price-prediction-1

December 4, 2023

[2]:
```
import pandas as pd
import numpy as np
from matplotlib import pyplot as plt
%matplotlib inline
import matplotlib
matplotlib.rcParams["figure.figsize"] = (20,10)
```

[3]:
```
df1 = pd.read_csv("Bengaluru_House_Data.csv")
df1.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]:
```
df1.shape
```

[4]:
```
(13320, 9)
```

[5]:
```
df1.groupby('area_type')['area_type'].agg('count')
```

[5]:
```
area_type
Built-up  Area          2418
Carpet  Area              87
Plot  Area              2025
Super built-up  Area    8790
Name: area_type, dtype: int64
```

[6]:
```
df2 = df1.drop(['area_type','society','balcony','availability'],axis='columns')
df2.head()
```

[6]:

	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

[7]:
```
df2.isnull().sum()
```

[7]:
```
location       1
size          16
total_sqft     0
bath          73
price          0
dtype: int64
```

[8]:
```
df3 = df2.dropna()
df3.isnull().sum()
```

[8]:
```
location      0
size          0
total_sqft    0
bath          0
price         0
dtype: int64
```

[9]:
```
df3.shape
```

[9]:
```
(13246, 5)
```

[10]:
```
df3['size'].unique()
```

[10]:
```
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)
```

[11]:
```
df3['bhk'] = df3['size'].apply(lambda x: int(x.split(' ')[0]))
```

```
C:\Users\admin\AppData\Local\Temp\ipykernel_13200\2222900254.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
  df3['bhk'] = df3['size'].apply(lambda x: int(x.split(' ')[0]))
```

[12]:
```
df3.head()
```

[12]:

	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

[13]:
```
df3['bhk'].unique()
```

[13]:
```
array([ 2,  4,  3,  6,  1,  8,  7,  5, 11,  9, 27, 10, 19, 16, 43, 14, 12,
       13, 18], dtype=int64)
```

[14]:
```
df3[df3.bhk>20]
```

[14]:

	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

[15]:
```
df3.total_sqft.unique()
```

[15]:
```
array(['1056', '2600', '1440', …, '1133 - 1384', '774', '4689'],
      dtype=object)
```

[16]:
```
def is_float(x):
    try:
        float(x)
    except:
        return False
    return True
```

[17]:
```
df3[~df3['total_sqft'].apply(is_float)].head(10)
```

[17]:

	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
```

[18]:
```
def convert_sqft_to_num(x):
    tokens = x.split('-')
    if len(tokens) == 2:
        return (float(tokens[0])+float(tokens[1]))/2
    try:
        return float(x)
    except:
        return None
```

[19]:
```
convert_sqft_to_num('2100 - 2850')
```

[19]:
```
2475.0
```

[20]:
```
df4 = df3.copy()
df4['total_sqft'] = df4['total_sqft'].apply(convert_sqft_to_num)
df4.head(3)
```

[20]:
```
                  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
```

[21]:
```
df5 = df4.copy()
df5['price_per_sqft'] = df5['price']*100000/df5['total_sqft']
df5.head()
```

[21]:
```
                  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_sqft
0     3699.810606
1     4615.384615
2     4305.555556
3     6245.890861
4     4250.000000
```

[22]:
```
len(df5.location.unique())
```

[22]:
```
1304
```

[23]:
```
df5.location = df5.location.apply(lambda x: x.strip())
location_stats = df5.groupby('location')['location'].agg('count').
 ↪sort_values(ascending = False)
location_stats
```

[23]:
```
location
Whitefield               535
Sarjapur  Road           392
Electronic City          304
Kanakpura Road           266
Thanisandra              236
                        …
1 Giri Nagar               1
Kanakapura Road,           1
Kanakapura main  Road      1
Karnataka Shabarimala      1
whitefiled                 1
Name: location, Length: 1293, dtype: int64
```

[24]:
```
len(location_stats[location_stats<=10])
```

[24]:
```
1052
```

[25]:
```
location_stats_less_than_10 = location_stats[location_stats<=10]
location_stats_less_than_10
```

[25]:
```
location
Basapura                 10
1st Block Koramangala    10
Gunjur Palya             10
Kalkere                  10
Sector 1 HSR Layout      10
                         ..
1 Giri Nagar              1
Kanakapura Road,          1
Kanakapura main  Road     1
Karnataka Shabarimala     1
whitefiled                1
Name: location, Length: 1052, dtype: int64
```

[26]:
```
len(df5.location.unique())
```

[26]:
```
1293
```

[27]:
```
df5.location = df5.location.apply(lambda x:'other' if x in␣
 ↪location_stats_less_than_10 else x)
len(df5.location.unique())
```

[27]:
```
242
```

[28]:
```
df5.head()
```

[28]:
```
                  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_sqft
0     3699.810606
1     4615.384615
2     4305.555556
3     6245.890861
4     4250.000000
```

[29]:
```
df5[df5.total_sqft/df5.bhk<300].head()
```

[29]:
```
               location       size  total_sqft  bath  price  bhk  \
9                 other  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                other  3 Bedroom       500.0   3.0  100.0    3

    price_per_sqft
9     36274.509804
45    33333.333333
58    10660.980810
68     6296.296296
70    20000.000000
```

[30]:
```
df5.shape
```

[30]:
```
(13246, 7)
```

[31]:
```
df6 = df5[~(df5.total_sqft/df5.bhk<300)]
df6.shape
```

[31]:
```
(12502, 7)
```

[32]:
```
df6.price_per_sqft.describe()
```

[32]:
```
count     12456.000000
mean       6308.502826
```

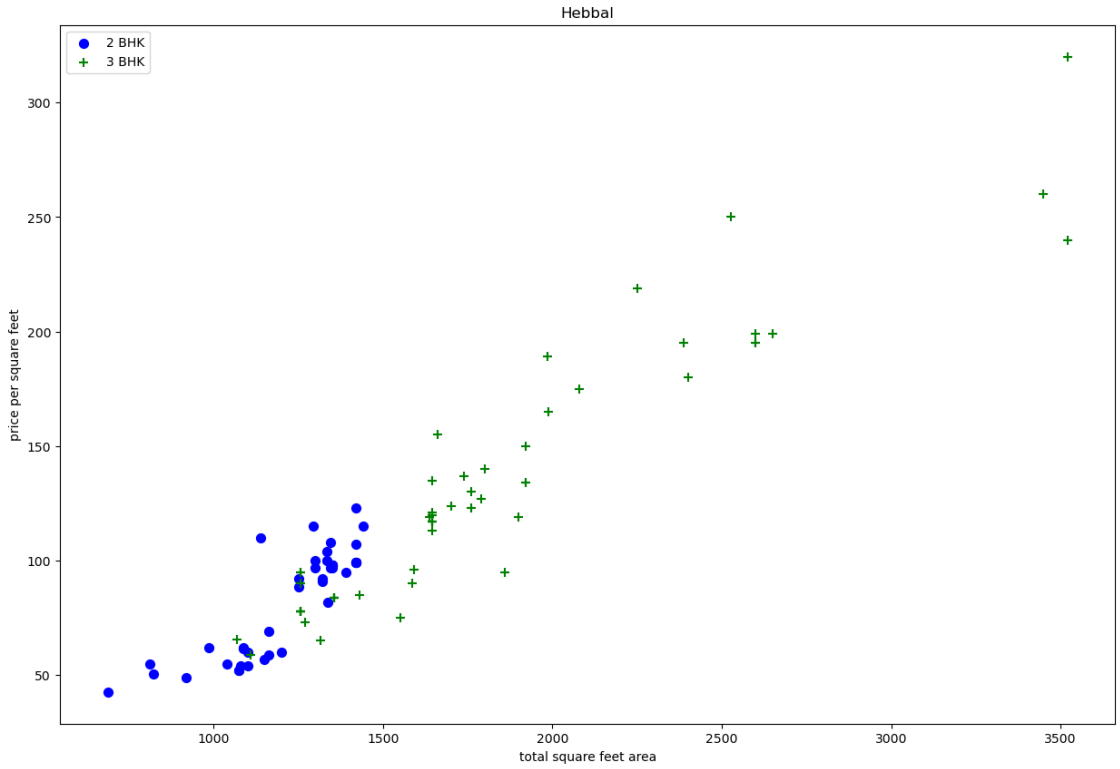
```
std         4168.127339
min          267.829813
25%         4210.526316
50%         5294.117647
75%         6916.666667
max       176470.588235
Name: price_per_sqft, dtype: float64
```

[33]:
```
def remove_pps_outliers(df):
    df_out = pd.DataFrame()
    for key, subdf in df.groupby('location'):
        m = np.mean(subdf.price_per_sqft)
        st = np.std(subdf.price_per_sqft)
        reduced_df = subdf[(subdf.price_per_sqft>(m-st)) & (subdf.
 ↪price_per_sqft<=(m+st))]
        df_out = pd.concat([df_out,reduced_df],ignore_index=True)
    return df_out
df7 = remove_pps_outliers(df6)
df7.shape
```

[33]:
```
(10241, 7)
```

[34]:
```
def plot_scatter_chart(df,location):
    bhk2 = df[(df.location==location) & (df.bhk==2)]
    bhk3 = df[(df.location==location) & (df.bhk==3)]
    matplotlib.rcParams['figure.figsize'] = (15,10)
    plt.scatter(bhk2.total_sqft,bhk2.price,color='blue',label='2 BHK',s=50)
    plt.scatter(bhk3.total_sqft,bhk3.price,marker='+',color='green',label='3␣
 ↪BHK',s=50)
    plt.xlabel("total square feet area")
    plt.ylabel("price per square feet")
    plt.title(location)
    plt.legend()

plot_scatter_chart(df7,"Hebbal")
```

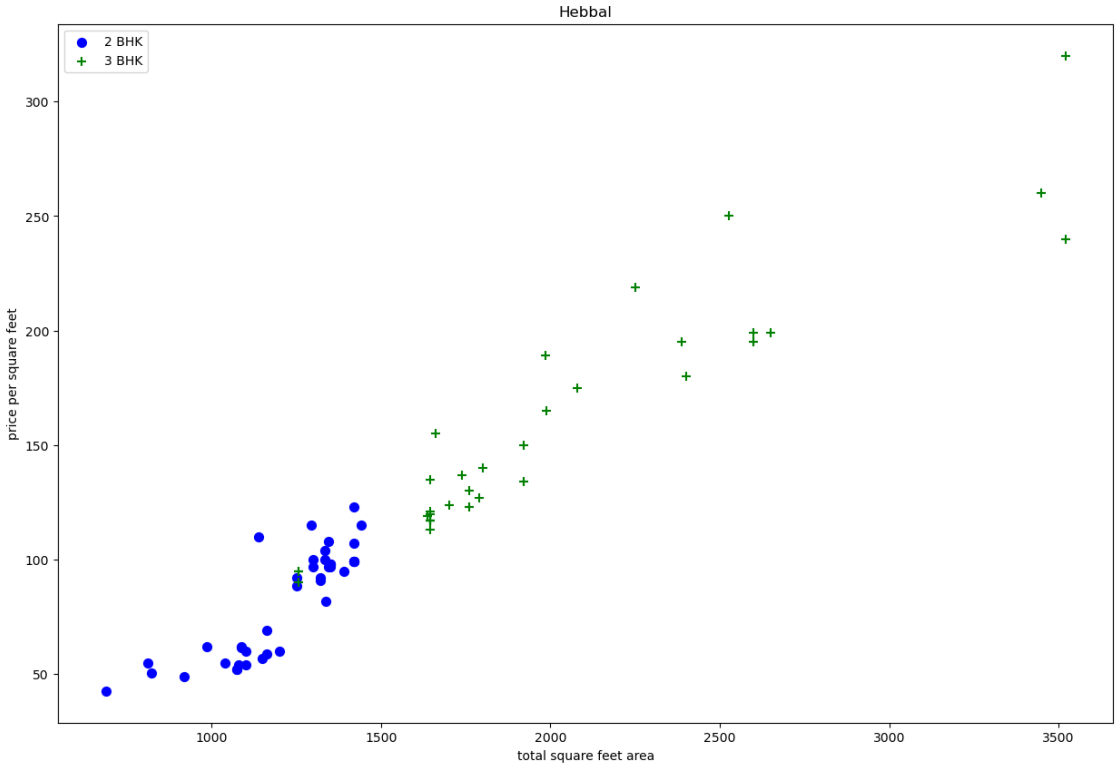


[35]:
```
def remove_bhk_outliers(df):
    exclude_indices = np.array([])
    for location, location_df in df.groupby('location'):
        bhk_stats= {}
        for bhk, bhk_df in location_df.groupby('bhk'):
            bhk_stats[bhk] = {
                'mean': np.mean(bhk_df.price_per_sqft),
                'std': np.std(bhk_df.price_per_sqft),
                'count': bhk_df.shape[0]
            }
        for bhk,bhk_df in location_df.groupby('bhk'):
            stats = bhk_stats.get(bhk-1)
            if stats and stats['count']>5:
                exclude_indices = np.append(exclude_indices,bhk_df[bhk_df.
 ↪price_per_sqft<(stats['mean'])].index.values)
    return df.drop(exclude_indices,axis='index')

df8 = remove_bhk_outliers(df7)
df8.shape
```

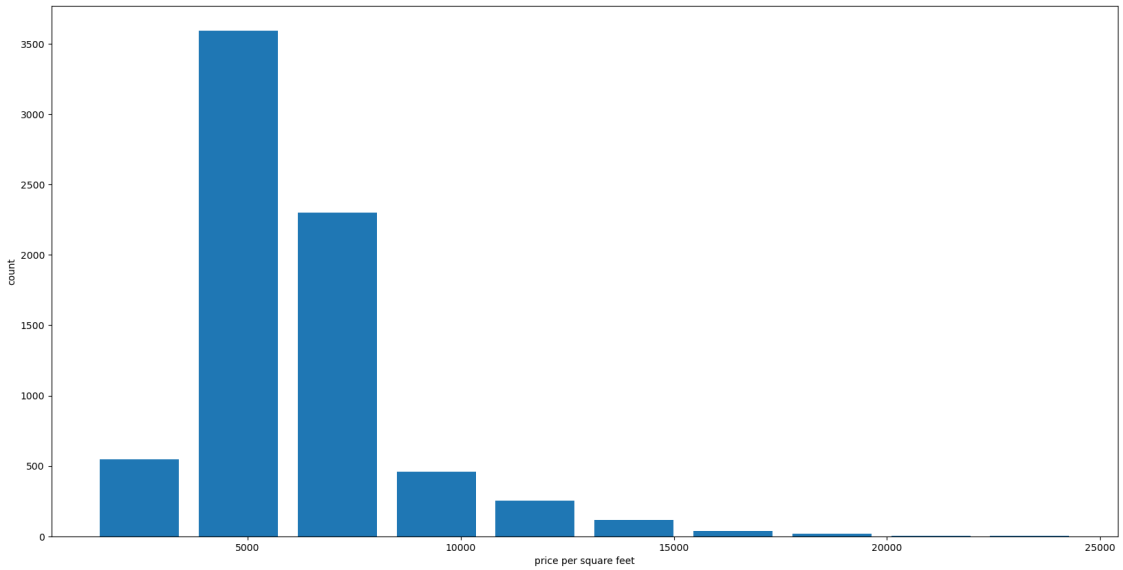
[35]: (7329, 7)

[36]:
```
plot_scatter_chart(df8,"Hebbal")
```



[37]:
```
import matplotlib
matplotlib.rcParams["figure.figsize"] = (20,10)
plt.hist(df8.price_per_sqft,rwidth=0.8)
plt.xlabel("price per square feet")
plt.ylabel("count")
```

[37]:
```
Text(0, 0.5, 'count')
```



[38]:
```
df8.bath.unique()
```

[38]:
```
array([ 4.,  3.,  2.,  5.,  8.,  1.,  6.,  7.,  9., 12., 16., 13.])
```

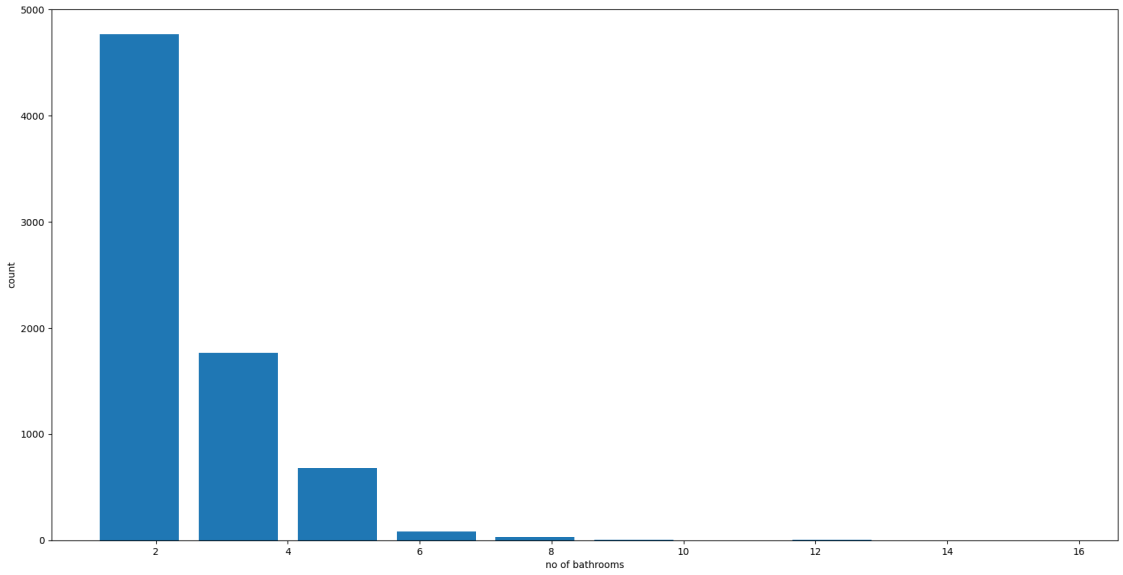
[39]:
```
df8[df8.bath>10]
```

[39]:

	location	size	total_sqft	bath	price	bhk	price_per_sqft
5277	Neeladri Nagar	10 BHK	4000.0	12.0	160.0	10	4000.000000
8486	other	10 BHK	12000.0	12.0	525.0	10	4375.000000
8575	other	16 BHK	10000.0	16.0	550.0	16	5500.000000
9308	other	11 BHK	6000.0	12.0	150.0	11	2500.000000
9639	other	13 BHK	5425.0	13.0	275.0	13	5069.124424

[40]:
```
plt.hist(df8.bath,rwidth=0.8)
plt.xlabel("no of bathrooms")
plt.ylabel("count")
```

[40]:
```
Text(0, 0.5, 'count')
```



[41]:
```
df8[df8.bath>df8.bhk+2]
```

[41]:

	location	size	total_sqft	bath	price	bhk	price_per_sqft
1626	Chikkabanavar	4 Bedroom	2460.0	7.0	80.0	4	3252.032520
5238	Nagasandra	4 Bedroom	7000.0	8.0	450.0	4	6428.571429
6711	Thanisandra	3 BHK	1806.0	6.0	116.0	3	6423.034330
8411	other	6 BHK	11338.0	9.0	1000.0	6	8819.897689

[42]:
```
df9 = df8[df8.bath<df8.bhk+2]
df9.shape
```

[42]: (7251, 7)

[43]:
```
df10 = df9.drop(['size','price_per_sqft'],axis='columns')
df10.head(3)
```

[43]:

	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

[45]:
```
dummies = pd.get_dummies(df10.location)
dummies.head(3)
```

[45]:

	1st Block Jayanagar	1st Phase JP Nagar	2nd Phase Judicial Layout	\
0	1	0	0	
1	1	0	0	
2	1	0	0	

```
   2nd Stage Nagarbhavi  5th Block Hbr Layout  5th Phase JP Nagar  \
0                     0                     0                   0
1                     0                     0                   0
2                     0                     0                   0

   6th Phase JP Nagar  7th Phase JP Nagar  8th Phase JP Nagar  \
0                   0                   0                   0
1                   0                   0                   0
2                   0                   0                   0

   9th Phase JP Nagar  …  Vishveshwarya Layout  Vishwapriya Layout  \
0                   0  …                     0                   0
1                   0  …                     0                   0
2                   0  …                     0                   0

   Vittasandra  Whitefield  Yelachenahalli  Yelahanka  Yelahanka New Town  \
0            0           0               0          0                   0
1            0           0               0          0                   0
2            0           0               0          0                   0

   Yelenahalli  Yeshwanthpur  other
0            0             0      0
1            0             0      0
2            0             0      0

[3 rows x 242 columns]
```

[46]:
```
df11 = pd.concat([df10,dummies.drop('other',axis='columns')],axis='columns')
df11.head(3)
```

[46]:
```
              location  total_sqft  bath  price  bhk  1st Block Jayanagar  \
0  1st Block Jayanagar      2850.0   4.0  428.0    4                    1
1  1st Block Jayanagar      1630.0   3.0  194.0    3                    1
2  1st Block Jayanagar      1875.0   2.0  235.0    3                    1

   1st Phase JP Nagar  2nd Phase Judicial Layout  2nd Stage Nagarbhavi  \
0                   0                          0                     0
1                   0                          0                     0
2                   0                          0                     0

   5th Block Hbr Layout  …  Vijayanagar  Vishveshwarya Layout  \
0                     0  …            0                     0
1                     0  …            0                     0
2                     0  …            0                     0

   Vishwapriya Layout  Vittasandra  Whitefield  Yelachenahalli  Yelahanka  \
```

```
0                    0            0           0                0          0
1                    0            0           0                0          0
2                    0            0           0                0          0

   Yelahanka New Town  Yelenahalli  Yeshwanthpur
0                    0            0             0
1                    0            0             0
2                    0            0             0

[3 rows x 246 columns]
```

[47]:
```
df12 = df11.drop('location',axis='columns')
df12.head(2)
```

[47]:
```
   total_sqft  bath  price  bhk  1st Block Jayanagar  1st Phase JP Nagar  \
0      2850.0   4.0  428.0    4                    1                   0
1      1630.0   3.0  194.0    3                    1                   0

   2nd Phase Judicial Layout  2nd Stage Nagarbhavi  5th Block Hbr Layout  \
0                          0                     0                     0
1                          0                     0                     0

   5th Phase JP Nagar  …  Vijayanagar  Vishveshwarya Layout  \
0                   0  …            0                     0
1                   0  …            0                     0

   Vishwapriya Layout  Vittasandra  Whitefield  Yelachenahalli  Yelahanka  \
0                   0            0           0               0          0
1                   0            0           0               0          0

   Yelahanka New Town  Yelenahalli  Yeshwanthpur
0                   0            0             0
1                   0            0             0

[2 rows x 245 columns]
```

[48]:
```
df12.shape
```

[48]:
```
(7251, 245)
```

[50]:
```
X = df12.drop('price',axis='columns')
X.head()
```

[50]:
```
   total_sqft  bath  bhk  1st Block Jayanagar  1st Phase JP Nagar  \
0      2850.0   4.0    4                    1                   0
1      1630.0   3.0    3                    1                   0
2      1875.0   2.0    3                    1                   0
```

```
3      1200.0   2.0    3                   1                  0
4      1235.0   2.0    2                   1                  0

   2nd Phase Judicial Layout  2nd Stage Nagarbhavi  5th Block Hbr Layout  \
0                          0                     0                     0
1                          0                     0                     0
2                          0                     0                     0
3                          0                     0                     0
4                          0                     0                     0

   5th Phase JP Nagar  6th Phase JP Nagar  …  Vijayanagar  \
0                   0                   0  …            0
1                   0                   0  …            0
2                   0                   0  …            0
3                   0                   0  …            0
4                   0                   0  …            0

   Vishveshwarya Layout  Vishwapriya Layout  Vittasandra  Whitefield  \
0                     0                   0            0           0
1                     0                   0            0           0
2                     0                   0            0           0
3                     0                   0            0           0
4                     0                   0            0           0

   Yelachenahalli  Yelahanka  Yelahanka New Town  Yelenahalli  Yeshwanthpur
0               0          0                   0            0             0
1               0          0                   0            0             0
2               0          0                   0            0             0
3               0          0                   0            0             0
4               0          0                   0            0             0

[5 rows x 244 columns]
```

[51]:
```
y = df12.price
y.head()
```

[51]:
```
0    428.0
1    194.0
2    235.0
3    130.0
4    148.0
Name: price, dtype: float64
```

[53]:
```
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=10)
```

[55]:
```
from sklearn.linear_model import LinearRegression
lr_clf = LinearRegression()
lr_clf.fit(X_train,y_train)
```

[55]:
```
LinearRegression()
```

[56]:
```
lr_clf.score(X_test,y_test)
```

[56]:
```
0.8452277697874279
```

[60]:
```
from sklearn.model_selection import ShuffleSplit
from sklearn.model_selection import cross_val_score

cv = ShuffleSplit(n_splits=5, test_size=0.2, random_state=0)

cross_val_score(LinearRegression(),X,y, cv=cv)
```

[60]:
```
array([0.82430186, 0.77166234, 0.85089567, 0.80837764, 0.83653286])
```

[63]:
```
def predict_price(location,sqft,bath,bhk):
    loc_index = np.where(X.columns==location)[0][0]

    x = np.zeros(len(X.columns))
    x[0] = sqft
    x[1] = bath
    x[2] = bhk
    if loc_index >= 0:
        x[loc_index] = 1

    return lr_clf.predict([x])[0]
```

[64]:
```
predict_price('1st Phase JP Nagar',1000,2,2)
```

```
D:\anaconda\Lib\site-packages\sklearn\base.py:464: UserWarning: X does not have
valid feature names, but LinearRegression was fitted with feature names
  warnings.warn(
```

[64]:
```
83.49904677167738
```

[65]:
```
predict_price('Vijayanagar',1000,2,2)
```

```
D:\anaconda\Lib\site-packages\sklearn\base.py:464: UserWarning: X does not have
valid feature names, but LinearRegression was fitted with feature names
  warnings.warn(
```

[65]:
```
62.29709374581037
```

[66]:
```
import pickle
with open('house_price_prediction_bangalore','wb') as f:
    pickle.dump(lr_clf,f)
```

[68]:
```
import json
columns = {
    'data_columns' : [col.lower() for col in X.columns]
}
with open("columns.json","w") as f:
    f.write(json.dumps(columns))
```