

```
import pandas as pd
```

```
# Wczytanie danych
```

```
df = pd.read_csv('Housing.csv')
```

```
# Podstawowe informacje o danych
```

```
print(df.info())
```

```
print(df.describe())
```

```
<class 'pandas.core.frame.DataFrame'>
```

```
RangeIndex: 545 entries, 0 to 544
```

```
Data columns (total 13 columns):
```

#	Column	Non-Null Count	Dtype
0	price	545 non-null	int64
1	area	545 non-null	int64
2	bedrooms	545 non-null	int64
3	bathrooms	545 non-null	int64
4	stories	545 non-null	int64
5	mainroad	545 non-null	object
6	guestroom	545 non-null	object
7	basement	545 non-null	object
8	hotwaterheating	545 non-null	object
9	airconditioning	545 non-null	object
10	parking	545 non-null	int64
11	prefarea	545 non-null	object
12	furnishingstatus	545 non-null	object

```
dtypes: int64(6), object(7)
```

```
memory usage: 55.5+ KB
```

```
None
```

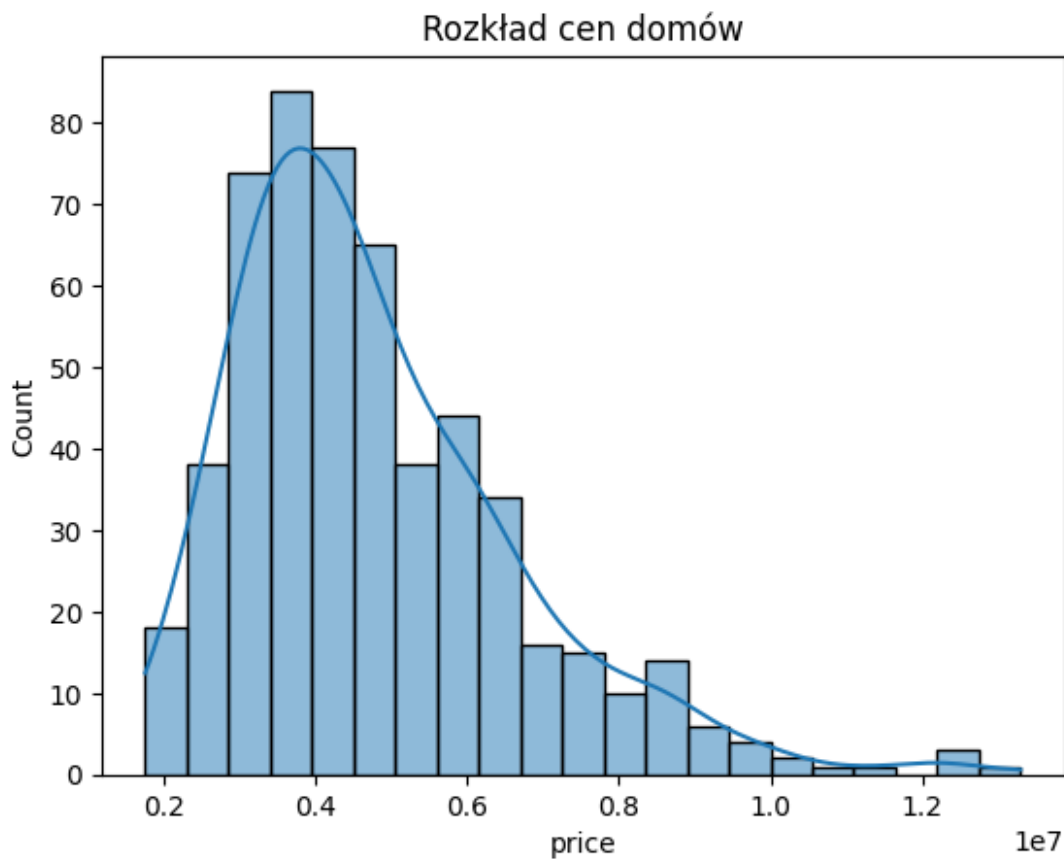
	price	area	bedrooms	bathrooms	stories
\					
count	5.450000e+02	545.000000	545.000000	545.000000	545.000000
mean	4.766729e+06	5150.541284	2.965138	1.286239	1.805505
std	1.870440e+06	2170.141023	0.738064	0.502470	0.867492
min	1.750000e+06	1650.000000	1.000000	1.000000	1.000000
25%	3.430000e+06	3600.000000	2.000000	1.000000	1.000000
50%	4.340000e+06	4600.000000	3.000000	1.000000	2.000000
75%	5.740000e+06	6360.000000	3.000000	2.000000	2.000000
max	1.330000e+07	16200.000000	6.000000	4.000000	4.000000

	parking
count	545.000000

```
mean    0.693578
std     0.861586
min     0.000000
25%     0.000000
50%     0.000000
75%     1.000000
max     3.000000
```

```
import seaborn as sns
import matplotlib.pyplot as plt

# Histogram rozkładu cen
sns.histplot(df['price'], kde=True)
plt.title('Rozkład cen domów')
plt.show()
```



```
from sklearn.ensemble import IsolationForest

# Dopasowanie modelu Isolation Forest
isolation_forest = IsolationForest(contamination=0.05)
df['outliers'] = isolation_forest.fit_predict(df[['price', 'area']])
# Wyświetlenie wartości odstających
print(df[df['outliers'] == -1])
```

\	price	area	bedrooms	bathrooms	stories	mainroad	guestroom
0	13300000	7420	4	2	3	yes	no
1	12250000	8960	4	4	4	yes	no
2	12250000	9960	3	2	2	yes	no
3	12215000	7500	4	2	2	yes	no
4	11410000	7420	4	1	2	yes	yes
5	10850000	7500	3	3	1	yes	no
6	10150000	8580	4	3	4	yes	no
7	10150000	16200	5	3	2	yes	no
8	9870000	8100	4	1	2	yes	yes
9	9800000	5750	3	2	4	yes	yes
10	9800000	13200	3	1	2	yes	no
13	9240000	3500	4	2	2	yes	no
20	8750000	4320	3	1	2	yes	no
56	7343000	11440	4	1	2	yes	no
64	7000000	11175	3	1	1	yes	no
66	6930000	13200	2	1	1	yes	no
69	6790000	12090	4	2	2	yes	no
125	5943000	15600	3	1	1	yes	no
129	5873000	11460	3	1	3	yes	no
186	5110000	11410	2	1	2	yes	no
211	4900000	12900	3	1	1	yes	no
403	3500000	12944	3	1	1	yes	no
520	2450000	7700	2	1	1	yes	no
527	2275000	1836	2	1	1	no	no
530	2240000	1950	3	1	1	no	no

537	1890000	1700	3	1	2	yes	no
541	1767150	2400	3	1	1	no	no
544	1750000	3850	3	1	2	yes	no
	basement	hotwaterheating	airconditioning	parking	prefarea	\	
0	no	no	yes	2	yes		
1	no	no	yes	3	no		
2	yes	no	no	2	yes		
3	yes	no	yes	3	yes		
4	yes	no	yes	2	no		
5	yes	no	yes	2	yes		
6	no	no	yes	2	yes		
7	no	no	no	0	no		
8	yes	no	yes	2	yes		
9	no	no	yes	1	yes		
10	yes	no	yes	2	yes		
13	no	yes	no	2	no		
20	yes	yes	no	2	no		
56	yes	no	no	1	yes		
64	yes	no	yes	1	yes		
66	yes	yes	no	1	no		
69	no	no	no	2	yes		
125	no	no	yes	2	no		
129	no	no	no	2	yes		
186	no	no	no	0	yes		
211	no	no	no	2	no		
403	no	no	no	0	no		
520	no	no	no	0	no		
527	yes	no	no	0	no		
530	no	yes	no	0	no		
537	no	no	no	0	no		
541	no	no	no	0	no		
544	no	no	no	0	no		
	furnishingstatus	outliers					
0	furnished	-1					
1	furnished	-1					
2	semi-furnished	-1					
3	furnished	-1					
4	furnished	-1					
5	semi-furnished	-1					
6	semi-furnished	-1					
7	unfurnished	-1					
8	furnished	-1					
9	unfurnished	-1					
10	furnished	-1					
13	furnished	-1					

20	semi-furnished	-1
56	semi-furnished	-1
64	furnished	-1
66	furnished	-1
69	furnished	-1
125	semi-furnished	-1
129	semi-furnished	-1
186	furnished	-1
211	furnished	-1
403	unfurnished	-1
520	unfurnished	-1
527	semi-furnished	-1
530	unfurnished	-1
537	unfurnished	-1
541	semi-furnished	-1
544	unfurnished	-1

```
import plotly.express as px
```

```
fig = px.scatter(df, y='outliers', x='price', color='outliers',
title='Wartości odstające w danych')
fig.show()
```

[illegible]

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```

```

from sklearn.decomposition import PCA
from sklearn.preprocessing import StandardScaler

```

Skalowanie danych

```

scaler = StandardScaler()
scaled_data = scaler.fit_transform(df[['area', 'price', 'bedrooms']])

```

PCA

```

pca = PCA(n_components=2)
principal_components = pca.fit_transform(scaled_data)

```

Wynik PCA

```

df['PC1'] = principal_components[:, 0]
df['PC2'] = principal_components[:, 1]
print(pca.explained_variance_ratio_)

```

```

[0.57528546 0.28653528]

```

```

fig = px.scatter(df, x='PC1', y='PC2', color='price',
title='Wizualizacja głównych składowych')

```

```

fig.show()

```

```

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    {"standoff": 15}, "zerolinecolor": "white", "zerolinewidth": 2}}}, "title":
    {"text": "Wizualizacja głównych składowych"}, "xaxis":
    {"anchor": "y", "domain": [0, 1], "title": {"text": "PC1"}}, "yaxis":
    {"anchor": "x", "domain": [0, 1], "title": {"text": "PC2"}}}]
```

```
from sklearn.manifold import TSNE
```

```
# t-SNE
```

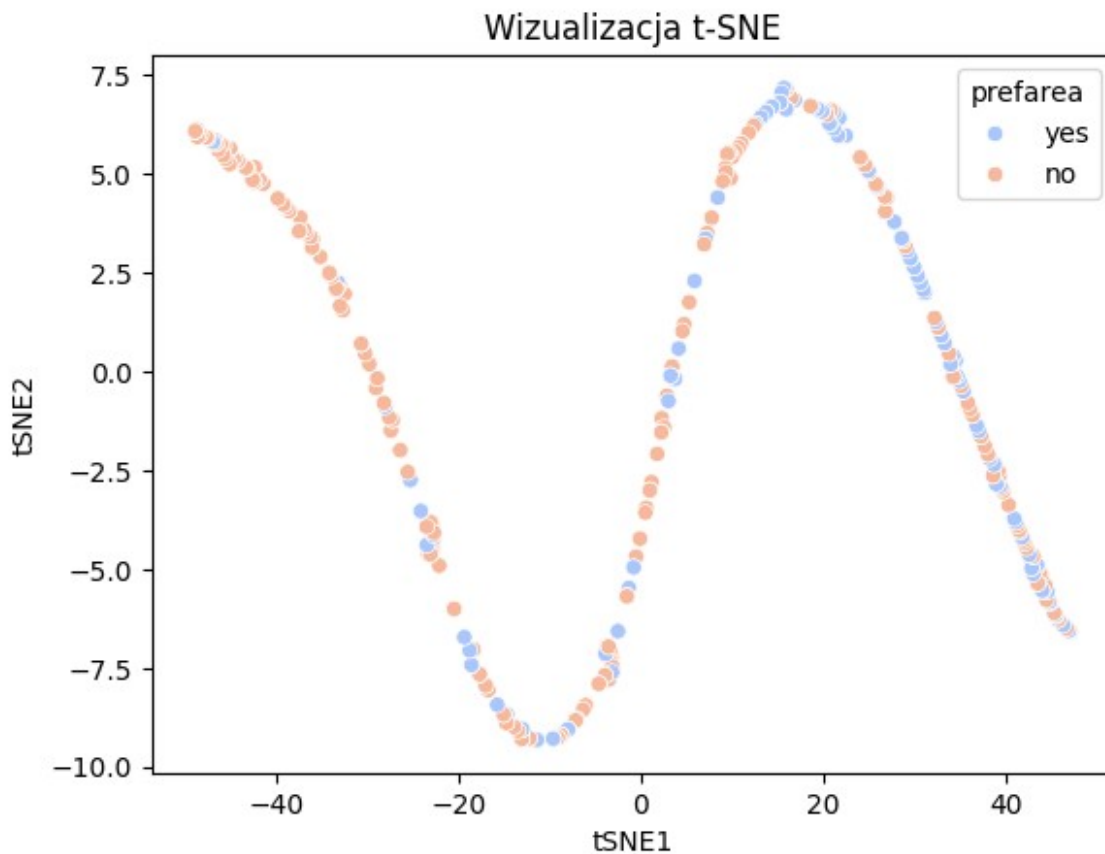
```
tsne = TSNE(n_components=2, random_state=42)
tsne_results = tsne.fit_transform(df[['price', 'area',
'bedrooms', 'bathrooms', 'stories', 'parking']])
```

```
# Dodanie wyników do ramki danych
```

```
df['tSNE1'] = tsne_results[:, 0]
```

```
df['tSNE2'] = tsne_results[:, 1]

# Wizualizacja
sns.scatterplot(data=df, x='tSNE1', y='tSNE2', hue='prefarea',
palette='coolwarm')
plt.title('Wizualizacja t-SNE')
plt.show()
```



```
import umap

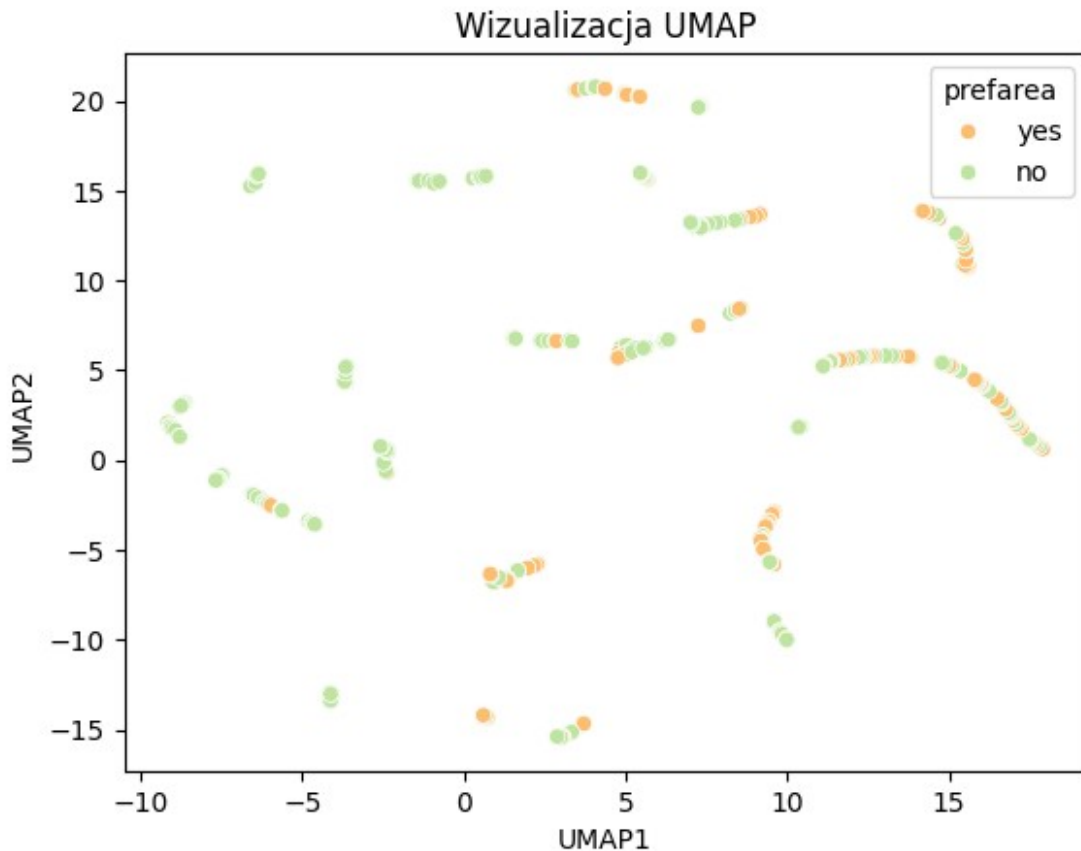
# UMAP
reducer = umap.UMAP(n_neighbors=10, min_dist=0.1, random_state=42)
umap_results = reducer.fit_transform(df[['price', 'area', 'bedrooms',
'bathrooms', 'stories', 'parking']])

# Dodanie wyników do ramki danych
df['UMAP1'] = umap_results[:, 0]
df['UMAP2'] = umap_results[:, 1]
# wizualizacja
sns.scatterplot(data=df, x='UMAP1', y='UMAP2', hue='prefarea',
palette='Spectral')
```

```
plt.title('Wizualizacja UMAP')
plt.show()
```

c:\Users\Szymon\AppData\Local\Programs\Python\Python312\Lib\site-packages\umap\umap_.py:1952: UserWarning:

n_jobs value 1 overridden to 1 by setting random_state. Use no seed for parallelism.



```
import altair as alt

chart = alt.Chart(df).mark_circle(size=60).encode(
    x='area',
    y='price',
    color='bedrooms',
    tooltip=['area', 'price', 'bedrooms']
).interactive()

chart.show()

alt.Chart(...)
```



```

from statsmodels.formula.api import ols
from statsmodels.stats.anova import anova_lm

# Model ANOVA
model = ols('price ~ C.bedrooms)', data=df).fit()
anova_results = anova_lm(model)

print(anova_results)

```

	df	sum_sq	mean_sq	F	
PR(>F)					
C.bedrooms	5.0	2.933324e+14	5.866649e+13	19.642037	5.359906e-18
Residual	539.0	1.609876e+15	2.986782e+12		NaN
NaN					