21bce5304-linearregression

January 18, 2024

[32]:

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

[3]:

```
# Importing USA Housing.csv
data = pd.read_csv('house.csv')
```

0.0.1 EDA

[ ]:

```
data.head()
```

[ ]:

```
   Avg. Area Income                        …
Address
0      79545.458574                        …                        208
Michael Ferry Apt. 674\nLaurabury, NE 3701…
1      79248.642455                        …                        188
Johnson Views Suite 079\nLake Kathleen, CA…
2      61287.067179                        …                        9127
Elizabeth Stravenue\nDanieltown, WI 06482…
3      63345.240046                        …
USS Barnett\nFPO AP 44820
4      59982.197226                        …
USNS Raymond\nFPO AE 09386

[5 rows x 7 columns]
```

[4]:

```
# Checking for Null Values
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5000 entries, 0 to 4999
Data columns (total 7 columns):
 #   Column                        Non-Null Count  Dtype
---  ------                        --------------  -----
 0   Avg. Area Income              5000 non-null   float64
 1   Avg. Area House Age           5000 non-null   float64
 2   Avg. Area Number of Rooms     5000 non-null   float64
 3   Avg. Area Number of Bedrooms  5000 non-null   float64
 4   Area Population               5000 non-null   float64
 5   Price                         5000 non-null   float64
 6   Address                       5000 non-null   object
dtypes: float64(6), object(1)
memory usage: 273.6+ KB
```

```
[5]: # Getting the summary of Data
     data.describe()
```

```
[5]:        Avg. Area Income  Avg. Area House Age  Avg. Area Number of Rooms  \
     count       5000.000000          5000.000000                5000.000000
     mean       68583.108984             5.977222                   6.987792
     std        10657.991214             0.991456                   1.005833
     min        17796.631190             2.644304                   3.236194
     25%        61480.562388             5.322283                   6.299250
     50%        68804.286404             5.970429                   7.002902
     75%        75783.338666             6.650808                   7.665871
     max       107701.748378             9.519088                  10.759588

            Avg. Area Number of Bedrooms  Area Population         Price
     count                   5000.000000      5000.000000  5.000000e+03
     mean                       3.981330     36163.516039  1.232073e+06
     std                        1.234137      9925.650114  3.531176e+05
     min                        2.000000       172.610686  1.593866e+04
     25%                        3.140000     29403.928702  9.975771e+05
     50%                        4.050000     36199.406689  1.232669e+06
     75%                        4.490000     42861.290769  1.471210e+06
     max                        6.500000     69621.713378  2.469066e+06
```

0.0.2 Data Preparation

1. There are no null values, so there is no need of deleting or replacing the data.
2. There is no necessity of having Address column/feature, so i am dropping it.

```
[6]: # Dropping Address Column
     data.drop(['Address'],axis=1,inplace=True)
```

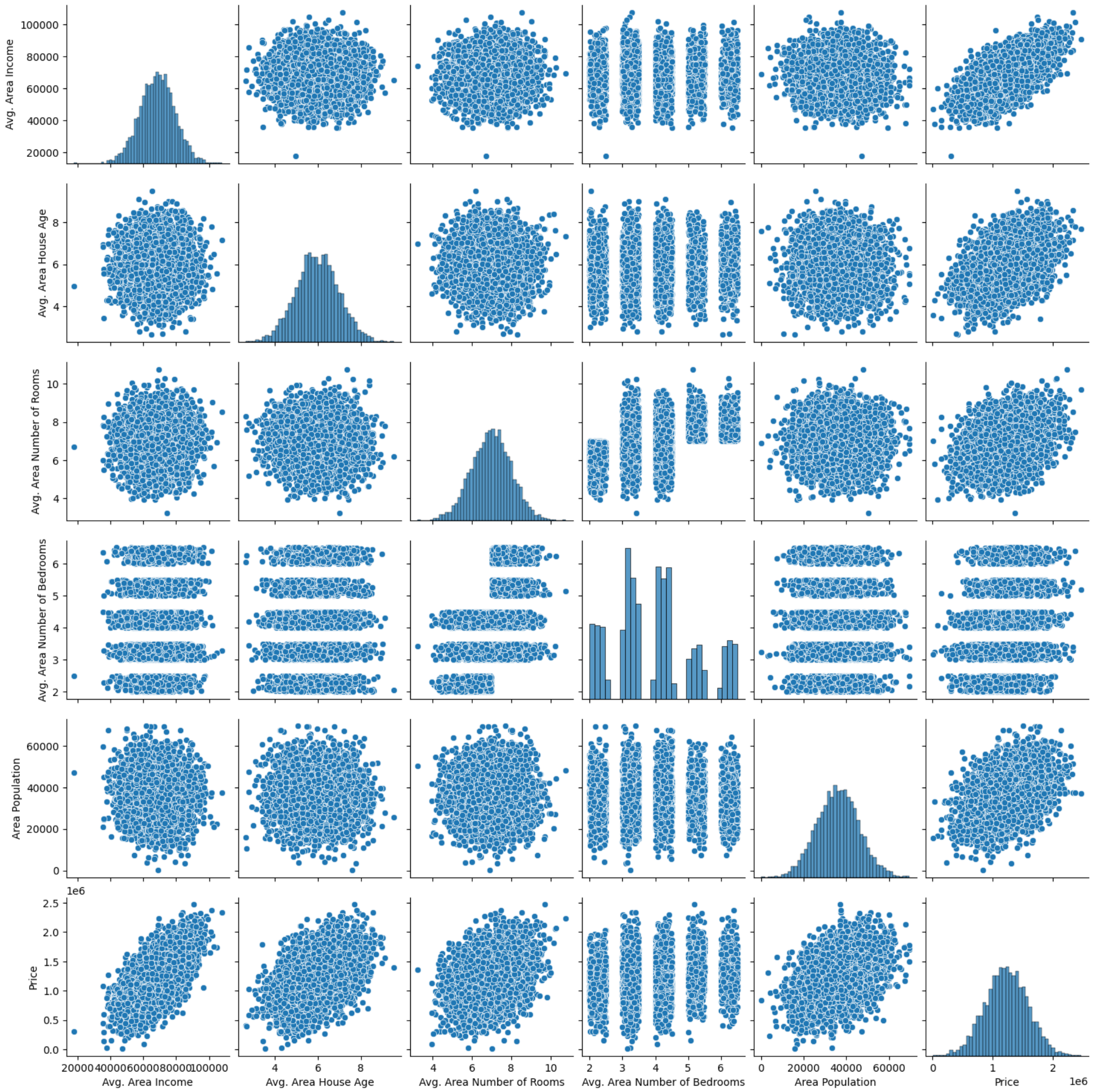
```
[7]: data.head()
```

```
[7]:    Avg. Area Income  Avg. Area House Age  Avg. Area Number of Rooms  \
     0      79545.458574             5.682861                   7.009188
     1      79248.642455             6.002900                   6.730821
     2      61287.067179             5.865890                   8.512727
     3      63345.240046             7.188236                   5.586729
     4      59982.197226             5.040555                   7.839388
```

```
   Avg. Area Number of Bedrooms  Area Population         Price
0                          4.09     23086.800503  1.059034e+06
1                          3.09     40173.072174  1.505891e+06
2                          5.13     36882.159400  1.058988e+06
3                          3.26     34310.242831  1.260617e+06
4                          4.23     26354.109472  6.309435e+05
```

[8]:
```
sns.pairplot(data)
```

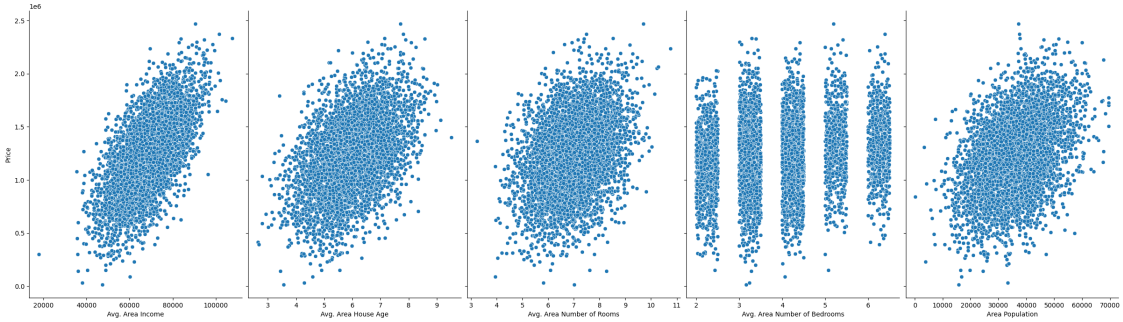
[8]:
```
<seaborn.axisgrid.PairGrid at 0x7d6ea4fe69b0>
```



[9]:
```
# Visualise the relationship between the features and the response using␣
 ↪scatterplots
```

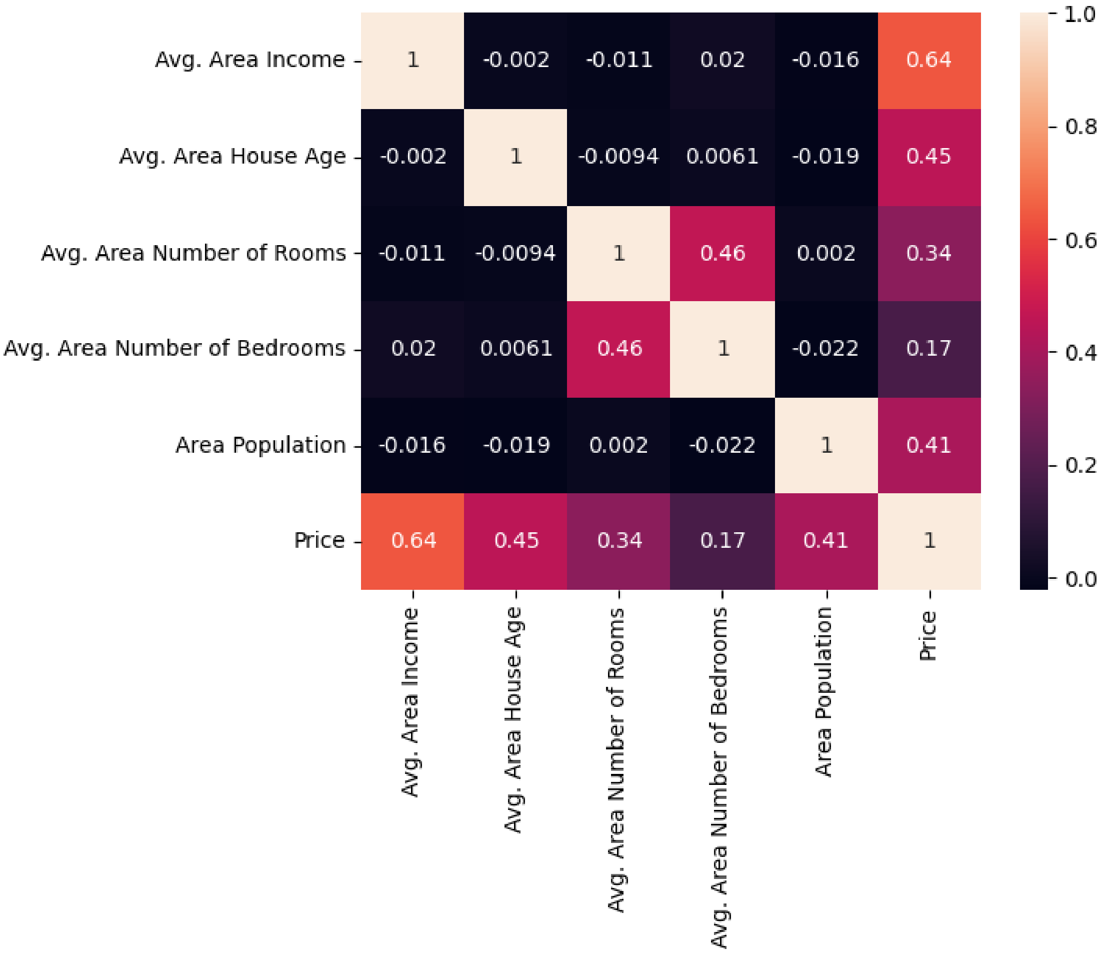
```
sns.pairplot(data, x_vars=['Avg. Area Income','Avg. Area House Age','Avg. Area␣
↪Number of Rooms','Avg. Area Number of Bedrooms','Area Population'],␣
↪y_vars='Price',height=7, aspect=0.7, kind='scatter')
```

```
[9]: <seaborn.axisgrid.PairGrid at 0x7d6ea12c9c60>
```



```
[10]: sns.heatmap(data.corr(),annot=True)
```

```
[10]: <Axes: >
```



[11]:

```
data.corr().Price.sort_values(ascending=False)
```

[11]:

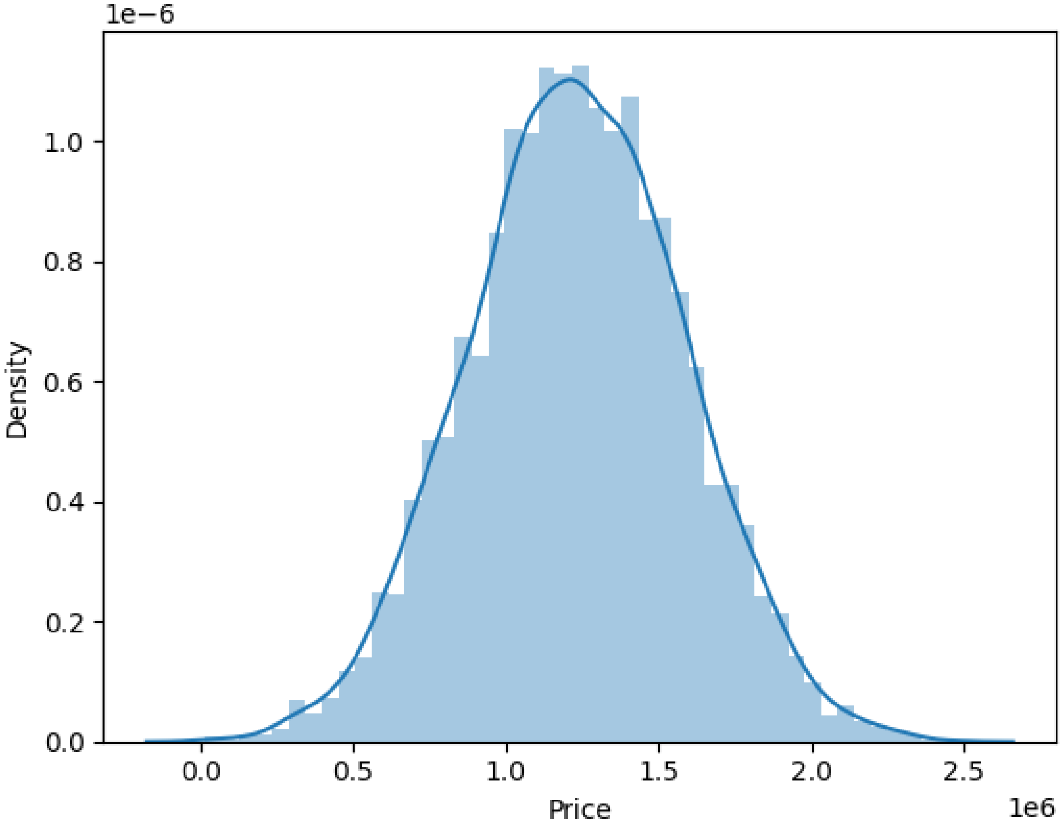
```
Price                           1.000000
Avg. Area Income                0.639734
Avg. Area House Age             0.452543
Area Population                 0.408556
Avg. Area Number of Rooms       0.335664
Avg. Area Number of Bedrooms    0.171071
Name: Price, dtype: float64
```

[12]:

```
sns.distplot(data.Price)
```

```
<ipython-input-12-dbe2555afa70>:1: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(data.Price)
```

[12]:
```
<Axes: xlabel='Price', ylabel='Density'>
```



Creating a Base Model

[13]:
```
from sklearn import preprocessing
pre_process = preprocessing.StandardScaler()
```

[14]:
```
X = data[['Avg. Area Income','Avg. Area House Age','Avg. Area Number of␣
↪Rooms','Avg. Area Number of Bedrooms','Area Population']]
y = data['Price']
```

[15]:
```
X = pd.DataFrame(pre_process.fit_transform(X))
```

[16]:
```
X.head()
```

```
[16]:           0         1         2         3         4
      0  1.028660 -0.296927  0.021274  0.088062 -1.317599
      1  1.000808  0.025902 -0.255506 -0.722301  0.403999
      2 -0.684629 -0.112303  1.516243  0.930840  0.072410
      3 -0.491499  1.221572 -1.393077 -0.584540 -0.186734
      4 -0.807073 -0.944834  0.846742  0.201513 -0.988387
```

```
[17]: y.head()
```

```
[17]: 0    1.059034e+06
      1    1.505891e+06
      2    1.058988e+06
      3    1.260617e+06
      4    6.309435e+05
      Name: Price, dtype: float64
```

```
[19]: from sklearn.model_selection import train_test_split
      X_train, X_test, y_train, y_test = train_test_split(X, y, train_size=0.7 ,test_size = 0.3, random_state=2)
```

```
[20]: print(X_train.shape)
      print(X_test.shape)
      print(y_train.shape)
      print(y_test.shape)
```

```
(3500, 5)
(1500, 5)
(3500,)
(1500,)
```

```
[21]: from sklearn.linear_model import LinearRegression
```

```
[22]: lm = LinearRegression()
```

```
[23]: # fit the model to the training data
      lm.fit(X_train, y_train)
```

```
[23]: LinearRegression()
```

```
[24]: # print the intercept
      print(lm.intercept_)
```

```
1231006.3190642651
```

```
[25]: coeff_df = pd.DataFrame(lm.coef_,X_test.columns,columns=['Coefficient'])
      coeff_df
```

```
[25]:      Coefficient
      0  229275.224032
      1  163592.487140
      2  120113.253351
      3    3015.847572
      4  150556.340296
```

```
[26]: # Making predictions using the model
      y_pred = lm.predict(X_test)
```

```
[27]: from sklearn.metrics import mean_squared_error, r2_score
      mse = mean_squared_error(y_test, y_pred)
      r_squared = r2_score(y_test, y_pred)
```

```
[28]: print('Mean_Squared_Error :' ,mse)
      print('r_square_value :',r_squared)
```

```
Mean_Squared_Error : 9831074697.74044
r_square_value : 0.9199287959786013
```

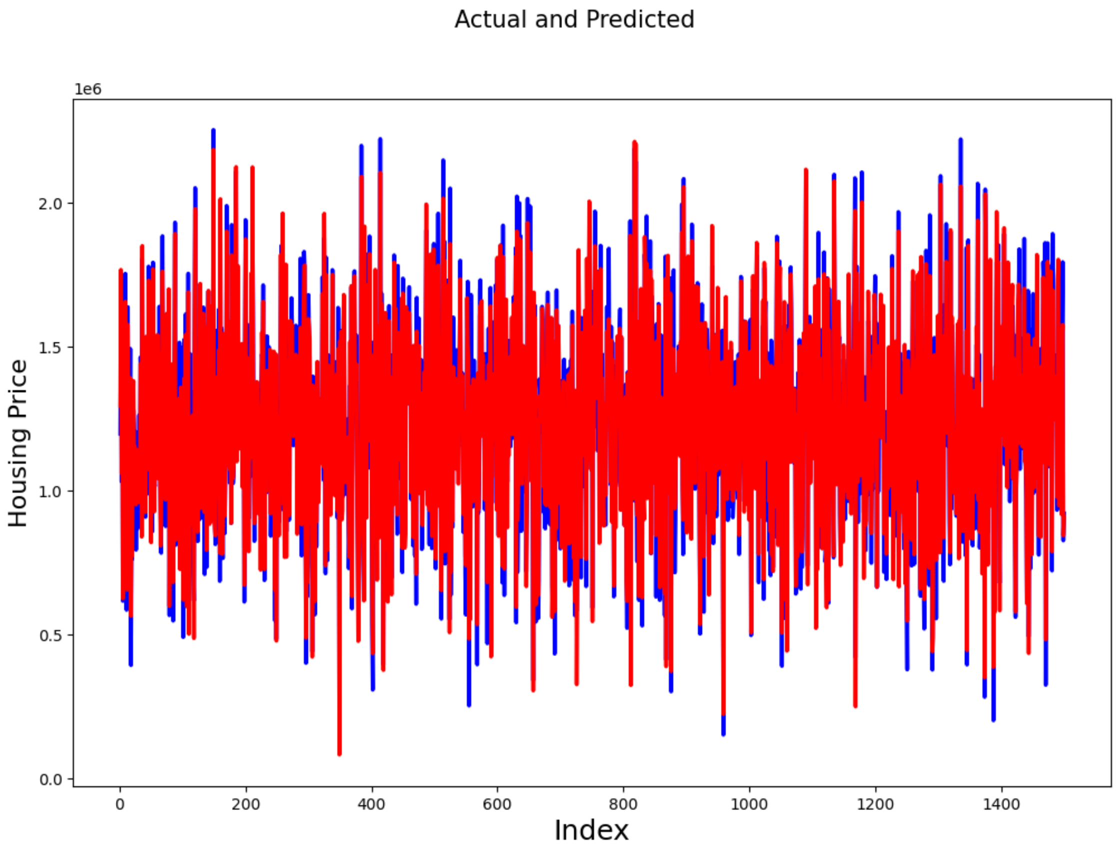
```
[29]: from math import sqrt

      rms = sqrt(mse)
      rms
```

```
[29]: 99151.77606952102
```

From the above result we may infer that, mse is huge which shouldn't be, hence we need to improve our model.

```
[31]: # Actual and Predicted
      c = [i for i in range(1,1501,1)]
      fig = plt.figure(figsize=(12,8))
      plt.plot(c,y_test, color="blue", linewidth=2.5, linestyle="-")
      plt.plot(c,y_pred, color="red",  linewidth=2.5, linestyle="-")
      fig.suptitle('Actual and Predicted', fontsize=15)
      plt.xlabel('Index', fontsize=18)
      plt.ylabel('Housing Price', fontsize=16)
```

```
[31]: Text(0, 0.5, 'Housing Price')
```


Actual and Predicted
1e6
Housing Price
0.0
0.5
1.0
1.5
2.0
0
200
400
600
800
1000
1200
1400
Index