Bengaluru House Price Predictor

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1 Bengaluru House Price Prediction Model By Navjoth Singh

[1]:
```
import pandas as pd
import numpy as np
```

[2]:
```
data = pd.read_csv("C:/Users/hp/OneDrive/Desktop/Data Science/Data for Practice/
↪Bengaluru_House_Data.csv")
```

[3]:
```
data.head()
```

[3]:

	area_type	availability	location	size	society	total_sqft	bath	balcony	price
0	Super built-up Area	19-Dec	Electronic City Phase II	2 BHK	Coomee	1056	2.0	1.0	39.07
1	Plot Area	Ready To Move	Chikka Tirupathi	4 Bedroom	Theanmp	2600	5.0	3.0	120.00
2	Built-up Area	Ready To Move	Uttarahalli	3 BHK	NaN	1440	2.0	3.0	62.00
3	Super built-up Area	Ready To Move	Lingadheeranahalli	3 BHK	Soiewre	1521	3.0	1.0	95.00
4	Super built-up Area	Ready To Move	Kothanur	2 BHK	NaN	1200	2.0	1.0	51.00

[4]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 13320 entries, 0 to 13319
Data columns (total 9 columns):
 #   Column        Non-Null Count  Dtype
---  ------        --------------  -----
 0   area_type     13320 non-null  object
 1   availability  13320 non-null  object
 2   location      13319 non-null  object
 3   size          13304 non-null  object
 4   society       7818 non-null   object
 5   total_sqft    13320 non-null  object
 6   bath          13247 non-null  float64
```

```
 7   balcony       12711 non-null  float64
 8   price         13320 non-null  float64
dtypes: float64(3), object(6)
memory usage: 936.7+ KB
```

[5]:
```
data.shape
```

[5]:
```
(13320, 9)
```

[6]:
```
data.columns
```

[6]:
```
Index(['area_type', 'availability', 'location', 'size', 'society',
       'total_sqft', 'bath', 'balcony', 'price'],
      dtype='object')
```

[7]:
```
data.area_type
```

[7]:
```
0        Super built-up  Area
1                  Plot  Area
2              Built-up  Area
3        Super built-up  Area
4        Super built-up  Area
                 ...
13315          Built-up  Area
13316    Super built-up  Area
13317          Built-up  Area
13318    Super built-up  Area
13319    Super built-up  Area
Name: area_type, Length: 13320, dtype: object
```

[8]:
```
data.area_type.value_counts()
```

[8]:
```
area_type
Super built-up  Area    8790
Built-up  Area          2418
Plot  Area              2025
Carpet  Area              87
Name: count, dtype: int64
```

[9]:
```
data["area_type"].value_counts()
```

[9]:
```
area_type
Super built-up  Area    8790
Built-up  Area          2418
Plot  Area              2025
Carpet  Area              87
Name: count, dtype: int64
```

[10]:
```
for column in data.columns:
    print(data[column].value_counts())
    print("*"*20)
```

```
area_type
Super built-up  Area    8790
Built-up  Area          2418
Plot  Area              2025
Carpet  Area              87
Name: count, dtype: int64
**********
availability
Ready To Move    10581
18-Dec             307
18-May             295
18-Apr             271
18-Aug             200
                  …
15-Aug               1
17-Jan               1
16-Nov               1
16-Jan               1
14-Jul               1
Name: count, Length: 81, dtype: int64
**********
location
Whitefield                        540
Sarjapur  Road                    399
Electronic City                   302
Kanakpura Road                    273
Thanisandra                       234
                                 …
Bapuji Layout                       1
1st Stage Radha Krishna Layout      1
BEML Layout 5th stage               1
singapura paradise                  1
Abshot Layout                       1
Name: count, Length: 1305, dtype: int64
**********
size
2 BHK         5199
3 BHK         4310
4 Bedroom      826
4 BHK          591
3 Bedroom      547
1 BHK          538
2 Bedroom      329
5 Bedroom      297
```

```
6 Bedroom      191
1 Bedroom      105
8 Bedroom       84
7 Bedroom       83
5 BHK           59
9 Bedroom       46
6 BHK           30
7 BHK           17
1 RK            13
10 Bedroom      12
9 BHK            8
8 BHK            5
11 BHK           2
11 Bedroom       2
10 BHK           2
14 BHK           1
13 BHK           1
12 Bedroom       1
27 BHK           1
43 Bedroom       1
16 BHK           1
19 BHK           1
18 Bedroom       1
Name: count, dtype: int64
**********
society
GrrvaGr    80
PrarePa    76
Sryalan    59
Prtates    59
GMown E    56
           ..
Amionce     1
JaghtDe     1
Jauraht     1
Brity U     1
RSntsAp     1
Name: count, Length: 2688, dtype: int64
**********
total_sqft
1200    843
1100    221
1500    205
2400    196
600     180
       …
3580      1
2461      1
```

```
1437      1
2155      1
4689      1
Name: count, Length: 2117, dtype: int64
**********
bath
2.0     6908
3.0     3286
4.0     1226
1.0      788
5.0      524
6.0      273
7.0      102
8.0       64
9.0       43
10.0      13
12.0       7
13.0       3
11.0       3
16.0       2
27.0       1
40.0       1
15.0       1
14.0       1
18.0       1
Name: count, dtype: int64
**********
balcony
2.0    5113
1.0    4897
3.0    1672
0.0    1029
Name: count, dtype: int64
**********
price
75.00     310
65.00     302
55.00     275
60.00     270
45.00     240
         …
351.00      1
54.10       1
80.64       1
32.73       1
488.00      1
Name: count, Length: 1994, dtype: int64
**********
```

[11]:
```
data.isna().sum()
```

[11]:
```
area_type          0
availability       0
location           1
size              16
society         5502
total_sqft         0
bath              73
balcony          609
price              0
dtype: int64
```

2 Data Cleaning

[12]:
```
data.drop(columns
 ↪=['area_type','availability','society','balcony'],inplace=True)
# Dropping columns that is no longer required
```

[13]:
```
data.describe()
```

[13]:
```
                bath         price
count  13247.000000  13320.000000
mean       2.692610    112.565627
std        1.341458    148.971674
min        1.000000      8.000000
25%        2.000000     50.000000
50%        2.000000     72.000000
75%        3.000000    120.000000
max       40.000000   3600.000000
```

[14]:
```
data.isnull().sum()
```

[14]:
```
location       1
size          16
total_sqft     0
bath          73
price          0
dtype: int64
```

[15]:
```
data['location'].value_counts().head()
```

[15]:
```
location
Whitefield         540
Sarjapur  Road     399
Electronic City    302
Kanakpura Road     273
```

```
Thanisandra        234
Name: count, dtype: int64
```

[16]:
```
data['location'].fillna('Whitefield',inplace=True)    # 1 is added to Whitefield
```

[17]:
```
data['location'].value_counts().head()
```

[17]:
```
location
Whitefield         541
Sarjapur  Road     399
Electronic City    302
Kanakpura Road     273
Thanisandra        234
Name: count, dtype: int64
```

[18]:
```
data['bath'].value_counts().head(5)
```

[18]:
```
bath
2.0    6908
3.0    3286
4.0    1226
1.0     788
5.0     524
Name: count, dtype: int64
```

[19]:
```
data['bath'].fillna(data['bath'].mode()[0],inplace=True)
```

[20]:
```
data['bath'].value_counts().head()
```

[20]:
```
bath
2.0    6981
3.0    3286
4.0    1226
1.0     788
5.0     524
Name: count, dtype: int64
```

[21]:
```
data['size'].value_counts().head()
```

[21]:
```
size
2 BHK        5199
3 BHK        4310
4 Bedroom     826
4 BHK         591
3 Bedroom     547
Name: count, dtype: int64
```

[22]:
```
data['size'].fillna(data['size'].mode()[0],inplace=True)
```

[23]:
```
data['size'].value_counts().head()
```

[23]:
```
size
2 BHK         5215
3 BHK         4310
4 Bedroom      826
4 BHK          591
3 Bedroom      547
Name: count, dtype: int64
```

[24]:
```
data['bhk']=data['size'].str.split().str.get(0).astype(int)      # New column
↪created with name BHK
```

[25]:
```
data.head()
```

[25]:

	location	size	total_sqft	bath	price	bhk
0	Electronic City Phase II	2 BHK	1056	2.0	39.07	2
1	Chikka Tirupathi	4 Bedroom	2600	5.0	120.00	4
2	Uttarahalli	3 BHK	1440	2.0	62.00	3
3	Lingadheeranahalli	3 BHK	1521	3.0	95.00	3
4	Kothanur	2 BHK	1200	2.0	51.00	2

[26]:
```
data[data.bhk > 20]     # We have to fix them because more than 20 Room bedroom
↪is hypothetical - 1
```

[26]:

	location	size	total_sqft	bath	price	bhk
1718	2Electronic City Phase II	27 BHK	8000	27.0	230.0	27
4684	Munnekollal	43 Bedroom	2400	40.0	660.0	43

[27]:
```
data['total_sqft'].unique()      # We have to fix them because hyphen are there
↪- 2
```

[27]:
```
array(['1056', '2600', '1440', …, '1133 - 1384', '774', '4689'],
      dtype=object)
```

[28]:
```
def convertRange(x):      # Fixing - 2

    temp = x.split('-')
    if len(temp) == 2:
        return (float(temp[0])+float(temp[1]))/2
    try:
        return float(x)
    except:
        return None
```

[29]:
```
data['total_sqft']=data['total_sqft'].apply(convertRange)
```

[30]:
```
data['total_sqft'].unique()    # You may see that '1133 - 1384' changes to 1258.5
```

[30]:
```
array([1056. , 2600. , 1440. , …, 1258.5,  774. , 4689. ])
```

[31]:
```
# Price Per Square feet

data['price_per_sqft']=data['price']*100000/data['total_sqft']
```

[32]:
```
data.head()
```

[32]:

	location	size	total_sqft	bath	price	bhk	price_per_sqft
0	Electronic City Phase II	2 BHK	1056.0	2.0	39.07	2	3699.810606
1	Chikka Tirupathi	4 Bedroom	2600.0	5.0	120.00	4	4615.384615
2	Uttarahalli	3 BHK	1440.0	2.0	62.00	3	4305.555556
3	Lingadheeranahalli	3 BHK	1521.0	3.0	95.00	3	6245.890861
4	Kothanur	2 BHK	1200.0	2.0	51.00	2	4250.000000

[33]:
```
data.describe()
```

[33]:

	total_sqft	bath	price	bhk	price_per_sqft
count	13274.000000	13320.000000	13320.000000	13320.000000	1.327400e+04
mean	1559.626694	2.688814	112.565627	2.802778	7.907501e+03
std	1238.405258	1.338754	148.971674	1.294496	1.064296e+05
min	1.000000	1.000000	8.000000	1.000000	2.678298e+02
25%	1100.000000	2.000000	50.000000	2.000000	4.266865e+03
50%	1276.000000	2.000000	72.000000	3.000000	5.434306e+03
75%	1680.000000	3.000000	120.000000	3.000000	7.311746e+03
max	52272.000000	40.000000	3600.000000	43.000000	1.200000e+07

[34]:
```
data['location'].value_counts()
# Now here we cannot use all these location on the model so we have to reduce␣
 ↪this
# what will do, which ever location is less than 10 will replace it with␣
 ↪'other'
```

[34]:
```
location
Whitefield                    541
Sarjapur  Road                399
Electronic City               302
Kanakpura Road                273
```

```
Thanisandra                          234
                                     ...
Bapuji Layout                          1
1st Stage Radha Krishna Layout         1
BEML Layout 5th stage                  1
singapura paradise                     1
Abshot Layout                          1
Name: count, Length: 1305, dtype: int64
```

[35]:
```
data['location'] = data['location'].apply(lambda x : x.strip())

# it uses a lambda function, which strips whitespace characters (like spaces,␣
 ↪tabs, or newlines)
# from both ends of each string in the 'location' column.
```

[36]:
```
data['location'].value_counts()   # Now we can see that length reduce to 1294␣
 ↪from 1305
```

[36]:
```
location
Whitefield                           542
Sarjapur  Road                       399
Electronic City                      304
Kanakpura Road                       273
Thanisandra                          237
                                     ...
Bapuji Layout                          1
1st Stage Radha Krishna Layout         1
BEML Layout 5th stage                  1
singapura paradise                     1
Abshot Layout                          1
Name: count, Length: 1294, dtype: int64
```

[37]:
```
location_counts = data['location'].value_counts()
location_count_less_10 = location_counts[location_counts <= 10]
location_count_less_10
```

[37]:
```
location
Dairy Circle                        10
Nagappa Reddy Layout                10
Basapura                            10
1st Block Koramangala               10
Sector 1 HSR Layout                 10
                                    ..
Bapuji Layout                        1
1st Stage Radha Krishna Layout       1
BEML Layout 5th stage                1
singapura paradise                   1
```

```
Abshot Layout                          1
Name: count, Length: 1053, dtype: int64
```

[38]:
```
data['location'] = data['location'].apply(lambda x: 'other' if x in␣
 ↪location_count_less_10 else x)
```

[39]:
```
data['location'].value_counts()
```

[39]:
```
location
other                 2885
Whitefield             542
Sarjapur  Road         399
Electronic City        304
Kanakpura Road         273
                      ...
Nehru Nagar             11
Banjara Layout          11
LB Shastri Nagar        11
Pattandur Agrahara      11
Narayanapura            11
Name: count, Length: 242, dtype: int64
```

3 Dealing with outliers

[40]:
```
data.describe()
```

[40]:

	total_sqft	bath	price	bhk	price_per_sqft
count	13274.000000	13320.000000	13320.000000	13320.000000	1.327400e+04
mean	1559.626694	2.688814	112.565627	2.802778	7.907501e+03
std	1238.405258	1.338754	148.971674	1.294496	1.064296e+05
min	1.000000	1.000000	8.000000	1.000000	2.678298e+02
25%	1100.000000	2.000000	50.000000	2.000000	4.266865e+03
50%	1276.000000	2.000000	72.000000	3.000000	5.434306e+03
75%	1680.000000	3.000000	120.000000	3.000000	7.311746e+03
max	52272.000000	40.000000	3600.000000	43.000000	1.200000e+07

[41]:
```
(data['total_sqft']/data['bhk']).describe()    # representing the average␣
 ↪square footage per room
```

[41]:
```
count    13274.000000
mean       575.074878
std        388.205175
min          0.250000
25%        473.333333
50%        552.500000
75%        625.000000
max      26136.000000
```

```
dtype: float64
```

[42]:
```
data = data[((data['total_sqft']/data['bhk']) >= 300)]
# I selected only those room which are more than 300 sqrft
```

[43]:
```
data.shape   # earlier it was (13320,9)
```

[43]:
```
(12530, 7)
```

[44]:
```
data.price_per_sqft.describe()
# Now here is 176470.588235 a outlier because this is unexpected price for a␣
 ↪sqft
```

[44]:
```
count     12530.000000
mean       6303.979357
std        4162.237981
min         267.829813
25%        4210.526316
50%        5294.117647
75%        6916.666667
max      176470.588235
Name: price_per_sqft, dtype: float64
```

[45]:
```
def remove_outliers_sqft(df):
    df_output = pd.DataFrame()
    for key, subdf in df.groupby('location'):
        m = np.mean(subdf.price_per_sqft)
        st = np.std(subdf.price_per_sqft)

        gen_df = subdf[(subdf.price_per_sqft > (m-st)) & (subdf.price_per_sqft␣
 ↪<= (m+st))]
        df_output = pd.concat([df_output, gen_df], ignore_index = True)
    return df_output
data = remove_outliers_sqft(data)

# Creates an empty DataFrame `df_output` to store the filtered data.

# During each iteration of the loop, key will take the value of the 'location'␣
 ↪('Whitefield', 'Sarjapur  Road ', 'Electronic City')
# and subdf will contain the data(price_per_sqft) of the DataFrame␣
 ↪corresponding to that 'location'

# Grouping by 'location': Iterates through each group formed by grouping the␣
 ↪DataFrame `df` by the 'location' column using `df.groupby('location')`.

# Outlier Removal: For each group:
```

```
    # Calculates the mean (`m`) and standard deviation (`st`) of the␣
 ↪'price_per_sqft' within that location.
    # Generates a new DataFrame `gen_df` containing rows where the␣
 ↪'price_per_sqft' falls within one standard deviation from the mean for that␣
 ↪location.

# Appends the filtered data (`gen_df`) to the empty `df_output` DataFrame using␣
 ↪`pd.concat()`.
```

[46]:
```
data.describe()   # See price_per_sqft is changed now & the rows is reduced to␣
 ↪10301 from 12530
```

[46]:

	total_sqft	bath	price	bhk	price_per_sqft
count	10301.000000	10301.000000	10301.000000	10301.000000	10301.000000
mean	1508.440608	2.471702	91.286372	2.574896	5659.062876
std	880.694214	0.979449	86.342786	0.897649	2265.774749
min	300.000000	1.000000	10.000000	1.000000	1250.000000
25%	1110.000000	2.000000	49.000000	2.000000	4244.897959
50%	1286.000000	2.000000	67.000000	2.000000	5175.600739
75%	1650.000000	3.000000	100.000000	3.000000	6428.571429
max	30400.000000	16.000000	2200.000000	16.000000	24509.803922

[47]:
```
def bhk_outlier_remover(df):
    exclude_indices = np.array([])
    for key, subdf in df.groupby('location'):
        bhk_stats = {}
        for bhk, bhkdf in subdf.groupby('bhk'):
            bhk_stats[bhk] = { 'mean' : np.mean(bhkdf.price_per_sqft),
                               'std' : np.std(bhkdf.price_per_sqft),
                               'count' : bhkdf.shape[0] }
        print(key, bhk_stats)
```

[48]:
```
test_data = bhk_outlier_remover(data)
```

```
1st Block Jayanagar {2: {'mean': 11983.805668016194, 'std': 0.0, 'count': 1}, 3:
{'mean': 11756.16905248807, 'std': 701.6243657657865, 'count': 3}, 4: {'mean':
15018.711280365416, 'std': 1.2278182423353805, 'count': 3}}
1st Phase JP Nagar {1: {'mean': 5952.380952380952, 'std': 0.0, 'count': 1}, 2:
{'mean': 7931.806799837383, 'std': 1534.1422783514056, 'count': 8}, 3: {'mean':
9151.192151725822, 'std': 1054.731726021645, 'count': 7}, 4: {'mean':
7537.92218148637, 'std': 1607.0591069513537, 'count': 3}, 5: {'mean':
5666.666666666667, 'std': 0.0, 'count': 1}}
2nd Phase Judicial Layout {2: {'mean': 3851.8518518518517, 'std':
497.593660834978, 'count': 3}, 3: {'mean': 3620.93991671624, 'std':
241.87983343248052, 'count': 5}}
2nd Stage Nagarbhavi {4: {'mean': 15891.203703703704, 'std': 1668.9846920398563,
'count': 4}, 6: {'mean': 16891.666666666668, 'std': 1858.333333333333, 'count':
2}}
```

5th Block Hbr Layout {2: {'mean': 4755.410708222867, 'std': 374.06419031565235, 'count': 3}, 3: {'mean': 5511.811023622047, 'std': 0.0, 'count': 1}, 5: {'mean': 3611.1111111111113, 'std': 0.0, 'count': 1}, 6: {'mean': 5882.35294117647, 'std': 0.0, 'count': 1}}
5th Phase JP Nagar {1: {'mean': 4628.623188405797, 'std': 371.376811594203, 'count': 2}, 2: {'mean': 5067.359785883266, 'std': 453.24956183513086, 'count': 17}, 3: {'mean': 5112.892626961968, 'std': 526.8794907246175, 'count': 8}, 5: {'mean': 4325.0, 'std': 75.0, 'count': 2}}
6th Phase JP Nagar {2: {'mean': 5932.976565810137, 'std': 671.9347030151997, 'count': 8}, 3: {'mean': 8403.2863080867, 'std': 1515.4146231166221, 'count': 5}, 4: {'mean': 7704.160246533128, 'std': 0.0, 'count': 1}}
7th Phase JP Nagar {1: {'mean': 6133.333333333334, 'std': 133.33333333333348, 'count': 2}, 2: {'mean': 6272.516842644273, 'std': 1012.7881476778178, 'count': 40}, 3: {'mean': 6612.861682598103, 'std': 1181.6582893458344, 'count': 57}, 4: {'mean': 6028.22068063778, 'std': 1482.7661351832348, 'count': 2}}
8th Phase JP Nagar {1: {'mean': 6357.427937915743, 'std': 267.1694064501245, 'count': 4}, 2: {'mean': 4324.406715739656, 'std': 1131.8308808521078, 'count': 22}, 3: {'mean': 4293.744876160689, 'std': 723.4267508470379, 'count': 17}, 4: {'mean': 4539.6147062813725, 'std': 195.35428340140427, 'count': 3}, 5: {'mean': 4335.260115606937, 'std': 0.0, 'count': 1}}
9th Phase JP Nagar {1: {'mean': 3333.3333333333335, 'std': 0.0, 'count': 1}, 2: {'mean': 4653.05138390364, 'std': 834.4408302683471, 'count': 20}, 3: {'mean': 4518.339436369508, 'std': 790.2476753262926, 'count': 9}, 4: {'mean': 5336.8421052631575, 'std': 800.5999597024291, 'count': 3}}
AECS Layout {2: {'mean': 4921.300339526721, 'std': 619.6355499375203, 'count': 7}, 3: {'mean': 4500.0, 'std': 0.0, 'count': 1}}
Abbigere {1: {'mean': 3310.9205535075066, 'std': 610.6480739434737, 'count': 2}, 2: {'mean': 4058.165803016323, 'std': 62.235187280114864, 'count': 13}, 3: {'mean': 3571.4285714285716, 'std': 0.0, 'count': 1}, 6: {'mean': 3165.4545454545455, 'std': 74.5454545454545, 'count': 2}, 8: {'mean': 5000.0, 'std': 0.0, 'count': 1}}
Akshaya Nagar {2: {'mean': 4781.22783734999, 'std': 453.10974836521865, 'count': 17}, 3: {'mean': 5294.361032273932, 'std': 513.4396107693667, 'count': 30}}
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Ambedkar Nagar {2: {'mean': 6454.091928430547, 'std': 182.0843219299883, 'count': 5}, 3: {'mean': 6572.746532916982, 'std': 422.13464472691317, 'count': 19}, 4: {'mean': 7684.086312870249, 'std': 531.2111375546801, 'count': 2}}
Amruthahalli {1: {'mean': 4020.618556701031, 'std': 0.0, 'count': 1}, 2: {'mean': 4953.838379629301, 'std': 823.6966143070669, 'count': 12}, 3: {'mean': 5574.846418310635, 'std': 1077.4444900329127, 'count': 7}}
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Ananth Nagar {1: {'mean': 2800.0, 'std': 0.0, 'count': 4}, 2: {'mean': 3015.4242497371583, 'std': 491.5389870277812, 'count': 19}, 3: {'mean':

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Anjanapura {2: {'mean': 3451.5654968214635, 'std': 402.7964034804156, 'count':
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Attibele {1: {'mean': 2823.0512983538965, 'std': 440.8851261837879, 'count':
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BEML Layout {2: {'mean': 5944.048212904286, 'std': 1628.8084083258766, 'count':
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BTM 2nd Stage {2: {'mean': 5621.791028153005, 'std': 795.7682556051348, 'count':
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BTM Layout {1: {'mean': 4444.444444444444, 'std': 0.0, 'count': 1}, 2: {'mean':
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Babusapalaya {2: {'mean': 3799.9594889549185, 'std': 423.8304869618116, 'count':
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Badavala Nagar {2: {'mean': 6357.9277864992155, 'std': 0.0, 'count': 2}, 3:
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Balagere {1: {'mean': 5865.01000449379, 'std': 539.315075028032, 'count': 9}, 2:
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Banashankari {1: {'mean': 8333.333333333334, 'std': 0.0, 'count': 2}, 2:
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Banashankari Stage II {2: {'mean': 8701.636799298034, 'std': 1030.287972433991,
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Banashankari Stage III {2: {'mean': 5430.250387687147, 'std':
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Banashankari Stage V {2: {'mean': 3983.4541062801936, 'std': 527.4154589371976,

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Banashankari Stage VI {2: {'mean': 5072.0195454829345, 'std': 22.81429179660186,
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Banaswadi {1: {'mean': 6641.366223908918, 'std': 0.0, 'count': 1}, 2: {'mean':
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Banjara Layout {2: {'mean': 6635.496110794916, 'std': 905.9365352849989,
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Bannerghatta {2: {'mean': 6630.037324398989, 'std': 872.6962508901346, 'count':
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Bannerghatta Road {1: {'mean': 4932.455648926237, 'std': 741.987966876004,
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Basavangudi {2: {'mean': 9700.42512839123, 'std': 665.8646001174526, 'count':
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Basaveshwara Nagar {2: {'mean': 6750.0, 'std': 552.7707983925667, 'count': 5},
3: {'mean': 7834.767884859602, 'std': 59.968957245661386, 'count': 2}, 5:
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Battarahalli {2: {'mean': 4345.7243068848575, 'std': 823.6340914029164, 'count':
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Begur {2: {'mean': 4961.668185533498, 'std': 39.10751993914706, 'count': 3}, 3:
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Begur Road {2: {'mean': 3624.166282880882, 'std': 262.3730178311292, 'count':
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Bellandur {1: {'mean': 4210.526315789473, 'std': 0.0, 'count': 1}, 2: {'mean':
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Benson Town {2: {'mean': 12686.709975197631, 'std': 3611.8164390019756, 'count':
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Bharathi Nagar {2: {'mean': 4813.740209190311, 'std': 471.43026983759114,
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Bhoganhalli {2: {'mean': 5417.416718889453, 'std': 285.36806332317167, 'count':
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Billekahalli {2: {'mean': 5962.1264143650205, 'std': 952.8379048046246, 'count':
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Bisuvanahalli {2: {'mean': 3863.8012733035357, 'std': 405.2872025065846, 'count': 12}, 3: {'mean': 4006.5825354643744, 'std': 468.0230389083769, 'count': 31}}
Bommanahalli {1: {'mean': 4302.184466019417, 'std': 552.1844660194174, 'count': 2}, 2: {'mean': 4544.41960101665, 'std': 569.7400942075514, 'count': 9}, 3: {'mean': 4254.328104328105, 'std': 505.922183603648, 'count': 4}, 4: {'mean': 4047.6190476190477, 'std': 0.0, 'count': 1}, 8: {'mean': 4666.666666666667, 'std': 0.0, 'count': 1}}
Bommasandra {2: {'mean': 3813.947572153106, 'std': 244.236658864445, 'count': 19}, 3: {'mean': 3815.8530659565145, 'std': 403.8116627539011, 'count': 11}}
Bommasandra Industrial Area {2: {'mean': 2887.892987573868, 'std': 0.47920744469383775, 'count': 11}, 3: {'mean': 2863.160206574431, 'std': 59.9654742104211, 'count': 7}}
Bommenahalli {3: {'mean': 8565.382032363164, 'std': 1314.9620051314946, 'count': 3}, 4: {'mean': 8564.836466843257, 'std': 717.6221010374835, 'count': 6}}
Brookefield {2: {'mean': 5837.492693390221, 'std': 903.6255944977522, 'count': 19}, 3: {'mean': 5795.407173862258, 'std': 1201.0625471599164, 'count': 13}, 4: {'mean': 6680.252598242926, 'std': 2089.3417875296827, 'count': 7}, 5: {'mean': 8974.358974358975, 'std': 0.0, 'count': 1}}
Budigere {1: {'mean': 5155.722891566265, 'std': 166.41859289793305, 'count': 4}, 2: {'mean': 5034.160717791254, 'std': 199.1459774106948, 'count': 23}, 3: {'mean': 4995.782145950289, 'std': 304.7321376982579, 'count': 22}}
CV Raman Nagar {1: {'mean': 7092.198581560284, 'std': 0.0, 'count': 1}, 2: {'mean': 5155.724160108177, 'std': 750.6157631590067, 'count': 18}, 3: {'mean': 5069.1182815641005, 'std': 895.7302193450797, 'count': 8}}
Chamrajpet {1: {'mean': 16831.68316831683, 'std': 0.0, 'count': 1}, 2: {'mean': 9792.423102012144, 'std': 3818.3998448404645, 'count': 5}, 3: {'mean': 7141.805995187703, 'std': 751.0857983228121, 'count': 3}, 4: {'mean': 10827.574839290468, 'std': 1880.2064182378372, 'count': 2}}
Chandapura {1: {'mean': 2520.6090114704184, 'std': 140.1570055608275, 'count': 19}, 2: {'mean': 2822.6938747446193, 'std': 410.55761448180084, 'count': 37}, 3: {'mean': 2853.1236984866746, 'std': 427.653808367682, 'count': 26}, 4: {'mean': 3498.942358540455, 'std': 0.0, 'count': 1}}
Channasandra {2: {'mean': 3613.5088756107493, 'std': 502.50868004330425, 'count': 24}, 3: {'mean': 4500.644242719408, 'std': 1005.213241509808, 'count': 9}, 4: {'mean': 5963.333333333333, 'std': 0.0, 'count': 1}, 6: {'mean': 4285.714285714285, 'std': 0.0, 'count': 1}}
Chikka Tirupathi {3: {'mean': 4090.4654941407116, 'std': 246.87536752515462, 'count': 4}, 4: {'mean': 4568.837506464278, 'std': 449.90860011916783, 'count': 7}}
Chikkabanavar {2: {'mean': 3979.526682999282, 'std': 296.21104114438486, 'count': 3}, 3: {'mean': 4242.424242424242, 'std': 757.5757575757575, 'count': 2}, 4: {'mean': 3252.032520325203, 'std': 0.0, 'count': 1}, 5: {'mean': 3645.833333333333, 'std': 395.83333333333326, 'count': 2}, 8: {'mean': 2750.0,

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Chikkalasandra {2: {'mean': 4680.665935758178, 'std': 906.7207027292568,
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Choodasandra {2: {'mean': 4782.163531612381, 'std': 528.754856051744, 'count':
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Cooke Town {2: {'mean': 9450.335685771604, 'std': 1592.310446826406, 'count':
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Cox Town {2: {'mean': 8230.365020192607, 'std': 2084.870283562963, 'count': 5},
3: {'mean': 7780.757079649942, 'std': 1186.6163940265649, 'count': 4}}
Cunningham Road {3: {'mean': 19562.042390433755, 'std': 1371.6473545157753,
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Dasanapura {1: {'mean': 5790.960451977401, 'std': 0.0, 'count': 1}, 2: {'mean':
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Dasarahalli {2: {'mean': 5117.938928017428, 'std': 689.5131286166418, 'count':
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Devanahalli {1: {'mean': 4606.9148770709035, 'std': 456.2054151733658, 'count':
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Devarachikkanahalli {1: {'mean': 3902.439024390244, 'std': 0.0, 'count': 1}, 2:
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Dodda Nekkundi {2: {'mean': 4271.409551033765, 'std': 572.5384233681567,
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Doddaballapur {1: {'mean': 7492.354740061162, 'std': 0.0, 'count': 1}, 3:
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Doddakallasandra {2: {'mean': 4009.260011822078, 'std': 22.428701187061954,
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Doddathoguru {1: {'mean': 3193.939393939394, 'std': 145.7068518808643, 'count':
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Domlur {1: {'mean': 9445.779914529914, 'std': 948.6331997307019, 'count': 3}, 2:
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Dommasandra {2: {'mean': 3322.660889824189, 'std': 544.174150775161, 'count':
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EPIP Zone {2: {'mean': 6352.512219589275, 'std': 547.9667498496266, 'count': 7},
3: {'mean': 6961.117262886345, 'std': 262.90361114936303, 'count': 8}, 4:

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Electronic City {1: {'mean': 4328.254265940121, 'std': 1179.3241254681986,
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179}, 3: {'mean': 4585.774797046125, 'std': 1204.6558833568276, 'count': 75}, 4:
{'mean': 5201.660222644956, 'std': 931.5912756321039, 'count': 5}}
Electronic City Phase II {1: {'mean': 4265.886287625418, 'std':
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Electronics City Phase 1 {1: {'mean': 4522.306447815004, 'std':
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Frazer Town {1: {'mean': 11160.714285714286, 'std': 0.0, 'count': 1}, 2:
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GM Palaya {2: {'mean': 4065.297171500179, 'std': 228.5624776226282, 'count': 2},
3: {'mean': 4628.867942650349, 'std': 354.0596141419346, 'count': 6}}
Garudachar Palya {2: {'mean': 4567.292659219588, 'std': 35.16727856616533,
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Giri Nagar {3: {'mean': 15888.888888888889, 'std': 1888.8888888888887, 'count':
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Gollarapalya Hosahalli {2: {'mean': 4170.472980827493, 'std':
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159.71264119139414, 'count': 5}, 4: {'mean': 4514.435695538058, 'std': 0.0,
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Gottigere {1: {'mean': 3201.9704433497536, 'std': 0.0, 'count': 2}, 2: {'mean':
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Green Glen Layout {2: {'mean': 5874.64951344219, 'std': 208.0884384424191,
'count': 3}, 3: {'mean': 6639.764255543528, 'std': 469.4210339773065, 'count':
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Gubbalala {2: {'mean': 5018.120021443538, 'std': 616.24268015249, 'count': 4},
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Mahadevpura {1: {'mean': 4794.520547945205, 'std': 0.0, 'count': 1}, 2: {'mean': 4655.718115723708, 'std': 376.41780517833274, 'count': 12}, 3: {'mean': 4870.419072507448, 'std': 464.96928202282703, 'count': 9}}
Mahalakshmi Layout {2: {'mean': 7239.819004524887, 'std': 0.0, 'count': 1}, 3: {'mean': 8581.201137171287, 'std': 585.46552949538, 'count': 2}, 4: {'mean': 11682.539682539682, 'std': 1650.793650793651, 'count': 2}}
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Malleshpalya {2: {'mean': 4450.045021893327, 'std': 715.3637519675409, 'count': 10}, 3: {'mean': 4425.035578878555, 'std': 860.0436344837372, 'count': 4}}
Malleshwaram {1: {'mean': 10574.590792191524, 'std': 2309.1199297340045, 'count': 5}, 2: {'mean': 10448.283856388975, 'std': 2127.1295449855343, 'count': 11}, 3: {'mean': 12878.871444966015, 'std': 1697.9956830033232, 'count': 23}, 4: {'mean': 11241.379310344826, 'std': 1668.290924746567, 'count': 3}, 7: {'mean': 18333.333333333332, 'std': 0.0, 'count': 1}}
Marathahalli {1: {'mean': 6443.713889143229, 'std': 707.710000973837, 'count': 5}, 2: {'mean': 5343.012421942326, 'std': 805.7151229412377, 'count': 71}, 3: {'mean': 5765.1456000207645, 'std': 889.5759940637466, 'count': 53}, 4: {'mean': 6160.540698577994, 'std': 807.182049168838, 'count': 20}}
Margondanahalli {2: {'mean': 5437.351523296367, 'std': 285.9823054456937, 'count': 14}, 3: {'mean': 5057.999244463333, 'std': 256.1953829260381, 'count': 3}}
Marsur {3: {'mean': 8750.0, 'std': 1250.0, 'count': 2}, 4: {'mean': 8055.555555555556, 'std': 0.0, 'count': 1}}
Mico Layout {1: {'mean': 3687.5, 'std': 0.0, 'count': 1}, 2: {'mean': 3682.9249609262856, 'std': 423.6831720283269, 'count': 5}, 3: {'mean': 3748.827506277767, 'std': 314.5094797917012, 'count': 3}, 9: {'mean': 4200.0, 'std': 0.0, 'count': 1}}
Munnekollal {2: {'mean': 4633.305616995026, 'std': 352.4310127906283, 'count': 7}, 3: {'mean': 4802.422395043424, 'std': 125.38772727852572, 'count': 6}}
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Mysore Road {2: {'mean': 5045.139694906341, 'std': 676.0447047409737, 'count': 22}, 3: {'mean': 5084.04096522042, 'std': 644.0777907893389, 'count': 13}}
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Nagarbhavi {1: {'mean': 5457.622557871108, 'std': 1066.4073158513404, 'count': 3}, 2: {'mean': 6395.988878268281, 'std': 3229.6096758102262, 'count': 16}, 3: {'mean': 5500.568824727775, 'std': 1968.8111694638114, 'count': 17}, 4: {'mean': 12000.0, 'std': 2000.0, 'count': 2}, 5: {'mean': 7200.0, 'std': 0.0, 'count': 1}}
Nagasandra {2: {'mean': 5482.312925170068, 'std': 584.353741496599, 'count': 2}, 3: {'mean': 5757.575757575758, 'std': 0.0, 'count': 1}, 4: {'mean': 6235.119047619048, 'std': 193.45238095238074, 'count': 2}}
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Narayanapura {2: {'mean': 6417.676818637855, 'std': 641.5678764128289, 'count': 4}, 3: {'mean': 5624.607559361702, 'std': 176.28469731669043, 'count': 4}}
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Nehru Nagar {2: {'mean': 4397.856538497696, 'std': 147.59800695684862, 'count': 2}, 3: {'mean': 5323.390108322737, 'std': 476.8505751937556, 'count': 5}, 4: {'mean': 4994.3116788028365, 'std': 83.97863012649077, 'count': 2}}
OMBR Layout {2: {'mean': 6060.732226936822, 'std': 765.1028054888121, 'count': 8}, 3: {'mean': 6395.974418965156, 'std': 1354.455921644706, 'count': 4}, 4: {'mean': 8088.235294117647, 'std': 0.0, 'count': 1}}
Old Airport Road {2: {'mean': 6488.103629335819, 'std': 666.8103212209145, 'count': 8}, 3: {'mean': 7732.476289952065, 'std': 1345.392120110078, 'count': 3}, 4: {'mean': 7400.652269436282, 'std': 366.65275351747255, 'count': 19}}
Old Madras Road {2: {'mean': 5660.295741126655, 'std': 850.7558483817651, 'count': 17}, 3: {'mean': 5877.469949423396, 'std': 658.1522060566687, 'count': 17}, 4: {'mean': 5568.646870314652, 'std': 445.15305178998693, 'count': 10}, 5: {'mean': 6125.232403718459, 'std': 408.1009296148736, 'count': 2}}
Padmanabhanagar {2: {'mean': 6353.3984086808305, 'std': 1620.4038971043078, 'count': 8}, 3: {'mean': 6103.133559343508, 'std': 1413.7555415488598, 'count': 11}, 4: {'mean': 6176.470588235294, 'std': 0.0, 'count': 1}}
Pai Layout {2: {'mean': 4275.598787873179, 'std': 847.9319844868568, 'count': 11}, 3: {'mean': 4565.193665374716, 'std': 692.5145408804893, 'count': 5}, 6: {'mean': 4605.263157894737, 'std': 0.0, 'count': 1}}
Panathur {1: {'mean': 6051.437216338881, 'std': 0.0, 'count': 1}, 2: {'mean': 6163.683079124271, 'std': 522.5629147973473, 'count': 24}, 3: {'mean': 5824.381873424201, 'std': 756.1120640080887, 'count': 5}}
Parappana Agrahara {1: {'mean': 3750.0, 'std': 0.0, 'count': 1}, 2: {'mean': 3894.570971024669, 'std': 52.57420919375578, 'count': 14}}
Pattandur Agrahara {2: {'mean': 4818.300127405684, 'std': 256.46926050536257,

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Poorna Pragna Layout {2: {'mean': 4413.125572360624, 'std': 495.68839972297116,
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Prithvi Layout {2: {'mean': 6037.440123978585, 'std': 549.2881072143185,
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R.T. Nagar {2: {'mean': 6166.0990284595455, 'std': 2401.6080179377695, 'count':
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Rachenahalli {1: {'mean': 5122.705314009661, 'std': 456.3742317223319, 'count':
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Raja Rajeshwari Nagar {1: {'mean': 4339.6530666138515, 'std': 543.1788208229217,
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Rajaji Nagar {1: {'mean': 11363.636363636364, 'std': 0.0, 'count': 1}, 2:
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Rajiv Nagar {2: {'mean': 6830.924551419025, 'std': 533.7908722073457, 'count':
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Ramagondanahalli {1: {'mean': 5555.555555555556, 'std': 0.0, 'count': 1}, 2:
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Ramamurthy Nagar {1: {'mean': 6956.790123456791, 'std': 336.85836171956186,
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Rayasandra {1: {'mean': 4541.075143242948, 'std': 72.99003685996877, 'count':
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Sahakara Nagar {2: {'mean': 5176.637205930016, 'std': 925.9779110123279,
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Sanjay nagar {2: {'mean': 6408.0027636555515, 'std': 1008.5806527993848,

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Sarakki Nagar {3: {'mean': 11677.772648686641, 'std': 1164.2113099564785,
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Sarjapur {1: {'mean': 2874.133538039441, 'std': 174.43064872118748, 'count': 4},
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Sarjapur Road {1: {'mean': 5133.293879111827, 'std': 1040.4585511011248,
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Sarjapura - Attibele Road {1: {'mean': 3195.945945945946, 'std': 0.0, 'count':
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Sector 2 HSR Layout {1: {'mean': 7556.675062972292, 'std': 0.0, 'count': 1}, 2:
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Sector 7 HSR Layout {2: {'mean': 8517.539849533492, 'std': 29.88399409911783,
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6}, 4: {'mean': 9166.666666666666, 'std': 0.0, 'count': 1}}
Seegehalli {2: {'mean': 4329.211790848419, 'std': 1166.1042598803597, 'count':
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Shampura {2: {'mean': 4708.333333333334, 'std': 291.6666666666665, 'count': 2},
3: {'mean': 4899.966766367564, 'std': 364.7021331777603, 'count': 3}, 4:
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Shivaji Nagar {1: {'mean': 8010.471204188481, 'std': 0.0, 'count': 1}, 2:
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Singasandra {2: {'mean': 4612.819625700124, 'std': 506.83386852214045, 'count':
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Somasundara Palya {2: {'mean': 5360.675549919208, 'std': 593.8769277607065,
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Sompura {2: {'mean': 3840.4959109430956, 'std': 224.1921863747153, 'count': 4},
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Sonnenahalli {1: {'mean': 4998.3598840688865, 'std': 0.012776630869666405,
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Subramanyapura {2: {'mean': 5320.00259492858, 'std': 564.6089957428895, 'count':
14}, 3: {'mean': 5419.591639044803, 'std': 543.0872192059437, 'count': 13}}
Sultan Palaya {2: {'mean': 5516.726902965547, 'std': 1253.3841087551375,
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TC Palaya {1: {'mean': 4074.074074074074, 'std': 0.0, 'count': 1}, 2: {'mean':
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Talaghattapura {2: {'mean': 4580.285299806576, 'std': 455.35287836606403,
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Thanisandra {1: {'mean': 5536.748748889186, 'std': 843.232658024744, 'count':
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{'mean': 5963.98561560378, 'std': 646.7048899935487, 'count': 74}, 4: {'mean':
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Thigalarapalya {2: {'mean': 7367.662128690889, 'std': 250.42902893834395,
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Thubarahalli {2: {'mean': 6177.474880875318, 'std': 550.0809877574004, 'count':
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Thyagaraja Nagar {1: {'mean': 12500.0, 'std': 0.0, 'count': 1}, 2: {'mean':
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Tindlu {2: {'mean': 5123.714149465223, 'std': 97.42574991353615, 'count': 3}, 3:
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Tumkur Road {2: {'mean': 6222.216116265259, 'std': 565.4013168608795, 'count':
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Ulsoor {2: {'mean': 8730.998103368149, 'std': 2062.5115260500042, 'count': 5},
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Uttarahalli {1: {'mean': 5446.293494704993, 'std': 0.0, 'count': 1}, 2: {'mean':
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Varthur {2: {'mean': 4331.910572925388, 'std': 847.3795043583863, 'count': 32},
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Varthur Road {2: {'mean': 3754.9654055540996, 'std': 648.3927903937736, 'count':
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Vasanthapura {2: {'mean': 3558.48776757308, 'std': 145.0953916099316, 'count':
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Vijayanagar {1: {'mean': 7513.33715688642, 'std': 1470.1647292081748, 'count':
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Vishveshwarya Layout {1: {'mean': 4000.0, 'std': 0.0, 'count': 1}, 4: {'mean': 4125.0, 'std': 375.0, 'count': 2}, 6: {'mean': 4380.952380952381, 'std': 0.0, 'count': 1}}
Vishwapriya Layout {2: {'mean': 3916.9969520750556, 'std': 177.84130871379733, 'count': 4}}
Vittasandra {2: {'mean': 5265.466588027838, 'std': 172.68575428865756, 'count': 31}, 3: {'mean': 5113.14174326139, 'std': 100.56430016629145, 'count': 7}}
Whitefield {1: {'mean': 5765.189888976462, 'std': 1080.9401060122182, 'count': 26}, 2: {'mean': 4996.679555545075, 'std': 1261.8095382276895, 'count': 232}, 3: {'mean': 5529.545307677018, 'std': 1325.8662058810887, 'count': 166}, 4: {'mean': 6781.90623203223, 'std': 1157.6199849662542, 'count': 57}, 5: {'mean': 7836.874286815605, 'std': 794.7110211453303, 'count': 4}}
Yelachenahalli {2: {'mean': 5157.852477694467, 'std': 706.3466043126809, 'count': 7}, 3: {'mean': 5909.760492768157, 'std': 1348.1242403302067, 'count': 5}}
Yelahanka {1: {'mean': 5250.754432669086, 'std': 708.1864329017459, 'count': 16}, 2: {'mean': 4885.50009150766, 'std': 834.2738830938632, 'count': 78}, 3: {'mean': 5121.284167853846, 'std': 819.858135054314, 'count': 65}, 4: {'mean': 5396.634458670808, 'std': 859.2313582889707, 'count': 9}, 5: {'mean': 5150.0, 'std': 350.0, 'count': 2}, 6: {'mean': 5555.555555555556, 'std': 0.0, 'count': 1}}
Yelahanka New Town {1: {'mean': 3711.0711616859157, 'std': 705.7257959858678, 'count': 12}, 2: {'mean': 5255.289619148657, 'std': 1329.2576472001515, 'count': 7}, 3: {'mean': 5244.8328585493755, 'std': 1308.1039897883682, 'count': 12}, 4: {'mean': 5202.863961813842, 'std': 0.0, 'count': 1}}
Yelenahalli {2: {'mean': 3878.617021276596, 'std': 155.17896357207565, 'count': 7}, 3: {'mean': 3918.9457070707067, 'std': 143.76151982471873, 'count': 3}}
Yeshwanthpur {1: {'mean': 5660.648244572341, 'std': 397.81389558095225, 'count': 13}, 2: {'mean': 6313.582176150229, 'std': 1092.0986164191115, 'count': 23}, 3: {'mean': 6136.843144871886, 'std': 999.1342919214298, 'count': 31}, 4: {'mean': 6388.888888888889, 'std': 277.7777777777778, 'count': 2}, 6: {'mean': 7400.0, 'std': 0.0, 'count': 1}}
other {1: {'mean': 5321.358826419817, 'std': 2357.705900996028, 'count': 132}, 2: {'mean': 5288.580186585407, 'std': 1981.8078111382472, 'count': 987}, 3: {'mean': 6303.178181413831, 'std': 2552.0634251169135, 'count': 858}, 4: {'mean': 8334.159251776744, 'std': 2892.9656869519777, 'count': 224}, 5: {'mean': 7278.542458208993, 'std': 3393.9728786041032, 'count': 42}, 6: {'mean': 6975.5623689134, 'std': 3043.3045406755605, 'count': 34}, 7: {'mean': 4272.049254022647, 'std': 1900.0507646394972, 'count': 11}, 8: {'mean': 5384.347002204145, 'std': 1946.6298824910634, 'count': 7}, 9: {'mean': 5530.842391304348, 'std': 3234.230886145459, 'count': 4}, 10: {'mean': 9005.681818181818, 'std': 4630.681818181818, 'count': 2}, 11: {'mean': 4850.0, 'std': 2350.0, 'count': 2}, 13: {'mean': 5069.124423963133, 'std': 0.0, 'count': 1}, 16: {'mean': 5500.0, 'std': 0.0, 'count': 1}}

[49]:
```
def bhk_outlier_remover(df):
    exclude_indices = np.array([])
    for key, subdf in df.groupby('location'):
        bhk_stats = {}
        for bhk, bhkdf in subdf.groupby('bhk'):
            bhk_stats[bhk] = { 'mean' : np.mean(bhkdf.price_per_sqft),
                               'std' : np.std(bhkdf.price_per_sqft),
                               'count' : bhkdf.shape[0] }
        for bhk, bhkdf in subdf.groupby('bhk'):
            stats = bhk_stats.get(bhk-1)
            if stats and stats['count'] > 5:
                exclude_indices = np.append(exclude_indices, bhkdf[bhkdf.
 ↪price_per_sqft < (stats['mean'])].index.values)
    return df.drop(exclude_indices, axis = 'index')
```

[50]:
```
data = bhk_outlier_remover(data)
```

[51]:
```
data.shape
```

[51]:
```
(7361, 7)
```

[52]:
```
data.head()
```

[52]:

	location	size	total_sqft	bath	price	bhk	price_per_sqft
0	1st Block Jayanagar	4 BHK	2850.0	4.0	428.0	4	15017.543860
1	1st Block Jayanagar	3 BHK	1630.0	3.0	194.0	3	11901.840491
2	1st Block Jayanagar	3 BHK	1875.0	2.0	235.0	3	12533.333333
3	1st Block Jayanagar	3 BHK	1200.0	2.0	130.0	3	10833.333333
4	1st Block Jayanagar	2 BHK	1235.0	2.0	148.0	2	11983.805668

[53]:
```
data.drop(columns = ['size','price_per_sqft'],inplace=True)
# price_per_sqft only used to extract the outliers from the data
```

[54]:
```
data.head()
```

[54]:

	location	total_sqft	bath	price	bhk
0	1st Block Jayanagar	2850.0	4.0	428.0	4
1	1st Block Jayanagar	1630.0	3.0	194.0	3
2	1st Block Jayanagar	1875.0	2.0	235.0	3
3	1st Block Jayanagar	1200.0	2.0	130.0	3
4	1st Block Jayanagar	1235.0	2.0	148.0	2

[55]:
```
data.to_csv("Cleaned_data.csv")
```

[56]:
```
X = data.drop(columns = ['price'])    # X without price
y = data['price']    # y is only price
```

[57]:
```
X.head()
```

[57]:

	location	total_sqft	bath	bhk
0	1st Block Jayanagar	2850.0	4.0	4
1	1st Block Jayanagar	1630.0	3.0	3
2	1st Block Jayanagar	1875.0	2.0	3
3	1st Block Jayanagar	1200.0	2.0	3
4	1st Block Jayanagar	1235.0	2.0	2

[58]:
```
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression, Lasso, Ridge
from sklearn.preprocessing import OneHotEncoder, StandardScaler
from sklearn.compose import make_column_transformer
from sklearn.pipeline import make_pipeline
from sklearn.metrics import r2_score
```

[59]:
```
X.shape
```

[59]:
```
(7361, 4)
```

[60]:
```
X_train, X_test, y_train, y_test = train_test_split(X,y, test_size = 0.2,␣
↪random_state=0)
```

[61]:
```
print(X_train.shape)
print(X_test.shape)
# 5888+1473 = 7361
# also 20% of 7361 is 1473
```

```
(5888, 4)
(1473, 4)
```

[62]:
```
column_trans = make_column_transformer((OneHotEncoder(sparse_output=False),␣
↪['location']),remainder='passthrough')
```

[63]:
```
scaler = StandardScaler()
```

4 Linear Regression

[64]:
```
pipe = make_pipeline(column_trans, scaler, LinearRegression())
```

[65]:
```
pipe.fit(X_train, y_train)
```

[65]:
```
Pipeline(steps=[('columntransformer',
                 ColumnTransformer(remainder='passthrough',
                                   transformers=[('onehotencoder',
OneHotEncoder(sparse_output=False),
                                                  ['location'])])),
                ('standardscaler', StandardScaler()),
                ('linearregression', LinearRegression())])
```

[66]:
```
y_pred_lr = pipe.predict(X_test)
```

[67]:
```
r2_score(y_test, y_pred_lr)
```

[67]:
```
0.825224489680086
```

5 Lasso

[68]:
```
lasso = Lasso()
```

[69]:
```
pipe = make_pipeline(column_trans, scaler, lasso)
```

[70]:
```
pipe.fit(X_train, y_train)
```

[70]:
```
Pipeline(steps=[('columntransformer',
                 ColumnTransformer(remainder='passthrough',
                                   transformers=[('onehotencoder',
OneHotEncoder(sparse_output=False),
                                                  ['location'])])),
                ('standardscaler', StandardScaler()), ('lasso', Lasso())])
```

[71]:
```
y_pred_lasso = pipe.predict(X_test)
```

[72]:
```
r2_score(y_test, y_pred_lasso)
```

[72]:
```
0.814689475169039
```

6 Ridge

[73]:
```
ridge = Ridge()
```

[74]:
```
pipe = make_pipeline(column_trans, scaler, ridge)
```

[75]:
```
pipe.fit(X_train, y_train)
```

[75]:
```
Pipeline(steps=[('columntransformer',
                 ColumnTransformer(remainder='passthrough',
                                   transformers=[('onehotencoder',
OneHotEncoder(sparse_output=False),
                                                  ['location'])])),
                ('standardscaler', StandardScaler()), ('ridge', Ridge())])
```

[76]:
```
y_pred_ridge = pipe.predict(X_test)
```

[77]:
```
r2_score(y_test, y_pred_ridge)
```

[77]:
```
0.8252348502290107
```

[78]:
```
print('No Regularization:', r2_score(y_test, y_pred_lr))
print('Lasso:', r2_score(y_test, y_pred_lasso))
print('Ridge:', r2_score(y_test, y_pred_ridge))
```

```
No Regularization: 0.825224489680086
Lasso: 0.814689475169039
Ridge: 0.8252348502290107
```

[79]:
```
import pickle
```

[80]:
```
pickle.dump(pipe, open('RidgeModel.pkl','wb'))
```

7 Thank You by Navjoth Singh