```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.neighbors import KNeighborsRegressor
from sklearn.pipeline import Pipeline
from sklearn.metrics import r2_score
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import cross_val_score , train_test_split
from sklearn.preprocessing import RobustScaler
from scipy.stats.mstats import winsorize
```

```
data = pd.read_csv('data.csv')
```

```
data.head()
```

| | Avg. Area Income | Avg. Area House Age | Avg. Area Number of Rooms | Avg. Area Number of Bedrooms | Area Population | Price | Address |
|---|---|---|---|---|---|---|---|
| 0 | 79545.458574 | 5.682861 | 7.009188 | 4.09 | 23086.800503 | 1.059034e+06 | 208 Michael Ferry Apt. 674\nLaurabury, NE 3701... |
| 1 | 79248.642455 | 6.002900 | 6.730821 | 3.09 | 40173.072174 | 1.505891e+06 | 188 Johnson Views Suite 079\nLake Kathleen, CA... |
| 2 | 61287.067179 | 5.865890 | 8.512727 | 5.13 | 36882.159400 | 1.058988e+06 | 9127 Elizabeth Stravenue\nDanieltown, WI 06482... |
| 3 | 63345.240046 | 7.188236 | 5.586729 | 3.26 | 34310.242831 | 1.260617e+06 | USS Barnett\nFPO AP 44820 |

Next steps: View recommended plots | New interactive sheet

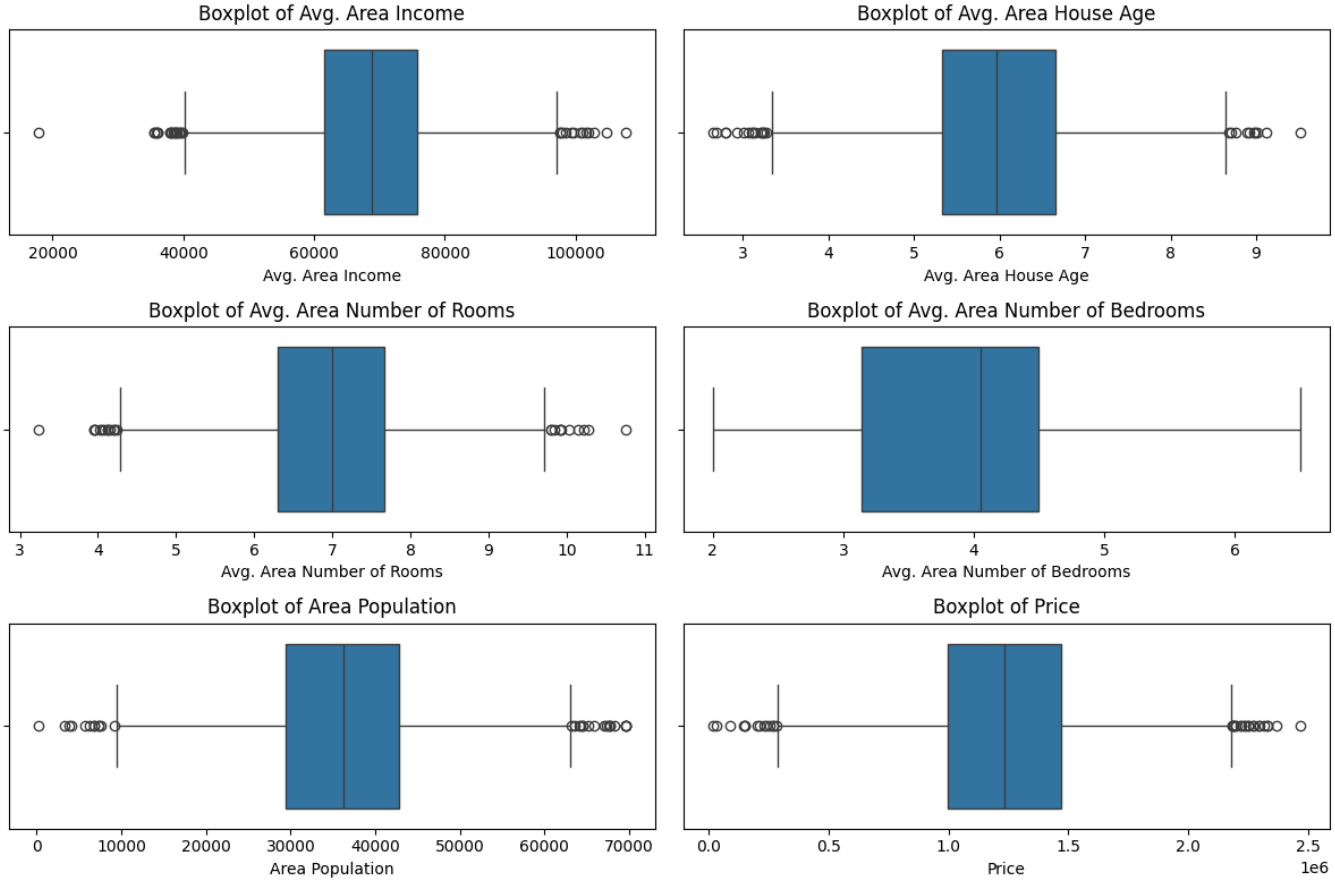
```
data.drop('Address' , axis=1 , inplace=True)
```

```
data['Price'] =data['Price'].round()
```

```
data.describe()
```

| | Avg. Area Income | Avg. Area House Age | Avg. Area Number of Rooms | Avg. Area Number of Bedrooms | Area Population | Price |
|---|---|---|---|---|---|---|
| **count** | 5000.000000 | 5000.000000 | 5000.000000 | 5000.000000 | 5000.000000 | 5.000000e+03 |
| **mean** | 68583.108984 | 5.977222 | 6.987792 | 3.981330 | 36163.516039 | 1.232073e+06 |
| **std** | 10657.991214 | 0.991456 | 1.005833 | 1.234137 | 9925.650114 | 3.531176e+05 |
| **min** | 17796.631190 | 2.644304 | 3.236194 | 2.000000 | 172.610686 | 1.593900e+04 |
| **25%** | 61480.562388 | 5.322283 | 6.299250 | 3.140000 | 29403.928702 | 9.975775e+05 |
| **50%** | 68804.286404 | 5.970429 | 7.002902 | 4.050000 | 36199.406689 | 1.232669e+06 |
| **75%** | 75783.338666 | 6.650808 | 7.665871 | 4.490000 | 42861.290769 | 1.471210e+06 |
| **max** | 107701.748378 | 9.519088 | 10.759588 | 6.500000 | 69621.713378 | 2.469066e+06 |

```
fig, ax = plt.subplots(3, 2, figsize=(12, 8))
axes_ = ax.flatten()


for i, column in enumerate(data.columns):
    sns.boxplot(x=data[column], ax=axes_[i])
    axes_[i].set_title(f"Boxplot of {column}")

plt.tight_layout()
plt.show()
```

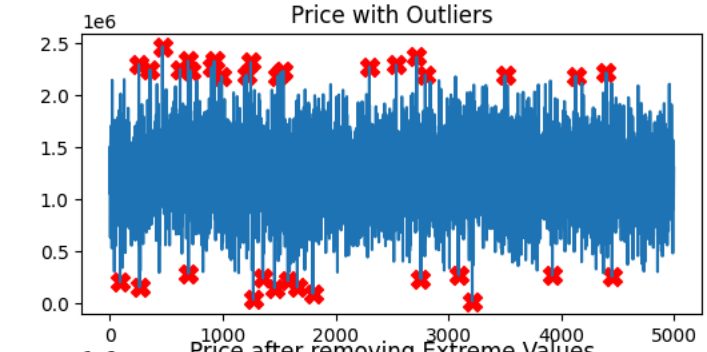

Boxplot of Avg. Area Income
20000
40000
60000
80000
100000
Avg. Area Income
Boxplot of Avg. Area House Age
3
4
5
6
7
8
9
Avg. Area House Age
Boxplot of Avg. Area Number of Rooms
3
4
5
6
7
8
9
10
11
Avg. Area Number of Rooms
Boxplot of Avg. Area Number of Bedrooms
2
3
4
5
6
Avg. Area Number of Bedrooms
Boxplot of Area Population
0
10000
20000
30000
40000
50000
60000
70000
Area Population
Boxplot of Price
0.0
0.5
1.0
1.5
2.0
2.5
1e6
Price

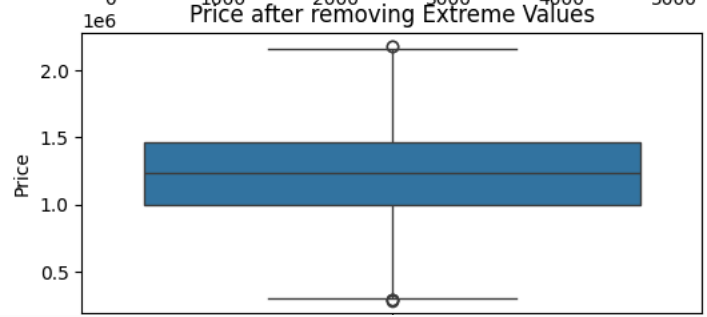
```
col = data.columns
```

```
def check_outliers(data, col):
    Q1 = data[col].quantile(0.25)
    Q3 = data[col].quantile(0.75)

    IQR = Q3 - Q1

    lower_bound = Q1 - 1.5*IQR
    upper_bound = Q3 + 1.5*IQR

    outliers = data[col][(data[col] < lower_bound) | (data[col] > upper_bound)]

    print("Outliers Report")

    print(f"The total number of outliers in Data: {len(outliers)}")

    plt.figure(figsize=(6,6))
    plt.subplot(211)
    plt.plot(data[col])
    plt.title(col + " with Outliers")
    plt.scatter(x=outliers.index, y=outliers.values, marker="X", color='r', s=100)

    plt.subplot(212)
    plt.title(col + " after removing Extreme Values")
    filter_data = data[col][-(data[col].isin(outliers))]
    sns.boxplot(filter_data)
```

```
check_outliers(data , col[5])
```

```
Outliers Report
The total number of outliers in Data: 35
```

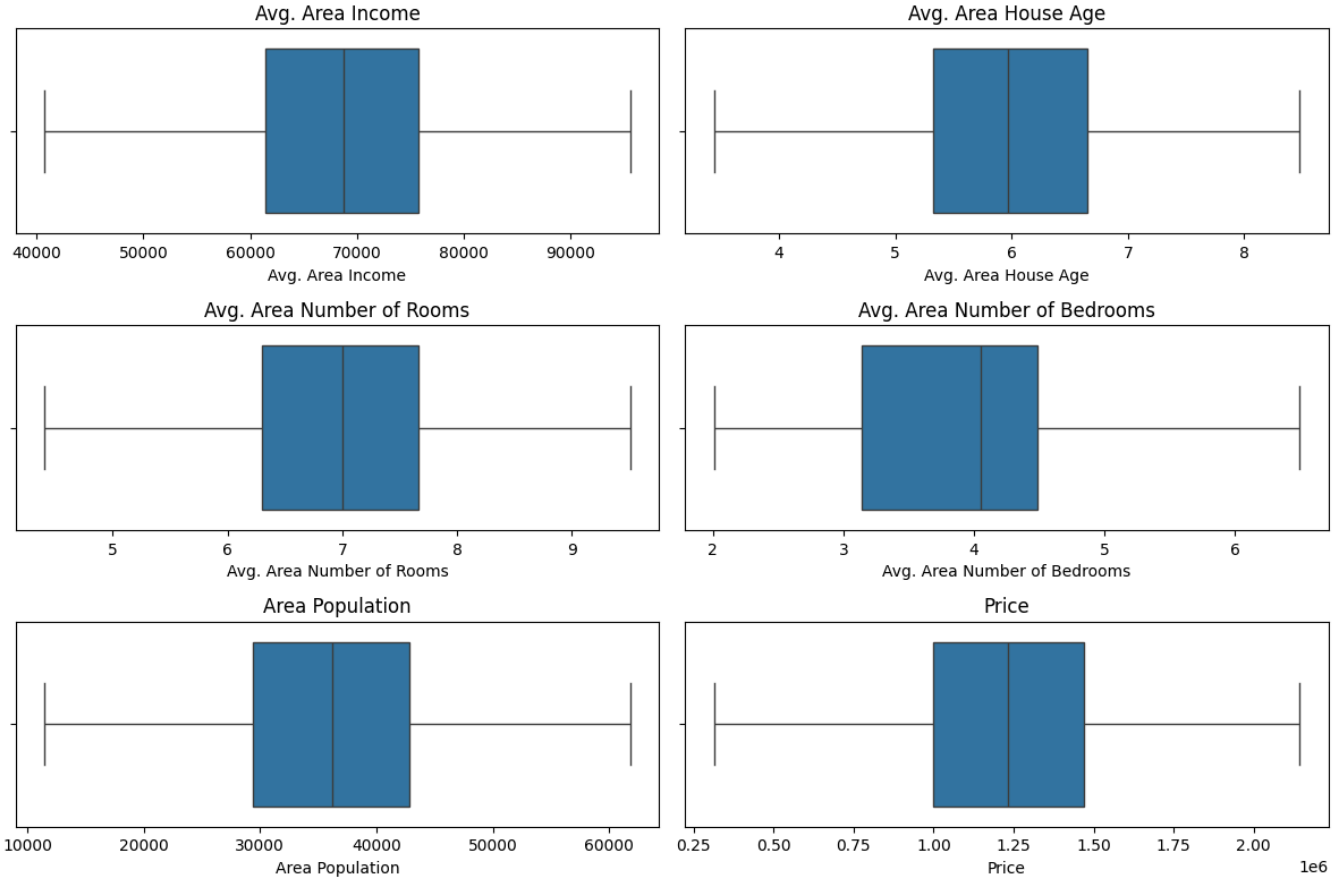



```
data_copy = data.copy()
```

```
def apply_winsorize(data, col):
    winsorize(data[col], limits= [0.005, 0.005], inplace=True)
for i, j in data.items():
    apply_winsorize(data_copy, i)
```

```
fig, ax = plt.subplots(3,2, figsize=(12,8))
axes_ = [axes_row for axes in ax for axes_row in axes]

for i, j in enumerate(data.columns):
    g = sns.boxplot(x = data_copy[j], ax = axes_[i])
    g.set_title(j)
    plt.tight_layout()
```


Avg. Area Income
40000
50000
60000
70000
80000
90000
Avg. Area Income
Avg. Area House Age
4
5
6
7
8
Avg. Area House Age
Avg. Area Number of Rooms
5
6
7
8
9
Avg. Area Number of Rooms
Avg. Area Number of Bedrooms
2
3
4
5
6
Avg. Area Number of Bedrooms
Area Population
10000
20000
30000
40000
50000
60000
Area Population
Price
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
1e6
Price

```
X = data_copy.iloc[: , data.columns!='Price']
Y = data['Price']
```

```
Y.shape
```

```
(5000,)
```

```
X_train , X_test , Y_train , Y_test = train_test_split(X , Y , test_size=0.3 , random_state=0)
```

```
sc = StandardScaler()
sc.fit(X_train)
```

```
StandardScaler
StandardScaler()
```

```
X_train = sc.transform(X_train)
X_test = sc.transform(X_test)
```

```
k_val = range(1,20)
cross_val = []
```

```
for k in k_val:
  knn = KNeighborsRegressor(n_neighbors=k , metric='manhattan')
  mse = -cross_val_score(knn, X_train, Y_train, cv=5, scoring='neg_mean_squared_error')
  cross_val.append(np.mean(mse))
```

```
best_k = k_val[np.argmin(cross_val)]
print(f"Best k value: {best_k}")
```

```
Best k value: 9
```

```
model = KNeighborsRegressor(n_neighbors=9)
model.fit(X_train, Y_train)
```