carprediction

October 24, 2023

1 Car Price Prediction

[193]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.linear_model import Lasso
from sklearn import metrics
```

[194]:
```
car_dataset = pd.read_csv('./archive/train-data.csv')
```

[195]:
```
car_dataset.head()
```

[195]:

	Unnamed: 0	Name	Location	Year	Kilometers_Driven	Fuel_Type	Transmission	Owner_Type	Mileage	Engine	Power	Seats	New_Price	Price
0	0	Maruti Wagon R LXI CNG	Mumbai	2010	72000	CNG	Manual	First	26.6 km/kg	998 CC	58.16 bhp	5.0	NaN	1.75
1	1	Hyundai Creta 1.6 CRDi SX Option	Pune	2015	41000	Diesel	Manual	First	19.67 kmpl	1582 CC	126.2 bhp	5.0	NaN	12.50
2	2	Honda Jazz V	Chennai	2011	46000	Petrol	Manual	First	18.2 kmpl	1199 CC	88.7 bhp	5.0	8.61 Lakh	4.50
3	3	Maruti Ertiga VDI	Chennai	2012	87000	Diesel	Manual	First	20.77 kmpl	1248 CC	88.76 bhp	7.0	NaN	6.00
4	4	Audi A4 New 2.0 TDI Multitronic	Coimbatore	2013	40670	Diesel	Automatic	Second	15.2 kmpl	1968 CC	140.8 bhp	5.0	NaN	17.74

[196]:
```
car_dataset.shape
```

[196]: (6019, 14)

[197]:
```
car_dataset.info()
```

```
<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
```

[198]:
```
car_dataset.isnull().sum()
```

[198]:
```
Unnamed: 0            0
Name                  0
Location              0
Year                  0
Kilometers_Driven     0
Fuel_Type             0
Transmission          0
Owner_Type            0
Mileage               2
Engine               36
Power                36
Seats                42
New_Price          5195
Price                 0
dtype: int64
```

[199]:
```
print("Shape of train data Before dropping any Row: ",car_dataset.shape)
car_dataset = car_dataset[car_dataset['Mileage'].notna()]
```

```
print("Shape of train data After dropping Rows with NULL values in Mileage:␣
 ↪",car_dataset.shape)
car_dataset = car_dataset[car_dataset['Engine'].notna()]
print("Shape of train data After dropping Rows with NULL values in Engine :␣
 ↪",car_dataset.shape)
car_dataset = car_dataset[car_dataset['Power'].notna()]
print("Shape of train data After dropping Rows with NULL values in Power  :␣
 ↪",car_dataset.shape)
car_dataset = car_dataset[car_dataset['Seats'].notna()]
print("Shape of train data After dropping Rows with NULL values in Seats  :␣
 ↪",car_dataset.shape)
```

```
Shape of train data Before dropping any Row:  (6019, 14)
Shape of train data After dropping Rows with NULL values in Mileage:  (6017, 14)
Shape of train data After dropping Rows with NULL values in Engine :  (5981, 14)
Shape of train data After dropping Rows with NULL values in Power  :  (5981, 14)
Shape of train data After dropping Rows with NULL values in Seats  :  (5975, 14)
```

[200]:
```
car_dataset = car_dataset.reset_index(drop=True)
```

[201]:
```
for i in range(car_dataset.shape[0]):
    car_dataset.at[i, 'Company'] = car_dataset['Name'][i].split()[0]
    car_dataset.at[i, 'Mileage(km/kg)'] = car_dataset['Mileage'][i].split()[0]
    car_dataset.at[i, 'Engine(CC)'] = car_dataset['Engine'][i].split()[0]
    car_dataset.at[i, 'Power(bhp)'] = car_dataset['Power'][i].split()[0]
```

[202]:
```
car_dataset['Mileage(km/kg)'] = car_dataset['Mileage(km/kg)'].astype(float)
car_dataset['Engine(CC)'] = car_dataset['Engine(CC)'].astype(float)
```

[203]:
```
x = 'n'
count = 0
position = []
for i in range(car_dataset.shape[0]):
    if car_dataset['Power(bhp)'][i]=='null':
        x = 'Y'
        count = count + 1
        position.append(i)
```

[204]:
```
car_dataset = car_dataset.drop(car_dataset.index[position])
car_dataset = car_dataset.reset_index(drop=True)
```

[205]:
```
car_dataset.shape
```

[205]:
```
(5872, 18)
```

[206]:
```
car_dataset['Power(bhp)'] = car_dataset['Power(bhp)'].astype(float)
```

[207]:
```
car_dataset.head()
```

[207]:
```
   Unnamed: 0                                Name    Location  Year  \
0           0            Maruti Wagon R LXI CNG      Mumbai  2010
1           1  Hyundai Creta 1.6 CRDi SX Option        Pune  2015
2           2                      Honda Jazz V     Chennai  2011
3           3                 Maruti Ertiga VDI     Chennai  2012
4           4   Audi A4 New 2.0 TDI Multitronic  Coimbatore  2013

   Kilometers_Driven Fuel_Type Transmission Owner_Type     Mileage   Engine  \
0              72000       CNG       Manual      First  26.6 km/kg   998 CC
1              41000    Diesel       Manual      First  19.67 kmpl  1582 CC
2              46000    Petrol       Manual      First   18.2 kmpl  1199 CC
3              87000    Diesel       Manual      First  20.77 kmpl  1248 CC
4              40670    Diesel    Automatic     Second   15.2 kmpl  1968 CC

       Power  Seats  New_Price  Price  Company  Mileage(km/kg)  Engine(CC)  \
0  58.16 bhp    5.0        NaN   1.75   Maruti           26.60       998.0
1  126.2 bhp    5.0        NaN  12.50  Hyundai           19.67      1582.0
2   88.7 bhp    5.0  8.61 Lakh   4.50    Honda           18.20      1199.0
3  88.76 bhp    7.0        NaN   6.00   Maruti           20.77      1248.0
4  140.8 bhp    5.0        NaN  17.74     Audi           15.20      1968.0

   Power(bhp)
0       58.16
1      126.20
2       88.70
3       88.76
4      140.80
```

[208]:
```
for i in range(car_dataset.shape[0]):
    if pd.isnull(car_dataset.loc[i,'New_Price']) == False:
        car_dataset.at[i,'New_car_Price'] = car_dataset['New_Price'][i].
↪split()[0]
```

[209]:
```
car_dataset['New_car_Price'] = car_dataset['New_car_Price'].astype(float)
```

[210]:
```
car_dataset.head()
```

[210]:
```
   Unnamed: 0                                Name    Location  Year  \
0           0            Maruti Wagon R LXI CNG      Mumbai  2010
1           1  Hyundai Creta 1.6 CRDi SX Option        Pune  2015
2           2                      Honda Jazz V     Chennai  2011
3           3                 Maruti Ertiga VDI     Chennai  2012
4           4   Audi A4 New 2.0 TDI Multitronic  Coimbatore  2013

   Kilometers_Driven Fuel_Type Transmission Owner_Type     Mileage   Engine  \
```

```
0              72000       CNG       Manual      First  26.6 km/kg   998 CC
1              41000    Diesel       Manual      First  19.67 kmpl  1582 CC
2              46000    Petrol       Manual      First   18.2 kmpl  1199 CC
3              87000    Diesel       Manual      First  20.77 kmpl  1248 CC
4              40670    Diesel    Automatic     Second   15.2 kmpl  1968 CC

       Power  Seats  New_Price  Price  Company  Mileage(km/kg)  Engine(CC)  \
0  58.16 bhp    5.0        NaN   1.75   Maruti           26.60       998.0
1  126.2 bhp    5.0        NaN  12.50  Hyundai           19.67      1582.0
2   88.7 bhp    5.0  8.61 Lakh   4.50    Honda           18.20      1199.0
3  88.76 bhp    7.0        NaN   6.00   Maruti           20.77      1248.0
4  140.8 bhp    5.0        NaN  17.74     Audi           15.20      1968.0

   Power(bhp)  New_car_Price
0       58.16            NaN
1      126.20            NaN
2       88.70           8.61
3       88.76            NaN
4      140.80            NaN
```

[211]:
```
car_dataset.drop(["Name"],axis=1,inplace=True)
car_dataset.drop(["Mileage"],axis=1,inplace=True)
car_dataset.drop(["Engine"],axis=1,inplace=True)
car_dataset.drop(["Power"],axis=1,inplace=True)
car_dataset.drop(["New_Price"],axis=1,inplace=True)
```

[212]:
```
car_dataset.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5872 entries, 0 to 5871
Data columns (total 14 columns):
 #   Column             Non-Null Count  Dtype
---  ------             --------------  -----
 0   Unnamed: 0         5872 non-null   int64
 1   Location           5872 non-null   object
 2   Year               5872 non-null   int64
 3   Kilometers_Driven  5872 non-null   int64
 4   Fuel_Type          5872 non-null   object
 5   Transmission       5872 non-null   object
 6   Owner_Type         5872 non-null   object
 7   Seats              5872 non-null   float64
 8   Price              5872 non-null   float64
 9   Company            5872 non-null   object
 10  Mileage(km/kg)     5872 non-null   float64
 11  Engine(CC)         5872 non-null   float64
 12  Power(bhp)         5872 non-null   float64
 13  New_car_Price      823 non-null    float64
```

```
dtypes: float64(6), int64(3), object(5)
memory usage: 642.4+ KB
```

[213]:
```
car_dataset.head()
```

[213]:
```
   Unnamed: 0    Location  Year  Kilometers_Driven Fuel_Type Transmission  \
0           0      Mumbai  2010              72000       CNG       Manual
1           1        Pune  2015              41000    Diesel       Manual
2           2     Chennai  2011              46000    Petrol       Manual
3           3     Chennai  2012              87000    Diesel       Manual
4           4  Coimbatore  2013              40670    Diesel    Automatic

  Owner_Type  Seats  Price  Company  Mileage(km/kg)  Engine(CC)  Power(bhp)  \
0      First    5.0   1.75   Maruti           26.60       998.0       58.16
1      First    5.0  12.50  Hyundai           19.67      1582.0      126.20
2      First    5.0   4.50    Honda           18.20      1199.0       88.70
3      First    7.0   6.00   Maruti           20.77      1248.0       88.76
4     Second    5.0  17.74     Audi           15.20      1968.0      140.80

   New_car_Price
0            NaN
1            NaN
2           8.61
3            NaN
4            NaN
```

4 categorical features to check:

Location Fuel_Type Transmission Owner_Type

[214]:
```
var = 'Seats'
car_dataset[var].value_counts()
```

[214]:
```
5.0     4919
7.0      672
8.0      133
4.0       99
6.0       29
2.0       13
10.0       4
9.0        3
Name: Seats, dtype: int64
```

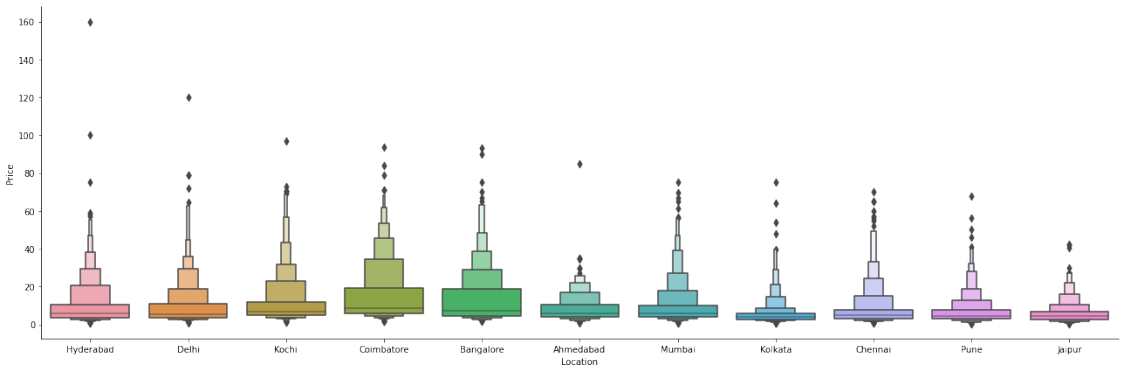
[215]:
```
var = 'Location'
car_dataset[var].value_counts()
```

[215]:
```
Mumbai        775
Hyderabad     718
```

```
Kochi          645
Coimbatore     629
Pune           594
Delhi          545
Kolkata        521
Chennai        476
Jaipur         402
Bangalore      347
Ahmedabad      220
Name: Location, dtype: int64
```

[216]:
```
# Plot Location vs Price
sns.catplot(y='Price',x=var,data= car_dataset.
 ↪sort_values('Price',ascending=False),kind="boxen",height=6, aspect=3)
plt.show
```

[216]:
```
<function matplotlib.pyplot.show(close=None, block=None)>
```



One-hot-encoding here

[217]:
```
Location = car_dataset[[var]]
Location = pd.get_dummies(Location,drop_first=True)
Location.head()
```

[217]:

	Location_Bangalore	Location_Chennai	Location_Coimbatore	Location_Delhi	\
0	0	0	0	0	
1	0	0	0	0	
2	0	1	0	0	
3	0	1	0	0	
4	0	0	1	0	

	Location_Hyderabad	Location_Jaipur	Location_Kochi	Location_Kolkata	\
0	0	0	0	0	
1	0	0	0	0	

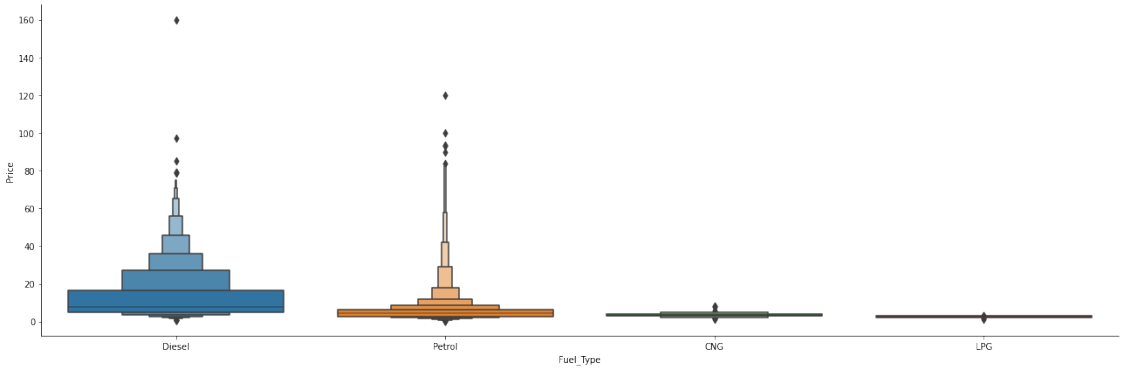
```
2                    0                    0                    0                    0
3                    0                    0                    0                    0
4                    0                    0                    0                    0

   Location_Mumbai  Location_Pune
0                1              0
1                0              1
2                0              0
3                0              0
4                0              0
```

[218]:
```
var = 'Fuel_Type'
car_dataset[var].value_counts()
```

[218]:
```
Diesel    3152
Petrol    2655
CNG         55
LPG         10
Name: Fuel_Type, dtype: int64
```

[219]:
```
# Plot Fuel_Type vs Price
sns.catplot(y='Price',x=var,data= car_dataset.
 ↪sort_values('Price',ascending=False),kind="boxen",height=6, aspect=3)
plt.show
```

[219]:
```
<function matplotlib.pyplot.show(close=None, block=None)>
```



One-hot-encoding here

[220]:
```
Fuel_t = car_dataset[[var]]
Fuel_t = pd.get_dummies(Fuel_t,drop_first=True)
Fuel_t.head()
```

[220]:

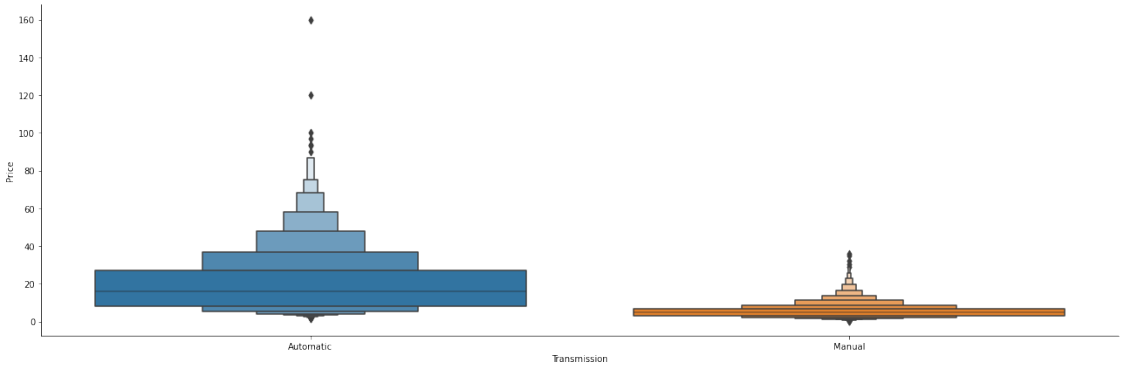
	Fuel_Type_Diesel	Fuel_Type_LPG	Fuel_Type_Petrol
0	0	0	0
1	1	0	0
2	0	0	1
3	1	0	0
4	1	0	0

[221]:
```
var = 'Transmission'
car_dataset[var].value_counts()
```

[221]:
```
Manual       4170
Automatic    1702
Name: Transmission, dtype: int64
```

[222]:
```
# Plot Transmission vs Price
sns.catplot(y='Price',x=var,data= car_dataset.
 ↪sort_values('Price',ascending=False),kind="boxen",height=6, aspect=3)
plt.show
```

[222]:
```
<function matplotlib.pyplot.show(close=None, block=None)>
```



One-hot-encoding here

[223]:
```
Transmission = car_dataset[[var]]
Transmission = pd.get_dummies(Transmission,drop_first=True)
Transmission.head()
```

[223]:

	Transmission_Manual
0	1
1	1
2	1
3	1
4	0

[224]:
```
var = 'Owner_Type'
car_dataset[var].value_counts()
```

[224]:
```
First             4839
Second             925
Third              101
Fourth & Above       7
Name: Owner_Type, dtype: int64
```

As Owner_Type column has ordered data so Label Encoding here

[225]:
```
car_dataset.replace({"First":1,"Second":2,"Third": 3,"Fourth & Above":
 ↪4},inplace=True)
car_dataset.head()
```

[225]:

	Unnamed: 0	Location	Year	Kilometers_Driven	Fuel_Type	Transmission	\
0	0	Mumbai	2010	72000	CNG	Manual	
1	1	Pune	2015	41000	Diesel	Manual	
2	2	Chennai	2011	46000	Petrol	Manual	
3	3	Chennai	2012	87000	Diesel	Manual	
4	4	Coimbatore	2013	40670	Diesel	Automatic	

	Owner_Type	Seats	Price	Company	Mileage(km/kg)	Engine(CC)	Power(bhp)	\
0	1	5.0	1.75	Maruti	26.60	998.0	58.16	
1	1	5.0	12.50	Hyundai	19.67	1582.0	126.20	
2	1	5.0	4.50	Honda	18.20	1199.0	88.70	
3	1	7.0	6.00	Maruti	20.77	1248.0	88.76	
4	2	5.0	17.74	Audi	15.20	1968.0	140.80	

	New_car_Price
0	NaN
1	NaN
2	8.61
3	NaN
4	NaN

[226]:
```
car_dataset.drop(["Company"],axis=1,inplace=True)
```

[249]:
```
final_train= pd.concat([car_dataset,Location,Fuel_t,Transmission],axis=1)
final_train.head()
```

[249]:

	Unnamed: 0	Location	Year	Kilometers_Driven	Fuel_Type	Transmission	\
0	0	Mumbai	2010	72000	CNG	Manual	
1	1	Pune	2015	41000	Diesel	Manual	
2	2	Chennai	2011	46000	Petrol	Manual	
3	3	Chennai	2012	87000	Diesel	Manual	
4	4	Coimbatore	2013	40670	Diesel	Automatic	

```
   Owner_Type  Seats  Price  Mileage(km/kg)  …  Location_Hyderabad  \
0           1    5.0   1.75           26.60  …                   0
1           1    5.0  12.50           19.67  …                   0
2           1    5.0   4.50           18.20  …                   0
3           1    7.0   6.00           20.77  …                   0
4           2    5.0  17.74           15.20  …                   0

   Location_Jaipur  Location_Kochi  Location_Kolkata  Location_Mumbai  \
0                0               0                 0                1
1                0               0                 0                0
2                0               0                 0                0
3                0               0                 0                0
4                0               0                 0                0

   Location_Pune  Fuel_Type_Diesel  Fuel_Type_LPG  Fuel_Type_Petrol  \
0              0                 0              0                 0
1              1                 1              0                 0
2              0                 0              0                 1
3              0                 1              0                 0
4              0                 1              0                 0

   Transmission_Manual
0                    1
1                    1
2                    1
3                    1
4                    0

[5 rows x 27 columns]
```

[250]:
```
final_train.
  ↪drop(["Location","Fuel_Type","Transmission","New_car_Price"],axis=1,inplace=True)
final_train.head()
```

[250]:
```
   Unnamed: 0  Year  Kilometers_Driven  Owner_Type  Seats  Price  \
0           0  2010              72000           1    5.0   1.75
1           1  2015              41000           1    5.0  12.50
2           2  2011              46000           1    5.0   4.50
3           3  2012              87000           1    7.0   6.00
4           4  2013              40670           2    5.0  17.74

   Mileage(km/kg)  Engine(CC)  Power(bhp)  Location_Bangalore  …  \
0           26.60       998.0       58.16                   0  …
1           19.67      1582.0      126.20                   0  …
2           18.20      1199.0       88.70                   0  …
3           20.77      1248.0       88.76                   0  …
```

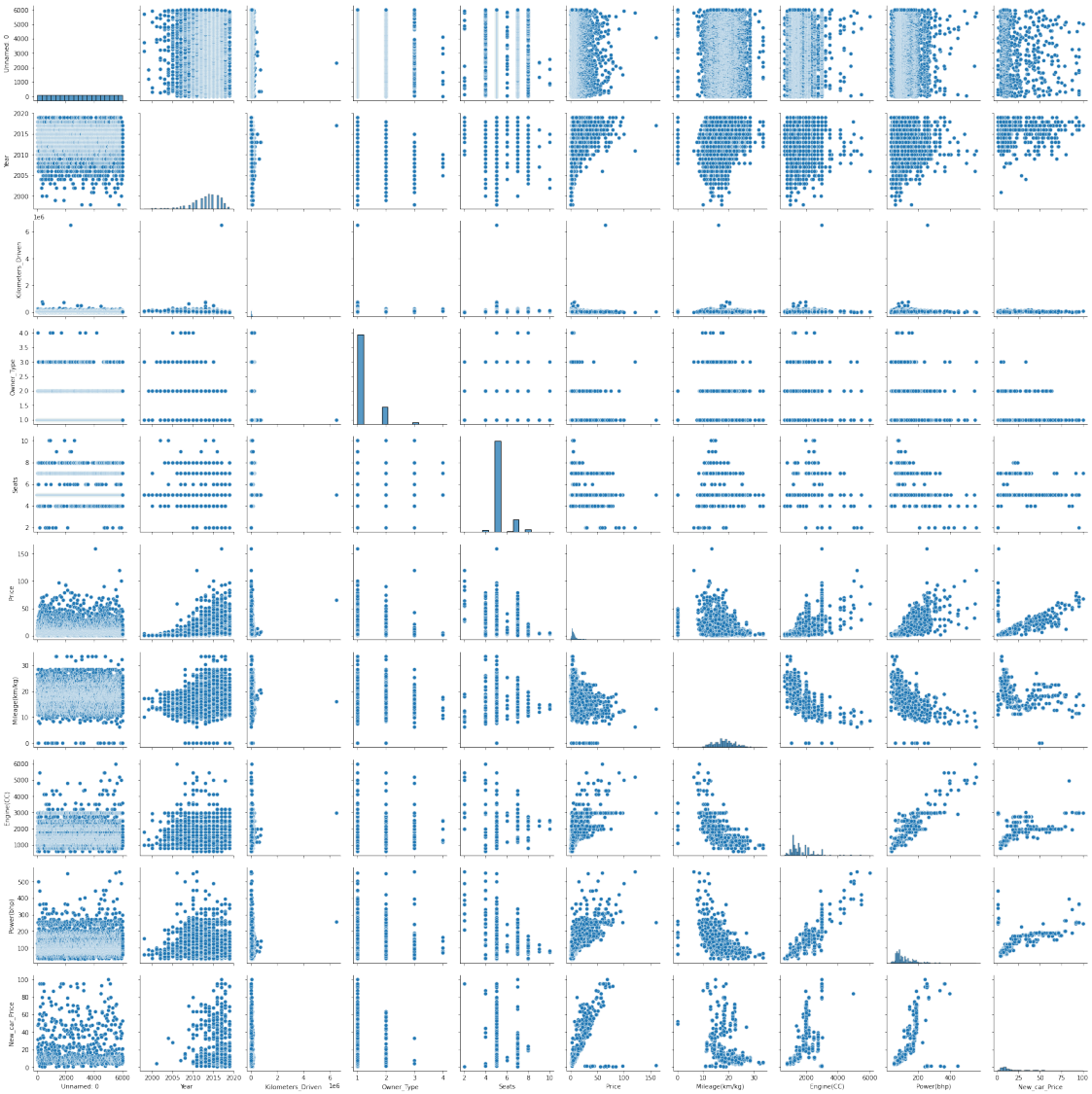
```
4           15.20      1968.0      140.80                    0  …

   Location_Hyderabad  Location_Jaipur  Location_Kochi  Location_Kolkata  \
0                   0                0               0                 0
1                   0                0               0                 0
2                   0                0               0                 0
3                   0                0               0                 0
4                   0                0               0                 0

   Location_Mumbai  Location_Pune  Fuel_Type_Diesel  Fuel_Type_LPG  \
0                1              0                 0              0
1                0              1                 1              0
2                0              0                 0              0
3                0              0                 1              0
4                0              0                 1              0

   Fuel_Type_Petrol  Transmission_Manual
0                 0                    1
1                 0                    1
2                 1                    1
3                 0                    1
4                 0                    0

[5 rows x 23 columns]
```

[251]:
```
final_train.shape
```

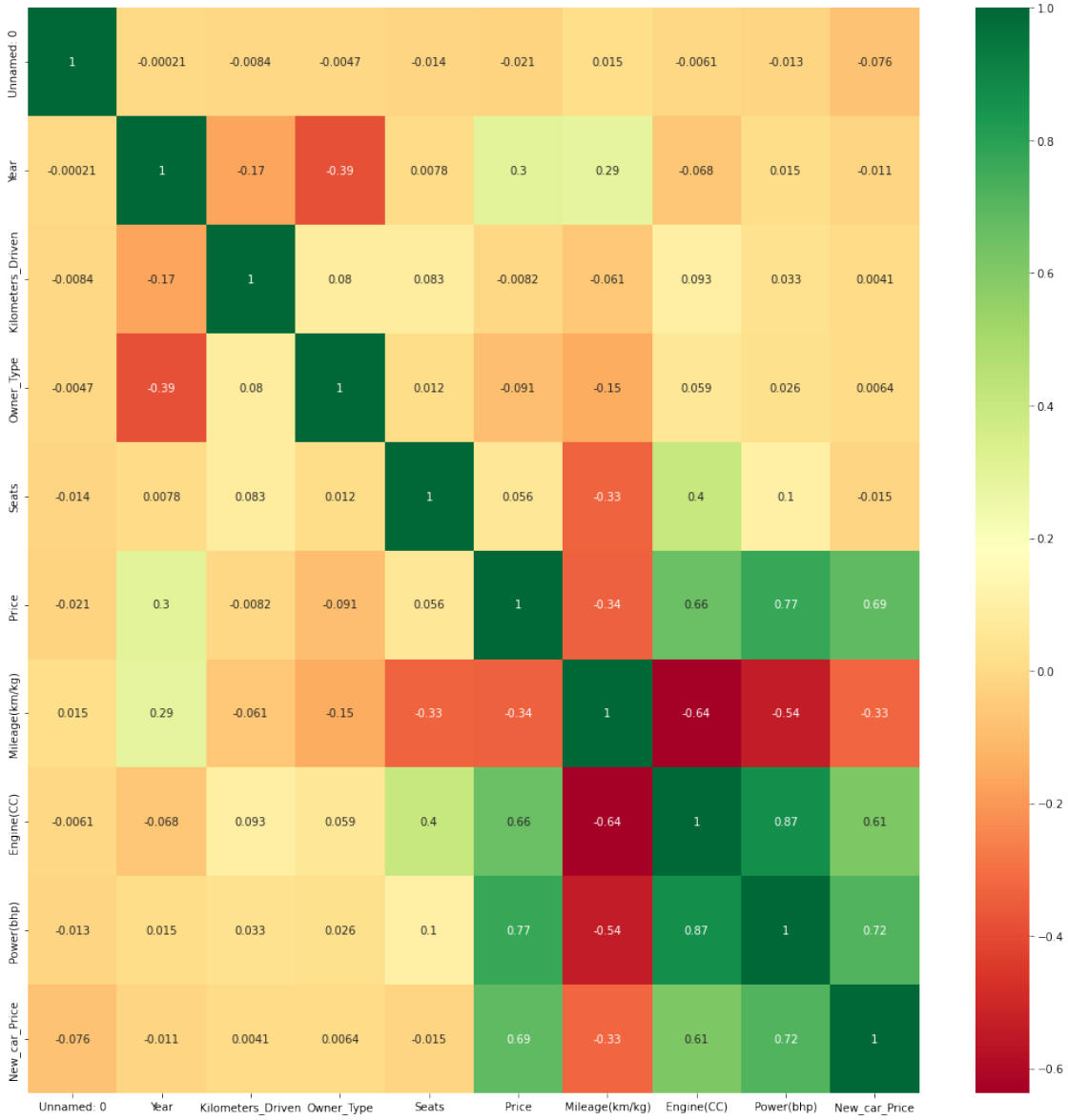
[251]:
```
(5872, 23)
```

[252]:
```
sns.pairplot(car_dataset)
```

[252]:
```
<seaborn.axisgrid.PairGrid at 0x1595c51b0>
```



[253]:
```
plt.figure(figsize=(18,18))
sns.heatmap(car_dataset.corr(),annot=True,cmap='RdYlGn')

plt.show()
```



2 Final Features Selection

[254]:
```
final_train.columns
```

[254]:
```
Index(['Unnamed: 0', 'Year', 'Kilometers_Driven', 'Owner_Type', 'Seats',
       'Price', 'Mileage(km/kg)', 'Engine(CC)', 'Power(bhp)',
       'Location_Bangalore', 'Location_Chennai', 'Location_Coimbatore',
       'Location_Delhi', 'Location_Hyderabad', 'Location_Jaipur',
       'Location_Kochi', 'Location_Kolkata', 'Location_Mumbai',
       'Location_Pune', 'Fuel_Type_Diesel', 'Fuel_Type_LPG',
```

```
       'Fuel_Type_Petrol', 'Transmission_Manual'],
      dtype='object')
```

[255]:
```
X = final_train.loc[:,['Year', 'Kilometers_Driven',␣
 ↪'Owner_Type','Seats','Mileage(km/kg)','Engine(CC)','Power(bhp)',
       'Location_Bangalore', 'Location_Chennai', 'Location_Coimbatore',
       'Location_Delhi', 'Location_Hyderabad', 'Location_Jaipur',
       'Location_Kochi', 'Location_Kolkata', 'Location_Mumbai',
       'Location_Pune', 'Fuel_Type_Diesel', 'Fuel_Type_LPG',
       'Fuel_Type_Petrol', 'Transmission_Manual']]
y = final_train.loc[:,['Price']]
y.head()
```

[255]:

	Price
0	1.75
1	12.50
2	4.50
3	6.00
4	17.74

[256]:
```
X.head()
```

[256]:

	Year	Kilometers_Driven	Owner_Type	Seats	Mileage(km/kg)	Engine(CC)	\
0	2010	72000	1	5.0	26.60	998.0	
1	2015	41000	1	5.0	19.67	1582.0	
2	2011	46000	1	5.0	18.20	1199.0	
3	2012	87000	1	7.0	20.77	1248.0	
4	2013	40670	2	5.0	15.20	1968.0	

	Power(bhp)	Location_Bangalore	Location_Chennai	Location_Coimbatore	…	\
0	58.16	0	0	0	…	
1	126.20	0	0	0	…	
2	88.70	0	1	0	…	
3	88.76	0	1	0	…	
4	140.80	0	0	1	…	

	Location_Hyderabad	Location_Jaipur	Location_Kochi	Location_Kolkata	\
0	0	0	0	0	
1	0	0	0	0	
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	

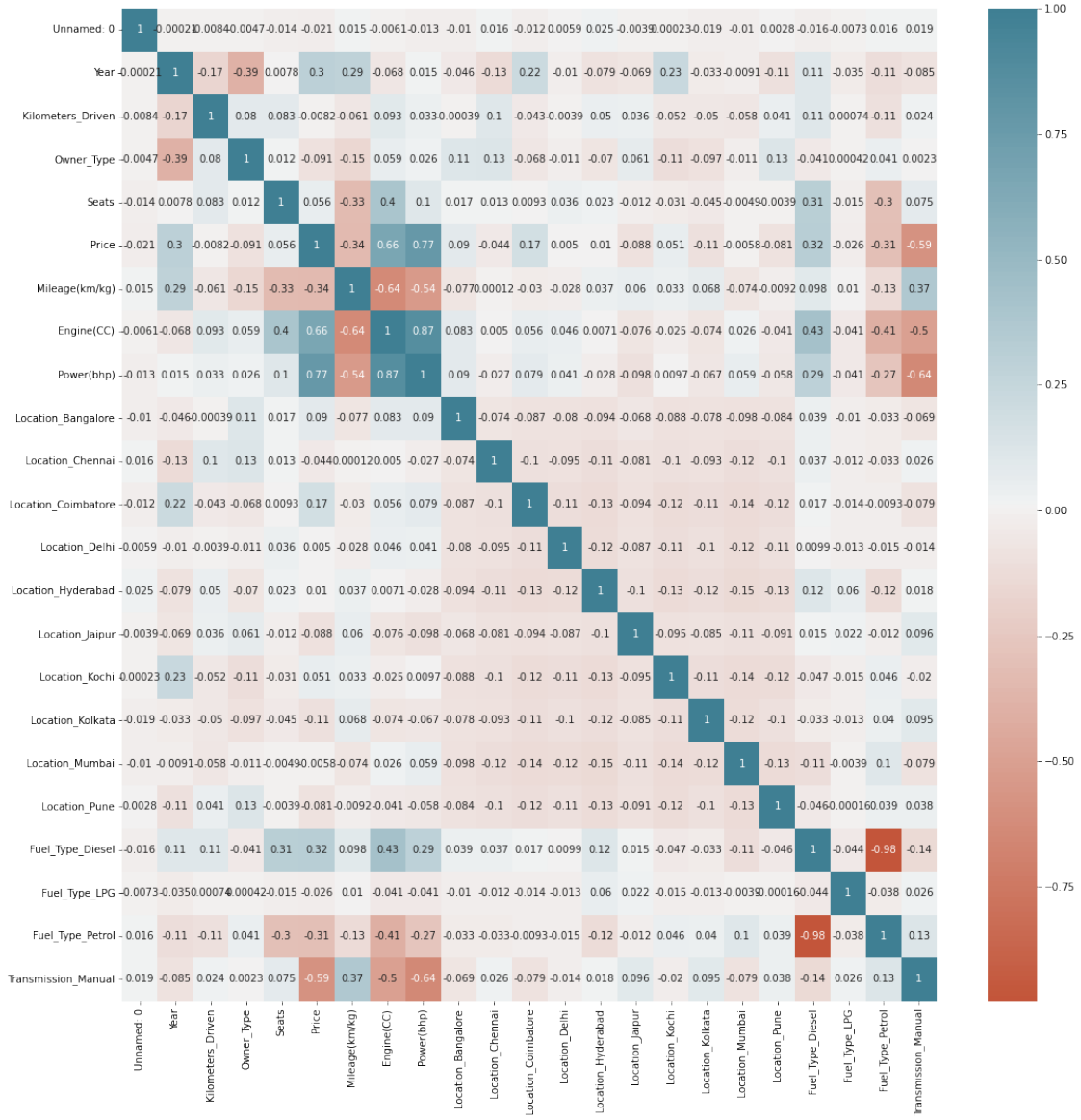
	Location_Mumbai	Location_Pune	Fuel_Type_Diesel	Fuel_Type_LPG	\
0	1	0	0	0	
1	0	1	1	0	
2	0	0	0	0	

```
3                0              0                1              0
4                0              0                1              0

   Fuel_Type_Petrol  Transmission_Manual
0                 0                    1
1                 0                    1
2                 1                    1
3                 0                    1
4                 0                    0

[5 rows x 21 columns]
```

[257]:
```
X.shape
```

[257]:
```
(5872, 21)
```

[258]:
```
plt.figure(figsize=(18,18))
sns.heatmap(final_train.corr(),annot=True,cmap=sns.diverging_palette(20, 220,␣
 ↪n=200))

plt.show()
```

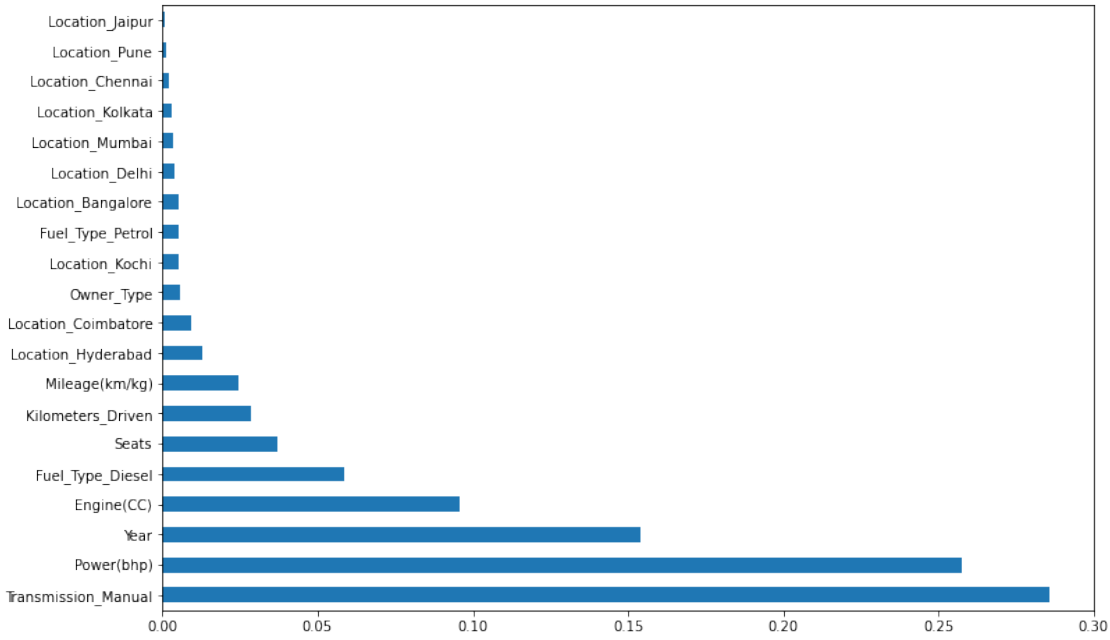


[259]:
```
from sklearn.ensemble import ExtraTreesRegressor
selection= ExtraTreesRegressor()
selection.fit(X,y)
```

```
/var/folders/jq/7j50kp6j4g3_5ypz5359z9cr0000gn/T/ipykernel_12908/1302846868.py:3
: DataConversionWarning: A column-vector y was passed when a 1d array was
expected. Please change the shape of y to (n_samples,), for example using
ravel().
  selection.fit(X,y)
```

[259]:
```
ExtraTreesRegressor()
```

[260]:
```
plt.figure(figsize = (12,8))
feat_importances = pd.Series(selection.feature_importances_, index=X.columns)
feat_importances.nlargest(20).plot(kind='barh')
plt.show()
```



[261]:
```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test=train_test_split(X,y,test_size=0.
  ↪2,random_state=0)
```

[262]:
```
from sklearn.linear_model import LinearRegression
linear_reg = LinearRegression()
linear_reg.fit(X_train, y_train)
y_pred= linear_reg.predict(X_test)
print("Accuracy on Traing set: ",linear_reg.score(X_train,y_train))
print("Accuracy on Testing set: ",linear_reg.score(X_test,y_test))
```

```
Accuracy on Traing set:  0.7005621804529992
Accuracy on Testing set:  0.7256102038308836
```

[263]:
```
from sklearn.tree import DecisionTreeRegressor
dt_reg = DecisionTreeRegressor()
dt_reg.fit(X_train, y_train)
y_pred= dt_reg.predict(X_test)
print("Accuracy on Traing set: ",dt_reg.score(X_train,y_train))
print("Accuracy on Testing set: ",dt_reg.score(X_test,y_test))
```

```
Accuracy on Traing set:  0.9999957727341057
```

```
Accuracy on Testing set:  0.83075389002561
```

[264]:

```python
from sklearn.ensemble import RandomForestRegressor
rf_reg = RandomForestRegressor()
rf_reg.fit(X_train, y_train)
y_pred= rf_reg.predict(X_test)
print("Accuracy on Traing set: ",rf_reg.score(X_train,y_train))
print("Accuracy on Testing set: ",rf_reg.score(X_test,y_test))
```

```
/var/folders/jq/7j50kp6j4g3_5ypz5359z9cr0000gn/T/ipykernel_12908/1618603712.py:3
: DataConversionWarning: A column-vector y was passed when a 1d array was
expected. Please change the shape of y to (n_samples,), for example using
ravel().
  rf_reg.fit(X_train, y_train)
```

```
Accuracy on Traing set:  0.9820475348555948
Accuracy on Testing set:  0.9106433763624514
```

[265]:

```python
from sklearn.model_selection import cross_val_score
cross_val_score(RandomForestRegressor(n_estimators=120, min_samples_split=2,␣
 ↪min_samples_leaf=1, max_depth=20), X,y,cv=cv)
```

```
/Library/Frameworks/Python.framework/Versions/3.10/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py:686: DataConversionWarning: A
column-vector y was passed when a 1d array was expected. Please change the shape
of y to (n_samples,), for example using ravel().
  estimator.fit(X_train, y_train, **fit_params)
/Library/Frameworks/Python.framework/Versions/3.10/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py:686: DataConversionWarning: A
column-vector y was passed when a 1d array was expected. Please change the shape
of y to (n_samples,), for example using ravel().
  estimator.fit(X_train, y_train, **fit_params)
/Library/Frameworks/Python.framework/Versions/3.10/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py:686: DataConversionWarning: A
column-vector y was passed when a 1d array was expected. Please change the shape
of y to (n_samples,), for example using ravel().
  estimator.fit(X_train, y_train, **fit_params)
/Library/Frameworks/Python.framework/Versions/3.10/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py:686: DataConversionWarning: A
column-vector y was passed when a 1d array was expected. Please change the shape
of y to (n_samples,), for example using ravel().
  estimator.fit(X_train, y_train, **fit_params)
/Library/Frameworks/Python.framework/Versions/3.10/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py:686: DataConversionWarning: A
column-vector y was passed when a 1d array was expected. Please change the shape
of y to (n_samples,), for example using ravel().
  estimator.fit(X_train, y_train, **fit_params)
```

[265]: array([0.91576411, 0.90297975, 0.90090799, 0.8707727 , 0.89790138])

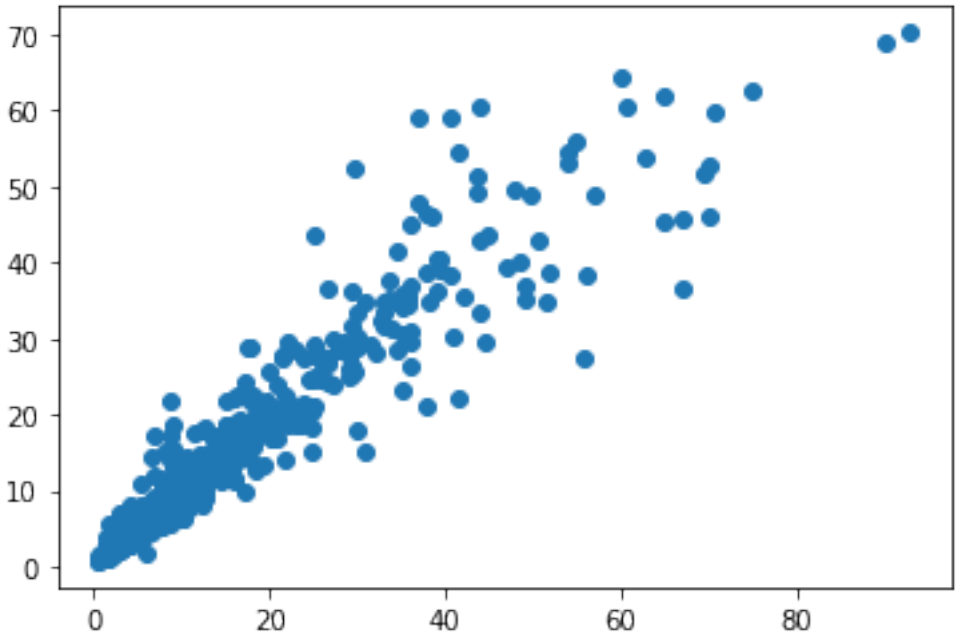
[266]:
```
cross_val_score(DecisionTreeRegressor(splitter='best', min_samples_leaf= 2,␣
↪max_depth=15, criterion='mae'), X,y,cv=cv)
```

```
/Library/Frameworks/Python.framework/Versions/3.10/lib/python3.10/site-
packages/sklearn/tree/_classes.py:404: FutureWarning: Criterion 'mae' was
deprecated in v1.0 and will be removed in version 1.2. Use
`criterion='absolute_error'` which is equivalent.
  warnings.warn(
/Library/Frameworks/Python.framework/Versions/3.10/lib/python3.10/site-
packages/sklearn/tree/_classes.py:404: FutureWarning: Criterion 'mae' was
deprecated in v1.0 and will be removed in version 1.2. Use
`criterion='absolute_error'` which is equivalent.
  warnings.warn(
/Library/Frameworks/Python.framework/Versions/3.10/lib/python3.10/site-
packages/sklearn/tree/_classes.py:404: FutureWarning: Criterion 'mae' was
deprecated in v1.0 and will be removed in version 1.2. Use
`criterion='absolute_error'` which is equivalent.
  warnings.warn(
/Library/Frameworks/Python.framework/Versions/3.10/lib/python3.10/site-
packages/sklearn/tree/_classes.py:404: FutureWarning: Criterion 'mae' was
deprecated in v1.0 and will be removed in version 1.2. Use
`criterion='absolute_error'` which is equivalent.
  warnings.warn(
/Library/Frameworks/Python.framework/Versions/3.10/lib/python3.10/site-
packages/sklearn/tree/_classes.py:404: FutureWarning: Criterion 'mae' was
deprecated in v1.0 and will be removed in version 1.2. Use
`criterion='absolute_error'` which is equivalent.
  warnings.warn(
```

[266]: array([0.85390693, 0.86213437, 0.84959856, 0.71326544, 0.83333883])

[267]:
```
predictions=rf_reg.predict(X_test)
plt.scatter(y_test,predictions)
```

[267]: <matplotlib.collections.PathCollection at 0x1339fbdc0>



[268]:
```
import pickle
with open('RF_price_predicting_model.pkl', 'wb') as file:
  # dump information to that file
  pickle.dump(rf_reg, file)
```