

Import Librarys

```
In [2]: import numpy as np
import pandas as pd
import seaborn as sns
from matplotlib import pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error
```

Understand the data

```
In [3]: data = pd.read_csv("car_price_prediction_.csv")
```

```
In [4]: data.head()
```

```
Out[4]:
```

	Car ID	Brand	Year	Engine Size	Fuel Type	Transmission	Mileage	Condition	Price	Model
0	1	Tesla	2016	2.3	Petrol	Manual	114832	New	26613.92	Model X
1	2	BMW	2018	4.4	Electric	Manual	143190	Used	14679.61	5 Series
2	3	Audi	2013	4.5	Electric	Manual	181601	New	44402.61	A4
3	4	Tesla	2011	4.1	Diesel	Automatic	68682	New	86374.33	Model Y
4	5	Ford	2009	2.6	Diesel	Manual	223009	Like New	73577.10	Mustang

```
In [5]: data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2500 entries, 0 to 2499
Data columns (total 10 columns):
#   Column          Non-Null Count  Dtype
---  ---
0   Car ID          2500 non-null  int64
1   Brand           2500 non-null  object
2   Year            2500 non-null  int64
3   Engine Size     2500 non-null  float64
4   Fuel Type       2500 non-null  object
5   Transmission    2500 non-null  object
6   Mileage         2500 non-null  int64
7   Condition       2500 non-null  object
8   Price           2500 non-null  float64
9   Model           2500 non-null  object
dtypes: float64(2), int64(3), object(5)
memory usage: 195.4+ KB
```

```
In [6]: data.describe()
```

Out[6]:

	Car ID	Year	Engine Size	Mileage	Price
count	2500.00000	2500.0000	2500.000000	2500.000000	2500.000000
mean	1250.50000	2011.6268	3.465240	149749.844800	52638.022532
std	721.83216	6.9917	1.432053	87919.952034	27295.833455
min	1.00000	2000.0000	1.000000	15.000000	5011.270000
25%	625.75000	2005.0000	2.200000	71831.500000	28908.485000
50%	1250.50000	2012.0000	3.400000	149085.000000	53485.240000
75%	1875.25000	2018.0000	4.700000	225990.500000	75838.532500
max	2500.00000	2023.0000	6.000000	299967.000000	99982.590000

In [7]:

data.isna().sum()

Out[7]:

Car ID	0
Brand	0
Year	0
Engine Size	0
Fuel Type	0
Transmission	0
Mileage	0
Condition	0
Price	0
Model	0
dtype:	int64

In [8]:

data.head()

Out[8]:

	Car ID	Brand	Year	Engine Size	Fuel Type	Transmission	Mileage	Condition	Price	Model
0	1	Tesla	2016	2.3	Petrol	Manual	114832	New	26613.92	Model X
1	2	BMW	2018	4.4	Electric	Manual	143190	Used	14679.61	5 Series
2	3	Audi	2013	4.5	Electric	Manual	181601	New	44402.61	A4
3	4	Tesla	2011	4.1	Diesel	Automatic	68682	New	86374.33	Model Y
4	5	Ford	2009	2.6	Diesel	Manual	223009	Like New	73577.10	Mustang

Clean the data

In [9]:

data = data.drop("Car ID", axis = 1)

In [10]:

data.head()

Out[10]:

	Brand	Year	Engine Size	Fuel Type	Transmission	Mileage	Condition	Price	Model
0	Tesla	2016	2.3	Petrol	Manual	114832	New	26613.92	Model X
1	BMW	2018	4.4	Electric	Manual	143190	Used	14679.61	5 Series
2	Audi	2013	4.5	Electric	Manual	181601	New	44402.61	A4
3	Tesla	2011	4.1	Diesel	Automatic	68682	New	86374.33	Model Y
4	Ford	2009	2.6	Diesel	Manual	223009	Like New	73577.10	Mustang

In [11]:

```
data.shape
```

Out[11]: (2500, 9)

In [12]:

```
data["Year"] = pd.to_datetime(data["Year"])
```

In [13]:

```
data["Year"] = data["Year"].dt.year
```

In [14]:

```
data
```

Out[14]:

	Brand	Year	Engine Size	Fuel Type	Transmission	Mileage	Condition	Price	Model
0	Tesla	1970	2.3	Petrol	Manual	114832	New	26613.92	Model X
1	BMW	1970	4.4	Electric	Manual	143190	Used	14679.61	5 Series
2	Audi	1970	4.5	Electric	Manual	181601	New	44402.61	A4
3	Tesla	1970	4.1	Diesel	Automatic	68682	New	86374.33	Model Y
4	Ford	1970	2.6	Diesel	Manual	223009	Like New	73577.10	Mustang
...
2495	Audi	1970	2.4	Petrol	Automatic	22650	Like New	61384.10	Q5
2496	Audi	1970	5.7	Hybrid	Manual	77701	Like New	24710.35	A3
2497	Ford	1970	1.1	Hybrid	Manual	272827	Like New	29902.45	Fiesta
2498	Audi	1970	4.5	Diesel	Manual	229164	Like New	46085.67	Q5
2499	Toyota	1970	4.6	Diesel	Automatic	80978	Used	16594.14	RAV4

2500 rows × 9 columns

In [15]:

```
data["Brand"].unique()
```

Out[15]: array(['Tesla', 'BMW', 'Audi', 'Ford', 'Honda', 'Mercedes', 'Toyota'],
 dtype=object)

Analyze the data

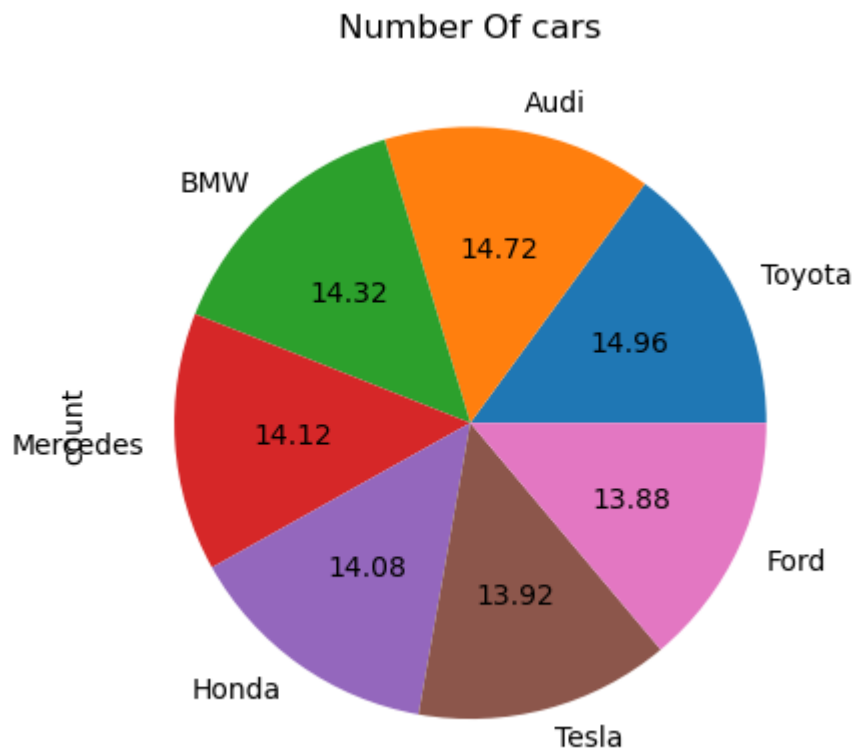
In [16]:

```
data.groupby("Brand").count()["Fuel Type"]
```

```
Out[16]: Brand
Audi      368
BMW       358
Ford      347
Honda     352
Mercedes  353
Tesla     348
Toyota    374
Name: Fuel Type, dtype: int64
```

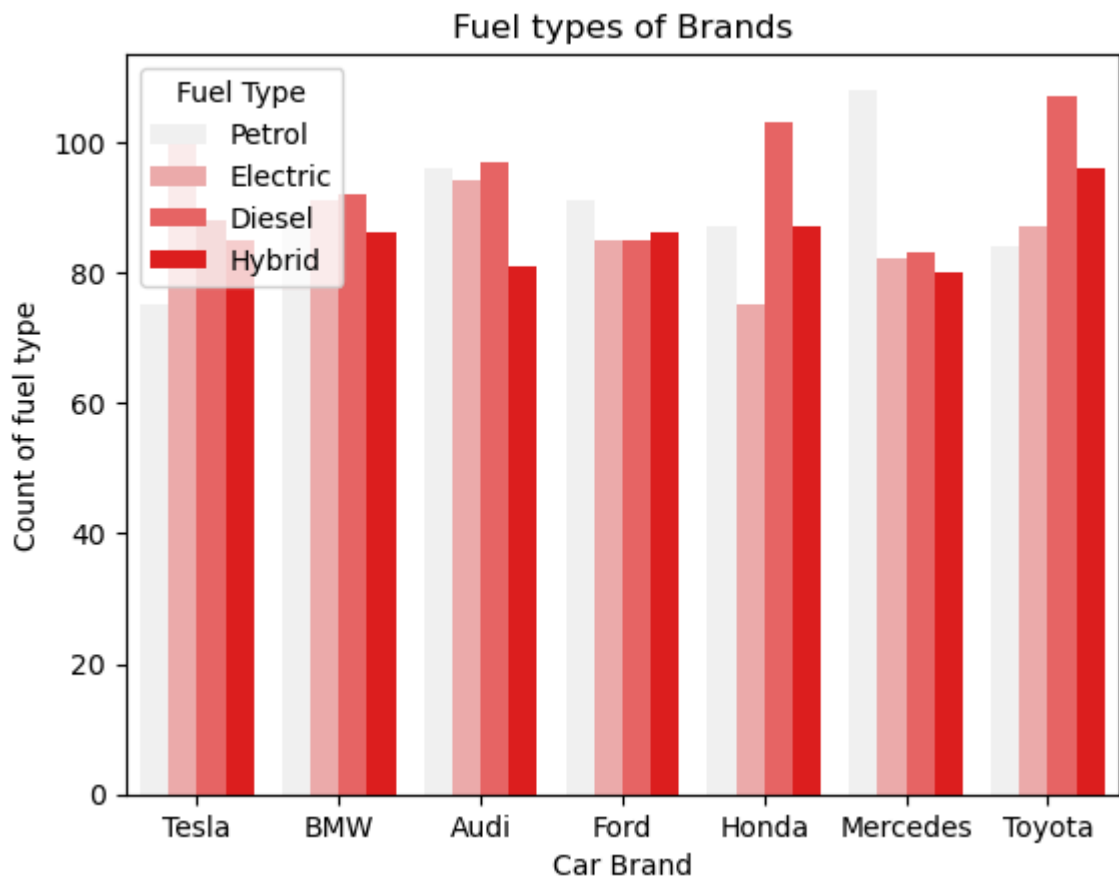
```
In [17]: data["Brand"].value_counts().plot(kind = "pie" , autopct = "%.2f" , title = "Number
```

```
Out[17]: <Axes: title={'center': 'Number Of cars'}, ylabel='count'>
```



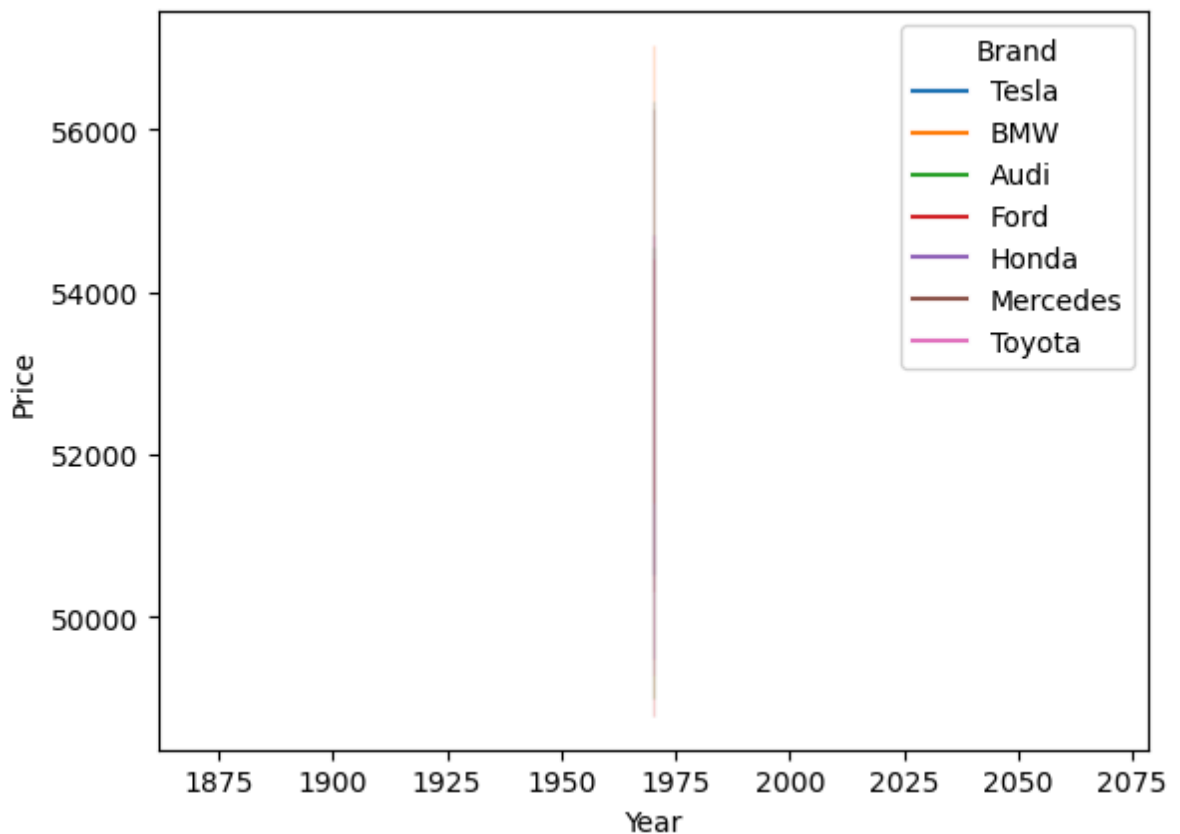
```
In [18]: sns.countplot(data = data , x = "Brand" , hue = "Fuel Type" , color = "red")
plt.xlabel("Car Brand")
plt.ylabel("Count of fuel type")
plt.title("Fuel types of Brands")
```

```
Out[18]: Text(0.5, 1.0, 'Fuel types of Brands')
```



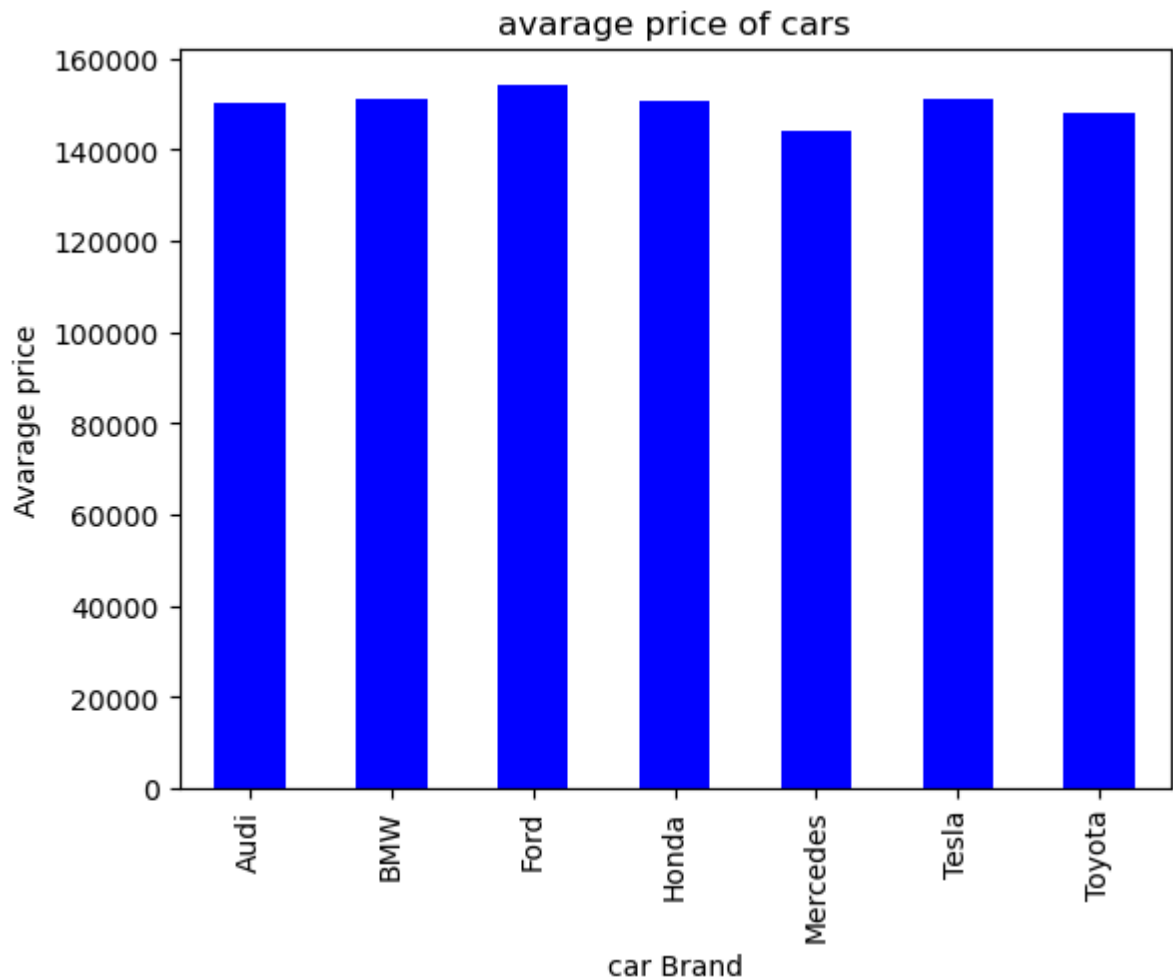
```
In [19]: sns.lineplot(data = data , x = "Year" , y = "Price" , hue = "Brand")
```

```
Out[19]: <Axes: xlabel='Year', ylabel='Price'>
```



```
In [20]: data.groupby("Brand")["Mileage"].mean().plot(kind = "bar" , color = "blue" , xlabel
```

```
Out[20]: <Axes: title={'center': 'avarage price of cars'}, xlabel='car Brand', ylabel='Avarage price'>
```



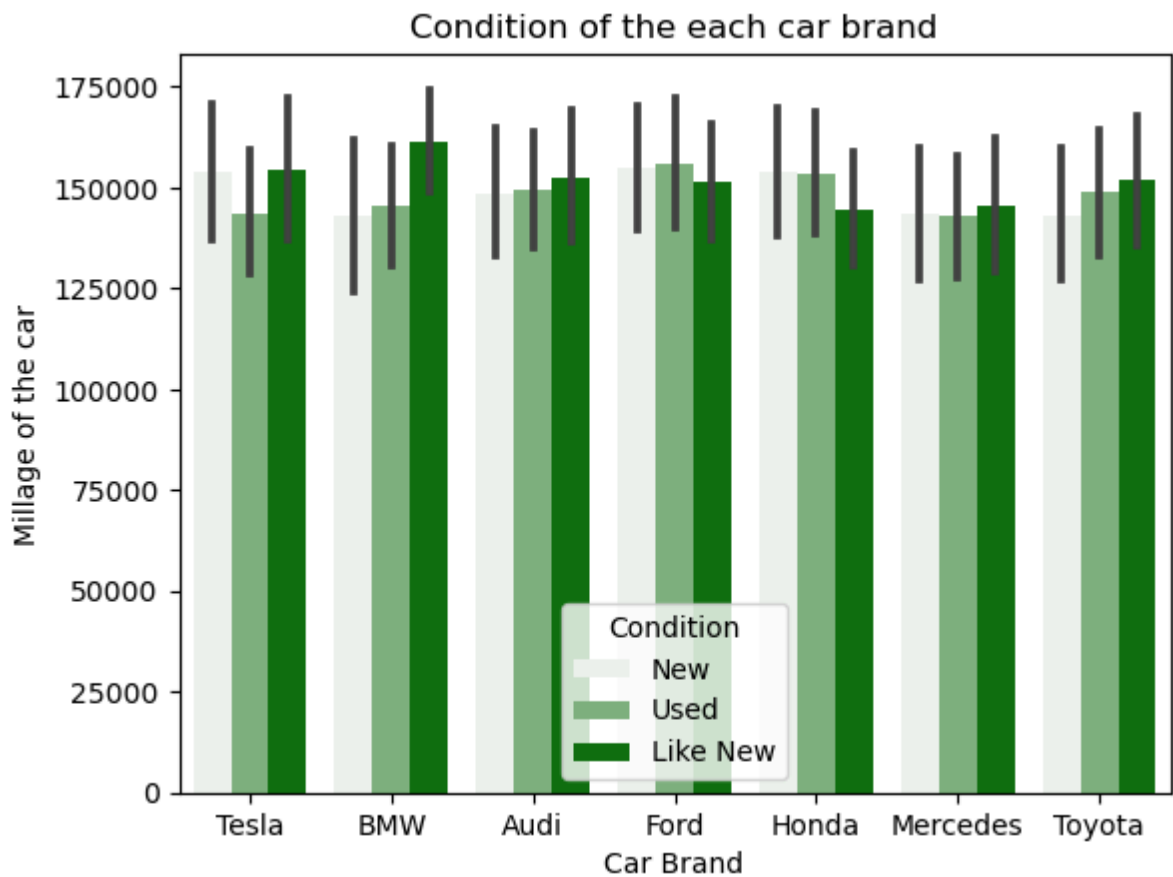
```
In [21]: data.head()
```

```
Out[21]:
```

	Brand	Year	Engine Size	Fuel Type	Transmission	Mileage	Condition	Price	Model
0	Tesla	1970	2.3	Petrol	Manual	114832	New	26613.92	Model X
1	BMW	1970	4.4	Electric	Manual	143190	Used	14679.61	5 Series
2	Audi	1970	4.5	Electric	Manual	181601	New	44402.61	A4
3	Tesla	1970	4.1	Diesel	Automatic	68682	New	86374.33	Model Y
4	Ford	1970	2.6	Diesel	Manual	223009	Like New	73577.10	Mustang

```
In [22]: sns.barplot(data = data ,x = "Brand", y = "Mileage" , hue = "Condition" ,color = "g")
plt.xlabel("Car Brand")
plt.ylabel("Millage of the car")
plt.title("Condition of the each car brand")
```

```
Out[22]: Text(0.5, 1.0, 'Condition of the each car brand')
```



In [23]: data

Out[23]:

	Brand	Year	Engine Size	Fuel Type	Transmission	Mileage	Condition	Price	Model
0	Tesla	1970	2.3	Petrol	Manual	114832	New	26613.92	Model X
1	BMW	1970	4.4	Electric	Manual	143190	Used	14679.61	5 Series
2	Audi	1970	4.5	Electric	Manual	181601	New	44402.61	A4
3	Tesla	1970	4.1	Diesel	Automatic	68682	New	86374.33	Model Y
4	Ford	1970	2.6	Diesel	Manual	223009	Like New	73577.10	Mustang
...
2495	Audi	1970	2.4	Petrol	Automatic	22650	Like New	61384.10	Q5
2496	Audi	1970	5.7	Hybrid	Manual	77701	Like New	24710.35	A3
2497	Ford	1970	1.1	Hybrid	Manual	272827	Like New	29902.45	Fiesta
2498	Audi	1970	4.5	Diesel	Manual	229164	Like New	46085.67	Q5
2499	Toyota	1970	4.6	Diesel	Automatic	80978	Used	16594.14	RAV4

2500 rows × 9 columns

In [24]: `Brand = pd.get_dummies(data["Brand"], drop_first = True)`

In [25]: `Brand = Brand.astype(int)`

In [26]: `data = pd.concat([Brand, data], axis = 1)`

In [27]: data

Out[27]:

	BMW	Ford	Honda	Mercedes	Tesla	Toyota	Brand	Year	Engine Size	Fuel Type	Transmission
0	0	0	0	0	1	0	Tesla	1970	2.3	Petrol	Manual
1	1	0	0	0	0	0	BMW	1970	4.4	Electric	Manual
2	0	0	0	0	0	0	Audi	1970	4.5	Electric	Manual
3	0	0	0	0	1	0	Tesla	1970	4.1	Diesel	Automatic
4	0	1	0	0	0	0	Ford	1970	2.6	Diesel	Manual
...
2495	0	0	0	0	0	0	Audi	1970	2.4	Petrol	Automatic
2496	0	0	0	0	0	0	Audi	1970	5.7	Hybrid	Manual
2497	0	1	0	0	0	0	Ford	1970	1.1	Hybrid	Manual
2498	0	0	0	0	0	0	Audi	1970	4.5	Diesel	Manual
2499	0	0	0	0	0	1	Toyota	1970	4.6	Diesel	Automatic

2500 rows × 15 columns

```
In [28]: fuel_type = pd.get_dummies(data["Fuel Type"], drop_first = True)
fuel_type = fuel_type.astype(int)
data = pd.concat([data, fuel_type], axis = 1)
```

```
In [29]: data.drop("Fuel Type", axis = 1)
```

Out[29]:

	BMW	Ford	Honda	Mercedes	Tesla	Toyota	Brand	Year	Engine Size	Transmission	Mileage
0	0	0	0	0	1	0	Tesla	1970	2.3	Manual	114832
1	1	0	0	0	0	0	BMW	1970	4.4	Manual	143190
2	0	0	0	0	0	0	Audi	1970	4.5	Manual	181601
3	0	0	0	0	1	0	Tesla	1970	4.1	Automatic	68682
4	0	1	0	0	0	0	Ford	1970	2.6	Manual	223009
...
2495	0	0	0	0	0	0	Audi	1970	2.4	Automatic	22650
2496	0	0	0	0	0	0	Audi	1970	5.7	Manual	77701
2497	0	1	0	0	0	0	Ford	1970	1.1	Manual	272827
2498	0	0	0	0	0	0	Audi	1970	4.5	Manual	229164
2499	0	0	0	0	0	1	Toyota	1970	4.6	Automatic	80978

2500 rows × 17 columns

```
In [30]: trans = pd.get_dummies(data["Transmission"])
trans = trans.astype(int)
```



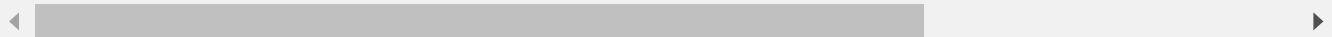
```
data = pd.concat([trans , data],axis = 1)
```

```
In [31]: data.drop(["Automatic", "Automatic" ,"Transmission" , "Brand", "Fuel Type"],axis =
```

```
Out[31]:
```

	Manual	BMW	Ford	Honda	Mercedes	Tesla	Toyota	Year	Engine Size	Mileage	Condition
0	1	0	0	0	0	1	0	1970	2.3	114832	New
1	1	1	0	0	0	0	0	1970	4.4	143190	Used
2	1	0	0	0	0	0	0	1970	4.5	181601	New
3	0	0	0	0	0	1	0	1970	4.1	68682	New
4	1	0	1	0	0	0	0	1970	2.6	223009	Like New
...
2495	0	0	0	0	0	0	0	1970	2.4	22650	Like New
2496	1	0	0	0	0	0	0	1970	5.7	77701	Like New
2497	1	0	1	0	0	0	0	1970	1.1	272827	Like New
2498	1	0	0	0	0	0	0	1970	4.5	229164	Like New
2499	0	0	0	0	0	0	1	1970	4.6	80978	Used

2500 rows × 16 columns



```
In [32]: df = data
```

```
In [33]: condition = pd.get_dummies(data["Condition"])
condition = condition.astype(int)
data = pd.concat([condition , data] , axis = 1)
```

```
In [34]: data
```

Out[34]:

	Like New	New	Used	Automatic	Manual	BMW	Ford	Honda	Mercedes	Tesla	...	Engine Size
0	0	1	0	0	1	0	0	0	0	1	...	2.3
1	0	0	1	0	1	1	0	0	0	0	...	4.4
2	0	1	0	0	1	0	0	0	0	0	...	4.5
3	0	1	0	1	0	0	0	0	0	1	...	4.1
4	1	0	0	0	1	0	1	0	0	0	...	2.6
...
2495	1	0	0	1	0	0	0	0	0	0	...	2.4
2496	1	0	0	0	1	0	0	0	0	0	...	5.7
2497	1	0	0	0	1	0	1	0	0	0	...	1.1
2498	1	0	0	0	1	0	0	0	0	0	...	4.5
2499	0	0	1	1	0	0	0	0	0	0	...	4.6

2500 rows × 23 columns

In [35]: data = data.drop(["Fuel Type" , "Transmission" , "Condition" , "Model"] , axis = 1)

In [36]: data = data.drop("Brand" , axis = 1)

In [37]: data

Out[37]:

	Like New	New	Used	Automatic	Manual	BMW	Ford	Honda	Mercedes	Tesla	Toyota	Year
0	0	1	0	0	1	0	0	0	0	1	0	1970
1	0	0	1	0	1	1	0	0	0	0	0	1970
2	0	1	0	0	1	0	0	0	0	0	0	1970
3	0	1	0	1	0	0	0	0	0	1	0	1970
4	1	0	0	0	1	0	1	0	0	0	0	1970
...
2495	1	0	0	1	0	0	0	0	0	0	0	1970
2496	1	0	0	0	1	0	0	0	0	0	0	1970
2497	1	0	0	0	1	0	1	0	0	0	0	1970
2498	1	0	0	0	1	0	0	0	0	0	0	1970
2499	0	0	1	1	0	0	0	0	0	0	1	1970

2500 rows × 18 columns

Split the data

```
In [38]: x = data[['Like New', 'New', 'Used', 'Automatic', 'Manual', 'BMW', 'Ford',
                'Honda', 'Mercedes', 'Tesla', 'Toyota', 'Year', 'Engine Size',
                'Electric', 'Hybrid', 'Petrol']]
y = data[["Mileage", "Price"]]
```

```
In [39]: x
```

```
Out[39]:
```

	Like New	New	Used	Automatic	Manual	BMW	Ford	Honda	Mercedes	Tesla	Toyota	Year
0	0	1	0	0	1	0	0	0	0	1	0	1970
1	0	0	1	0	1	1	0	0	0	0	0	1970
2	0	1	0	0	1	0	0	0	0	0	0	1970
3	0	1	0	1	0	0	0	0	0	1	0	1970
4	1	0	0	0	1	0	1	0	0	0	0	1970
...
2495	1	0	0	1	0	0	0	0	0	0	0	1970
2496	1	0	0	0	1	0	0	0	0	0	0	1970
2497	1	0	0	0	1	0	1	0	0	0	0	1970
2498	1	0	0	0	1	0	0	0	0	0	0	1970
2499	0	0	1	1	0	0	0	0	0	0	1	1970

2500 rows × 16 columns

```
In [40]: y
```

```
Out[40]:
```

	Mileage	Price
0	114832	26613.92
1	143190	14679.61
2	181601	44402.61
3	68682	86374.33
4	223009	73577.10
...
2495	22650	61384.10
2496	77701	24710.35
2497	272827	29902.45
2498	229164	46085.67
2499	80978	16594.14

2500 rows × 2 columns

```
In [41]: x_train , x_test , y_train , y_test = train_test_split(x , y , test_size = 0.2 , ra
```

```
In [42]: x_train
```

```
Out[42]:
```

	Like New	New	Used	Automatic	Manual	BMW	Ford	Honda	Mercedes	Tesla	Toyota	Year
1865	1	0	0	1	0	0	0	0	0	0	1	1970
2325	0	1	0	0	1	0	0	0	0	1	0	1970
2263	1	0	0	1	0	0	0	0	0	1	0	1970
728	0	0	1	0	1	0	0	1	0	0	0	1970
1975	0	1	0	0	1	1	0	0	0	0	0	1970
...
2009	0	1	0	0	1	0	0	0	0	0	0	1970
1180	0	0	1	0	1	1	0	0	0	0	0	1970
1344	0	0	1	1	0	0	1	0	0	0	0	1970
527	0	0	1	1	0	0	0	0	0	0	1	1970
1289	0	1	0	0	1	0	0	1	0	0	0	1970

2000 rows × 16 columns

```
In [43]: x_train.shape
```

```
Out[43]: (2000, 16)
```

```
In [44]: x_test
```

```
Out[44]:
```

	Like New	New	Used	Automatic	Manual	BMW	Ford	Honda	Mercedes	Tesla	Toyota	Year
648	1	0	0	1	0	0	0	1	0	0	0	1970
331	0	0	1	0	1	0	0	0	0	0	1	1970
1158	0	1	0	0	1	0	0	0	0	0	1	1970
2300	1	0	0	1	0	1	0	0	0	0	0	1970
1967	1	0	0	0	1	0	1	0	0	0	0	1970
...
1758	1	0	0	1	0	0	0	0	0	0	1	1970
801	1	0	0	0	1	0	0	0	0	0	1	1970
1616	1	0	0	1	0	0	0	0	1	0	0	1970
2178	0	0	1	0	1	0	0	0	0	0	1	1970
1911	1	0	0	0	1	0	0	0	0	0	1	1970

500 rows × 16 columns

```
In [45]: x_test.shape
```

Out[45]: (500, 16)

In [46]: y_train

Out[46]:

	Mileage	Price
1865	210323	29390.09
2325	28365	34931.80
2263	291727	82465.80
728	277845	21525.04
1975	54418	68178.02
...
2009	3273	36792.44
1180	16191	77017.26
1344	145762	99153.11
527	272409	35238.25
1289	126372	96800.26

2000 rows × 2 columns

In [47]: y_train.shape

Out[47]: (2000, 2)

In [48]: y_test

Out[48]:

	Mileage	Price
648	129851	65324.02
331	15487	77417.09
1158	93034	78449.12
2300	280372	43398.25
1967	283539	26755.14
...
1758	160592	56158.34
801	231832	62939.91
1616	201664	68739.20
2178	269915	73796.14
1911	178475	95329.96

500 rows × 2 columns

In [49]: y_test.shape

Out[49]: (500, 2)

training

```
In [50]: model = LinearRegression()
```

```
In [51]: model
```

```
Out[51]: ▼ LinearRegression  
LinearRegression()
```

```
In [52]: model.fit(x_train , y_train)
```

```
Out[52]: ▼ LinearRegression  
LinearRegression()
```

predictions

```
In [53]: y_prediction = model.predict(x_test)
```

```
In [54]: y_prediction
```

```
Out[54]: array([[161029.70289774, 51878.14952212],
 [144118.99589469, 55756.49952697],
 [141755.0110939 , 56464.05077334],
 [144620.73574505, 51783.33971457],
 [159288.58748748, 51779.22259637],
 [146743.3216414 , 49991.75725279],
 [144811.37207487, 54145.84298935],
 [160369.53890725, 55062.67198465],
 [153727.13595776, 54330.01492801],
 [161125.43786948, 50641.4748312 ],
 [150320.57356461, 50170.94583902],
 [152599.97672912, 53591.18549734],
 [151536.38207707, 52386.35497232],
 [149054.21699188, 49792.72229095],
 [165555.12206581, 52275.12156679],
 [160780.0678951 , 50538.32295445],
 [165182.57144491, 52229.25790294],
 [144147.81277263, 53882.25102295],
 [158851.38396664, 56856.16668847],
 [149608.48407741, 54137.46228096],
 [153620.95931145, 56669.72334829],
 [157009.41076994, 56306.02334582],
 [153070.705169 , 52259.6307145 ],
 [138398.65732826, 48410.62872286],
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In [55]: y_test

Out[55]:

	Mileage	Price
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331	15487	77417.09
1158	93034	78449.12
2300	280372	43398.25
1967	283539	26755.14
...
1758	160592	56158.34
801	231832	62939.91
1616	201664	68739.20
2178	269915	73796.14
1911	178475	95329.96

500 rows × 2 columns

In [56]: `error = mean_squared_error(y_prediction , y_test)`

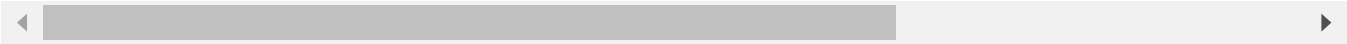
In [57]: `error`

Out[57]: 4227868973.771002

In [58]: `data.head()`

Out[58]:

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3	0	1	0	1	0	0	0	0	0	1	0	1970	
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In [59]: `y_prediction`

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