1)
```

8]: 269

]:
```
# Opening the homepage of cartrade

url = "https://www.cartrade.com/"
driver.get(url)

time.sleep(2)
driver.find_element_by_xpath('//*[@id="ucity"]').click()
driver.find_element_by_xpath('//*[@id="ucity"]/optgroup[1]/option[5]').click()
driver.find_element_by_xpath('//*[@id="rvwtop"]/div/div[1]/div[2]/div[2]/input').click()
time.sleep(2)
bodytype = driver.find_element_by_xpath('//*[@id="selectlistarrow6"]')
Hatchback = driver.find_element_by_xpath('//*[@id="body_Hatchback"]')
Sedan = driver.find_element_by_xpath('//*[@id="body_Sedan"]')
SUV = driver.find_element_by_xpath('//*[@id="body_SUV"]')
Van_Minivan = driver.find_element_by_xpath('//*[@id="body_Van_Minivan"]')
action= ActionChains(driver)
action.move_to_element(bodytype).move_to_element(Hatchback).click().move_to_element(Sedan).click().move_to_element(SUV).click().move_to_element(Van_Min
```

]:
```
links2=[]
driver.execute_script("window.scrollTo(0,document.body.scrollHeight)")
time.sleep(2)
try:
    for l in driver.find_elements_by_xpath('//h2[@class="h2heading truncate"]/a'):
        links2.append(l.get_attribute('href'))
        time.sleep(1)
except NoSuchElementException:
        links2.append("-")
        time.sleep(1)

for page in range(0,10):
        nxt_button=driver.find_elements_by_xpath('//div[@class="pagination"]/ul/li[@class="next"]/a')#scraping the list of buttons from the page
        time.sleep(2)
        try:
            driver.get(nxt_button[1].get_attribute('href'))#getting the link from the list for next page
            time.sleep(2)
        except:
            driver.get(nxt_button[0].get_attribute('href'))
            time.sleep(2)
        driver.execute_script("window.scrollTo(0,document.body.scrollHeight)")
        time.sleep(2)
        try:
            for l in driver.find_elements_by_xpath('//h2[@class="h2heading truncate"]/a'):
                links2.append(l.get_attribute('href'))
                time.sleep(1)
        except NoSuchElementException:
                links2.append("-")
                time.sleep(1)
```

]:
```
len(links2)
```

]:
```
272
```

```
# Opening the homepage of cartrade

url = "https://www.cartrade.com/"
driver.get(url)

time.sleep(2)
driver.find_element_by_xpath('//*[@id="ucity"]').click()
driver.find_element_by_xpath('//*[@id="ucity"]/optgroup[1]/option[6]').click()
driver.find_element_by_xpath('//*[@id="rvwtop"]/div/div[1]/div[2]/div[2]/input').click()
time.sleep(2)
bodytype = driver.find_element_by_xpath('//*[@id="selectlistarrow6"]')
Hatchback = driver.find_element_by_xpath('//*[@id="body_Hatchback"]')
Sedan = driver.find_element_by_xpath('//*[@id="body_Sedan"]')
SUV = driver.find_element_by_xpath('//*[@id="body_SUV"]')
Van_Minivan = driver.find_element_by_xpath('//*[@id="body_Van_Minivan"]')
action= ActionChains(driver)
action.move_to_element(bodytype).move_to_element(Hatchback).click().move_to_element(Sedan).click().move_to_element(SUV).click().move_to_element(Van_Min
```

```
links3=[]
driver.execute_script("window.scrollTo(0,document.body.scrollHeight)")
time.sleep(2)
try:
    for l in driver.find_elements_by_xpath('//h2[@class="h2heading truncate"]/a'):
        links3.append(l.get_attribute('href'))
        time.sleep(1)
except NoSuchElementException:
        links3.append("-")
        time.sleep(1)

for page in range(0,3):
        nxt_button=driver.find_elements_by_xpath('//div[@class="pagination"]/ul/li[@class="next"]/a')#scraping the list of buttons from the page
        time.sleep(2)
        try:
            driver.get(nxt_button[1].get_attribute('href'))#getting the link from the list for next page
            time.sleep(2)
        except:
            driver.get(nxt_button[0].get_attribute('href'))
            time.sleep(2)
        driver.execute_script("window.scrollTo(0,document.body.scrollHeight)")
        time.sleep(2)
        try:
            for l in driver.find_elements_by_xpath('//h2[@class="h2heading truncate"]/a'):
                links3.append(l.get_attribute('href'))
                time.sleep(1)
        except NoSuchElementException:
                links3.append("-")
                time.sleep(1)
```

```
len(links3)
```

```
99
```

```
links=links1+links2+links3
len(links)
```

```
640
```

```
Brand=[]
Model=[]
Variant=[]
Man_year=[]
Driven_km=[]
Fuel=[]
Num_of_owners=[]
Location=[]
Price=[]
```

9]:
```
#webdriver
driver=webdriver.Chrome(r"D:\chromedriver\chromedriver.exe")
time.sleep(3)
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#cartrade


# Opening the homepage of cartrade

url = "https://www.cartrade.com/"
driver.get(url)

time.sleep(2)
driver.find_element_by_xpath('//*[@id="ucity"]').click()
driver.find_element_by_xpath('//*[@id="ucity"]/optgroup[1]/option[4]').click()
driver.find_element_by_xpath('//*[@id="rvwtop"]/div/div[1]/div[2]/div[2]/input').click()
time.sleep(2)
bodytype = driver.find_element_by_xpath('//*[@id="selectlistarrow6"]')
Hatchback = driver.find_element_by_xpath('//*[@id="body_Hatchback"]')
Sedan = driver.find_element_by_xpath('//*[@id="body_Sedan"]')
SUV = driver.find_element_by_xpath('//*[@id="body_SUV"]')
Van_Minivan = driver.find_element_by_xpath('//*[@id="body_Van_Minivan"]')
action= ActionChains(driver)
action.move_to_element(bodytype).move_to_element(Hatchback).click().move_to_element(Sedan).click().move_to_element(SUV).click().move_to_element(Van_Min
```

7]:
```
links1=[]
driver.execute_script("window.scrollTo(0,document.body.scrollHeight)")
time.sleep(2)
try:
    for l in driver.find_elements_by_xpath('//h2[@class="h2heading truncate"]/a'):
        links1.append(l.get_attribute('href'))
        time.sleep(1)
except NoSuchElementException:
        links1.append("-")
        time.sleep(1)
for page in range(0,10):
        nxt_button=driver.find_elements_by_xpath('//div[@class="pagination"]/ul/li[@class="next"]/a')#scraping the list of buttons from the page
        time.sleep(2)
        try:
            driver.get(nxt_button[1].get_attribute('href'))#getting the link from the list for next page
            time.sleep(2)
        except:
            driver.get(nxt_button[0].get_attribute('href'))
            time.sleep(2)
        driver.execute_script("window.scrollTo(0,document.body.scrollHeight)")
        time.sleep(2)
        try:
            for l in driver.find_elements_by_xpath('//h2[@class="h2heading truncate"]/a'):
                links1.append(l.get_attribute('href'))
                time.sleep(1)
        except NoSuchElementException:
                links1.append("-")
                time.sleep(1)
```

8]:
```
len(links1)
```

8]: 269

```
# dictionary of lists
dict4 = {'Brand': Brand, 'Model': Model, 'Variant': Variant,'Man_year':Man_year,'Driven_km':Driven_km,'Fuel':Fuel,
         'Num_of_owners':Num_of_owners,'Location':Location,'Price':Price}

df4 = pd.DataFrame(dict4)

# saving the dataframe
df4.to_csv('cartrade01.csv')
```

```
filename=['cartrade.csv', 'Olx.csv','carwale.csv','cartrade01.csv']
```

```
combined_csv = pd.concat([pd.read_csv(f) for f in filename])
```

```
combined_csv.to_excel( "Car_Price.xlsx", index=False, encoding='utf-8')
```

```
combined_csv.to_csv( "CarPrice.csv", index=False, encoding='utf-8')
```

```

```

```
#end
```

Firstly, we will start by importing required libraries and databases.

```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt

from sklearn.linear_model import LinearRegression,ElasticNet
from sklearn.gaussian_process import GaussianProcessRegressor
from sklearn.metrics import mean_absolute_error,mean_squared_error,r2_score
from sklearn.ensemble import AdaBoostRegressor, BaggingRegressor
from sklearn.neighbors import KNeighborsRegressor
from sklearn.tree import DecisionTreeRegressor
from scipy import stats
from scipy.stats import skew
import pylab


from sklearn.model_selection import train_test_split
from sklearn.model_selection import cross_val_score

import joblib
import warnings
warnings.filterwarnings('ignore')
```

Load the car price.csv file.

```
data=pd.read_csv("CarPrice.csv")
data
```

	Unnamed: 0	Brand	Model	Variant	Man_year	Driven_km	Fuel	Num_of_owners	Location	Price
0	0	Hyundai	Grand i10	Asta 1.2 Kappa VTVT [2013-2016]	2016	46,471 Kms	Petrol	First	Mumbai	5.5 Lakh
1	1	Hyundai	Verna	Fluidic 1.6 VTVT SX	2013	92,173 Kms	Petrol	First	Mumbai	4.25 Lakh
2	2	Jeep	Compass	Sport 2.0 Diesel	2018	34,335 Kms	Diesel	First	Mumbai	14.05 Lakh
3	3	Maruti Suzuki	Celerio	VXi [2017-2019]	2017	10,000 Kms	Petrol	First	Mumbai	4.25 Lakh
4	4	BMW	X1	sDrive20d M Sport	2019	49,000 Kms	Diesel	First	Mumbai	35 Lakh
...	...	...	...	...	...	...	...	...	...	...
4805	635	Hyundai	i20 Active	1.2 S	2016	79,000 Kms	Petrol	First	Kalyan	5.65 Lakh
4806	636	Mahindra	XUV500	W8	2012	78,000 Kms	Diesel	Second	Kalyan	5.25 Lakh
4807	637	Maruti Suzuki	Baleno	Zeta 1.2	2016	40,000 Kms	Petrol	First	Kalyan	5.95 Lakh
4808	638	Maruti Suzuki	Celerio	ZXi AMT [2017-2019]	2018	30,000 Kms	Petrol	First	Kalyan	4.95 Lakh
4809	639	Maruti Suzuki	Swift DZire	VDI	2012	28,645 Kms	Diesel	First	Kalyan	4.55 Lakh

4810 rows × 10 columns

```
data.columns
```

```
Index(['Unnamed: 0', 'Brand', 'Model', 'Variant', 'Man_year', 'Driven_km',
       'Fuel', 'Num_of_owners', 'Location', 'Price'],
      dtype='object')
```

Above is the list of all columns in our datasets.

Our datasets has 4810 rows and 10 columns .

```
data.dtypes
```

```
Unnamed: 0       int64
Brand           object
Model           object
Variant         object
Man_year        object
Driven_km       object
Fuel            object
Num_of_owners   object
Location        object
Price           object
dtype: object
```

We can see both type of columns numerical and object type.

```
#pd.set_option('display.max_rows',None)
data.describe(include='all').T
```

	count	unique	top	freq	mean	std	min	25%	50%	75%	max
Unnamed: 0	4810.0	NaN	NaN	NaN	719.205405	517.820003	0.0	300.0	601.0	1080.0	2002.0
Brand	4810	34	-	2657	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Model	4810	202	-	2657	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Variant	4810	790	-	2657	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Man_year	4810	167	-	2030	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Driven_km	4810	1250	-	2030	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Fuel	4810	10	-	2030	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Num_of_owners	4810	7	First	2074	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Location	4810	21	-	2657	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Price	4810	712	-	2657	NaN	NaN	NaN	NaN	NaN	NaN	NaN

We can see - in some variables most frequently value. We will work on it.

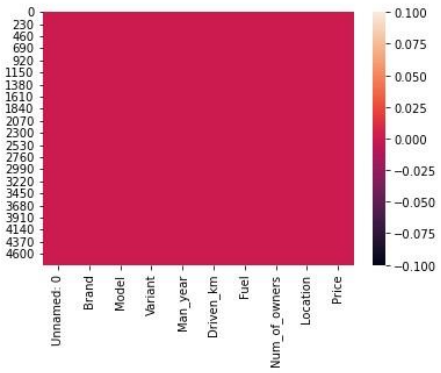
We can see count is all same for all variable, let's check for null values now:

```
data.isnull().sum()
```

```
Unnamed: 0       0
Brand            0
Model            0
Variant          0
Man_year         0
Driven_km        0
Fuel             0
Num_of_owners    0
Location         0
Price            0
dtype: int64
```

```
#Let's see it with the help of heatmap:
sns.heatmap(data.isnull())
```

```
<AxesSubplot:>
```



Our dataset does not contain null values.

```
# dropping 'Unnamed: 0 varible as its not further analysis
data.drop('Unnamed: 0', axis=1, inplace=True)
```

```
data['Driven_km'] = data['Driven_km'].str.replace('-', 'NA') # replaced - with NA
data['Driven_km'] = data['Driven_km'].str.replace(' Kms', '') # removed kms as column as column name already has km it in
```

```
data['Price'] = data['Price'].str.replace('₹', '')#removed ₹
data['Price'] = data['Price'].str.replace(',', '')#removed , as well
```

```
#dropping all rows where price column does not contain any price
data = data[~data.Price.str.contains("-") == True]
```

```
def isfloat(value):
    try:
        float(value)
        return float(value)
    except ValueError:
        return value
```

```
data['Price']=data['Price'].apply(isfloat)
```

```
def value_to_float(x):
    if type(x) == float or type(x) == int:
        return x
    if x.isdigit():
        x=float(x)
        return float(x)
    if 'Lakh' in x:
        if len(x) > 1:
            return float(x.replace(' Lakh','')) *100000
        return 100000.0
    if 'Crore' in x:
        if len(x) > 1:
            return float(x.replace(' Crore','')) * 10000000
        return 10000000.0
```

```
#changing all values of price column in numerical type
data['Price']=data['Price'].apply(value_to_float)
```

```
data['Price']
```

```
0        550000.0
1        425000.0
2       1405000.0
3        425000.0
4       3500000.0
          ...
4805     565000.0
4806     525000.0
4807     595000.0
4808     495000.0
4809     455000.0
Name: Price, Length: 2153, dtype: float64
```

```
#checking unique values for all object type columns
for i in data.columns:
    if data[i].dtype == 'object':
        print(i, ":", data[i].nunique())
```

```
Brand : 33
Model : 201
Variant : 789
Man_year : 134
Driven_km : 982
Fuel : 8
Num_of_owners : 6
Location : 20
```

we can see manufacturing year has 134,

```
data['Man_year'].value_counts()
```

```
2016        178
2017        166
2015        165
2012        148
2014        129
           ...
Dec 2012      1
Dec 2019      1
Oct 2016      1
Jul 2015      1
Mar 2010      1
Name: Man_year, Length: 134, dtype: int64
```

some values contain month as well. Let's remove months and only keep year.

```
data['Man_year'].replace(regex=True,inplace=True,to_replace=r'\D',value=r'')
data['Man_year'].value_counts()
```

```
2016    285
2017    254
2015    229
2018    207
2012    206
2014    178
2013    174
2011    137
2019    126
2010    115
2020     64
2009     61
2008     39
2021     30
2007     20
2006     11
2004      4
2001      4
2005      4
2002      3
2003      2
Name: Man_year, dtype: int64
```

```
#creating cat col list for unique value count till 60 as we will have clear visual for those many values.
cat_col=[]
for i in data:
    if data[i].nunique() <= 70:
        cat_col.append(i)

print(cat_col)
```

```
['Brand', 'Man_year', 'Fuel', 'Num_of_owners', 'Location']
```

```
# let check null values and value counts for all categorical variables
for i in cat_col:
    print(i,"Column value counts:\n", data[i].value_counts(), "\n")
```

```
Brand Column value counts:
 Maruti Suzuki       489
Hyundai              387
Honda                190
Mahindra             141
Toyota               135
Mercedes-Benz        121
BMW                  108
Ford                  75
Tata                  74
Volkswagen            72
Audi                  67
Skoda                 65
Renault               55
Chevrolet             32
Jaguar                18
MG                    15
Jeep                  14
Fiat                  13
Kia                   11
Datsun                11
Land Rover             9
Mitsubishi             9
Nissan                 8
MINI                   8
Porsche                7
Volvo                  5
Bentley                5
Ssangyong              2
Lexus                  2
Aston Martin           2
Premier                1
Isuzu                  1

Man_year Column value counts:
 2016    285
2017    254
2015    229
2018    207
2012    206
2014    178
2013    174
2011    137
2019    126
2010    115
2020     64
2009     61
2008     39
2021     30
2007     20
2006     11
2004      4
2001      4
2005      4
2002      3
2003      2
Name: Man_year, dtype: int64

Fuel Column value counts:
 Petrol          1109
Diesel           1014
CNG + Cng          12
CNG                 5
Electric            4
Hybrid              3
LPG                 3
Petrol + Cng        3
Name: Fuel, dtype: int64

Num_of_owners Column value counts:
 First               1546
Second               514
Third                 76
UnRegistered Car      11
4 or More              4
Fourth                 2
Name: Num_of_owners, dtype: int64
```

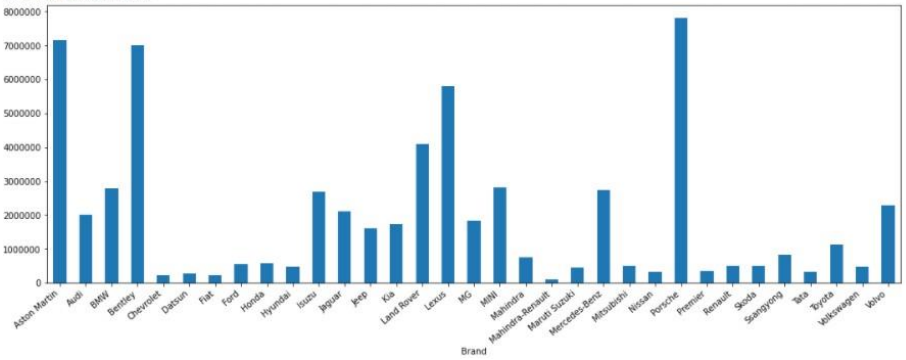
```
Location Column value counts:
 Mumbai         471
Bangalore       398
Indore          270
Bhopal          262
Nagpur          261
Chennai         128
Thane           107
Delhi            57
Kalyan           54
Navi Mumbai      40
Dehradun         37
Kolkata          30
Faridabad        15
Noida             6
Meerut            5
Pune              5
Agra              2
Lucknow           2
Patna             2
Ghaziabad         1
Name: Location, dtype: int64
```

Fuel variable has - value in it. And Number of owners has same value with different format. let's make required changes.

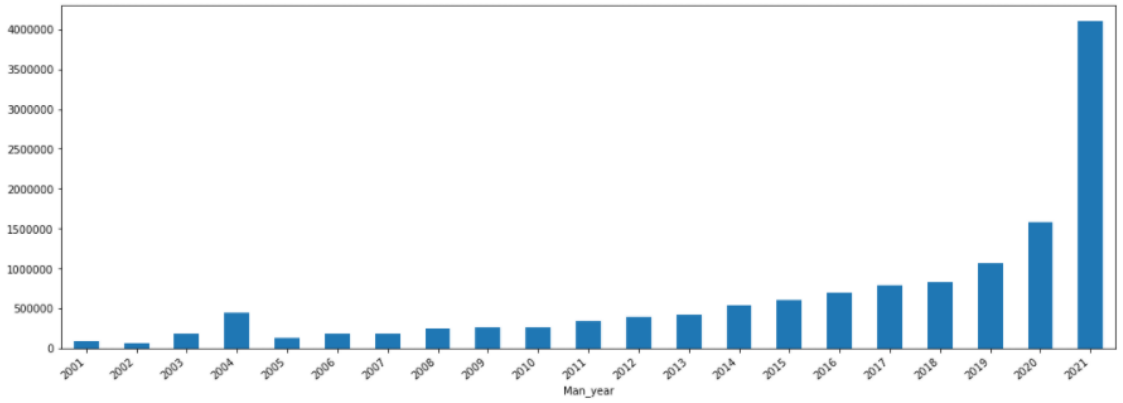
```
data['Fuel'] = data['Fuel'].str.replace('-', 'NA') #replacing - with NA
data['Num_of_owners'] = data['Num_of_owners'].str.replace('-', 'NA') #replacing - with NA
data['Num_of_owners'] = data['Num_of_owners'].str.replace('First','1st') # #replacing First with 1st
data['Num_of_owners'] = data['Num_of_owners'].str.replace('Second','2nd') #replacing Second with 2nd
data['Num_of_owners'] = data['Num_of_owners'].str.replace('Third','3rd') #replacing Third with 3rd
data['Num_of_owners'] = data['Num_of_owners'].str.replace('Fourth', '4th') #replacing Fourth with 4th
```

```
for i in cat_col:
    plt.figure(figsize=(18,6))
    #a=sns.countplot(train[i])
    a=data.groupby(i)['Price'].median().plot.bar()
    print(data[i].value_counts())
    a.set_xticklabels(a.get_xticklabels(), rotation=40, ha="right")
    #a.ticklabel_format(useOffset=False, style='plain')
    plt.gcf().axes[0].yaxis.get_major_formatter().set_scientific(False)
    plt.show()
```

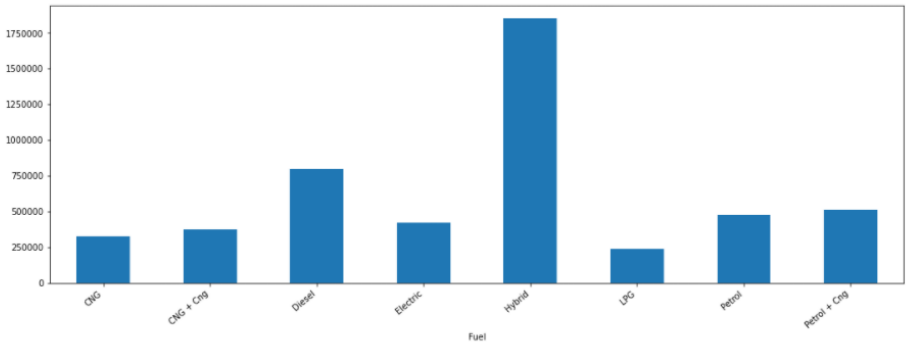
```
Maruti Suzuki      489
Hyundai            387
Honda              190
Mahindra           141
Toyota             135
Mercedes-Benz      121
BMW                108
Ford                75
Tata                74
Volkswagen          72
Audi                67
Skoda               65
Renault             55
Chevrolet           32
Jaguar              18
MG                  15
Jeep                14
Fiat                13
Kia                 11
Datsun              11
Land Rover           9
Mitsubishi           9
Nissan               8
MINI                 8
Porsche              7
Volvo                5
Bentley              5
Ssangyong            2
Lexus                2
Aston Martin         2
Premier              1
Isuzu                1
Mahindra-Renault     1
Name: Brand, dtype: int64
```



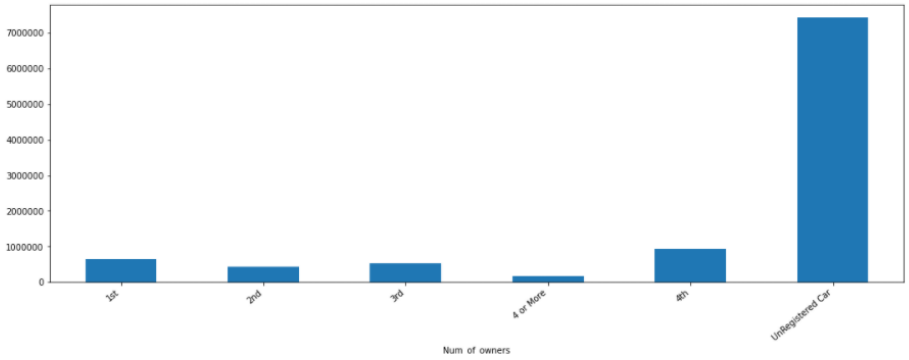
```
2016    285
2017    254
2015    229
2018    207
2012    206
2014    178
2013    174
2011    137
2019    126
2010    115
2020     64
2009     61
2008     39
2021     30
2007     20
2006     11
2004      4
2001      4
2005      4
2002      3
2003      2
Name: Man_year, dtype: int64
```



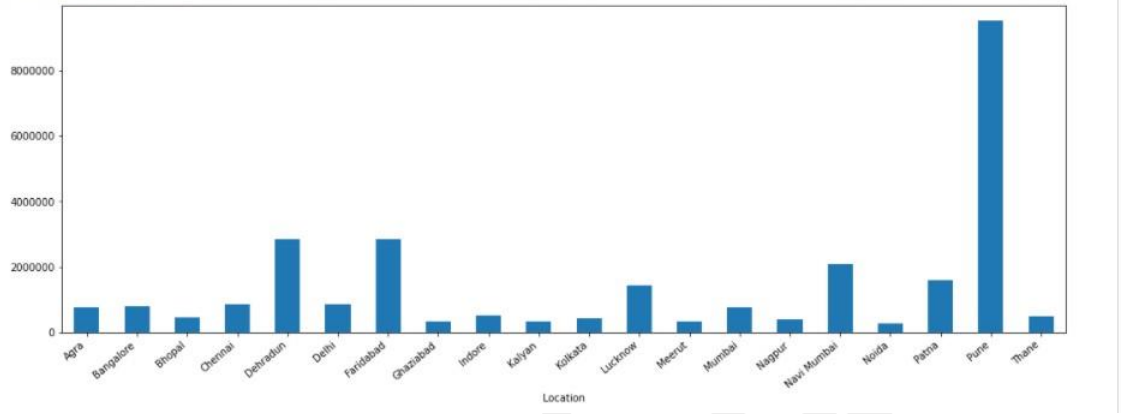

```
Petrol          1109
Diesel          1014
CNG + Cng         12
CNG                5
Electric           4
Hybrid             3
LPG                3
Petrol + Cng       3
Name: Fuel, dtype: int64
```




```
1st               1546
2nd                514
3rd                 76
UnRegistered Car    11
4 or More            4
4th                  2
Name: Num_of_owners, dtype: int64
```



```
Mumbai        471
Bangalore     398
Indore        270
Bhopal        262
Nagpur        261
Chennai       128
Thane         107
Delhi          57
Kalyan         54
Navi Mumbai    40
Dehradun       37
Kolkata        30
Faridabad      15
Noida           6
Meerut          5
Pune            5
Agra            2
Lucknow         2
Patna           2
Ghaziabad       1
Name: Location, dtype: int64
```



1. Highest price is for Porsche and maximum count is for Maruti Suzuki and then Hyundai.

2. Highest price is for manufacturing year 2021, maximum count is for year 2016 and 2017.

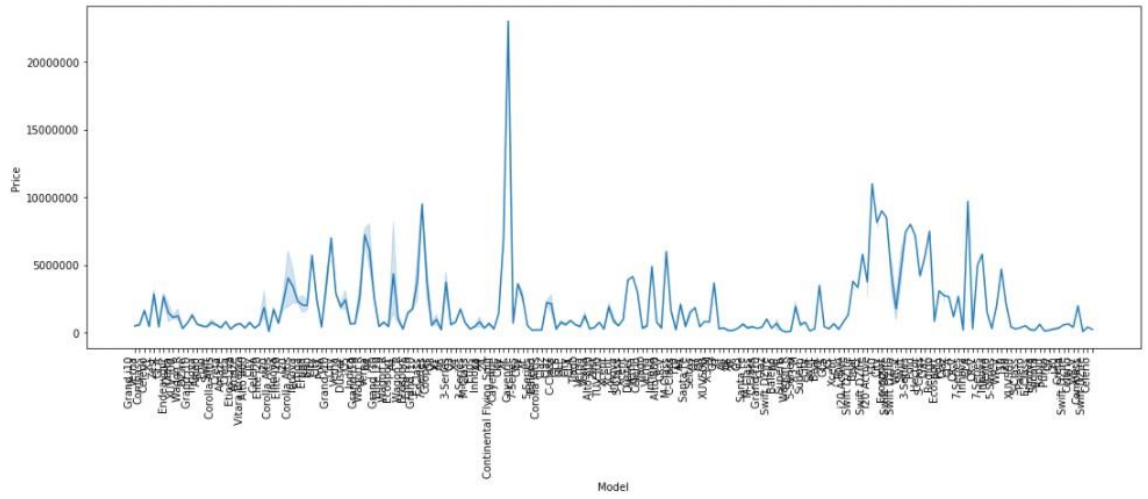
3. Highest price is for hybrid type of fuel; maximum count is for vehicle with fuel type petrol and Diesel.

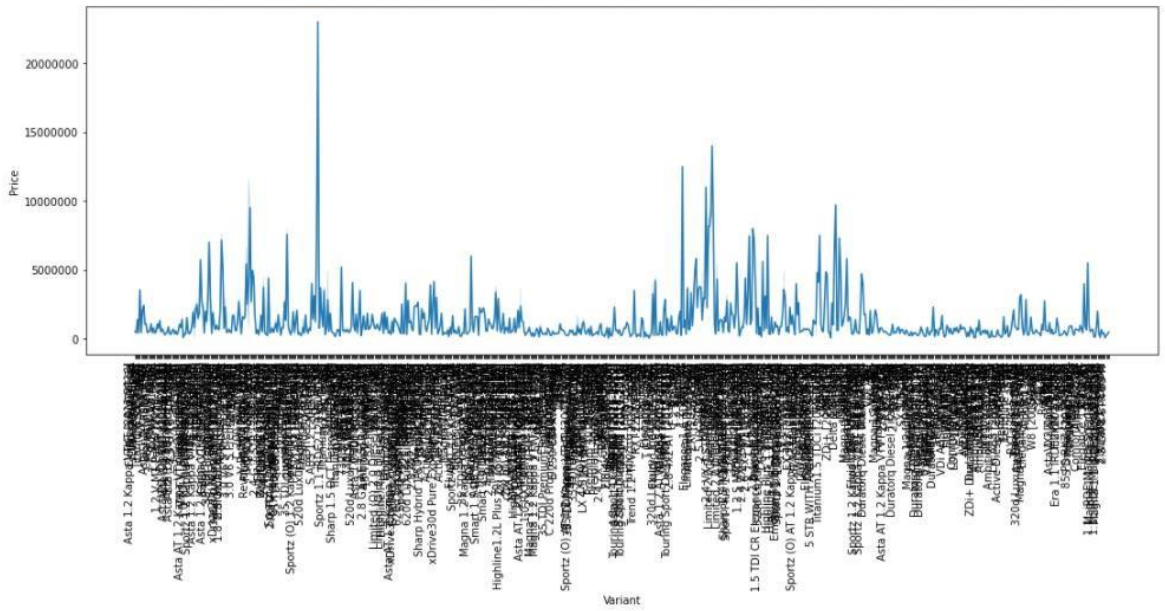
4. With respect to number of owners highest price is for Unregistered Car and maximum count is for 1st.

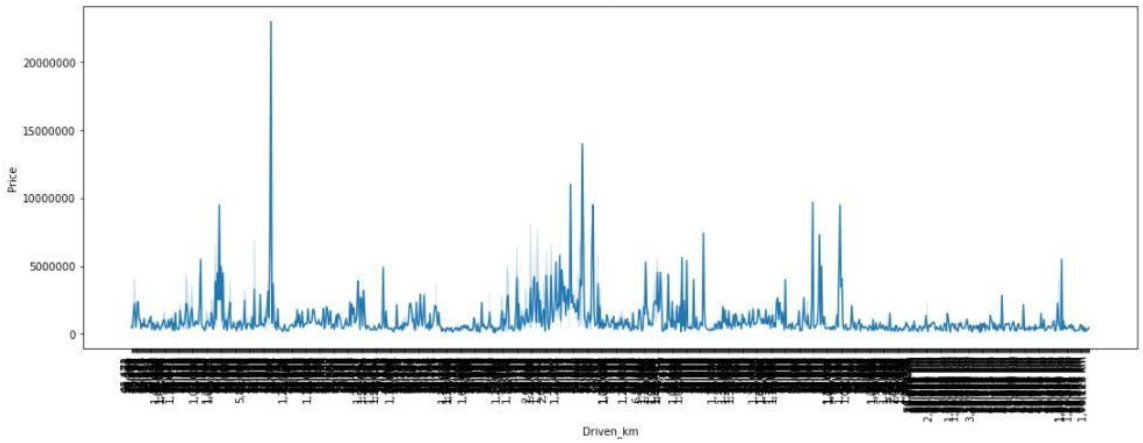
```
: #for more than 70 keeping it in one list
dis_col=[]
for i in data:
    if data[i].nunique() > 70:
        dis_col.append(i)

print(dis_col)
```

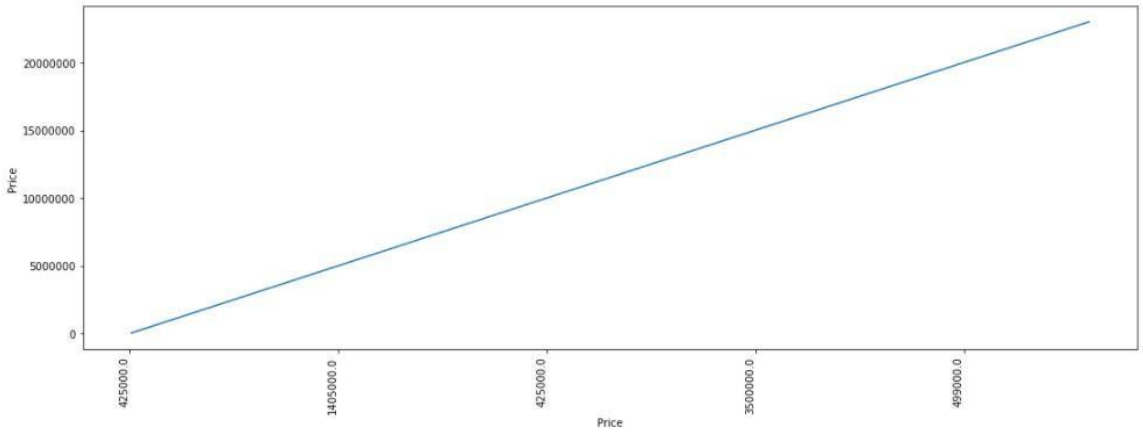
```
['Model', 'Variant', 'Driven_km', 'Price']
```

```
: for i in dis_col:
    plt.figure(figsize=(18,6))
    a=sns.lineplot(x=data[i],y=data['Price'],palette='Tableau')
    #a.set_xticklabels(a.get_xticklabels(), rotation=90, ha="right",visible=True)
    a.set_xticklabels(labels=data[i],rotation=90, ha="right")
    #ax.ticklabel_format(useOffset=False, style='plain')
    plt.gcf().axes[0].yaxis.get_major_formatter().set_scientific(False)
    plt.show()
```





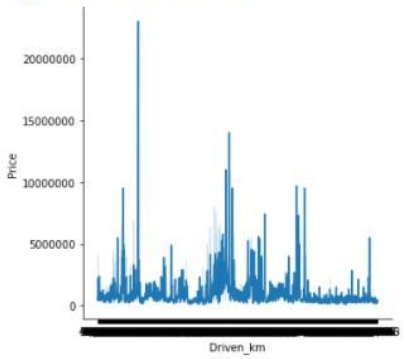

20000000
15000000
10000000
5000000
0
Price
Driven_km


20000000
15000000
10000000
5000000
0
Price
425000.0
1405000.0
425000.0
3500000.0
499000.0
Price

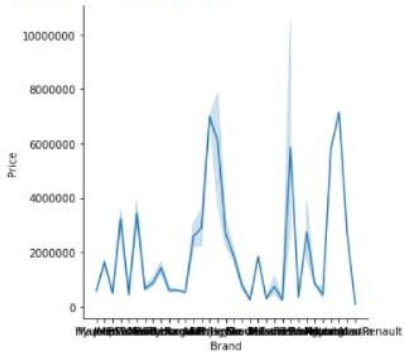
7]:

```
list=['Driven_km','Brand','Model','Variant','Fuel','Num_of_owners']
for i in list:
    plt.figure(figsize=(18,6))
    a=sns.relplot(x=i,y='Price',data=data,kind='line')
    #a.set_xticklabels(labels=data[i],rotation=90, ha="right")
    plt.gcf().axes[0].yaxis.get_major_formatter().set_scientific(False)
    plt.show()
```

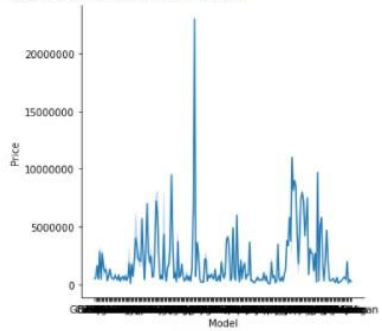
```
<Figure size 1296x432 with 0 Axes>
```



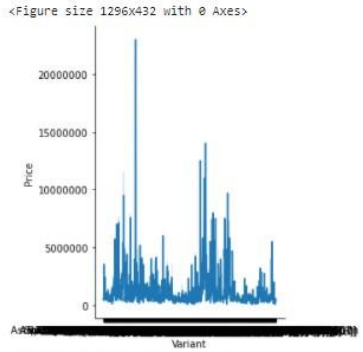

```
<Figure size 1296x432 with 0 Axes>
```



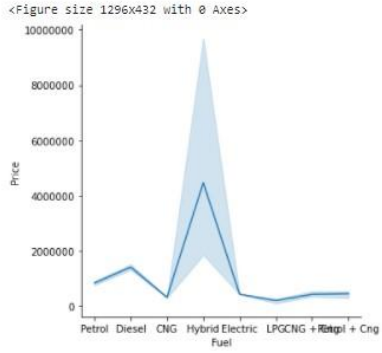
<Figure size 1296x432 with 0 Axes>



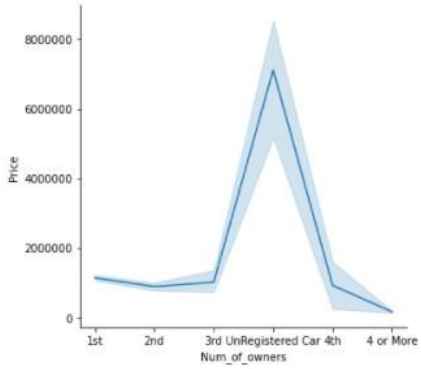
<Figure size 1296x432 with 0 Axes>



<Figure size 1296x432 with 0 Axes>



<Figure size 1296x432 with 0 Axes>



1. Maximum driven vehicles are for price less than 5000000.
2. Highest total of price Maruti Suzuki.
3. Maximum vehicles prices for models are with price less than 1000000.
4. Maximum vehicles prices for variants are with price less than 5000000.

5. Maximum vehicles prices for fuel are less with price than 100000.
6. Maximum vehicles for number of owners are with price less than 400000.

Let's Check the correlation now:

```
]: plt.figure(figsize=(20,10))
   sns.heatmap(data.corr(),annot=True,cmap='coolwarm')
   plt.show()
```

Let's change the data type of other object type columns.

```
]: data.dtypes
```

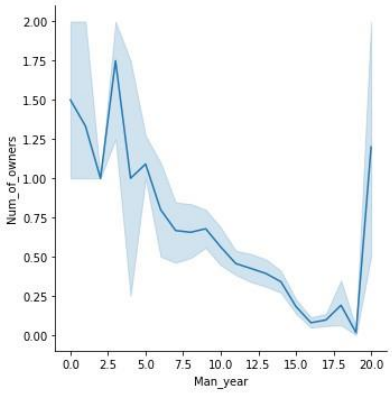
```
]: Brand            object
   Model            object
   Variant          object
   Man_year         object
   Driven_km        object
   Fuel             object
   Num_of_owners    object
   Location         object
   Price           float64
   dtype: object
```

Encoding:

```
[30]: from sklearn.preprocessing import LabelEncoder
      le=LabelEncoder()

      for i in data.columns:
          if data[i].dtypes=='object':
              data[i]=le.fit_transform(data[i].astype(str).values.reshape(-1,1))
```

```
[31]: sns.relplot(x='Man_year', y='Num_of_owners',data=data, kind='line')
```

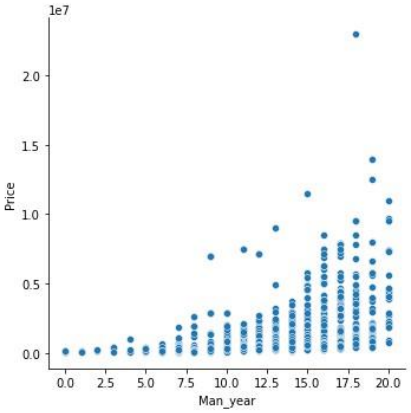
```
[31]: <seaborn.axisgrid.FacetGrid at 0x18b52ad5b80>
```



Num_of_owners.We can see negative relation between Man_year and Num_of_owners.

```
]: sns.relplot(x='Man_year', y='Price',data=data, kind='scatter')
```

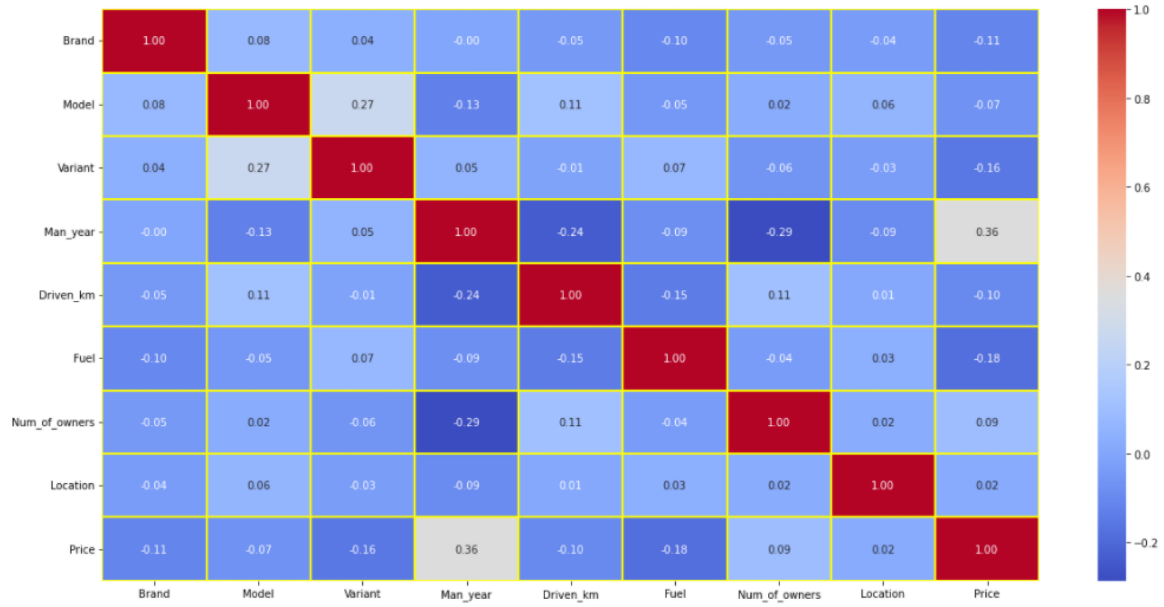
```
]: <seaborn.axisgrid.FacetGrid at 0x18b55c51310>
```



Num_of_owners.We can see positive relation between Man_year and Price.

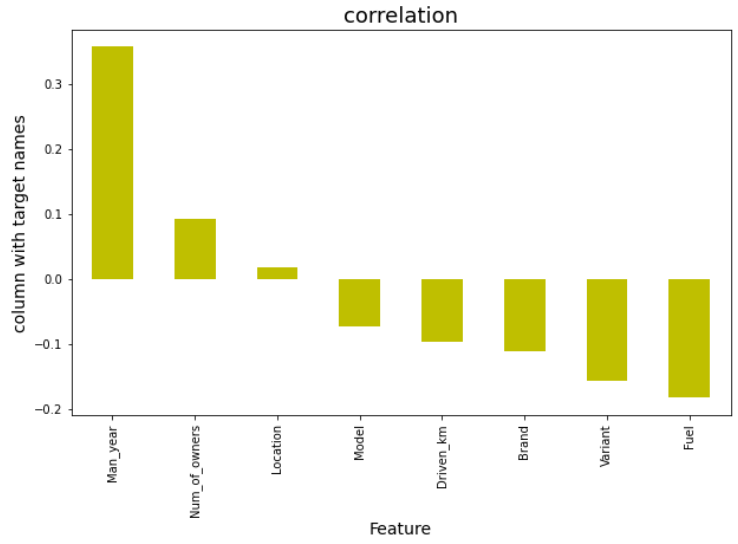
```
plt.figure(figsize=(20,10))
sns.heatmap(data.corr(),annot=True,linewidths=0.1,linecolor="yellow",fmt="0.2f",cmap="coolwarm")
```

```
<AxesSubplot:>
```



Checking the columns which are positively and negative correlated with the target columns:

```
plt.figure(figsize=(10,6))
data.corr()['Price'].sort_values(ascending=False).drop(['Price']).plot(kind='bar',color='y')
plt.xlabel('Feature',fontsize=14)
plt.ylabel('column with target names',fontsize=14)
plt.title('correlation',fontsize=18)
plt.show()
```



Our target column Price is positively correlated with Man_year and has negative correlation with Fuel column.

```
: x=data.drop('Price', axis=1)
  y=data['Price']
  print(x.shape)
  print(y.shape)
```

```
(2153, 8)
(2153,)
```

Other than price all other columns object type hence Skewness and outliers removal is not required.

MODEL/S DEVELOPMENT AND EVALUATION

Finding best random state:

```
maxAcc=0
maxRS=0
for i in range(1,200):
    x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=.20,random_state=i)
    Ln=LinearRegression()
    Ln.fit(x_train,y_train)
    pred=Ln.predict(x_test)
    acc=r2_score(y_test,pred)
    if acc>maxAcc:
        maxAcc=acc
        maxRS=i
print("Best accuracy is ",maxAcc, " at Random State ",maxRS)
```

```
Best accuracy is  0.368804915153224  at Random State  128
```

```
7]: x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=.20,random_state=maxRS)
```

```
8]: model=[LinearRegression(),AdaBoostRegressor(),ElasticNet(alpha=0.0001),
           KNeighborsRegressor(),DecisionTreeRegressor(), BaggingRegressor()]
    for m in model:
        m.fit(x_train,y_train)
        #sc=m.score(x_train,y_train)
        predm=m.predict(x_test)
        acc=r2_score(y_test,predm)
        print('Accuracy Score of',m,'is:',acc * 100,"%")
        print('mean_absolute_error:',mean_absolute_error(y_test,predm))
        print('mean_squared_error:',mean_squared_error(y_test,predm))
        print('Root mean_squared_error:',np.sqrt(mean_squared_error(y_test,predm)))
        print("\n")
```

```
Accuracy Score of LinearRegression() is: 36.8804915153224 %
mean_absolute_error: 696599.851574225
mean_squared_error: 1180949777699.0833
Root mean_squared_error: 1086715.131807358


Accuracy Score of AdaBoostRegressor() is: -71.56118347267582 %
mean_absolute_error: 1645165.5358417693
mean_squared_error: 3209865639765.4136
Root mean_squared_error: 1791609.790039509


Accuracy Score of ElasticNet(alpha=0.0001) is: 36.88020313586322 %
mean_absolute_error: 696595.5021424221
mean_squared_error: 1180955173204.631
Root mean_squared_error: 1086717.6142883813


Accuracy Score of KNeighborsRegressor() is: 36.69545108670842 %
mean_absolute_error: 617508.1234338747
mean_squared_error: 1184411836550.3506
Root mean_squared_error: 1088306.866903977


Accuracy Score of DecisionTreeRegressor() is: 79.48887419620074 %
mean_absolute_error: 204354.99071925753
mean_squared_error: 383757891020.884
Root mean_squared_error: 619481.9537491661


Accuracy Score of BaggingRegressor() is: 88.10017024796198 %
mean_absolute_error: 207770.30394431556
mean_squared_error: 222642755587.00928
Root mean_squared_error: 471850.35295844515
```

Highest Accuracy is BaggingRegressor which is 88.10%

Hyper parameter tunning:

```
39]: from sklearn.model_selection import RandomizedSearchCV
```

LinearRegression

```
40]: parameters1={'fit_intercept':[True, False],'normalize':[True, False],
                  'copy_X':[True, False],'positive':[True, False],
                  'n_jobs':range(0,20)}
```

```
41]: RSV1=RandomizedSearchCV(LinearRegression(),parameters1,cv=5)
```

```
42]: RSV1.fit(x_train,y_train)
```

```
42]: RandomizedSearchCV(cv=5, estimator=LinearRegression(),
                        param_distributions={'copy_X': [True, False],
                                             'fit_intercept': [True, False],
                                             'n_jobs': range(0, 20),
                                             'normalize': [True, False],
                                             'positive': [True, False]})
```

```
43]: RSV1.best_params_
```

```
43]: {'positive': False,
      'normalize': False,
      'n_jobs': 8,
      'fit_intercept': False,
      'copy_X': False}
```

```
44]: RSV1_pred=RSV1.best_estimator_.predict(x_test)
```

```
45]: RSV1_pred
```

```
45]: array([ 1418671.71125749,   954541.34794022,   784424.05548174,
        1181594.25943072,  1590473.88122576,  1358540.96930077,
        1360991.09704547,   104488.13189734,  1564631.45702457,
        1333636.3712676 ,   340539.44438589,  1300745.84347838,
         754754.74123859,   774704.92449167,   460183.11696796,
          69146.657204  ,  1544821.43075511,  1767513.85435983,
        1832195.31410202,  2016991.04041457,   610195.283242  ,
        1231079.96684274,  2744604.08101183,   966066.10242153,
         532560.32414682,  2268304.16769996,  1657873.35370536,
        1235461.16938424,   521604.67990413,  1638790.21652725,
        2455051.88554809,  1061911.29531507,  1308832.23757896,
         995076.28298662,  1363333.82840318,  1729035.39770281,
```

6]:
```
score1 = RSV1.score(x_train,y_train)
```

AdaBoostRegressor

7]:
```
param2={'n_estimators': [20, 50, 70, 100], 'learning_rate' : [0.01,0.05,0.1,0.3,1],
       'loss' : ['linear', 'square', 'exponential'],'random_state':range(0,20)}
```

8]:
```
RSV2=RandomizedSearchCV(AdaBoostRegressor(),param2,cv=5)
```

9]:
```
RSV2.fit(x_train,y_train)
```

9]:
```
RandomizedSearchCV(cv=5, estimator=AdaBoostRegressor(),
                   param_distributions={'learning_rate': [0.01, 0.05, 0.1, 0.3,
                                                          1],
                                        'loss': ['linear', 'square',
                                                 'exponential'],
                                        'n_estimators': [20, 50, 70, 100],
                                        'random_state': range(0, 20)})
```

0]:
```
RSV2_pred=RSV2.best_estimator_.predict(x_test)
```

1]:
```
RSV2.best_params_
```

1]:
```
{'random_state': 11,
 'n_estimators': 20,
 'loss': 'linear',
 'learning_rate': 0.1}
```

2]:
```
RSV2_pred
```

2]:
```
array([1286273.74301676, 1286273.74301676,  584814.85870889,
       1286273.74301676, 1286273.74301676, 1523386.66666667,
       1286273.74301676,  584814.85870889,  608143.71859903,
        608143.71859903,  608143.71859903, 4017096.77419355,
        584814.85870889,  608143.71859903, 4042236.84210526,
        584814.85870889, 1785048.54368932, 1986458.33333333,
       1934386.55462185, 1483556.12244898,  584814.85870889,
        608143.71859903, 2203058.82352941,  608143.71859903,
        608143.71859903, 1286273.74301676,  660428.9784792 ,
        608143.71859903,  608143.71859903, 1354225.6568779 ,
       2475666.66666667,  584814.85870889, 1286273.74301676,
        584814.85870889, 1286273.74301676, 1934386.55462185,
       2933953.48837209,  608143.71859903, 1483556.12244898,
       4702733.33333333,  608143.71859903,  608143.71859903,
        627796.92516556, 1286273.74301676,  608143.71859903
```

```
3]: score2 = RSV2.score(x_train,y_train)
```

ElasticNet

```
4]: parameters3={'fit_intercept':[True, False],'normalize':[True, False],'precompute':[True, False],
            'copy_X':[True, False],'positive':[True, False],'warm_start':[True, False],
            'random_state':range(0,20),'l1_ratio':[0.5,1], 'selection':['cyclic','random']}
```

```
5]: RSV3=RandomizedSearchCV(ElasticNet(alpha=0.0001),parameters3,cv=5)
```

```
6]: RSV3.fit(x_train,y_train)
```

```
6]: RandomizedSearchCV(cv=5, estimator=ElasticNet(alpha=0.0001),
                   param_distributions={'copy_X': [True, False],
                                        'fit_intercept': [True, False],
                                        'l1_ratio': [0.5, 1],
                                        'normalize': [True, False],
                                        'positive': [True, False],
                                        'precompute': [True, False],
                                        'random_state': range(0, 20),
                                        'selection': ['cyclic', 'random'],
                                        'warm_start': [True, False]})
```

```
7]: RSV3.best_params_
```

```
7]: {'warm_start': True,
     'selection': 'random',
     'random_state': 11,
     'precompute': True,
     'positive': False,
     'normalize': True,
     'l1_ratio': 1,
     'fit_intercept': False,
     'copy_X': False}
```

```
8]: RSV3_pred=RSV3.best_estimator_.predict(x_test)
```

```
9]: RSV3_pred
```

```
9]: array([ 1418671.71123986,   954541.34808601,   784424.05540006,
        1181594.25951506,  1590473.88129425,  1358540.9693916 ,
        1360991.09688972,   104488.13207025,  1564631.45662565,
        1333636.3712907 ,   340539.44453516,  1300745.84348142,
         754754.74107422,   774704.92458465,   460183.11707638,
```

```
50]: score3 = RSV3.score(x_train,y_train)
```

KNeighborsRegressor

```
51]: parameters4={'weights':['uniform','distance'],'algorithm':['auto','ball_tree','kd_tree','brute'],
                  'n_jobs':range(0,20)}

52]: RSV4=RandomizedSearchCV(KNeighborsRegressor(),parameters4,cv=5)

53]: RSV4.fit(x_train,y_train)

53]: RandomizedSearchCV(cv=5, estimator=KNeighborsRegressor(),
                        param_distributions={'algorithm': ['auto', 'ball_tree',
                                                           'kd_tree', 'brute'],
                                             'n_jobs': range(0, 20),
                                             'weights': ['uniform', 'distance']})

54]: RSV4.best_params_

54]: {'weights': 'distance', 'n_jobs': 17, 'algorithm': 'ball_tree'}

55]: RSV4_pred=RSV4.best_estimator_.predict(x_test)

56]: RSV4_pred

56]: array([ 799000.        ,  412033.80550763,  220000.        ,
            1025000.        ,  614849.5762396 , 1575000.        ,
             459280.52501306,  305105.64241383,  295000.        ,
             631936.72566773,  499000.        , 3366016.78604927,
             579362.46477122,  525051.52334772, 1930000.        ,
             310000.        , 1311625.1036861 , 3579952.15352909,
             870184.81621176, 2786455.24974295,  512805.91245694,
             599322.1032439 ,  752679.60282772, 1687456.51331861,
             343934.3018641 , 1767463.90779472, 1027286.68313695,
             666321.94216247,  260000.        ,  875000.        ,
            1951000.        ,  483295.25768397,  835000.        ,
             250715.79064489,  731119.7154237 ,  482561.60352938,
            4395000.        ,  440000.        , 5500000.        ,
            7423000.        , 1743446.05402131,  410909.69630147,
             595000.        ,  405750.65256375,  155000.        ,
             482561.60352938,  425000.        , 1533925.9069104 ,
             840229.85582036, 1334606.46005361,  503649.37210239,
            1810161.87893434,  320000.        ,  608061.01838121,
```

67]:
```
score4 = RSV4.score(x_train,y_train)
```

DecisionTreeRegressor

68]:
```
parameters5={'criterion':['mse', "friedman_mse", "mae", 'poisson'],'splitter':['best','random'],
             'max_features':['auto','sqrt','log2'],'random_state':range(0,20)}
```

69]:
```
RSV5=RandomizedSearchCV(DecisionTreeRegressor(),parameters5,cv=5)
```

70]:
```
RSV5.fit(x_train,y_train)
```

70]:
```
RandomizedSearchCV(cv=5, estimator=DecisionTreeRegressor(),
                   param_distributions={'criterion': ['mse', 'friedman_mse',
                                                      'mae', 'poisson'],
                                       'max_features': ['auto', 'sqrt',
                                                        'log2'],
                                       'random_state': range(0, 20),
                                       'splitter': ['best', 'random']})
```

71]:
```
RSV5.best_params_
```

71]:
```
{'splitter': 'best',
 'random_state': 4,
 'max_features': 'log2',
 'criterion': 'mae'}
```

72]:
```
RSV5_pred=RSV5.best_estimator_.predict(x_test)
```

73]:
```
RSV5_pred
```

73]:
```
array([ 799000.,  275000.,  220000., 1025000.,  575000., 1575000.,
        490000.,  235000.,  295000.,  595000.,  499000., 3500000.,
        570000.,  499000., 1930000.,  310000., 4850000., 4475000.,
       1150000., 2850000.,  225000.,  665000.,  990000.,  699000.,
        520000.,  520000., 1145000.,  265000.,  260000.,  875000.,
       1951000.,  465000.,  835000.,  465000.,  755000., 1895000.,
       4395000.,  440000., 3195000., 7423000., 1685000.,  390000.,
        595000.,  565000.,  155000., 1895000.,  425000.,  351000.,
        835000., 4150000.,  499000.,  520000.,  320000.,  190000.,
        390000.,  585000.,  500000.,  478000.,  480000.,  485000.,
        660000.,  395000.,  675000.,  998000.,  340000.,  168000.,
        655000., 4690000., 2390000.,  360000.,  370000., 7423000.,
        590000.,  259000.,  710000., 1175000.,  465000.,  600000.,
        421000.,  840000.,  670000.,  330000., 1051000.,  260000.,
```

```
score5 = RSV5.score(x_train,y_train)
```

BaggingRegressor

```
#creating  parameter list to pass in RandomizedSearchCV
param6={'base_estimator':[None],'n_estimators':[0,2,5,10],
      'bootstrap':[True,False],'oob_score':[True,False],'warm_start':[True,False],
       'bootstrap_features':[True,False],'random_state':range(0,20)}
```

```
RSV6=RandomizedSearchCV(BaggingRegressor(),param6,cv=5)
```

```
RSV6.fit(x_train,y_train)
```

```
RandomizedSearchCV(cv=5, estimator=BaggingRegressor(),
                   param_distributions={'base_estimator': [None],
                                        'bootstrap': [True, False],
                                        'bootstrap_features': [True, False],
                                        'n_estimators': [0, 2, 5, 10],
                                        'oob_score': [True, False],
                                        'random_state': range(0, 20),
                                        'warm_start': [True, False]})
```

```
RSV6.best_params_
```

```
{'warm_start': True,
 'random_state': 12,
 'oob_score': False,
 'n_estimators': 10,
 'bootstrap_features': False,
 'bootstrap': True,
 'base_estimator': None}
```

```
RSV6_pred=RSV6.best_estimator_.predict(x_test)
```

```
RSV6_pred
```

```
array([ 799000. ,  652600. ,  233600. ,  974400. ,  602300. , 1473500. ,
        595400. ,  223000. ,  282000. ,  605000. ,  499000. , 3295000. ,
        599500. ,  520400. , 1930000. ,  310000. , 6439800. , 2480000. ,
        906600. , 2995000. ,  233000. ,  637100. , 1881000. ,  416500. ,
        490900. , 2712600. , 1143000. ,  521500. ,  288000. ,  899000. ,
       1951000. ,  481000. ,  835000. ,  294700. ,  829300. , 1730100. ,
       4395000. ,  407500. , 3217000. , 7286100. , 1299500. ,  455800. ,
        578000. ,  639000. ,  253400. , 1730100. ,  425000. ,  887400. ,
```

```
score6 = RSV6.score(x_train,y_train)
```

After performing RandomizedSearchCV method accuracy:

After performing RandomizedSearchCV method accuracy:

```
print("Accuracy for LinearRegression is ",score1*100,"%\n")
print("Accuracy for AdaBoostRegressor is ",score2*100,"%\n")
print("Accuracy for ElasticNet(alpha=0.0001) is ",score3*100,"%\n")
print("Accuracy for KNeighborsRegressor is ",score4*100,"%\n")
print("Accuracy for DecisionTreeRegressor is ",score5*100,"%\n")
print("Accuracy for BaggingRegressor is ",score6*100,"%")
```

```
Accuracy for LinearRegression is  19.920651849197935 %

Accuracy for AdaBoostRegressor is  46.30006178848507 %

Accuracy for ElasticNet(alpha=0.0001) is  19.920651849197935 %

Accuracy for KNeighborsRegressor is  100.0 %

Accuracy for DecisionTreeRegressor is  99.9997925488852 %

Accuracy for BaggingRegressor is  93.1382428208946 %
```

Selecting KNeighborsRegressor as final model for saving, as it was having good accuracy with model as well.

Saving the Best Model:

```
import joblib
joblib.dump(RSV4,"RSCPR.obj")
```

```
['RSCPR.obj']
```

```
RSVfile=joblib.load("RSCPR.obj")
RSVfile.predict(x_test)
```

```
array([ 799000.        ,  412033.80550763,  220000.        ,
       1025000.        ,  614849.5762396 , 1575000.        ,
        459280.52501306,  305105.64241383,  295000.        ,
        631936.72566773,  499000.        , 3366016.78604927,
        579362.46477122,  525051.52334772, 1930000.        ,
        310000.        , 1311625.1036861 , 3579952.15352909,
        870184.81621176, 2786455.24974295,  512805.91245694,
        599322.1032439 ,  752679.60282772, 1687456.51331861,
        343934.3018641 , 1767463.90779472, 1027286.68313695,
        666321.94216247,  260000.        ,  875000.        ,
       1951000.        ,  483295.25768397,  835000.        ,
        250715.79064489,  731119.7154237 ,  482561.60352938,
       4395000.        ,  440000.        , 5500000.        ,
       7423000.        , 1743446.05402131,  410909.69630147,
        595000.        ,  405750.65256375,  155000.        ,
        482561.60352938,  425000.        , 1533925.9069104 ,
        840229.85582036, 1334606.46005361,  503649.37210239,
       1810161.87893434,  320000.        ,  608061.01838121,
        390000.        ,  449855.8723886 ,  841607.14874644,
```

```
#end
```

CONCLUSION

- In the Car Price Prediction, I have extracted Brand, model, variant, manufacturing year, driven kilometers, fuel, number of owners, location and atlast target variable Price of the car from different websites then saved the extracted csv file into one excel sheet. Our dataset mainly consists of 10 columns and 4810 rows. We have one column named Unnamed: 0 however that is not required for further analysis.

- Then I did some preprocessing like dropping replacing '-' with NA, Converted price column into numeric, removed alphabetes from Driven_km and Man_year and then removed duplication of values. Then I have performed some visualization. After encoding object type variables, we have check for correlation.

- Trying finding out best random state and then used same for model building. Used 6 methods for model building then with the help of RandomizedSearchCV I have tried to improve accuracy. Finally, I decided togo ahead with the KNeighborsRegressor and saved the model.