House_Price_Prediction

November 9, 2024

[1]:
```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

[2]:
```python
data= pd.read_csv("House Price India.csv")
```

[3]:
```python
data
```

[3]:
```
               id   Date  number of bedrooms  number of bathrooms  \
0      6762810145  42491                   5                 2.50
1      6762810635  42491                   4                 2.50
2      6762810998  42491                   5                 2.75
3      6762812605  42491                   4                 2.50
4      6762812919  42491                   3                 2.00
…           …    …                 …                  …
14615  6762830250  42734                   2                 1.50
14616  6762830339  42734                   3                 2.00
14617  6762830618  42734                   2                 1.00
14618  6762830709  42734                   4                 1.00
14619  6762831463  42734                   3                 1.00

       living area  lot area  number of floors  waterfront present  \
0             3650      9050               2.0                   0
1             2920      4000               1.5                   0
2             2910      9480               1.5                   0
3             3310     42998               2.0                   0
4             2710      4500               1.5                   0
…            …       …                …                 …
14615         1556     20000               1.0                   0
14616         1680      7000               1.5                   0
14617         1070      6120               1.0                   0
14618         1030      6621               1.0                   0
14619          900      4770               1.0                   0

       number of views  condition of the house  …  Built Year  \
0                    4                       5  …        1921
1                    0                       5  …        1909
```

```
2                    0                       3  …        1939
3                    0                       3  …        2001
4                    0                       4  …        1929
…                …                     …  …         …
14615                0                       4  …        1957
14616                0                       4  …        1968
14617                0                       3  …        1962
14618                0                       4  …        1955
14619                0                       3  …        1969

       Renovation Year  Postal Code  Lattitude  Longitude  living_area_renov  \
0                    0       122003    52.8645   -114.557               2880
1                    0       122004    52.8878   -114.470               2470
2                    0       122004    52.8852   -114.468               2940
3                    0       122005    52.9532   -114.321               3350
4                    0       122006    52.9047   -114.485               2060
…                …          …        …        …                …
14615                0       122066    52.6191   -114.472               2250
14616                0       122072    52.5075   -114.393               1540
14617                0       122056    52.7289   -114.507               1130
14618                0       122042    52.7157   -114.411               1420
14619             2009       122018    52.5338   -114.552                900

       lot_area_renov  Number of schools nearby  Distance from the airport  \
0                5400                         2                         58
1                4000                         2                         51
2                6600                         1                         53
3               42847                         3                         76
4                4500                         1                         51
…               …                       …                        …
14615           17286                         3                         76
14616            7480                         3                         59
14617            6120                         2                         64
14618            6631                         3                         54
14619            3480                         2                         55

         Price
0      2380000
1      1400000
2      1200000
3       838000
4       805000
…        …
14615   221700
14616   219200
14617   209000
14618   205000
```

```
14619   146000

[14620 rows x 23 columns]
```

[4]:

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 14620 entries, 0 to 14619
Data columns (total 23 columns):
 #   Column                                 Non-Null Count  Dtype  
---  ------                                 --------------  -----  
 0   id                                     14620 non-null  int64  
 1   Date                                   14620 non-null  int64  
 2   number of bedrooms                     14620 non-null  int64  
 3   number of bathrooms                    14620 non-null  float64
 4   living area                            14620 non-null  int64  
 5   lot area                               14620 non-null  int64  
 6   number of floors                       14620 non-null  float64
 7   waterfront present                     14620 non-null  int64  
 8   number of views                        14620 non-null  int64  
 9   condition of the house                 14620 non-null  int64  
 10  grade of the house                     14620 non-null  int64  
 11  Area of the house(excluding basement)  14620 non-null  int64  
 12  Area of the basement                   14620 non-null  int64  
 13  Built Year                             14620 non-null  int64  
 14  Renovation Year                        14620 non-null  int64  
 15  Postal Code                            14620 non-null  int64  
 16  Lattitude                              14620 non-null  float64
 17  Longitude                              14620 non-null  float64
 18  living_area_renov                      14620 non-null  int64  
 19  lot_area_renov                         14620 non-null  int64  
 20  Number of schools nearby               14620 non-null  int64  
 21  Distance from the airport              14620 non-null  int64  
 22  Price                                  14620 non-null  int64  
dtypes: float64(4), int64(19)
memory usage: 2.6 MB
```

[5]:

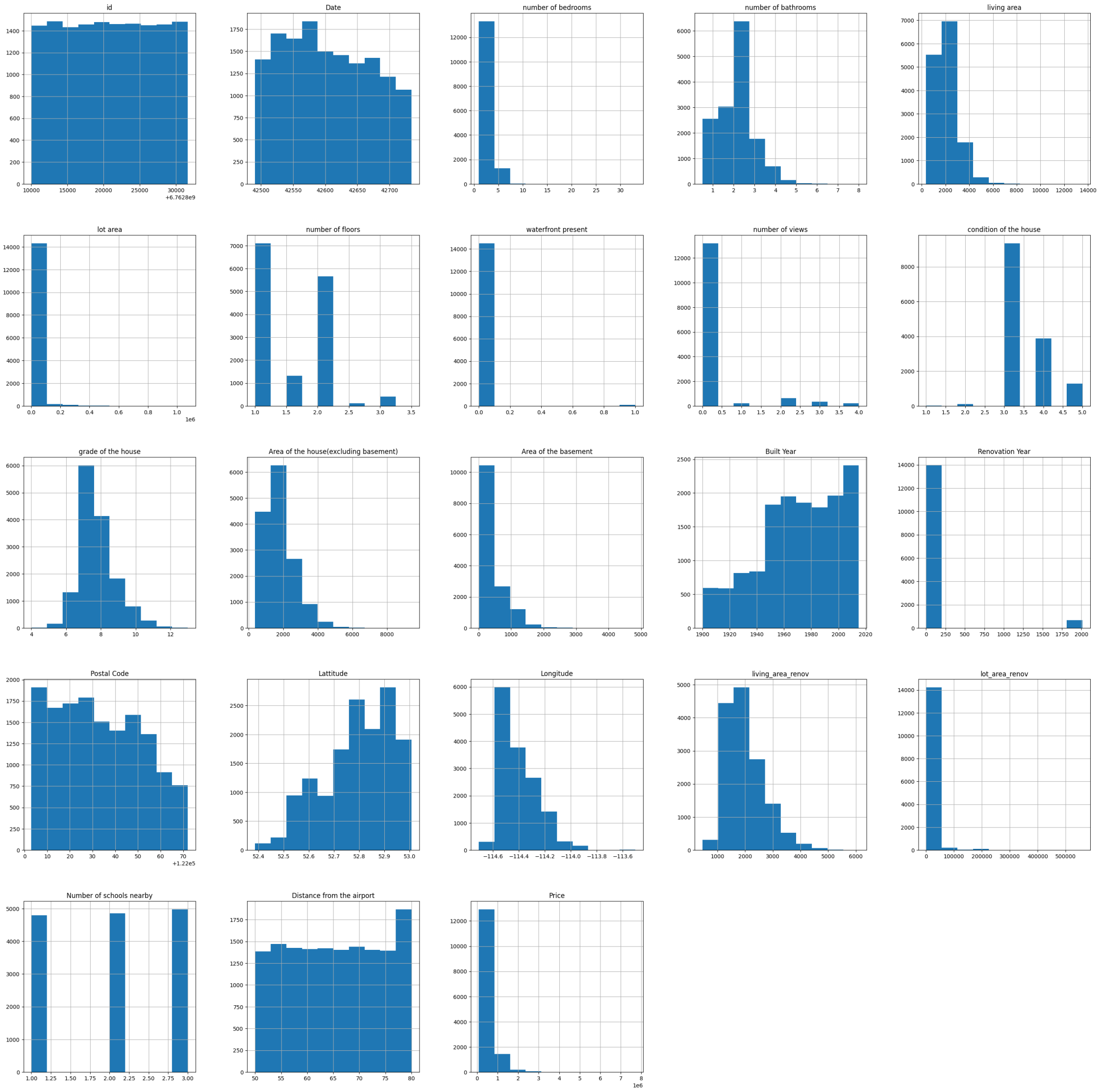
```
data.dropna(inplace=True)
```

[6]:

```
data.hist(figsize=(35, 35))
```

[6]:

```
array([[<Axes: title={'center': 'id'}>, <Axes: title={'center': 'Date'}>,
        <Axes: title={'center': 'number of bedrooms'}>,
        <Axes: title={'center': 'number of bathrooms'}>,
        <Axes: title={'center': 'living area'}>],
       [<Axes: title={'center': 'lot area'}>,
        <Axes: title={'center': 'number of floors'}>,
        <Axes: title={'center': 'waterfront present'}>,
  <Axes: title={'center': 'number of views'}>,
  <Axes: title={'center': 'condition of the house'}>],
 [<Axes: title={'center': 'grade of the house'}>,
  <Axes: title={'center': 'Area of the house(excluding basement)'}>,
  <Axes: title={'center': 'Area of the basement'}>,
  <Axes: title={'center': 'Built Year'}>,
  <Axes: title={'center': 'Renovation Year'}>],
 [<Axes: title={'center': 'Postal Code'}>,
  <Axes: title={'center': 'Lattitude'}>,
  <Axes: title={'center': 'Longitude'}>,
  <Axes: title={'center': 'living_area_renov'}>,
  <Axes: title={'center': 'lot_area_renov'}>],
 [<Axes: title={'center': 'Number of schools nearby'}>,
  <Axes: title={'center': 'Distance from the airport'}>,
  <Axes: title={'center': 'Price'}>, <Axes: >, <Axes: >]],
dtype=object)
```



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

```
[7]:                                   id      Date  number of bedrooms  \
     id                          1.000000  0.045966           -0.329034
     Date                        0.045966  1.000000           -0.015663
     number of bedrooms         -0.329034 -0.015663            1.000000
     number of bathrooms        -0.516909 -0.026485            0.509784
     living area                -0.648127 -0.021958            0.570526
     lot area                   -0.100269  0.004392            0.034416
     number of floors           -0.312305 -0.010335            0.177294
     waterfront present         -0.112937  0.012006           -0.006257
     number of views            -0.293004 -0.004782            0.078665
     condition of the house     -0.045061 -0.027402            0.026597
```

```
grade of the house                    -0.673448 -0.033097            0.352945
Area of the house(excluding basement) -0.565116 -0.015994            0.473599
Area of the basement                  -0.290806 -0.015711            0.300332
Built Year                            -0.068645 -0.005869            0.152954
Renovation Year                       -0.109155 -0.011636            0.016132
Postal Code                            0.294709  0.018243           -0.044156
Lattitude                             -0.479334 -0.023327           -0.013163
Longitude                             -0.070841 -0.018231            0.135712
living_area_renov                     -0.599900 -0.032495            0.389855
lot_area_renov                        -0.089604 -0.000050            0.029400
Number of schools nearby              -0.004821 -0.004071            0.003397
Distance from the airport             -0.004542  0.011457           -0.006157
Price                                 -0.773114 -0.027919            0.308460

                                       number of bathrooms  living area  \
id                                               -0.516909    -0.648127
Date                                             -0.026485    -0.021958
number of bedrooms                                0.509784     0.570526
number of bathrooms                               1.000000     0.753517
living area                                       0.753517     1.000000
lot area                                          0.080806     0.174420
number of floors                                  0.502924     0.354743
waterfront present                                0.060104     0.105837
number of views                                   0.183789     0.287728
condition of the house                           -0.128232    -0.063358
grade of the house                                0.663054     0.761835
Area of the house(excluding basement)             0.684391     0.875793
Area of the basement                              0.287190     0.441491
Built Year                                        0.498127     0.309602
Renovation Year                                   0.049669     0.059400
Postal Code                                      -0.105546    -0.080303
Lattitude                                         0.031156     0.054518
Longitude                                         0.223904     0.240208
living_area_renov                                 0.570530     0.757571
lot_area_renov                                    0.078627     0.180312
Number of schools nearby                          0.002180     0.002370
Distance from the airport                         0.009206     0.002511
Price                                             0.531735     0.712169

                                       lot area  number of floors  \
id                                    -0.100269         -0.312305
Date                                   0.004392         -0.010335
number of bedrooms                     0.034416          0.177294
number of bathrooms                    0.080806          0.502924
living area                            0.174420          0.354743
lot area                               1.000000         -0.004138
number of floors                      -0.004138          1.000000
```

```
waterfront present                     0.026282          0.016316
number of views                        0.078308          0.020153
condition of the house                -0.008548         -0.269928
grade of the house                     0.110546          0.463082
Area of the house(excluding basement)  0.183553          0.525643
Area of the basement                   0.019755         -0.242976
Built Year                             0.051615          0.481565
Renovation Year                        0.006848          0.006705
Postal Code                            0.070131         -0.129788
Lattitude                             -0.090983          0.050731
Longitude                              0.221432          0.127550
living_area_renov                      0.149744          0.285093
lot_area_renov                         0.706812         -0.010120
Number of schools nearby              -0.012671         -0.007579
Distance from the airport              0.003291          0.016567
Price                                  0.081992          0.262732

                                       waterfront present  number of views  \
id                                              -0.112937        -0.293004
Date                                             0.012006        -0.004782
number of bedrooms                              -0.006257         0.078665
number of bathrooms                              0.060104         0.183789
living area                                      0.105837         0.287728
lot area                                         0.026282         0.078308
number of floors                                 0.016316         0.020153
waterfront present                               1.000000         0.400206
number of views                                  0.400206         1.000000
condition of the house                           0.018644         0.052533
grade of the house                               0.079831         0.254532
Area of the house(excluding basement)            0.071865         0.162672
Area of the basement                             0.085441         0.293062
Built Year                                      -0.024226        -0.055357
Renovation Year                                  0.085865         0.102944
Postal Code                                      0.038318         0.039268
Lattitude                                       -0.021795        -0.004555
Longitude                                       -0.047791        -0.079706
living_area_renov                                0.085743         0.281452
lot_area_renov                                   0.032055         0.072300
Number of schools nearby                         0.001563         0.008004
Distance from the airport                        0.001448        -0.001657
Price                                            0.263687         0.395973

                                       condition of the house  …  \
id                                                  -0.045061  …
Date                                                -0.027402  …
number of bedrooms                                   0.026597  …
number of bathrooms                                 -0.128232  …
```

```
living area                                 -0.063358  …
lot area                                    -0.008548  …
number of floors                            -0.269928  …
waterfront present                           0.018644  …
number of views                              0.052533  …
condition of the house                       1.000000  …
grade of the house                          -0.152530  …
Area of the house(excluding basement)       -0.167695  …
Area of the basement                         0.180609  …
Built Year                                  -0.381718  …
Renovation Year                             -0.062126  …
Postal Code                                  0.045334  …
Lattitude                                   -0.002998  …
Longitude                                   -0.121189  …
living_area_renov                           -0.099743  …
lot_area_renov                              -0.004748  …
Number of schools nearby                    -0.006939  …
Distance from the airport                   -0.002136  …
Price                                        0.041376  …

                                       Built Year  Renovation Year  \
id                                      -0.068645        -0.109155
Date                                    -0.005869        -0.011636
number of bedrooms                       0.152954         0.016132
number of bathrooms                      0.498127         0.049669
living area                              0.309602         0.059400
lot area                                 0.051615         0.006848
number of floors                         0.481565         0.006705
waterfront present                      -0.024226         0.085865
number of views                         -0.055357         0.102944
condition of the house                  -0.381718        -0.062126
grade of the house                       0.440358         0.014501
Area of the house(excluding basement)    0.419369         0.025727
Area of the basement                    -0.138843         0.075104
Built Year                               1.000000        -0.233683
Renovation Year                         -0.233683         1.000000
Postal Code                             -0.062349         0.018006
Lattitude                               -0.143153         0.028908
Longitude                                0.414591        -0.080050
living_area_renov                        0.328625        -0.002601
lot_area_renov                           0.072874         0.005869
Number of schools nearby                -0.001631        -0.000826
Distance from the airport               -0.003968         0.005342
Price                                    0.050307         0.133173

                                       Postal Code  Lattitude  Longitude  \
id                                        0.294709  -0.479334  -0.070841
```

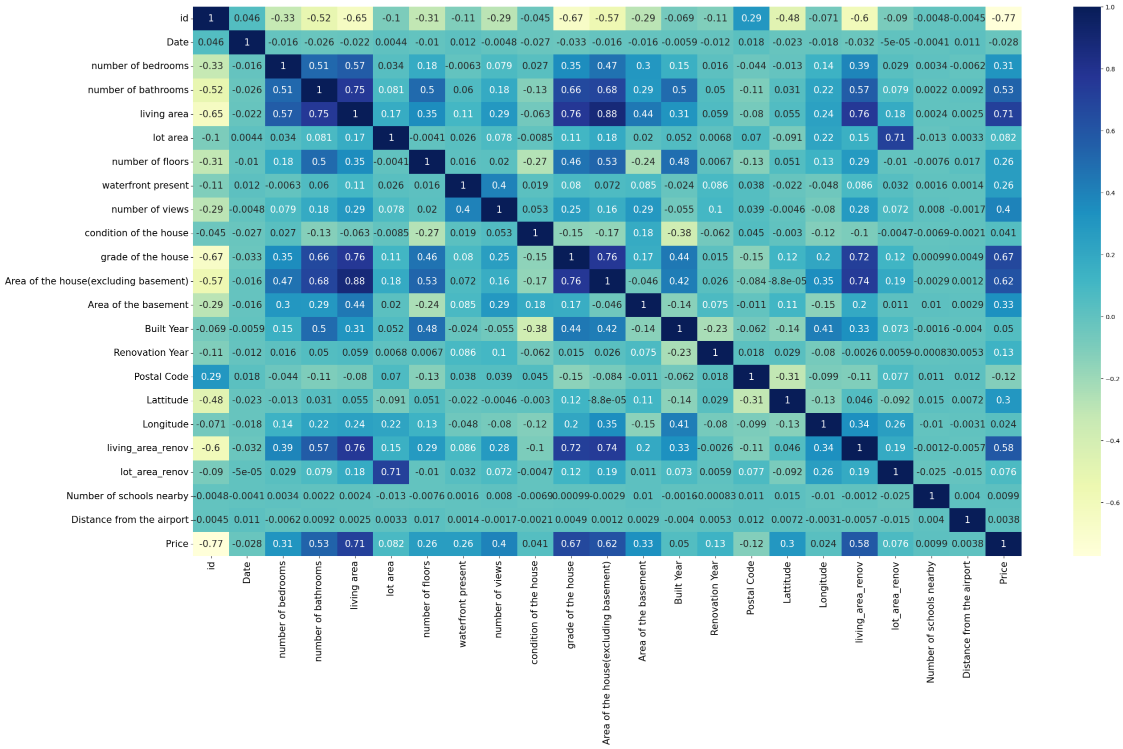
```
Date                                      0.018243  -0.023327  -0.018231
number of bedrooms                       -0.044156  -0.013163   0.135712
number of bathrooms                      -0.105546   0.031156   0.223904
living area                              -0.080303   0.054518   0.240208
lot area                                  0.070131  -0.090983   0.221432
number of floors                         -0.129788   0.050731   0.127550
waterfront present                        0.038318  -0.021795  -0.047791
number of views                           0.039268  -0.004555  -0.079706
condition of the house                    0.045334  -0.002998  -0.121189
grade of the house                       -0.146342   0.115256   0.203754
Area of the house(excluding basement)    -0.083730  -0.000088   0.345899
Area of the basement                     -0.010542   0.112989  -0.145879
Built Year                               -0.062349  -0.143153   0.414591
Renovation Year                           0.018006   0.028908  -0.080050
Postal Code                               1.000000  -0.310172  -0.099003
Lattitude                                -0.310172   1.000000  -0.131472
Longitude                                -0.099003  -0.131472   1.000000
living_area_renov                        -0.108454   0.046148   0.341221
lot_area_renov                            0.077483  -0.091622   0.258066
Number of schools nearby                  0.010605   0.014949  -0.010163
Distance from the airport                 0.011528   0.007193  -0.003100
Price                                    -0.115908   0.297490   0.024414

                                       living_area_renov  lot_area_renov  \
id                                             -0.599900       -0.089604
Date                                           -0.032495       -0.000050
number of bedrooms                              0.389855        0.029400
number of bathrooms                             0.570530        0.078627
living area                                     0.757571        0.180312
lot area                                        0.149744        0.706812
number of floors                                0.285093       -0.010120
waterfront present                              0.085743        0.032055
number of views                                 0.281452        0.072300
condition of the house                         -0.099743       -0.004748
grade of the house                              0.720019        0.116725
Area of the house(excluding basement)           0.737744        0.194670
Area of the basement                            0.196403        0.011283
Built Year                                      0.328625        0.072874
Renovation Year                                -0.002601        0.005869
Postal Code                                    -0.108454        0.077483
Lattitude                                       0.046148       -0.091622
Longitude                                       0.341221        0.258066
living_area_renov                               1.000000        0.189225
lot_area_renov                                  0.189225        1.000000
Number of schools nearby                       -0.001203       -0.025014
Distance from the airport                      -0.005673       -0.014587
Price                                           0.584924        0.075535
```

```
                                       Number of schools nearby  \
id                                                    -0.004821
Date                                                  -0.004071
number of bedrooms                                     0.003397
number of bathrooms                                    0.002180
living area                                            0.002370
lot area                                              -0.012671
number of floors                                      -0.007579
waterfront present                                     0.001563
number of views                                        0.008004
condition of the house                                -0.006939
grade of the house                                     0.000986
Area of the house(excluding basement)                 -0.002894
Area of the basement                                   0.010284
Built Year                                            -0.001631
Renovation Year                                       -0.000826
Postal Code                                            0.010605
Lattitude                                              0.014949
Longitude                                             -0.010163
living_area_renov                                     -0.001203
lot_area_renov                                        -0.025014
Number of schools nearby                               1.000000
Distance from the airport                              0.004035
Price                                                  0.009890

                                       Distance from the airport     Price
id                                                     -0.004542 -0.773114
Date                                                    0.011457 -0.027919
number of bedrooms                                     -0.006157  0.308460
number of bathrooms                                     0.009206  0.531735
living area                                             0.002511  0.712169
lot area                                                0.003291  0.081992
number of floors                                        0.016567  0.262732
waterfront present                                      0.001448  0.263687
number of views                                        -0.001657  0.395973
condition of the house                                 -0.002136  0.041376
grade of the house                                      0.004940  0.671814
Area of the house(excluding basement)                   0.001222  0.615220
Area of the basement                                    0.002926  0.330202
Built Year                                             -0.003968  0.050307
Renovation Year                                         0.005342  0.133173
Postal Code                                             0.011528 -0.115908
Lattitude                                               0.007193  0.297490
Longitude                                              -0.003100  0.024414
living_area_renov                                      -0.005673  0.584924
lot_area_renov                                         -0.014587  0.075535
```

```
Number of schools nearby                                  0.004035  0.009890
Distance from the airport                                 1.000000  0.003804
Price                                                     0.003804  1.000000

[23 rows x 23 columns]
```

```
[8]: plt.figure(figsize=(30,16))
     sns.heatmap(data.corr(),annot=True,cmap="YlGnBu",annot_kws={"size": 15},)
     plt.xticks(rotation=90, fontsize=15)
     plt.yticks(rotation=0, fontsize=15)
```

```
[8]: (array([ 0.5,  1.5,  2.5,  3.5,  4.5,  5.5,  6.5,  7.5,  8.5,  9.5, 10.5,
             11.5, 12.5, 13.5, 14.5, 15.5, 16.5, 17.5, 18.5, 19.5, 20.5, 21.5,
             22.5]),
      [Text(0, 0.5, 'id'),
       Text(0, 1.5, 'Date'),
       Text(0, 2.5, 'number of bedrooms'),
       Text(0, 3.5, 'number of bathrooms'),
       Text(0, 4.5, 'living area'),
       Text(0, 5.5, 'lot area'),
       Text(0, 6.5, 'number of floors'),
       Text(0, 7.5, 'waterfront present'),
       Text(0, 8.5, 'number of views'),
       Text(0, 9.5, 'condition of the house'),
       Text(0, 10.5, 'grade of the house'),
       Text(0, 11.5, 'Area of the house(excluding basement)'),
       Text(0, 12.5, 'Area of the basement'),
       Text(0, 13.5, 'Built Year'),
       Text(0, 14.5, 'Renovation Year'),
       Text(0, 15.5, 'Postal Code'),
       Text(0, 16.5, 'Lattitude'),
       Text(0, 17.5, 'Longitude'),
       Text(0, 18.5, 'living_area_renov'),
       Text(0, 19.5, 'lot_area_renov'),
       Text(0, 20.5, 'Number of schools nearby'),
       Text(0, 21.5, 'Distance from the airport'),
       Text(0, 22.5, 'Price')])
```



[9]:
```python
# Calculate Q1 (25th percentile) and Q3 (75th percentile) for the 'Price' column
Q1 = data['Price'].quantile(0.25)
Q3 = data['Price'].quantile(0.75)
IQR = Q3 - Q1

# Define the lower and upper bounds
lower_bound = Q1 - 1.5 * IQR
upper_bound = Q3 + 1.5 * IQR

# Remove outliers
data= data[(data['Price'] >= lower_bound) & (data['Price'] <= upper_bound)]
```

[10]:
```python
data.info()
```

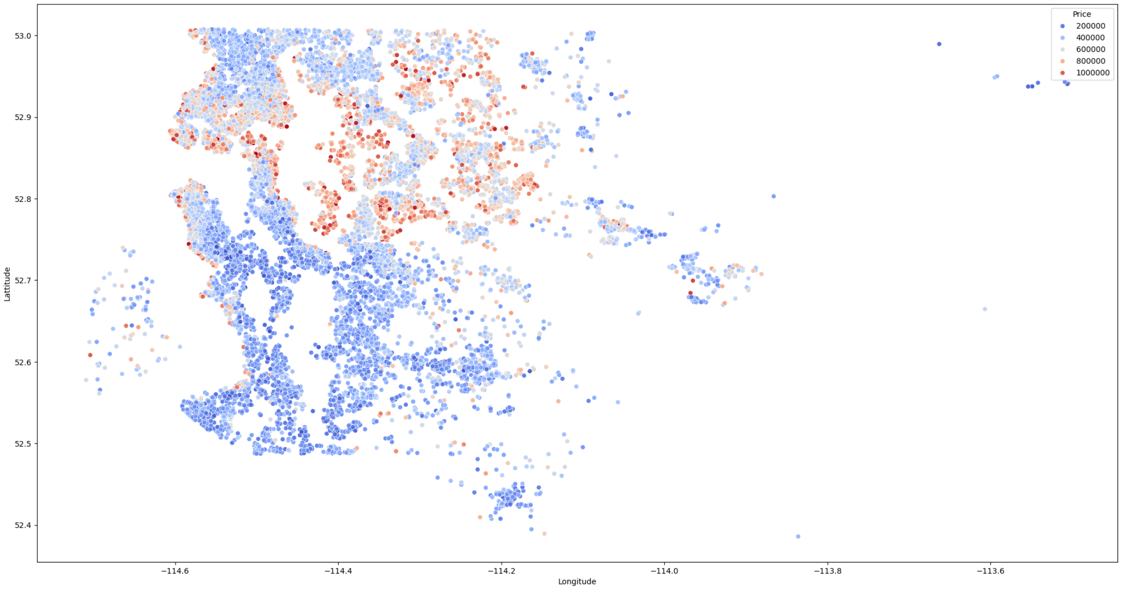
```
<class 'pandas.core.frame.DataFrame'>
Index: 13859 entries, 3 to 14619
Data columns (total 23 columns):
 #   Column                                 Non-Null Count  Dtype
---  ------                                 --------------  -----
 0   id                                     13859 non-null  int64
 1   Date                                   13859 non-null  int64
 2   number of bedrooms                     13859 non-null  int64
 3   number of bathrooms                    13859 non-null  float64
 4   living area                            13859 non-null  int64
 5   lot area                                13859 non-null  int64
 6   number of floors                        13859 non-null  float64
 7   waterfront present                      13859 non-null  int64
 8   number of views                         13859 non-null  int64
 9   condition of the house                  13859 non-null  int64
 10  grade of the house                      13859 non-null  int64
 11  Area of the house(excluding basement)   13859 non-null  int64
 12  Area of the basement                    13859 non-null  int64
 13  Built Year                              13859 non-null  int64
 14  Renovation Year                         13859 non-null  int64
 15  Postal Code                             13859 non-null  int64
 16  Lattitude                               13859 non-null  float64
 17  Longitude                               13859 non-null  float64
 18  living_area_renov                       13859 non-null  int64
 19  lot_area_renov                          13859 non-null  int64
 20  Number of schools nearby                13859 non-null  int64
 21  Distance from the airport               13859 non-null  int64
 22  Price                                   13859 non-null  int64
dtypes: float64(4), int64(19)
memory usage: 2.5 MB
```

[11]:

```
plt.figure(figsize=(25,13))
sns.
 ↪scatterplot(x='Longitude',y='Lattitude',data=data,hue='Price',palette='coolwarm')
```

[11]:

```
<Axes: xlabel='Longitude', ylabel='Lattitude'>
```



[12]:

```
from sklearn.model_selection import train_test_split
```

```
[13]: x = data.drop(['Price'], axis=1)  # Drop the 'Price' column from the dataframe␣
       ↪to use the rest as features
      y = data['Price']
```

```
[14]: x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.2)
```

```
[15]: from sklearn.linear_model import LinearRegression
      from sklearn.preprocessing import StandardScaler
      from sklearn.pipeline import Pipeline

      pipe=Pipeline([
          ('scale',StandardScaler()),
          ('model',LinearRegression())
      ])
      #mod = LinearRegression()

      pipe.fit(x_train, y_train)
```

```
[15]: Pipeline(steps=[('scale', StandardScaler()), ('model', LinearRegression())])
```

```
[16]: pipe.predict(x_test)  # Predicting the target values
```

```
[16]: array([568176.4472549 , 573986.47513395, 212987.23244887, …,
             296507.17230239, 450129.31341638, 461056.23040878])
```

```
[28]: pred = pipe.predict(x_test)
      pipe.score(x_test, y_test)
```

```
[28]: 0.943424082250265
```

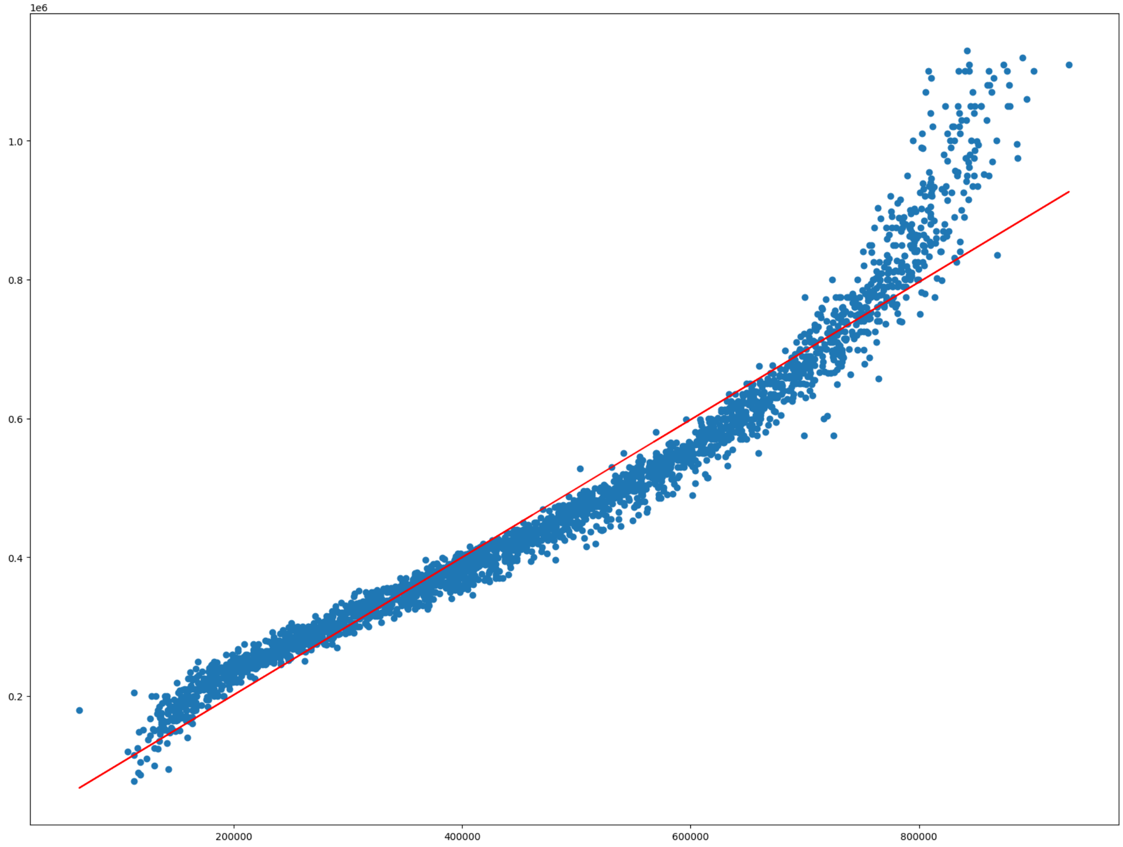
```
[33]: from sklearn.metrics import mean_absolute_error, root_mean_squared_error
      mae = mean_absolute_error(y_test, pred)
      rmse = root_mean_squared_error(y_test, pred)
      r2_score=pipe.score(x_test, y_test)

      print(f"Pipeline Model Evaluation:")
      print(f"- R² Score: {r2_score:.2f}")
      print(f"- Mean Absolute Error (MAE): {mae:.2f}")
      print(f"- Root Mean Squared Error (RMSE): {rmse:.2f}")
```

```
Pipeline Model Evaluation:
- R² Score: 0.94
- Mean Absolute Error (MAE): 35611.97
- Root Mean Squared Error (RMSE): 48895.75
```

```
[18]: plt.figure(figsize=(20,15))
      plt.scatter(pred,y_test)
      slope,intercept=np.polyfit(pred,y_test,1)
```

```
regression_line = slope * pred + intercept
plt.plot(pred, regression_line, color='red', label='Regression Line')
```

[18]:
```
[<matplotlib.lines.Line2D at 0x22ed5295d10>]
```



[19]:
```
 from sklearn.neighbors import KNeighborsRegressor

knn = Pipeline([
    ('scale', StandardScaler()),  # Feature scaling
    ('mod', KNeighborsRegressor())  # KNN model
])

# Fit the pipeline with the training data
knn.fit(x_train, y_train)
```

[19]:
```
Pipeline(steps=[('scale', StandardScaler()), ('mod', KNeighborsRegressor())])
```

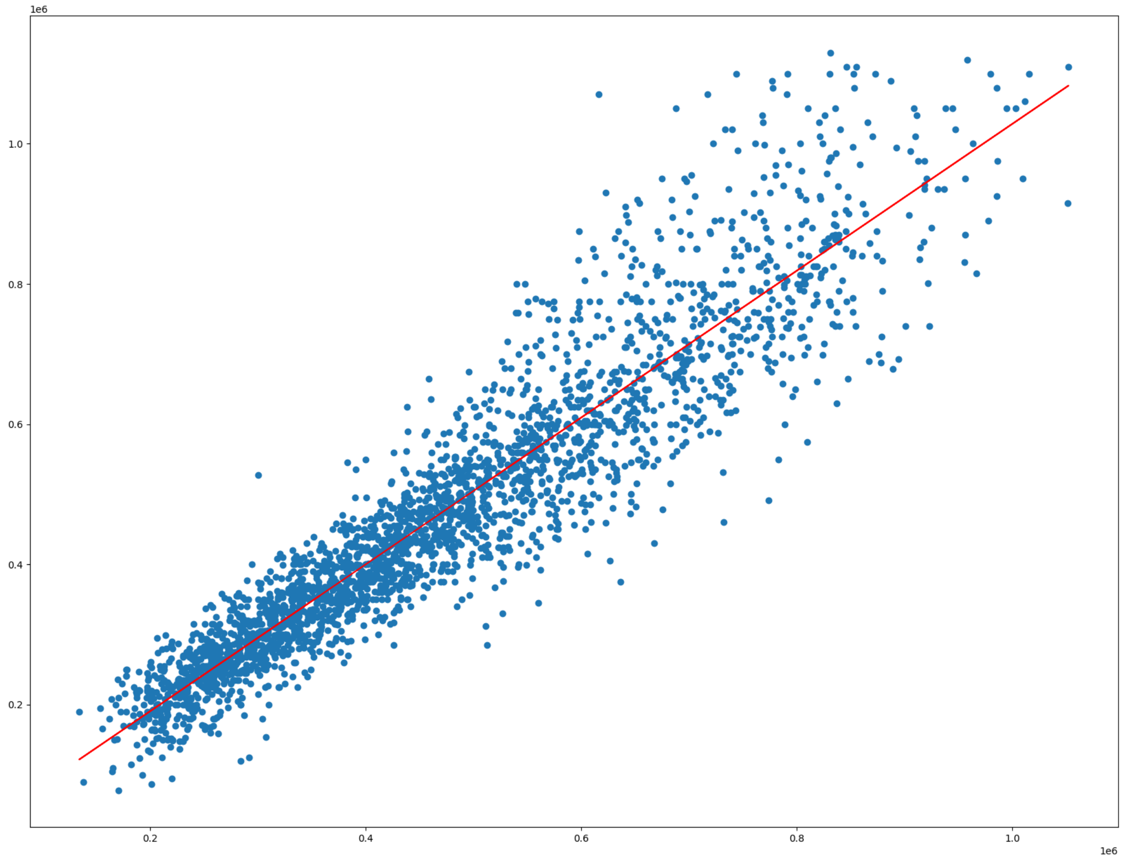
[34]:
```
Knnpred = knn.predict(x_test)  # Predicting the target values

mae = mean_absolute_error(y_test, Knnpred)
```

```
rmse = root_mean_squared_error(y_test, Knnpred)
r2_score=knn.score(x_test, y_test)

print(f"Pipeline Model Evaluation:")
print(f"- R² Score: {r2_score:.2f}")
print(f"- Mean Absolute Error (MAE): {mae:.2f}")
print(f"- Root Mean Squared Error (RMSE): {rmse:.2f}")
```

```
Pipeline Model Evaluation:
- R² Score: 0.87
- Mean Absolute Error (MAE): 51398.76
- Root Mean Squared Error (RMSE): 73307.49
```

[21]:
```
plt.figure(figsize=(20,15))
plt.scatter(Knnpred,y_test)
slope,intercept=np.polyfit(Knnpred,y_test,1)
regression_line = slope * Knnpred + intercept
plt.plot(Knnpred, regression_line, color='red', label='Regression Line')
```

[21]:
```
[<matplotlib.lines.Line2D at 0x22ed59b82d0>]
```



[22]:

```
knn.get_params()
```

[22]:

```
{'memory': None,
 'steps': [('scale', StandardScaler()), ('mod', KNeighborsRegressor())],
 'verbose': False,
 'scale': StandardScaler(),
 'mod': KNeighborsRegressor(),
 'scale__copy': True,
 'scale__with_mean': True,
 'scale__with_std': True,
 'mod__algorithm': 'auto',
 'mod__leaf_size': 30,
 'mod__metric': 'minkowski',
 'mod__metric_params': None,
 'mod__n_jobs': None,
 'mod__n_neighbors': 5,
 'mod__p': 2,
 'mod__weights': 'uniform'}
```

[23]:

```
from sklearn.model_selection import GridSearchCV
gridknn= GridSearchCV(estimator= knn,
                      param_grid={'mod__n_neighbors':[1,2,3,4,5,6,7,8,9,10]},
                      cv=3)
```

[24]:

```
gridknn.fit(x_train,y_train)
best_score = gridknn.best_score_

print(f"Best k value: {best_score}")
```

```
Best k value: 0.8619226424775815
```

[35]:

```
gridknn.score(x_test,y_test)

gridknnpred = gridknn.predict(x_test)  # Predicting the target values

mae = mean_absolute_error(y_test, gridknnpred)
rmse = root_mean_squared_error(y_test, gridknnpred)
r2_score=gridknn.score(x_test, y_test)

print(f"Pipeline Model Evaluation:")
print(f"- R² Score: {r2_score:.2f}")
print(f"- Mean Absolute Error (MAE): {mae:.2f}")
print(f"- Root Mean Squared Error (RMSE): {rmse:.2f}")
```

```
Pipeline Model Evaluation:
- R² Score: 0.88
- Mean Absolute Error (MAE): 50243.29
- Root Mean Squared Error (RMSE): 72401.31
```

[26]:

```
from sklearn.ensemble import RandomForestRegressor
rf = Pipeline([
    ('scale', StandardScaler()),
    ('rf', RandomForestRegressor())
])

rf.fit(x_train, y_train)
rfpred=rf.predict(x_test)
rf.score(x_test, y_test)
```

[26]:

```
0.9999990391404829
```

[37]:

```
mae = mean_absolute_error(y_test, rfpred)
rmse = root_mean_squared_error(y_test, rfpred)
r2_score=rf.score(x_test, y_test)

print(f"Pipeline Model Evaluation:")
print(f"- R² Score: {r2_score:.9f}")
print(f"- Mean Absolute Error (MAE): {mae:.2f}")
print(f"- Root Mean Squared Error (RMSE): {rmse:.2f}")
```

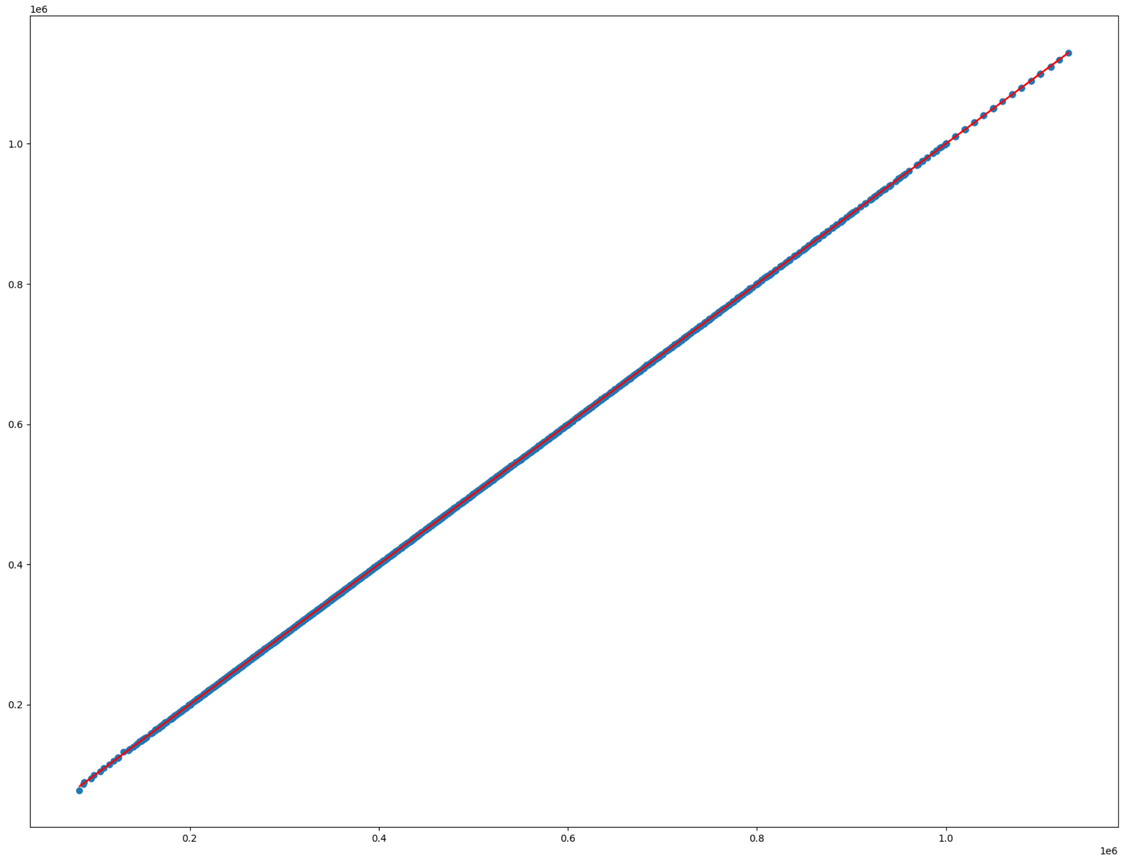
```
Pipeline Model Evaluation:
- R² Score: 0.999999039
- Mean Absolute Error (MAE): 77.56
- Root Mean Squared Error (RMSE): 201.50
```

[38]:

```
plt.figure(figsize=(20,15))
plt.scatter(rfpred,y_test)
slope,intercept=np.polyfit(rfpred,y_test,1)
regression_line = slope * rfpred + intercept
plt.plot(rfpred, regression_line, color='red', label='Regression Line')
```

[38]:

```
[<matplotlib.lines.Line2D at 0x22ee872c410>]
```


1e6
1.0
0.8
0.6
0.4
0.2
0.2
0.4
0.6
0.8
1.0
1e6

[ ]: