👩‍🔬 Predicting House Prices Using Linear Regression

```
# 📦 Import necessary libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

from sklearn.datasets import fetch_california_housing
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LinearRegression
from sklearn.metrics import r2_score, mean_squared_error
```

(module) preprocessing

Methods for scaling, centering, normalization, binarization, and more.

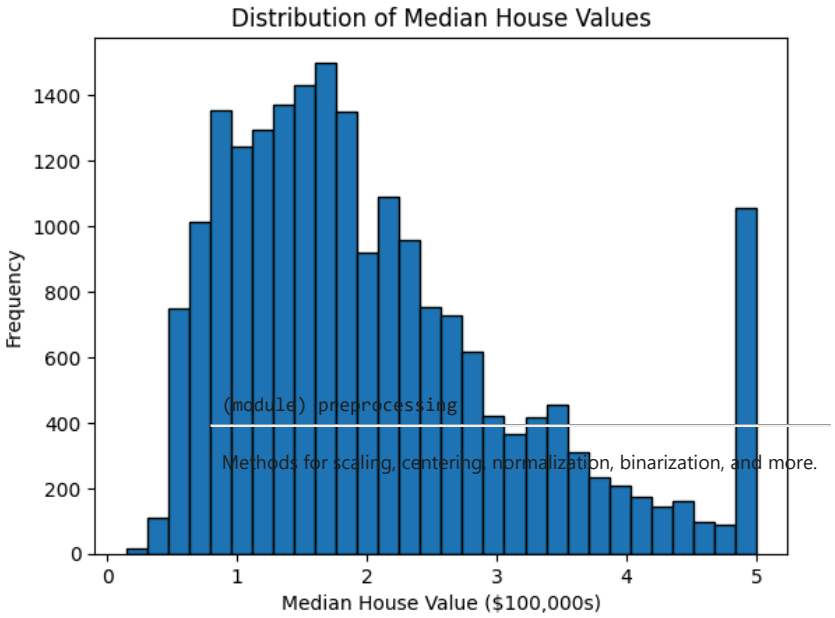
```
# 📂 Load the dataset
housing = fetch_california_housing(as_frame=True)
data = housing.frame
```

```
# 🔍 Explore the data
print(data.info())
print(data.describe())
```

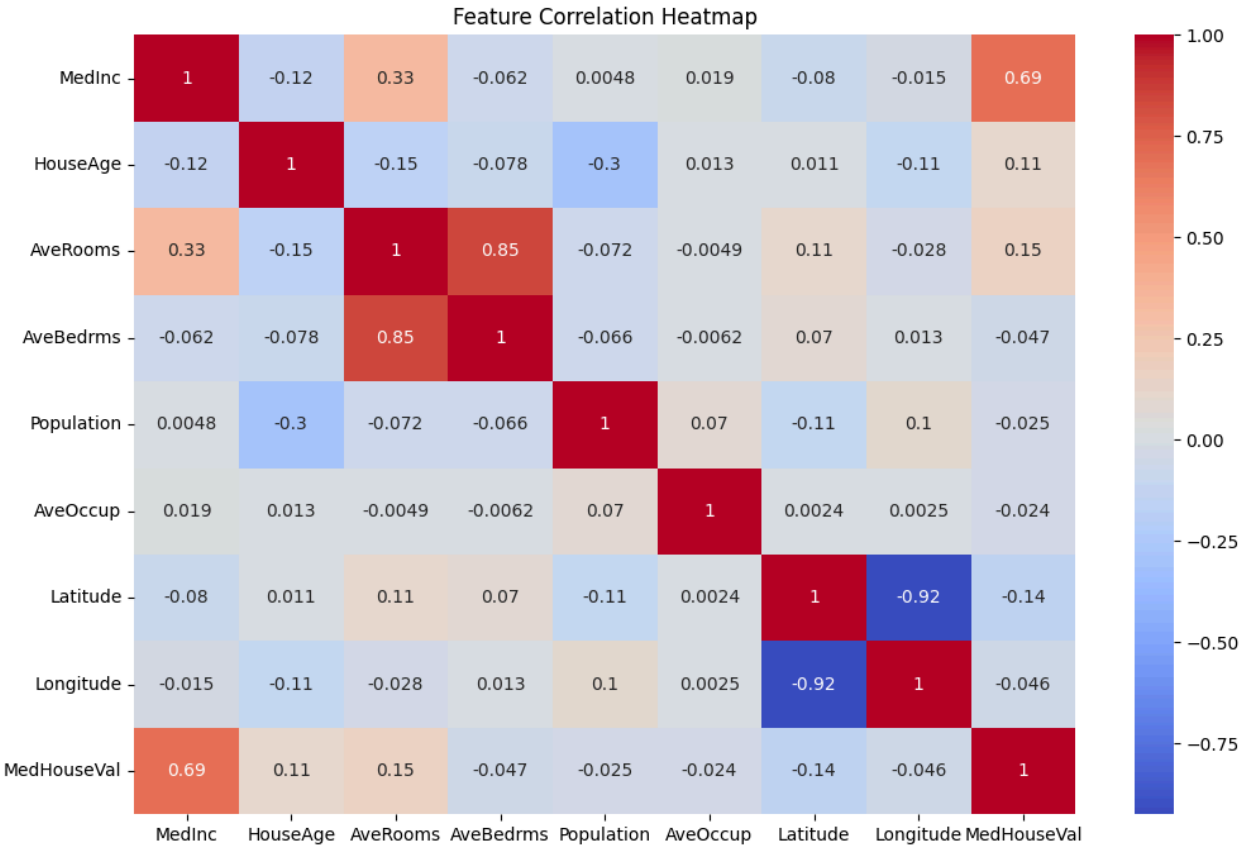
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 20640 entries, 0 to 20639
Data columns (total 9 columns):
 #   Column       Non-Null Count  Dtype  
---  ------       --------------  -----  
 0   MedInc       20640 non-null  float64
 1   HouseAge     20640 non-null  float64
 2   AveRooms     20640 non-null  float64
 3   AveBedrms    20640 non-null  float64
 4   Population   20640 non-null  float64
 5   AveOccup     20640 non-null  float64
 6   Latitude     20640 non-null  float64
 7   Longitude    20640 non-null  float64
 8   MedHouseVal  20640 non-null  float64
dtypes: float64(9)
memory usage: 1.4 MB
None
             MedInc      HouseAge      AveRooms     AveBedrms    Population  \
count  20640.000000  20640.000000  20640.000000  20640.000000  20640.000000   
mean       3.870671     28.639486      5.429000      1.096675   1425.476744   
std        1.899822     12.585558      2.474173      0.473911   1132.462122   
min        0.499900      1.000000      0.846154      0.333333      3.000000   
25%        2.563400     18.000000      4.440716      1.006079    787.000000   
50%        3.534800     29.000000      5.229129      1.048780   1166.000000   
75%        4.743250     37.000000      6.052381      1.099526   1725.000000   
max       15.000100     52.000000    141.909091     34.066667  35682.000000   

            AveOccup      Latitude     Longitude   MedHouseVal  
count  20640.000000  20640.000000  20640.000000  20640.000000  
mean       3.070655     35.631861   -119.569704      2.068558  
std       10.386050      2.135952      2.003532      1.153956  
min        0.692308     32.540000   -124.350000      0.149990  
25%        2.429741     33.930000   -121.800000      1.196000  
50%        2.818116     34.260000   -118.490000      1.797000  
75%        3.282261     37.710000   -118.010000      2.647250  
max     1243.333333     41.950000   -114.310000      5.000010  
```

```
# Plot histogram of target
plt.hist(data['MedHouseVal'], bins=30, edgecolor='k')
plt.title("Distribution of Median House Values")
plt.xlabel("Median House Value ($100,000s)")
plt.ylabel("Frequency")
plt.show()
```




```
# Correlation matrix
plt.figure(figsize=(12, 8))
sns.heatmap(data.corr(), annot=True, cmap='coolwarm')
plt.title("Feature Correlation Heatmap")
plt.show()
```




```
# 🧹 Data preparation
X = data.drop('MedHouseVal', axis=1)
y = data['MedHouseVal']
```

```
# Standardize the features
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)
X_scaled = pd.DataFrame(X_scaled, columns=X.columns)
```

```
# 🧠 Feature selection (based on correlation heatmap)
selected_features = ['MedInc', 'AveRooms', 'HouseAge']
X_selected = X_scaled[selected_features]
```

```
# 🧪 Split the data
X_train, X_test, y_train, y_test = train_test_split(X_selected, y, test_size=0.2, random_state=42)
```

```
# 📈 Train the model
model = LinearRegression()
model.fit(X_train, y_train)
```

▾ LinearRegression

LinearRegression()

(module) preprocessing

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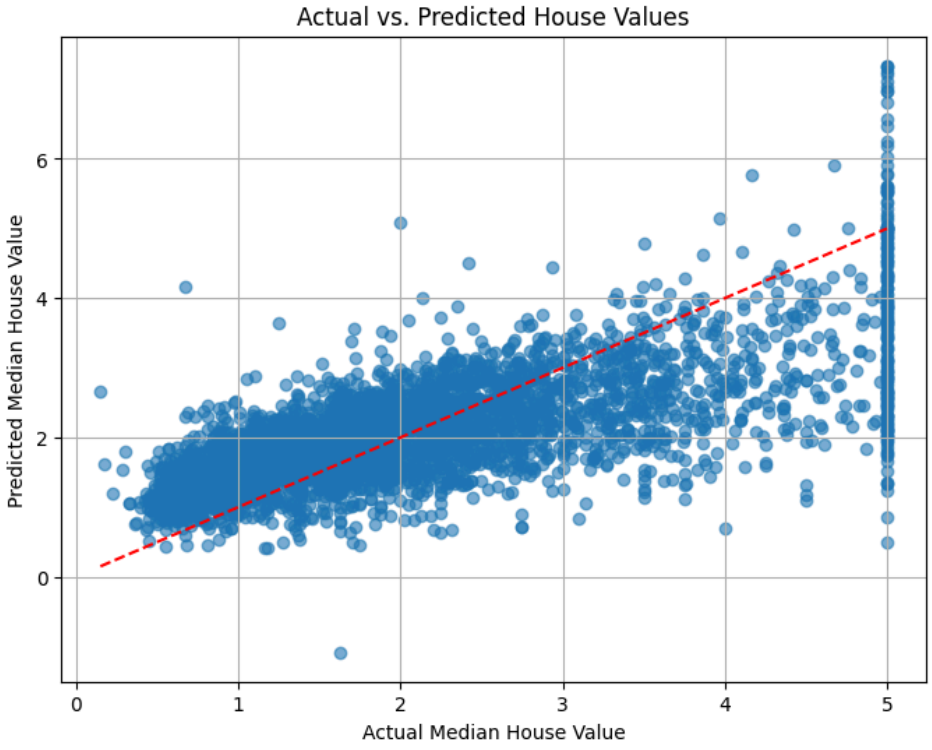
```
# 🔮 Predict
y_pred = model.predict(X_test)
```

```
# 📋 Evaluate the model
r2 = r2_score(y_test, y_pred)
mse = mean_squared_error(y_test, y_pred)

print(f"R-squared: {r2:.4f}")
print(f"Mean Squared Error: {mse:.4f}")
```

```
R-squared: 0.4972
Mean Squared Error: 0.6589
```

```
# 📊 Visualize predictions
plt.figure(figsize=(8, 6))
plt.scatter(y_test, y_pred, alpha=0.6)
plt.plot([y_test.min(), y_test.max()], [y_test.min(), y_test.max()], 'r--')
plt.xlabel("Actual Median House Value")
plt.ylabel("Predicted Median House Value")
plt.title("Actual vs. Predicted House Values")
plt.grid(True)
plt.show()
```



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