```
import pandas as pd
import numpy as np
from matplotlib import pyplot as plt
%matplotlib inline #it show plot inside notebook
import matplotlib #it is used for global plot setting
matplotlib.rcParams['figure.figsize']=(20,10) #set defalt figsize
```

```
UsageError: unrecognized arguments: #it show plot inside notebook
```

```
df=pd.read_csv('Bengaluru_House_Data.csv')
df.head()
```

```
              area_type   availability                  location
size  \
0  Super built-up  Area         19-Dec  Electronic City Phase II
2 BHK
1            Plot  Area   Ready To Move          Chikka Tirupathi  4
Bedroom
2        Built-up  Area   Ready To Move               Uttarahalli
3 BHK
3  Super built-up  Area   Ready To Move        Lingadheeranahalli
3 BHK
4  Super built-up  Area   Ready To Move                  Kothanur
2 BHK

   society total_sqft  bath  balcony   price
0  Coomee        1056   2.0      1.0   39.07
1  Theanmp       2600   5.0      3.0  120.00
2      NaN       1440   2.0      3.0   62.00
3  Soiewre       1521   3.0      1.0   95.00
4      NaN       1200   2.0      1.0   51.00
```

```
df.groupby('area_type')['area_type'].aggregate('count')
```

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

```
df1=df.drop(['area_type','availability','society','balcony'],axis='col
umns')
df1
```

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

```
...                        ...         ...          ...    ...      ...
13315               Whitefield   5 Bedroom         3453    4.0   231.00
13316            Richards Town       4 BHK         3600    5.0   400.00
13317    Raja Rajeshwari Nagar       2 BHK         1141    2.0    60.00
13318          Padmanabhanagar       4 BHK         4689    4.0   488.00
13319             Doddathoguru       1 BHK          550    1.0    17.00

[13320 rows x 5 columns]
```

```
df1.isnull().sum()
```

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

```
df2=df1.dropna()
df2.isnull().sum()
```

```
location      0
size          0
total_sqft    0
bath          0
price         0
dtype: int64
```

```
df2['size'].unique()
```

```
array(['2 BHK', '4 Bedroom', '3 BHK', '4 BHK', '6 Bedroom', '3 
Bedroom',
       '1 BHK', '1 RK', '1 Bedroom', '8 Bedroom', '2 Bedroom',
       '7 Bedroom', '5 BHK', '7 BHK', '6 BHK', '5 Bedroom', '11 BHK',
       '9 BHK', '9 Bedroom', '27 BHK', '10 Bedroom', '11 Bedroom',
       '10 BHK', '19 BHK', '16 BHK', '43 Bedroom', '14 BHK', '8 BHK',
       '12 Bedroom', '13 BHK', '18 Bedroom'], dtype=object)
```

```
df2['Bhk']=df2['size'].apply(lambda x: int(x.split(' ')[0]))
```

```
C:\Users\Admin\AppData\Local\Temp\ipykernel_15064\2704324914.py:1: 
SettingWithCopyWarning: 
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: 
https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#
returning-a-view-versus-a-copy
  df2['Bhk']=df2['size'].apply(lambda x: int(x.split(' ')[0]))
```

in above we convert size column to as bhk column

```
df2
```

```
                       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
...                         ...        ...        ...   ...     ...  .
..
13315                Whitefield  5 Bedroom       3453   4.0  231.00
5
13316             Richards Town      4 BHK       3600   5.0  400.00
4
13317     Raja Rajeshwari Nagar      2 BHK       1141   2.0   60.00
2
13318           Padmanabhanagar      4 BHK       4689   4.0  488.00
4
13319              Doddathoguru      1 BHK        550   1.0   17.00
1

[13246 rows x 6 columns]
```

```
df2['Bhk'].unique()
```

```
array([ 2,  4,  3,  6,  1,  8,  7,  5, 11,  9, 27, 10, 19, 16, 43, 14,
12,
       13, 18])
```

```
df2['total_sqft'].unique()
```

```
array(['1056', '2600', '1440', ..., '1133 - 1384', '774', '4689'],
      shape=(2067,), dtype=object)
```

```
def is_float(x):
    try:
        float(x)
    except:
        return False
    return True
```

in above we create function for check float value if value is not float then its throw exception

```
df2
```

```
                       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
...                         ...        ...         ...   ...     ...  .
..
13315                Whitefield  5 Bedroom        3453   4.0  231.00
5
13316             Richards Town      4 BHK        3600   5.0  400.00
4
13317     Raja Rajeshwari Nagar      2 BHK        1141   2.0   60.00
2
13318           Padmanabhanagar      4 BHK        4689   4.0  488.00
4
13319              Doddathoguru      1 BHK         550   1.0   17.00
1

[13246 rows x 6 columns]
```

```
df2[~df2['total_sqft'].apply(is_float)].head(10)
```

```
               location       size      total_sqft  bath    price  Bhk
30            Yelahanka      4 BHK     2100 - 2850   4.0  186.000    4
122              Hebbal      4 BHK     3067 - 8156   4.0  477.000    4
137  8th Phase JP Nagar      2 BHK     1042 - 1105   2.0   54.005    2
165            Sarjapur      2 BHK     1145 - 1340   2.0   43.490    2
188            KR Puram      2 BHK     1015 - 1540   2.0   56.800    2
410             Kengeri      1 BHK  34.46Sq. Meter   1.0   18.500    1
549         Hennur Road      2 BHK     1195 - 1440   2.0   63.770    2
648             Arekere  9 Bedroom       4125Perch   9.0  265.000    9
661           Yelahanka      2 BHK     1120 - 1145   2.0   48.130    2
672        Bettahalsoor  4 Bedroom     3090 - 5002   4.0  445.000    4
```

in above we checked non float value and using ~ we show only non floating value

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

above function is create for calculate avrage of range total-sqr column where two values is present

```
convert_sqrft_to_avg('4689')
```

```
4689.0
```

```
df3=df2.copy()
```

```
df3['total_sqft']=df3['total_sqft'].apply(convert_sqrft_to_avg)
df3
```

```
                       location       size  total_sqft  bath   price
Bhk
0      Electronic City Phase II      2 BHK      1056.0   2.0   39.07
2
1              Chikka Tirupathi  4 Bedroom      2600.0   5.0  120.00
4
2                   Uttarahalli      3 BHK      1440.0   2.0   62.00
3
3             Lingadheeranahalli      3 BHK      1521.0   3.0   95.00
3
4                      Kothanur      2 BHK      1200.0   2.0   51.00
2
...                         ...        ...         ...   ...     ...
...
13315                Whitefield  5 Bedroom      3453.0   4.0  231.00
5
13316             Richards Town      4 BHK      3600.0   5.0  400.00
4
13317      Raja Rajeshwari Nagar      2 BHK      1141.0   2.0   60.00
2
13318            Padmanabhanagar      4 BHK      4689.0   4.0  488.00
4
13319               Doddathoguru      1 BHK       550.0   1.0   17.00
1

[13246 rows x 6 columns]
```

```
df3[df3['total_sqft'].apply(is_float)]
```

```
                       location       size  total_sqft  bath   price
Bhk
0      Electronic City Phase II      2 BHK      1056.0   2.0   39.07
2
```

```
1              Chikka Tirupathi  4 Bedroom      2600.0   5.0  120.00
4
2                   Uttarahalli      3 BHK      1440.0   2.0   62.00
3
3            Lingadheeranahalli      3 BHK      1521.0   3.0   95.00
3
4                      Kothanur      2 BHK      1200.0   2.0   51.00
2
...                         ...        ...         ...   ...     ...
...
13315                Whitefield  5 Bedroom      3453.0   4.0  231.00
5
13316             Richards Town      4 BHK      3600.0   5.0  400.00
4
13317     Raja Rajeshwari Nagar      2 BHK      1141.0   2.0   60.00
2
13318           Padmanabhanagar      4 BHK      4689.0   4.0  488.00
4
13319              Doddathoguru      1 BHK       550.0   1.0   17.00
1

[13246 rows x 6 columns]

df3[(df3['location']=='Kengeri')&(df3['price']==18.5)]

    location   size  total_sqft  bath  price  Bhk
410  Kengeri  1 BHK         NaN   1.0   18.5    1

df2.iloc[410]

location      Kanakpura Road
size                   3 BHK
total_sqft              1550
bath                     3.0
price                   64.5
Bhk                        3
Name: 414, dtype: object

df4=df3.copy()

df4['price_per_sqr']=df4['price']*100000/df4['total_sqft']
df4.head()

                   location       size  total_sqft  bath   price  Bhk
\
0  Electronic City Phase II      2 BHK      1056.0   2.0   39.07    2

1          Chikka Tirupathi  4 Bedroom      2600.0   5.0  120.00    4

2               Uttarahalli      3 BHK      1440.0   2.0   62.00    3
```

```
3        Lingadheeranahalli       3 BHK       1521.0    3.0    95.00     3

4                  Kothanur       2 BHK       1200.0    2.0    51.00     2


   price_per_sqr
0    3699.810606
1    4615.384615
2    4305.555556
3    6245.890861
4    4250.000000
```

create new column for price per sqaure fit

now we check for category feature that is location in that we check how much unique data is preset

```
len(df4['location'].unique())

1304
```

in this multiple locations is present we have to minimise some data

```
df4.location=df4.location.apply(lambda x: x.strip())

location_stat=df4.groupby('location')
['location'].agg('count').sort_values(ascending=False)
location_stat

location
Whitefield                     535
Sarjapur  Road                 392
Electronic City                304
Kanakpura Road                 266
Thanisandra                    236
                              ...
adigondanhalli                   1
akshaya nagar t c palya          1
anjananager magdi road           1
arudi                            1
2Electronic City Phase II        1
Name: location, Length: 1293, dtype: int64

len(location_stat[location_stat<=10])
#check locaton is less then 10 data point

1052

location_less_then_10=(location_stat[location_stat<=10])

location_less_then_10
```

```
location
Ganga Nagar                     10
Gunjur Palya                    10
BTM 1st Stage                   10
Sadashiva Nagar                 10
Kalkere                         10
                                ..
adigondanhalli                   1
akshaya nagar t c palya          1
anjananager magdi road           1
arudi                            1
2Electronic City Phase II        1
Name: location, Length: 1052, dtype: int64
```

```
df4.location=df.location.apply(lambda x: 'Others' if x in
location_less_then_10 else x)
```

```
len(df4.location.unique())
```

```
283
```

```
df4.head(10)
```

```
                   location       size  total_sqft  bath   price  Bhk  \
0  Electronic City Phase II      2 BHK      1056.0   2.0   39.07    2   

1          Chikka Tirupathi  4 Bedroom      2600.0   5.0  120.00    4   

2               Uttarahalli      3 BHK      1440.0   2.0   62.00    3   

3        Lingadheeranahalli      3 BHK      1521.0   3.0   95.00    3   

4                  Kothanur      2 BHK      1200.0   2.0   51.00    2   

5                Whitefield      2 BHK      1170.0   2.0   38.00    2   

6          Old Airport Road      4 BHK      2732.0   4.0  204.00    4   

7              Rajaji Nagar      4 BHK      3300.0   4.0  600.00    4   

8            Marathahalli      3 BHK      1310.0   3.0   63.25    3   

9                    Others  6 Bedroom      1020.0   6.0  370.00    6   


   price_per_sqr
0    3699.810606
1    4615.384615
2    4305.555556
3    6245.890861
```

```
4     4250.000000
5     3247.863248
6     7467.057101
7    18181.818182
8     4828.244275
9    36274.509804
```

now we remove data error or outlier in database.in this we consider avareg 1bhk area is 300 and check how much data errors and outliers

```
df4[df4.total_sqft/df4.Bhk<300]

                   location       size  total_sqft  bath  price  Bhk  \
9                    Others  6 Bedroom      1020.0   6.0  370.0    6
45               HSR Layout  8 Bedroom       600.0   9.0  200.0    8
58             Murugeshpalya  6 Bedroom     1407.0   4.0  150.0    6
68      Devarachikkanahalli  8 Bedroom      1350.0   7.0   85.0    8
70                   Others  3 Bedroom       500.0   3.0  100.0    3
...                     ...        ...         ...   ...    ...  ...
13277                Others  7 Bedroom      1400.0   7.0  218.0    7
13279                Others  6 Bedroom      1200.0   5.0  130.0    6
13281        Margondanahalli  5 Bedroom      1375.0   5.0  125.0    5
13303         Vidyaranyapura  5 Bedroom       774.0   5.0   70.0    5
13311       Ramamurthy Nagar  7 Bedroom      1500.0   9.0  250.0    7

       price_per_sqr
9       36274.509804
45      33333.333333
58      10660.980810
68       6296.296296
70      20000.000000
...              ...
13277   15571.428571
13279   10833.333333
13281    9090.909091
13303    9043.927649
13311   16666.666667

[744 rows x 7 columns]

#remove data error row
df5=df4[~(df4.total_sqft/df4.Bhk<300)]

df5.shape

(12502, 7)

def remove_pps_outliers(df):
    df_out = pd.DataFrame()
    for key, subdf in df.groupby('location'):
        m = np.mean(subdf['price_per_sqr'])
        st = np.std(subdf['price_per_sqr'])
        reduced_df = subdf[(subdf['price_per_sqr'] > (m - st)) & 
(subdf['price_per_sqr'] <= (m + st))]
        df_out = pd.concat([df_out, reduced_df], ignore_index=True)
    return df_out

df6 = remove_pps_outliers(df5)

## create function for remove outliers of price per sqr location wise

df6.shape
```

```
(10201, 7)
```

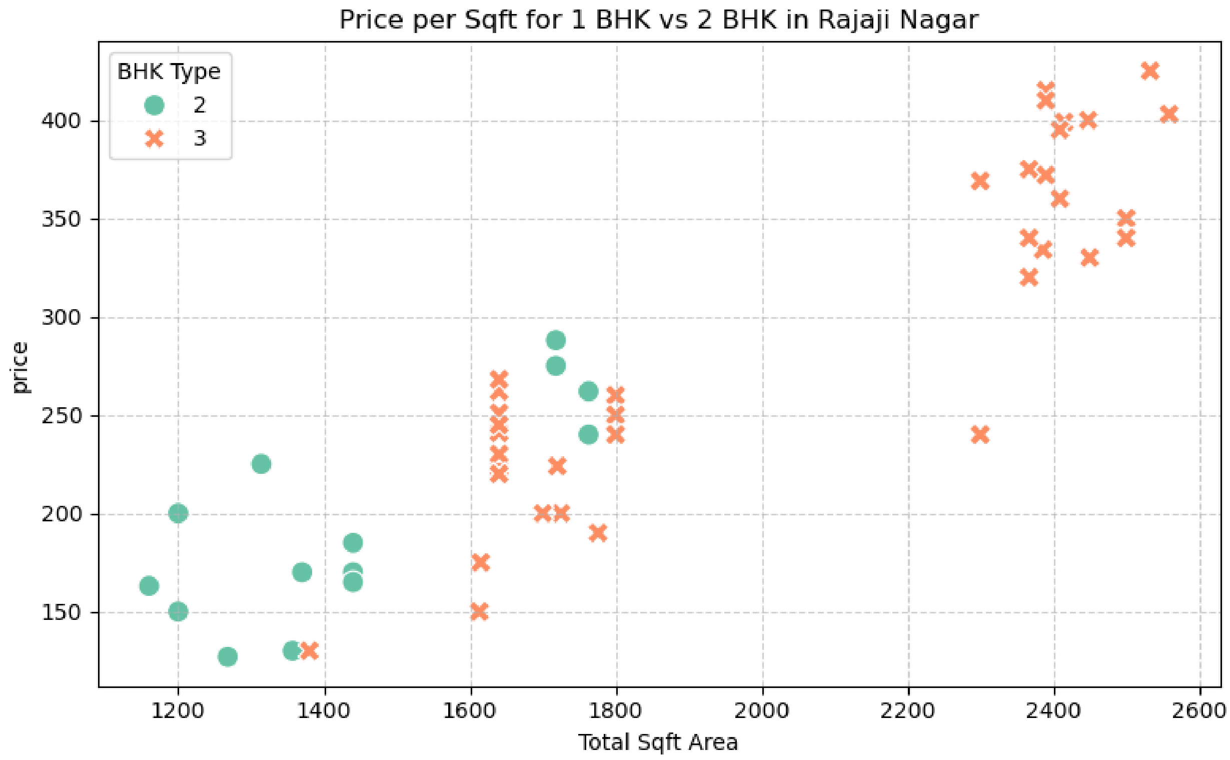
```
import seaborn as sns
def plot_bhk_price_comparison(df, area_name):
    # Filter data for the given area
    area_df = df[(df['location'] == area_name) & 
(df['Bhk'].isin([2,3]))]

    if area_df.empty:
        print(f"No data available for location: {area_name}")
        return

    plt.figure(figsize=(8,5))
    sns.scatterplot(
        data=area_df,
        x='total_sqft',
        y='price',
        hue='Bhk',
        style='Bhk',
        s=100,
        palette='Set2'
    )

    plt.title(f"Price per Sqft for 1 BHK vs 2 BHK in {area_name}")
    plt.xlabel("Total Sqft Area")
    plt.ylabel("price")
    plt.legend(title="BHK Type")
    plt.grid(True, linestyle='--', alpha=0.6)
    plt.tight_layout()
    plt.show()

plot_bhk_price_comparison(df6,'Rajaji Nagar')
```



in above diagram we undestand in some areas 2bhk price is greather then 3 bhk of same squarefit

```python
def remove_all_bhk_outliers(df):
    exclude_indices = np.array([])

    # Extract numeric BHK value (e.g., "3 BHK" → 3)

    for location, location_df in df.groupby('location'):
        bhk_stats = {}

        # Compute mean price_per_sqft for each BHK in the location
        for bhk, subdf in location_df.groupby('Bhk'):
            bhk_stats[bhk] = {
                'mean_price': subdf['price_per_sqr'].mean(),
                'indices': subdf.index
            }

        # Compare each higher BHK to the previous smaller BHK
        bhk_levels = sorted(bhk_stats.keys())
        for i in range(1, len(bhk_levels)):
            lower_bhk = bhk_levels[i - 1]
            higher_bhk = bhk_levels[i]

            lower_mean = bhk_stats[lower_bhk]['mean_price']
            higher_indices = bhk_stats[higher_bhk]['indices']
            # Mark higher BHK rows as outliers if price/sqft < smaller
BHK mean
            bad_index = df.loc[higher_indices][df.loc[higher_indices,
'price_per_sqr'] < lower_mean].index
            exclude_indices = np.concatenate((exclude_indices,
bad_index))

    print(f"Removed {len(exclude_indices)} outlier records across all
BHKs.")

    # Drop those bad rows
    return df.drop(exclude_indices, axis='index')
```

in above function we remove thoes outlier where higher bhk value is less then lower bhk value is same area and same sqr fit

```
df7=remove_all_bhk_outliers(df6)
df7.shape
```

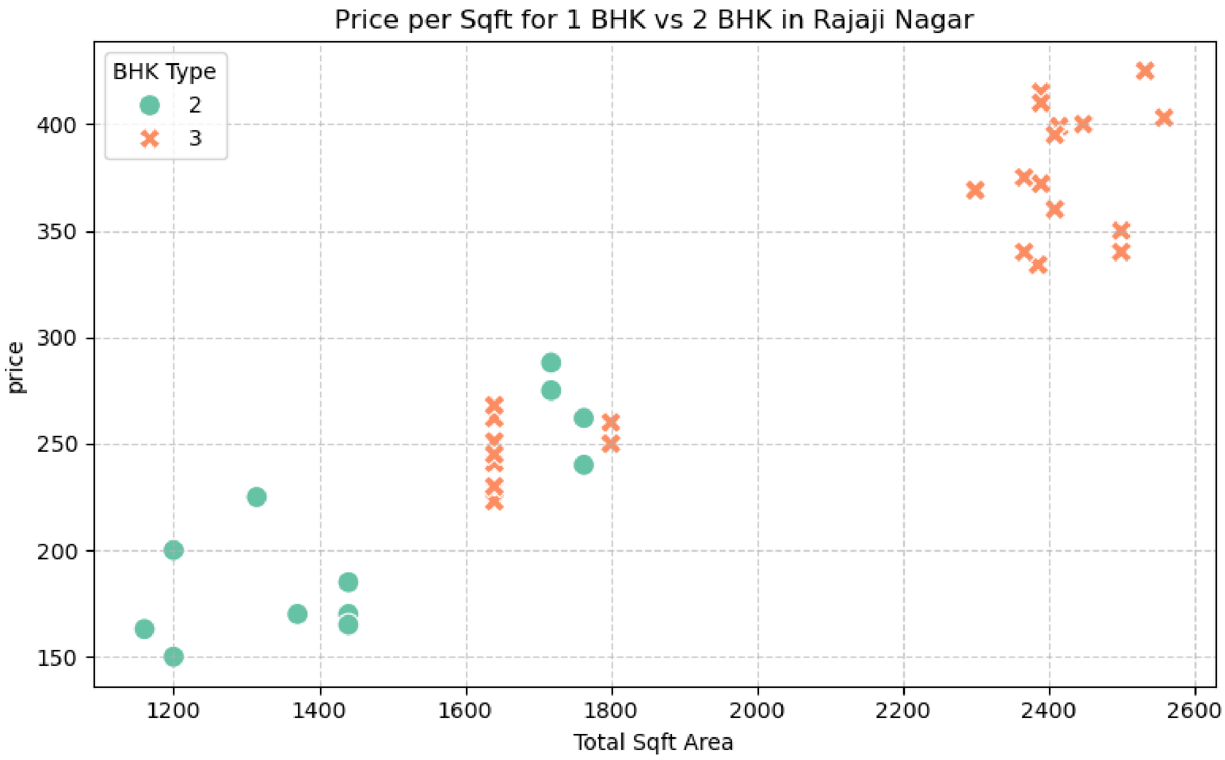
```
Removed 4072 outlier records across all BHKs.
```

```
(6129, 7)
```

```
df6.shape
```

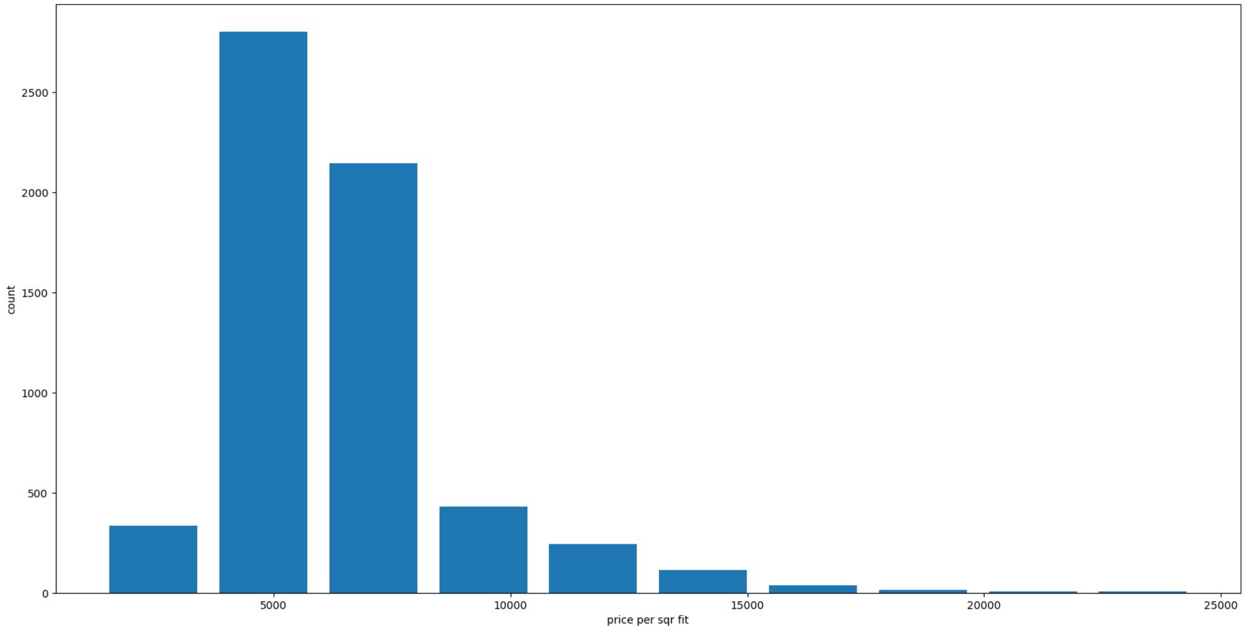
```
(10201, 7)
```

```
#check outlier remove or not
plot_bhk_price_comparison(df7,'Rajaji Nagar')
```



```
import matplotlib
matplotlib.rcParams["figure.figsize"]=(20,10)
plt.hist(df7.price_per_sqr,rwidth=0.8)
plt.xlabel('price per sqr fit')
plt.ylabel('count')

Text(0, 0.5, 'count')
```



```
df7[df7.bath>df7.Bhk+2]

        location       size  total_sqft  bath   price  Bhk  
price_per_sqr
5253   Nagasandra  4 Bedroom      7000.0   8.0   450.0    4  
6428.571429
5860       Others      6 BHK     11338.0   9.0  1000.0    6  
8819.897689
8969  Thanisandra      3 BHK      1806.0   6.0   116.0    3  
6423.034330
```

here we see some outlier related to bathrooms here we see bathrooms no is huge as comparied to bhk we remove this data

```
df7.shape

(6129, 7)

df8=df7[df7.bath<df7.Bhk+2]
df8.shape

(6057, 7)

#drop uwanted columns
df9=df8.drop(['size','price_per_sqr'],axis='columns')
df9.head(3)

               location  total_sqft  bath  price  Bhk
0   Devarabeesana Halli      1672.0   3.0  150.0    3
1   Devarabeesana Halli      1750.0   3.0  149.0    3
2   Devarabeesana Halli      1750.0   3.0  150.0    3

df9.columns

Index(['location', 'total_sqft', 'bath', 'price', 'Bhk'],
dtype='object')

#doing onehotencoder convert string column(location) in int
dummies=pd.get_dummies(df9['location'].astype(str),dtype=int)

df10=pd.concat([df9,dummies.drop('Others',axis='columns')],axis='colum
ns')
df10.head(3)

               location  total_sqft  bath  price  Bhk   Devarabeesana
Halli  \
0   Devarabeesana Halli      1672.0   3.0  150.0    3                     
1
1   Devarabeesana Halli      1750.0   3.0  149.0    3                     
1
2   Devarabeesana Halli      1750.0   3.0  150.0    3
```

```
1

    Devarachikkanahalli   Electronic City   Mysore Highway
Rachenahalli  \
0                     0                 0                0
0
1                     0                 0                0
0
2                     0                 0                0
0

   ...  Vishveshwarya Layout  Vishwapriya Layout  Vittasandra
Whitefield  \
0  ...                     0                   0            0
0
1  ...                     0                   0            0
0
2  ...                     0                   0            0
0

   Whitefield,   Yelachenahalli  Yelahanka  Yelahanka New Town
Yelenahalli  \
0             0               0          0                   0
0
1             0               0          0                   0
0
2             0               0          0                   0
0

   Yeshwanthpur
0             0
1             0
2             0

[3 rows x 264 columns]
```

```
df11=df10.drop('location',axis='columns')
df11.head(3)
```

```
   total_sqft  bath  price  Bhk   Devarabeesana Halli
Devarachikkanahalli  \
0      1672.0   3.0  150.0    3                     1
0
1      1750.0   3.0  149.0    3                     1
0
2      1750.0   3.0  150.0    3                     1
0

    Electronic City   Mysore Highway   Rachenahalli   Thanisandra  ...
\
0                 0                0              0              0  ...

1                 0                0              0              0  ...

2                 0                0              0              0  ...


   Vishveshwarya Layout  Vishwapriya Layout  Vittasandra
Whitefield  \
0                     0                   0            0            0

1                     0                   0            0            0

2                     0                   0            0            0


   Whitefield,   Yelachenahalli  Yelahanka  Yelahanka New Town
Yelenahalli  \
0             0               0          0                    0
0
1             0               0          0                    0
0
2             0               0          0                    0
0

   Yeshwanthpur
0             0
1             0
2             0

[3 rows x 263 columns]
```

```
#split column in x and y
x=df11.drop('price',axis='columns')
x.head(3)
```

```
   total_sqft  bath  Bhk   Devarabeesana Halli
Devarachikkanahalli  \
0      1672.0   3.0    3                     1                      0

1      1750.0   3.0    3                     1                      0

2      1750.0   3.0    3                     1                      0


    Electronic City   Mysore Highway   Rachenahalli    Thanisandra
south  \
0                 0                0              0              0
0
1                 0                0              0              0
0
```

```
2                 0                0              0             0
0

   ...  Vishveshwarya Layout  Vishwapriya Layout  Vittasandra
Whitefield  \
0  ...                     0                   0            0
0
1  ...                     0                   0            0
0
2  ...                     0                   0            0
0

   Whitefield,   Yelachenahalli  Yelahanka  Yelahanka New Town
Yelenahalli  \
0             0               0          0                   0
0
1             0               0          0                   0
0
2             0               0          0                   0
0

   Yeshwanthpur
0             0
1             0
2             0

[3 rows x 262 columns]
```

```
y=df11['price']
y.head(3)
```

```
0    150.0
1    149.0
2    150.0
Name: price, dtype: float64
```

```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.2,random_state=42)
```

```
from sklearn.linear_model import LinearRegression
lr_clf=LinearRegression()
```

```
lr_clf.fit(x_train,y_train)
```

```
LinearRegression()
```

```
lr_clf.score(x_test,y_test)
```

```
0.8468274396308201
```

```
#now using cross val score for model validation
from sklearn.model_selection import ShuffleSplit,cross_val_score
from sklearn.linear_model import LinearRegression

cv=ShuffleSplit( n_splits=10,test_size=0.2,random_state=42)
#its randomly shuffles dataset before splitting
cross_val_score(LinearRegression(),x,y,cv=cv)
```

```
array([0.84682744, 0.79622136, 0.87513203, 0.78195138, 0.86626837,
       0.81027867, 0.85960904, 0.84998744, 0.84588748, 0.80988841])
```

now we using gridsearchcv we check best model in lasso,linner and decisiontreealogorithm

```
from sklearn.model_selection import GridSearchCV, ShuffleSplit
from sklearn.linear_model import LinearRegression, Lasso
from sklearn.tree import DecisionTreeRegressor

def find_best_model(x,y):
    # Cross-validation strategy
    cv = ShuffleSplit(n_splits=5, test_size=0.2, random_state=42)

    # Models & their parameter grids
    models = {
        'LinearRegression': {
            'model': LinearRegression(),
            'params': {
                'fit_intercept': [True, False],
                'positive': [True, False]
            }
        },
        'Lasso': {
            'model': Lasso(),
            'params': {
                'alpha': [0.001, 0.01, 0.1, 1, 10],
                'selection': ['cyclic', 'random']
            }
        },
        'DecisionTree': {
            'model': DecisionTreeRegressor(random_state=42),
            'params': {
                'criterion': ['squared_error', 'friedman_mse'],
                'splitter': ['best', 'random'],
                'max_depth': [None, 5, 10, 15, 20]
            }
        }
    }

    # Store results
    scores = []
    for name, mp in models.items():
        print(f"\n□ Running GridSearch for {name}...")
        gs = GridSearchCV(
            mp['model'],
            mp['params'],
            cv=cv,
            scoring='r2',
            return_train_score=False
        )
        gs.fit(x, y)

        scores.append({
            'Model': name,
            'Best_Score': gs.best_score_,
            'Best_Params': gs.best_params_
        })

    # Convert results to DataFrame for easy comparison

    result_df = pd.DataFrame(scores, columns=['Model', 'Best_Score',
'Best_Params'])
    print("\n□ Model Comparison:\n", result_df)

    # Return best model info
    best_model = result_df.iloc[result_df['Best_Score'].idxmax()]
    print(f"\n□ Best Model: {best_model['Model']}")
    print(f"Best Parameters: {best_model['Best_Params']}")
    print(f"Best R² Score: {best_model['Best_Score']:.4f}")

    return result_df

find_best_model(x,y)
```

```
□ Running GridSearch for LinearRegression...

□ Running GridSearch for Lasso...

□ Running GridSearch for DecisionTree...

□ Model Comparison:
                Model   Best_Score  \
0  LinearRegression    0.834885
1             Lasso    0.833221
2      DecisionTree    0.727251

                                         Best_Params
0        {'fit_intercept': False, 'positive': False}
1            {'alpha': 0.001, 'selection': 'random'}
```

```
2  {'criterion': 'squared_error', 'max_depth': 20...

□ Best Model: LinearRegression
Best Parameters: {'fit_intercept': False, 'positive': False}
Best R² Score: 0.8349

              Model  Best_Score  \
0  LinearRegression    0.834885
1             Lasso    0.833221
2      DecisionTree    0.727251

                                         Best_Params
0        {'fit_intercept': False, 'positive': False}
1            {'alpha': 0.001, 'selection': 'random'}
2  {'criterion': 'squared_error', 'max_depth': 20...
```

as per above test LinnerRegression is best model for predication

```
x.columns

Index(['total_sqft', 'bath', 'Bhk', ' Devarabeesana Halli',
       ' Devarachikkanahalli', ' Electronic City', ' Mysore Highway',
       ' Rachenahalli', ' Thanisandra', ' south',
       ...
       'Vishveshwarya Layout', 'Vishwapriya Layout', 'Vittasandra',
       'Whitefield', 'Whitefield, ', 'Yelachenahalli', 'Yelahanka',
       'Yelahanka New Town', 'Yelenahalli', 'Yeshwanthpur'],
      dtype='object', length=262)

def predict_price(location, sqft, bath, bhk, lr_clf, x_columns):

    # Step 1: create zero-filled array same size as training columns
    x = np.zeros(len(x_columns))

    # Step 2: set numerical features (make sure column names match 
your training data)
    x[x_columns.get_loc('total_sqft')] = sqft
    x[x_columns.get_loc('bath')] = bath
    x[x_columns.get_loc('Bhk')] = bhk

    # Step 3: set one-hot encoded location column
    location_col = f"location_{location}"
    if location_col in x_columns:
        x[x_columns.get_loc(location_col)] = 1

    # Step 4: make prediction
    return round(lr_clf.predict([x])[0], 2)

x_columns = x.columns
```

```
pred = predict_price('1st Phase JP Nagar', 1500, 2, 3, lr_clf,
x_columns)
print("Predicted Price (Lakh):", pred)
```

```
Predicted Price (Lakh): 120.75

C:\Users\Admin\anaconda3\Lib\site-packages\sklearn\utils\
validation.py:2749: UserWarning: X does not have valid feature names,
but LinearRegression was fitted with feature names
  warnings.warn(
```

```
df[df['location'] == 'Whitefield'].shape
```

```
(540, 9)
```

```
for i in range(5):
    row = df10.sample(1).iloc[0]
    pred = predict_price(row.location, row.total_sqft, row.bath,
row.Bhk, lr_clf, x.columns)
    print(f"Actual: {row.price}, Predicted: {pred}, Location:
{row.location}")
```

```
Actual: 110.0, Predicted: 104.98, Location: Koramangala
Actual: 54.0, Predicted: 86.96, Location: Hebbal
Actual: 71.0, Predicted: 100.44, Location: Dodda Nekkundi
Actual: 280.0, Predicted: 322.78, Location: Sarjapur  Road
Actual: 52.81, Predicted: 114.31, Location: Bommasandra

C:\Users\Admin\anaconda3\Lib\site-packages\sklearn\utils\
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but LinearRegression was fitted with feature names
  warnings.warn(
```

```
import pickle
import os
```

```
with open('house price prediction.pickle','wb')as f:
    pickle.dump(lr_clf,f)
print(os.getcwd())
```

```
C:\Users\Admin
```

```
import json
columns={
    'data_columns':[col.lower() for col in x.columns]
}
with open('columns.json','w')as f:
    f.write(json.dumps(columns))
print(os.getcwd())
```

```
C:\Users\Admin
```