In [1]:
```python
import pandas as pd

train = pd.read_csv('train-data.csv')

train.info() #.info() 함수는 데이터에 대한 전반적인 정보를 나타냅니다.
#df를 구성하는 행과 열의 크기, 컬럼명, 컬럼을 구성하는 값의 자료형 등을 출력해줍니다.
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 6019 entries, 0 to 6018
Data columns (total 14 columns):
 #   Column             Non-Null Count  Dtype
---  ------             --------------  -----
 0   Unnamed: 0         6019 non-null   int64
 1   Name               6019 non-null   object
 2   Location           6019 non-null   object
 3   Year               6019 non-null   int64
 4   Kilometers_Driven  6019 non-null   int64
 5   Fuel_Type          6019 non-null   object
 6   Transmission       6019 non-null   object
 7   Owner_Type         6019 non-null   object
 8   Mileage            6017 non-null   object
 9   Engine             5983 non-null   object
 10  Power              5983 non-null   object
 11  Seats              5977 non-null   float64
 12  New_Price          824 non-null    object
 13  Price              6019 non-null   float64
dtypes: float64(2), int64(3), object(9)
memory usage: 658.5+ KB
```

데이터 분석

14개의 항목, 6019개의 데이터, 엔진 마력, 신차가격, 좌석 수에 결측치가 있다.

8 Mileage 6017 non-null object
연비 Mileage 은 2개만 빠졌다.

9 Engine 5983 non-null object

10 Power 5983 non-null object

11 Seats 5977 non-null float64

12 New_Price 824 non-null object
신차 가격은 결측치가 많다.

13 Price 6019 non-null float64

Name의 특성부터 처리 Name은 회사명만 남기고 뒤의 글자는 삭제한다.

Owner_Type 전처리 & csv 파일에서 인덱스 삭제

In [2]:
```python
train['Owner_Type'] = train['Owner_Type'].replace('First', 1)
train['Owner_Type'] = train['Owner_Type'].replace('Second', 2)
train['Owner_Type'] = train['Owner_Type'].replace('Third', 3)
train['Owner_Type'] = train['Owner_Type'].replace('Fourth & Above', 4)
train = train.drop('Unnamed: 0', axis=1)
train
#replace를 하려면, replace를 쓰고나서 다시 옮겨줘야한다. 그렇지 않으면 저장이 안되는듯.
#데이터 자체에 인덱스가 있어서 해당 열을 지워야했다.
```

Out[2]:

	Name	Location	Year	Kilometers_Driven	Fuel_Type	Transmission	Owner_Type	Mileage	Engine	Power	Seats	New_Price	Price
0	Maruti Wagon R LXI CNG	Mumbai	2010	72000	CNG	Manual	1	26.6 km/kg	998 CC	58.16 bhp	5.0	NaN	1.75
1	Hyundai Creta 1.6 CRDi SX Option	Pune	2015	41000	Diesel	Manual	1	19.67 kmpl	1582 CC	126.2 bhp	5.0	NaN	12.50
2	Honda Jazz V	Chennai	2011	46000	Petrol	Manual	1	18.2 kmpl	1199 CC	88.7 bhp	5.0	8.61 Lakh	4.50
3	Maruti Ertiga VDI	Chennai	2012	87000	Diesel	Manual	1	20.77 kmpl	1248 CC	88.76 bhp	7.0	NaN	6.00
4	Audi A4 New 2.0 TDI Multitronic	Coimbatore	2013	40670	Diesel	Automatic	2	15.2 kmpl	1968 CC	140.8 bhp	5.0	NaN	17.74
...	...	...	...	...	...	...	...	...	...	...	...	...	...
6014	Maruti Swift VDI	Delhi	2014	27365	Diesel	Manual	1	28.4 kmpl	1248 CC	74 bhp	5.0	7.88 Lakh	4.75
6015	Hyundai Xcent 1.1 CRDi S	Jaipur	2015	100000	Diesel	Manual	1	24.4 kmpl	1120 CC	71 bhp	5.0	NaN	4.00
6016	Mahindra Xylo D4 BSIV	Jaipur	2012	55000	Diesel	Manual	2	14.0 kmpl	2498 CC	112 bhp	8.0	NaN	2.90
6017	Maruti Wagon R VXI	Kolkata	2013	46000	Petrol	Manual	1	18.9 kmpl	998 CC	67.1 bhp	5.0	NaN	2.65
6018	Chevrolet Beat Diesel	Hyderabad	2011	47000	Diesel	Manual	1	25.44 kmpl	936 CC	57.6 bhp	5.0	NaN	2.50

6019 rows × 13 columns

Name 전처리

In [3]:
```python
train['Name'].str.extract('([A-Za-z]+).')
#[A-Za-z]는 문자를 대소문자 관계없이 하나를 추출, +가 붙어서 단어 단위로 추출한다.
train['Name'] = train['Name'].str.extract('([A-Za-z]+).')
```

Mileage 전처리

In [4]:
```python
train[train['Mileage'].isnull() == True]
#train데이터에는 Mileage에 결측값이 있다.
```

Out[4]:

	Name	Location	Year	Kilometers_Driven	Fuel_Type	Transmission	Owner_Type	Mileage	Engine	Power	Seats	New_Price	Price
4446	Mahindra	Chennai	2016	50000	Electric	Automatic	1	NaN	72 CC	41 bhp	5.0	13.58 Lakh	13.00
4904	Toyota	Mumbai	2011	44000	Electric	Automatic	1	NaN	1798 CC	73 bhp	5.0	NaN	12.75

In [5]:
```python
train[train['Fuel_Type'] == "Electric"]
```

Out[5]:

	Name	Location	Year	Kilometers_Driven	Fuel_Type	Transmission	Owner_Type	Mileage	Engine	Power	Seats	New_Price	Price
4446	Mahindra	Chennai	2016	50000	Electric	Automatic	1	NaN	72 CC	41 bhp	5.0	13.58 Lakh	13.00
4904	Toyota	Mumbai	2011	44000	Electric	Automatic	1	NaN	1798 CC	73 bhp	5.0	NaN	12.75

Madindra E verito D4 만이, 전기차이다.

따라서 연비가 리터당이 아니라 완충시 거리로 나오기 때문에 연비가 결측치로 나타난 것이다.

이런 경우, 데이터가 한 개뿐이라서 전체 모델에 미치는 영향은 아주 미미할 것으로 생각했다. 따라서 마힌드라 차량의 데이터는 지우기로 결정했다.

반면, 도요타 프리우스 2011년식은 29.3으로 연비가 존재한다. 따라서 이 경우에는 연비를 새로 입력해줬다.

In [6]:
```python
train.loc[4904,'Mileage'] = 29.3
#직접 찾은 도요타 프리우스의 연비를 입력해준다.
train['Mileage'].dropna()
#Mileage에 결측치 NaN값이 있는 데이터는 삭제한다.
```

Out[6]:
```
0       26.6 km/kg
1       19.67 kmpl
2        18.2 kmpl
3       20.77 kmpl
4        15.2 kmpl
           ...
6014     28.4 kmpl
6015     24.4 kmpl
6016     14.0 kmpl
6017     18.9 kmpl
6018    25.44 kmpl
Name: Mileage, Length: 6018, dtype: object
```

In [7]:
```python
train[train['Mileage'] == '0.0 kmpl']
#아래 출력에서 보듯이, 연비가 0.0kmpl인 차량들이 있다.
#이러한 이상치들은 우선 연비의 중앙값으로 채운 뒤, 나중에 모델의 성능이 떨어지면
#그때 더 세세한 전처리를 해보도록 할 것이다.
```

Out[7]:

	Name	Location	Year	Kilometers_Driven	Fuel_Type	Transmission	Owner_Type	Mileage	Engine	Power	Seats	New_Price	Price
14	Land	Pune	2012	85000	Diesel	Automatic	2	0.0 kmpl	2179 CC	115 bhp	5.0	NaN	17.50
67	Mercedes	Coimbatore	2019	15369	Diesel	Automatic	1	0.0 kmpl	1950 CC	194 bhp	5.0	49.14 Lakh	35.67
79	Hyundai	Hyderabad	2005	87591	Petrol	Manual	1	0.0 kmpl	1086 CC	null bhp	5.0	NaN	1.30
194	Honda	Ahmedabad	2007	60006	Petrol	Manual	1	0.0 kmpl	NaN	NaN	NaN	NaN	2.95
229	Ford	Bangalore	2015	70436	Diesel	Manual	1	0.0 kmpl	1498 CC	99 bhp	NaN	NaN	3.60
...	...	...	...	...	...	...	...	...	...	...	...	...	...
5647	Toyota	Mumbai	2001	227000	Diesel	Manual	4	0.0 kmpl	2446 CC	null bhp	8.0	NaN	2.20
5875	Mercedes	Ahmedabad	2019	4000	Diesel	Automatic	1	0.0 kmpl	1950 CC	194 bhp	5.0	49.14 Lakh	35.00
5943	Mahindra	Chennai	2002	75000	Diesel	Manual	1	0.0 kmpl	2112 CC	null bhp	6.0	NaN	1.70
5972	Hyundai	Mumbai	2008	65000	Petrol	Manual	2	0.0 kmpl	1086 CC	62 bhp	5.0	NaN	1.39
6011	Skoda	Hyderabad	2009	53000	Petrol	Automatic	1	0.0 kmpl	3597 CC	262.6 bhp	5.0	NaN	4.75

68 rows × 13 columns

오차 발생 가능성

아래 출력에서 보듯이, 연비가 0.0kmpl인 차량들이 있다.

이러한 이상치들은 우선 연비의 중앙값으로 채운 뒤, 나중에 모델의 성능이 떨어지면

그때 더 세세한 전처리를 해보도록 할 것이다.

In [8]:
```python
import numpy as np
train['Mileage'] = train["Mileage"].str.extract('([0-9]+\.[0-9]+)')
train['Mileage'] = train['Mileage'].astype(float)
train['Mileage'] = train['Mileage'].replace(0, train['Mileage'].median())

#연비 항목이 '0.0kmpl' 이었던 값들을, 우선 float형으로 바꿔주고,
#연비의 중앙값을 대입했다. (이 과정에서 정확도가 떨어질 것 같다.
```

Engine 전처리

In [9]:
```python
train[train['Engine'].isnull() == True]
#아래 출력에서 보듯이, Engine에 결측값들이 있다.
#또한 이 데이터는 특이하게, Engine 특성에 결측값이 있는 데이터들은 모두 Power특성도 결측되어있다.
#이러한 이상치들은 우선 Engine의 중앙값으로 채운 뒤, 나중에 모델의 성능이 떨어지면
#그때 더 세세한 전처리를 해보도록 할 것이다.
```

Out[9]:

	Name	Location	Year	Kilometers_Driven	Fuel_Type	Transmission	Owner_Type	Mileage	Engine	Power	Seats	New_Price	Price
194	Honda	Ahmedabad	2007	60006	Petrol	Manual	1	18.15	NaN	NaN	NaN	NaN	2.95
208	Maruti	Kolkata	2010	42001	Petrol	Manual	1	16.10	NaN	NaN	NaN	NaN	2.11
733	Maruti	Chennai	2006	97800	Petrol	Manual	3	16.10	NaN	NaN	NaN	NaN	1.75
749	Land	Mumbai	2008	55001	Diesel	Automatic	2	18.15	NaN	NaN	NaN	NaN	26.50
1294	Honda	Delhi	2009	55005	Petrol	Manual	1	12.80	NaN	NaN	NaN	NaN	3.20
1327	Maruti	Hyderabad	2015	50295	Petrol	Manual	1	16.10	NaN	NaN	NaN	NaN	5.80
1385	Honda	Pune	2004	115000	Petrol	Manual	2	18.15	NaN	NaN	NaN	NaN	1.50
1460	Land	Coimbatore	2008	69078	Petrol	Manual	1	18.15	NaN	NaN	NaN	NaN	40.88
2074	Maruti	Pune	2011	24255	Petrol	Manual	1	16.10	NaN	NaN	NaN	NaN	3.15
2096	Hyundai	Coimbatore	2004	52146	Petrol	Manual	1	18.15	NaN	NaN	NaN	NaN	1.93
2264	Toyota	Pune	2012	24500	Petrol	Manual	2	18.30	NaN	NaN	NaN	NaN	2.95
2325	Maruti	Pune	2015	67000	Petrol	Manual	1	16.10	NaN	NaN	NaN	NaN	4.70
2335	Maruti	Mumbai	2007	55000	Petrol	Manual	2	16.10	NaN	NaN	NaN	NaN	1.75
2530	BMW	Kochi	2014	64158	Diesel	Automatic	1	18.48	NaN	NaN	NaN	NaN	17.89
2542	Hyundai	Bangalore	2011	65000	Petrol	Manual	2	18.15	NaN	NaN	NaN	NaN	3.15
2623	BMW	Pune	2012	95000	Diesel	Automatic	2	18.48	NaN	NaN	NaN	NaN	18.00
2668	Maruti	Kolkata	2014	32986	Petrol	Manual	1	16.10	NaN	NaN	NaN	NaN	4.24
2737	Maruti	Jaipur	2001	200000	Petrol	Manual	1	12.00	NaN	NaN	NaN	NaN	0.70
2780	Hyundai	Pune	2009	100000	Petrol	Manual	1	18.15	NaN	NaN	NaN	NaN	1.60
2842	Hyundai	Bangalore	2012	43000	Petrol	Manual	1	18.15	NaN	NaN	NaN	NaN	3.25
3272	BMW	Mumbai	2008	81000	Diesel	Automatic	2	18.48	NaN	NaN	NaN	NaN	10.50
3404	Maruti	Jaipur	2006	125000	Petrol	Manual	4	16.10	NaN	NaN	NaN	NaN	2.35
3520	BMW	Delhi	2012	90000	Diesel	Automatic	1	18.48	NaN	NaN	NaN	NaN	14.50
3522	Hyundai	Kochi	2012	66400	Petrol	Manual	1	18.15	NaN	NaN	NaN	NaN	2.66
3810	Honda	Kolkata	2013	27000	Petrol	Automatic	1	14.00	NaN	NaN	NaN	NaN	11.99
4011	Fiat	Pune	2011	45271	Diesel	Manual	1	20.30	NaN	NaN	NaN	NaN	2.60
4152	Land	Mumbai	2003	75000	Diesel	Automatic	2	18.15	NaN	NaN	NaN	NaN	16.11
4229	Hyundai	Bangalore	2005	79000	Petrol	Manual	2	17.00	NaN	NaN	NaN	NaN	1.65
4577	BMW	Delhi	2012	72000	Diesel	Automatic	3	18.48	NaN	NaN	NaN	NaN	13.85
4604	Honda	Pune	2011	98000	Petrol	Manual	1	16.70	NaN	NaN	NaN	NaN	3.15
4697	Fiat	Kochi	2017	17941	Petrol	Manual	1	15.70	NaN	NaN	NaN	NaN	3.93
4712	Hyundai	Pune	2003	80000	Petrol	Manual	2	17.00	NaN	NaN	NaN	NaN	0.90
4952	Fiat	Kolkata	2010	47000	Petrol	Manual	1	14.60	NaN	NaN	NaN	NaN	1.49
5015	Maruti	Delhi	2006	63000	Petrol	Manual	1	16.10	NaN	NaN	NaN	NaN	1.60
5185	Maruti	Delhi	2012	52000	Petrol	Manual	1	16.10	NaN	NaN	NaN	NaN	3.65
5270	Honda	Bangalore	2002	53000	Petrol	Manual	2	18.15	NaN	NaN	NaN	NaN	1.85

In [10]:
```python
train['Power'] = train["Power"].str.extract('([0-9]+\.[0-9]+)')
train['Power'] = train['Power'].astype(float)

train['Engine'] = train['Engine'].str.extract('([0-9]+)')
train['Engine'] = train['Engine'].astype(float)

#Power와 Engine 모두 숫자데이터만 남기고 float형식으로 바꾼다.
```

In [11]:
```python
train_num = train.drop(['Name', 'Location', 'Fuel_Type','Transmission','New_Price'], axis = 1)

#문자로 된 데이터들도 분명히 중고가 책정에 이유가 되겠지만,
#제대로 다루기에는, 도메인 지식이 필요해서 문자로 된 데이터들의 열은 모두 지운다.
# .drop()함수를 사용한다. axis = 1은 열을 지운다는 뜻이다.
```

Year, Kilometers_Driven

In [12]:
```python
train['Kilometers_Driven'] = train['Kilometers_Driven'].astype(float)
```

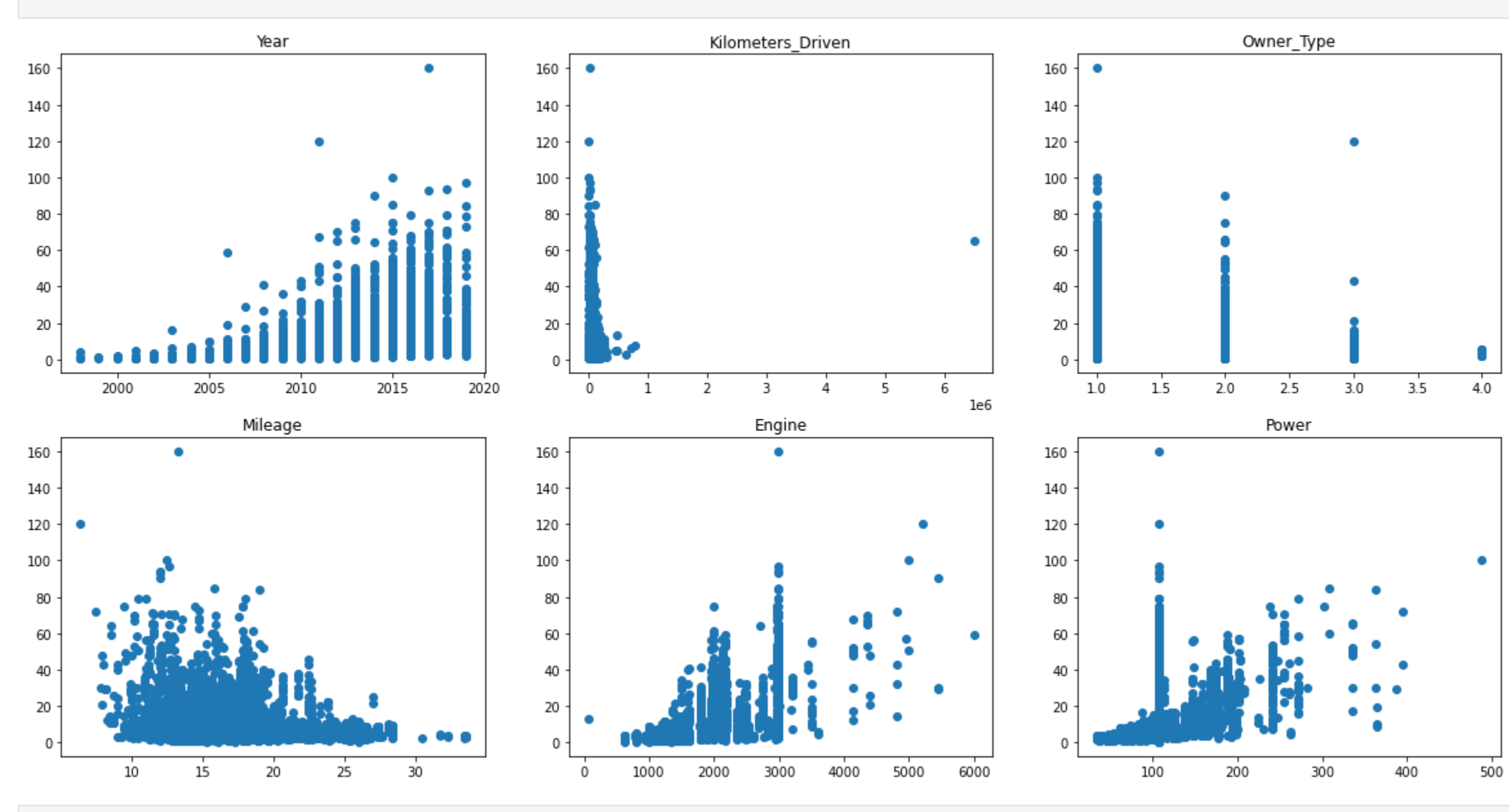
In [13]:
```python
from sklearn.impute import SimpleImputer

transformer = SimpleImputer()
transformer.fit(train_num)
X = transformer.transform(train_num)
#SimpleImputer의 transform을 이용해서, 결측치를 채운다.

train_num = pd.DataFrame(X, columns = train_num.columns, index = train_num.index)
```

In [14]:
```python
import matplotlib.pyplot as plt

plt.figure(figsize=(20,10))
for i in range(0,6):
    plt.subplot(2,3,i+1)
    plt.scatter(train_num.iloc[:,i], train_num['Price'])
    plt.title(train_num.columns[i])
#train 데이터의 숫자형데이터들을 matplotlib으로 시각화
```



In [15]:
```python
train_num[train_num['Kilometers_Driven']>6000000]
#인덱스 2328의 'Kilometers_Driven' 값이 잘못 입력된 것 같다,
#데이터가 하나 밖에 없으므로, 데이터를 제거해도 될 것 같아서 제거했다.
train_num.drop(2328, inplace= True)
```

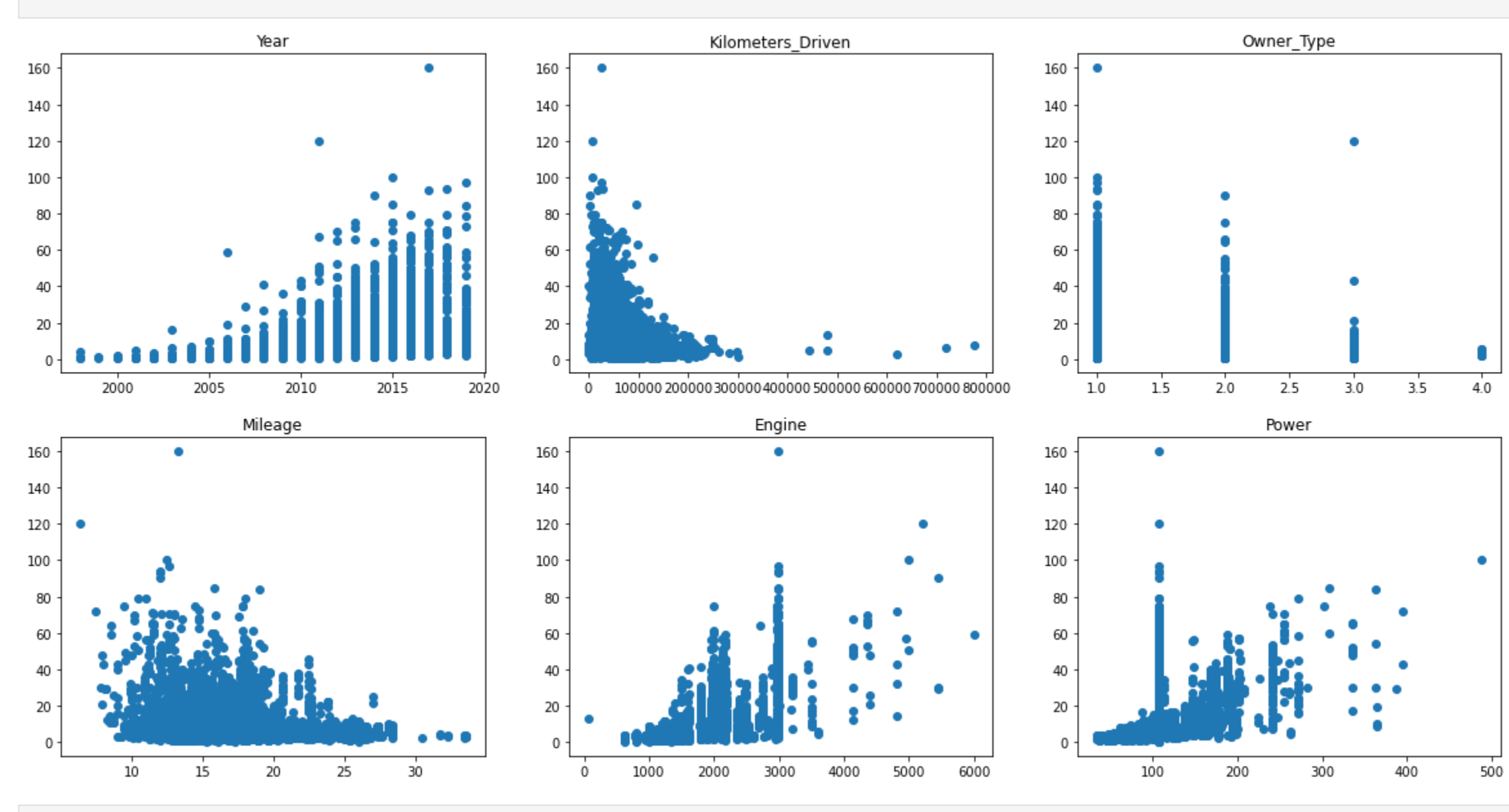
In [16]:
```python
train_num[train_num['Kilometers_Driven']>6000000]
```

Out[16]:

Year	Kilometers_Driven	Owner_Type	Mileage	Engine	Power	Seats	Price

In [17]:
```python
import matplotlib.pyplot as plt

plt.figure(figsize=(20,10))
for i in range(0,6):
    plt.subplot(2,3,i+1)
    plt.scatter(train_num.iloc[:,i], train_num['Price'])
    plt.title(train_num.columns[i])
#train 데이터의 숫자형데이터들을 matplotlib으로 시각화
#다시 그려보면 제대로 나온다,
```



In [18]:
```python
train_cat = train.drop(['Year', 'Kilometers_Driven','Owner_Type','Mileage', 'Engine', 'Power','Seats','New_Price','Price'], axis = 1)
#train_num = train.drop(['Name', 'Location', 'Fuel_Type','Transmission','New_Price'], axis = 1)
train_cat.drop(2328, inplace= True)

#범주형 데이터들을 처리하기 위해, train_cat을 선언한다.
#train_cat에도 train_num에서와 같은 전처리를 해주기 위해 2328을 삭제한다.
#train에서 이미 웬만한 전처리를 모두 마쳤기 때문에 2328만 해주면 된다.
train_cat
```

Out[18]:

	Name	Location	Fuel_Type	Transmission
0	Maruti	Mumbai	CNG	Manual
1	Hyundai	Pune	Diesel	Manual
2	Honda	Chennai	Petrol	Manual
3	Maruti	Chennai	Diesel	Manual
4	Audi	Coimbatore	Diesel	Automatic
...	...	...	...	...
6014	Maruti	Delhi	Diesel	Manual
6015	Hyundai	Jaipur	Diesel	Manual
6016	Mahindra	Jaipur	Diesel	Manual
6017	Maruti	Kolkata	Petrol	Manual
6018	Chevrolet	Hyderabad	Diesel	Manual

6018 rows × 4 columns

In [19]:
```python
train_cat = train_cat.astype(str)

#전처리 전에, 범주형 데이터들을 모두 str타입으로 변환해준다.
#그 후, 범주형 데이터의 열들을 따로 떼어내서 각각의 데이터프레임 객체로 저장한 뒤,
#get_dummies 메서드를 이용해서 범주형 데이터들을 더미변수화 한다.
train_cat
```

Out[19]:

	Name	Location	Fuel_Type	Transmission
0	Maruti	Mumbai	CNG	Manual
1	Hyundai	Pune	Diesel	Manual
2	Honda	Chennai	Petrol	Manual
3	Maruti	Chennai	Diesel	Manual
4	Audi	Coimbatore	Diesel	Automatic
...	...	...	...	...
6014	Maruti	Delhi	Diesel	Manual
6015	Hyundai	Jaipur	Diesel	Manual
6016	Mahindra	Jaipur	Diesel	Manual
6017	Maruti	Kolkata	Petrol	Manual
6018	Chevrolet	Hyderabad	Diesel	Manual

6018 rows × 4 columns

In [20]:
```python
name = pd.DataFrame(train_cat.iloc[:,0])
loc= pd.DataFrame(train_cat.iloc[:,1])
fuel = pd.DataFrame(train_cat.iloc[:,2])
trans = pd.DataFrame(train_cat.iloc[:,3])
#.iloc[]으로 접근해서, 인덱스로 접근할 수 있게 한다.
#name 리스트에 값들을 저장해준다.

name = pd.get_dummies(name, drop_first= True)
loc = pd.get_dummies(loc, drop_first= True)
fuel = pd.get_dummies(fuel, drop_first= True)
trans = pd.get_dummies(trans, drop_first= True)
#리스트의 첫번째 열은 사용하지 않고, 더미변수화한다.

train_cat = pd.concat([name,loc,fuel,trans], axis = 1)
train_num = train_num.astype(float)
#name, loc, fuel 등을 train_cat에 합쳐주고
#train_num은 float형으로 통일해준다.
train_cat
```

Out[20]:

	Name_Audi	Name_BMW	Name_Bentley	Name_Chevrolet	Name_Datsun	Name_Fiat	Name_Force	Name_Ford	Name_Honda	Name_Hyundai	...	Location_Jaipur	Location_Kochi	Location_Kolkata	Location_Mumbai	Loca
0	0	0	0	0	0	0	0	0	0	0	...	0	0	0	1	
1	0	0	0	0	0	0	0	0	0	1	...	0	0	0	0	
2	0	0	0	0	0	0	0	0	1	0	...	0	0	0	0	
3	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
4	1	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6014	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	
6015	0	0	0	0	0	0	0	0	0	1	...	1	0	0	0	
6016	0	0	0	0	0	0	0	0	0	0	...	1	0	0	0	
6017	0	0	0	0	0	0	0	0	0	0	...	0	0	1	0	
6018	0	0	0	1	0	0	0	0	0	0	...	0	0	0	0	

6018 rows × 45 columns

In [21]:
```python
from sklearn.preprocessing import StandardScaler

scaler = StandardScaler()
scaler.fit(train_num)
train_scaled = scaler.transform(train_num)

train_scaled = pd.DataFrame(train_scaled)
train_scaled.rename(columns = {0:'Year',1:'Kilometers_Driven',2:'Owner_Type',3:'Mileage',4:'Engine',5:'Power',6:'Seats',7:'Price'}, inplace = True)
#이제 숫자형 데이터들을 표준화해서 스케일을 맞춰준다.
#표준화한 값들을 train_scaled에 저장해준다.

train_prepared = pd.concat([train_scaled, train_cat], axis = 1)

train_labels = train_scaled['Price']

train_scaled.drop('Price', inplace= True, axis =1)
#표준화한 train_scaled와 train_cat을 pd.concat를 이용해서 train_prepared에 저장하고
#타겟값인 Price는 train_labels에 따로 떼어서 저장하고
#train_prepared에 타겟값을 지운다.

#이로써, train의 전처리를 모두 마쳤다.
train_prepared.drop(6018, inplace= True)
train_prepared
```

Out[21]:

	Year	Kilometers_Driven	Owner_Type	Mileage	Engine	Power	Seats	Price	Name_Audi	Name_BMW	...	Location_Jaipur	Location_Kochi	Location_Kolkata	Location_Mumbai	Location_Pune	Fuel_Ty
0	-1.026974	0.378395	-0.444598	1.989740	-1.039639	-1.322781	-0.345881	-0.691468	0.0	0.0	...	0.0	0.0	0.0	1.0	0.0	
1	0.502356	-0.440073	-0.444598	0.320286	-0.065158	0.533671	-0.345881	0.271362	0.0	0.0	...	0.0	0.0	0.0	0.0	1.0	
2	-0.721108	-0.308062	-0.444598	-0.033840	-0.704244	-0.489506	-0.345881	-0.445163	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	
3	-0.415242	0.774428	-0.444598	0.585279	-0.622481	-0.487868	2.135496	-0.310814	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	
4	-0.109376	-0.448786	1.746712	-0.756548	0.578935	0.932028	-0.345881	0.740686	1.0	0.0	...	0.0	0.0	0.0	0.0	0.0	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6013	0.196490	-0.800067	-0.444598	2.423365	-0.622481	0.000000	-0.345881	-0.422771	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	
6014	0.502356	1.117657	-0.444598	1.459755	-0.836066	0.000000	-0.345881	-0.489946	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	
6015	-0.415242	-0.070442	1.746712	-1.045631	1.463310	0.000000	3.376184	-0.588468	0.0	0.0	...	1.0	0.0	0.0	0.0	0.0	
6016	-0.109376	-0.308062	-0.444598	0.134791	-1.039639	-1.078855	-0.345881	-0.610859	0.0	0.0	...	1.0	0.0	0.0	0.0	0.0	
6017	-0.721108	-0.281660	-0.444598	1.710294	-1.143094	-1.338060	-0.345881	-0.624294	0.0	0.0	...	0.0	0.0	1.0	0.0	0.0	

6018 rows × 53 columns

from sklearn.linear_model import LinearRegression

linear = LinearRegression()

X_train = train_prepared y_train = train_labels

linear.fit(X_train,y_train)

linear.score(X_train, y_train)

In [22]:
```python
train_prepared[train_prepared['Location_Kolkata'].isnull() == True]
#2328이 문제가 되서 train_prepared와 train_lables 각각에서 2328을 삭제한다.
```

Out[22]:

	Year	Kilometers_Driven	Owner_Type	Mileage	Engine	Power	Seats	Price	Name_Audi	Name_BMW	...	Location_Jaipur	Location_Kochi	Location_Kolkata	Location_Mumbai	Location_Pune	Fuel_Type
2328	0.502356	0.140775	-0.444598	0.43351	-0.205323	-0.486777	-0.345881	-0.390528	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	

1 rows × 53 columns

In [23]:
```python
i = 0
if(i != 1):
    train_prepared.drop(2328, inplace = True)
    train_labels.drop(2328,inplace = True)
    i+=1
```

In [24]:
```python
train_prepared
```

Out[24]:

	Year	Kilometers_Driven	Owner_Type	Mileage	Engine	Power	Seats	Price	Name_Audi	Name_BMW	...	Location_Jaipur	Location_Kochi	Location_Kolkata	Location_Mumbai	Location_Pune	Fuel_Ty
0	-1.026974	0.378395	-0.444598	1.989740	-1.039639	-1.322781	-0.345881	-0.691468	0.0	0.0	...	0.0	0.0	0.0	1.0	0.0	
1	0.502356	-0.440073	-0.444598	0.320286	-0.065158	0.533671	-0.345881	0.271362	0.0	0.0	...	0.0	0.0	0.0	0.0	1.0	
2	-0.721108	-0.308062	-0.444598	-0.033840	-0.704244	-0.489506	-0.345881	-0.445163	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	
3	-0.415242	0.774428	-0.444598	0.585279	-0.622481	-0.487868	2.135496	-0.310814	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	
4	-0.109376	-0.448786	1.746712	-0.756548	0.578935	0.932028	-0.345881	0.740686	1.0	0.0	...	0.0	0.0	0.0	0.0	0.0	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6013	0.196490	-0.800067	-0.444598	2.423365	-0.622481	0.000000	-0.345881	-0.422771	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	
6014	0.502356	1.117657	-0.444598	1.459755	-0.836066	0.000000	-0.345881	-0.489946	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	
6015	-0.415242	-0.070442	1.746712	-1.045631	1.463310	0.000000	3.376184	-0.588468	0.0	0.0	...	1.0	0.0	0.0	0.0	0.0	
6016	-0.109376	-0.308062	-0.444598	0.134791	-1.039639	-1.078855	-0.345881	-0.610859	0.0	0.0	...	1.0	0.0	0.0	0.0	0.0	
6017	-0.721108	-0.281660	-0.444598	1.710294	-1.143094	-1.338060	-0.345881	-0.624294	0.0	0.0	...	0.0	0.0	1.0	0.0	0.0	

6017 rows × 53 columns

In [25]:
```python
train_labels = pd.DataFrame(train_labels)
train_labels
```

Out[25]:

	Price
0	-0.691468
1	0.271362
2	-0.445163
3	-0.310814
4	0.740686
...	...
6013	-0.422771
6014	-0.489946
6015	-0.588468
6016	-0.610859
6017	-0.624294

6017 rows × 1 columns

In [26]:
```python
data = train_prepared
target = train_labels
data
```

Out[26]:

	Year	Kilometers_Driven	Owner_Type	Mileage	Engine	Power	Seats	Price	Name_Audi	Name_BMW	...	Location_Jaipur	Location_Kochi	Location_Kolkata	Location_Mumbai	Location_Pune	Fuel_Ty
0	-1.026974	0.378395	-0.444598	1.989740	-1.039639	-1.322781	-0.345881	-0.691468	0.0	0.0	...	0.0	0.0	0.0	1.0	0.0	
1	0.502356	-0.440073	-0.444598	0.320286	-0.065158	0.533671	-0.345881	0.271362	0.0	0.0	...	0.0	0.0	0.0	0.0	1.0	
2	-0.721108	-0.308062	-0.444598	-0.033840	-0.704244	-0.489506	-0.345881	-0.445163	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	
3	-0.415242	0.774428	-0.444598	0.585279	-0.622481	-0.487868	2.135496	-0.310814	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	
4	-0.109376	-0.448786	1.746712	-0.756548	0.578935	0.932028	-0.345881	0.740686	1.0	0.0	...	0.0	0.0	0.0	0.0	0.0	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
6013	0.196490	-0.800067	-0.444598	2.423365	-0.622481	0.000000	-0.345881	-0.422771	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	
6014	0.502356	1.117657	-0.444598	1.459755	-0.836066	0.000000	-0.345881	-0.489946	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	
6015	-0.415242	-0.070442	1.746712	-1.045631	1.463310	0.000000	3.376184	-0.588468	0.0	0.0	...	1.0	0.0	0.0	0.0	0.0	
6016	-0.109376	-0.308062	-0.444598	0.134791	-1.039639	-1.078855	-0.345881	-0.610859	0.0	0.0	...	1.0	0.0	0.0	0.0	0.0	
6017	-0.721108	-0.281660	-0.444598	1.710294	-1.143094	-1.338060	-0.345881	-0.624294	0.0	0.0	...	0.0	0.0	1.0	0.0	0.0	

6017 rows × 53 columns

In [27]:
```python
from sklearn.model_selection import train_test_split

train_input, test_input, train_target, test_target = train_test_split(data, target, test_size = 0.2, shuffle = True, random_state = 34)
#훈련 세트(train_input,train_target)와 테스트 세트(test_input, test_target)로 나눈다.
#train_test_split함수의 여러 옵션 값들을 잘 확인해서 사용한다.

sub_input, val_input, sub_target, val_target = train_test_split(train_input, train_target,  test_size = 0.2, shuffle = True, random_state = 34)
#훈련 세트를 다시 훈련세트(sub_input, sub_target)과 검증세트(val_input, val_target)로 나눠서 교차 검증을 한다.
```

In [28]:
```python
from sklearn.neighbors import KNeighborsRegressor

knr = KNeighborsRegressor(n_neighbors = 3)

knr.fit(sub_input, sub_target)
print(knr.score(sub_input, sub_target))
```

```
0.9658296227422082
```

In [29]:
```python
from sklearn.neighbors import KNeighborsRegressor

knr = KNeighborsRegressor(n_neighbors = 3)

knr.fit(val_input, val_target)
print(knr.score(val_input, val_target))
```

```
0.9670111345521887
```

In [30]:
```python
from sklearn.linear_model import LinearRegression

linear = LinearRegression()

linear.fit(sub_input, sub_target)

linear.score(sub_input, sub_target)
```

Out[30]: 1.0

In [31]:
```python
from sklearn.linear_model import LinearRegression

linear = LinearRegression()

linear.fit(val_input, val_target)

linear.score(val_input, val_target)
```

Out[31]: 1.0

In [32]:
```python
sub_target.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 3850 entries, 662 to 2480
Data columns (total 1 columns):
 #   Column  Non-Null Count  Dtype
---  ------  --------------  -----
 0   Price   3850 non-null   float64
dtypes: float64(1)
memory usage: 60.2 KB
```

In [33]:
```python
sub_input = sub_input.astype(int)
sub_target = sub_target.astype(int)
```

In [35]:
```python
from sklearn.tree import DecisionTreeRegressor
dt = DecisionTreeRegressor(random_state = 34)

dt.fit(sub_input, sub_target)
print(dt.score(sub_input, sub_target))
print(dt.score(val_input, val_target))
```

```
1.0
0.8304148531676387
```

In [36]:
```python
train_input
```

Out[36]:

	Year	Kilometers_Driven	Owner_Type	Mileage	Engine	Power	Seats	Price	Name_Audi	Name_BMW	...	Location_Jaipur	Location_Kochi	Location_Kolkata	Location_Mumbai	Location_Pune	Fuel_Ty
3708	-0.721108	0.366672	-0.444598	-0.322923	-0.206991	0.000000	-0.345881	-0.355597	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	
5522	-1.944572	3.731474	1.746712	-1.334714	1.456636	0.000000	2.135496	-0.382467	0.0	0.0	...	0.0	0.0	0.0	0.0	1.0	
604	0.808222	-0.862508	-0.444598	0.761138	-0.205323	0.050732	-0.345881	-0.001813	0.0	0.0	...	0.0	0.0	0.0	1.0	0.0	
1177	-0.109376	-0.301990	-0.444598	0.354013	-0.892800	-1.052935	-0.345881	-0.570555	0.0	0.0	...	1.0	0.0	0.0	0.0	0.0	
5826	1.419954	-0.730497	-0.444598	1.011676	-0.375523	-0.488687	-0.345881	-0.154075	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
3831	-1.026974	1.513689	1.746712	-0.101293	-0.892800	-1.215279	-0.345881	-0.713860	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	
5994	0.502356	-0.730497	-0.444598	0.368467	-0.267062	-0.623201	-0.345881	-0.154075	0.0	0.0	...	0.0	0.0	0.0	0.0	1.0	
2539	1.114088	-1.205737	-0.444598	0.664777	-1.346668	-1.403543	-0.345881	-0.534728	0.0	0.0	...	0.0	0.0	0.0	0.0	1.0	
5243	0.196490	-0.422093	-0.444598	-0.322923	-0.707581	0.000000	-0.345881	-0.440685	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	
3490	-0.415242	0.854928	-0.444598	-0.272334	-0.213666	0.000000	2.135496	-0.507859	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	

4813 rows × 53 columns

In [38]:
```python
dt_f_i = (dt.feature_importances_)
dt_f_i[0:8] #Year~New_price
print("특성 중요도: Year, Kilometers_Driven, Owner_Type, Mileage, Engine, Power, Seats")
print("특성 중요도: ", dt_f_i[0:8])
```

```
특성 중요도: Year, Kilometers_Driven, Owner_Type, Mileage, Engine, Power, Seats
특성 중요도:  [0.00000000e+00 0.00000000e+00 0.00000000e+00 0.00000000e+00
 0.00000000e+00 5.75099248e-04 0.00000000e+00 9.95590906e-01]
```