Multiple Linear Regression on California Housing Dataset

In this notebook, we will use the **California Housing Dataset** to predict median house values using multiple features through **Multiple Linear Regression**.

In [1]:
```
# Importing 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.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, r2_score
```

```
c:\users\vamsi2001\appdata\local\programs\python\python39\lib\site-packages\num
py\_distributor_init.py:30: UserWarning: loaded more than 1 DLL from .libs:
c:\users\vamsi2001\appdata\local\programs\python\python39\lib\site-packages\num
py\.libs\libopenblas.EL2C6PLE4ZYW3ECEVIV3OXXGRN2NRFM2.gfortran-win_amd64.dll
c:\users\vamsi2001\appdata\local\programs\python\python39\lib\site-packages\num
py\.libs\libopenblas.XWYDX2IKJW2NMTWSFYNGFUWKQU3LYTCZ.gfortran-win_amd64.dll
  warnings.warn("loaded more than 1 DLL from .libs:"
```

In [3]:
```
#  Load the California Housing Dataset
california = fetch_california_housing()
df = pd.DataFrame(california.data, columns=california.feature_names)
df['MedHouseVal'] = california.target
df.head()
#california
```

Out[3]:

	MedInc	HouseAge	AveRooms	AveBedrms	Population	AveOccup	Latitude	Longitude	MedHou
0	8.3252	41.0	6.984127	1.023810	322.0	2.555556	37.88	-122.23	
1	8.3014	21.0	6.238137	0.971880	2401.0	2.109842	37.86	-122.22	
2	7.2574	52.0	8.288136	1.073446	496.0	2.802260	37.85	-122.24	
3	5.6431	52.0	5.817352	1.073059	558.0	2.547945	37.85	-122.25	
4	3.8462	52.0	6.281853	1.081081	565.0	2.181467	37.85	-122.25	

In [9]:
```
#california
```

About this file

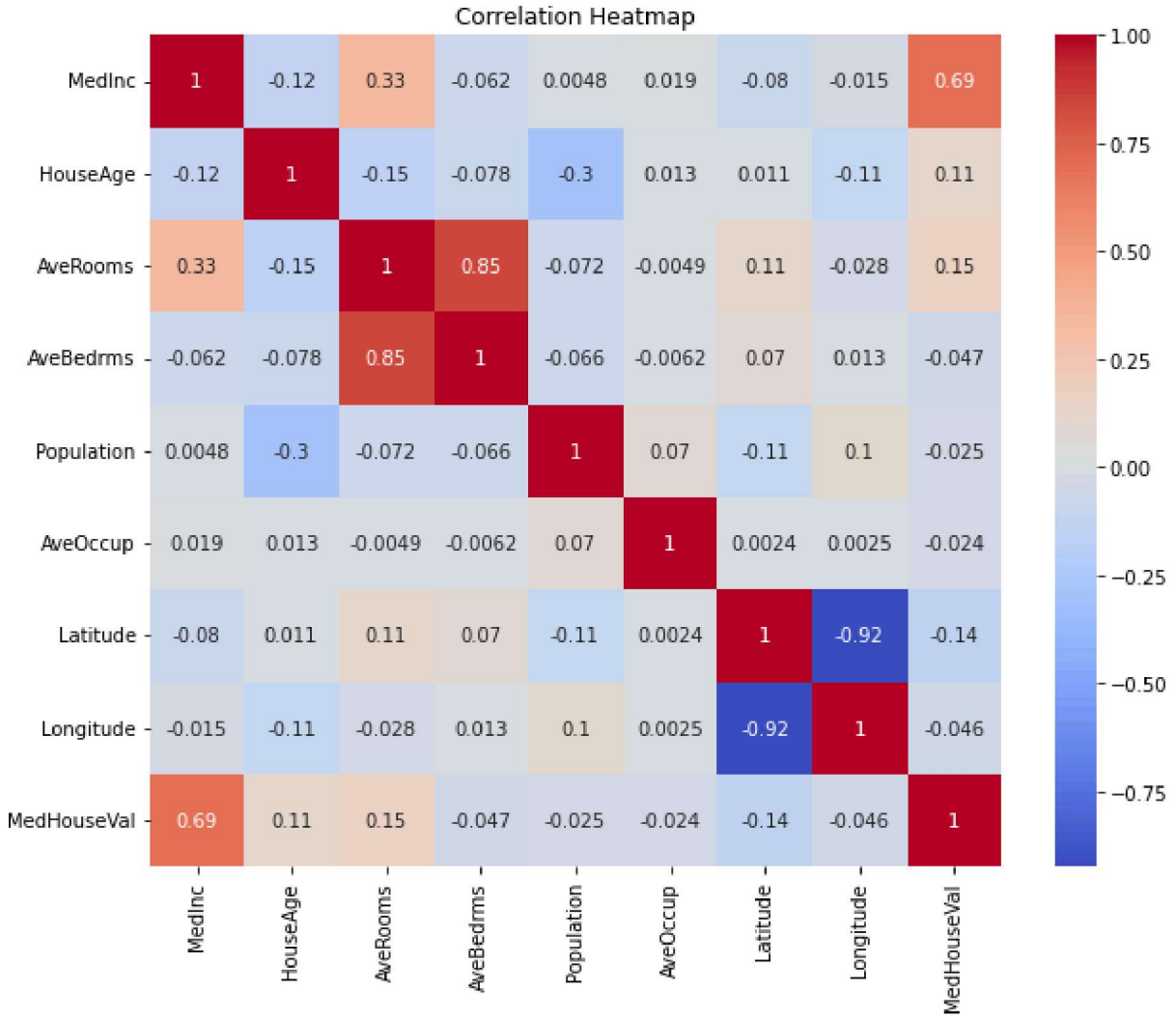
1. longitude: A measure of how far west a house is; a higher value is farther west
2. latitude: A measure of how far north a house is; a higher value is farther north
3. housingMedianAge: Median age of a house within a block; a lower number is a newer building

4. totalRooms: Total number of rooms within a block
5. totalBedrooms: Total number of bedrooms within a block
6. population: Total number of people residing within a block
7. households: Total number of households, a group of people residing within a home unit, for a block
8. medianIncome: Median income for households within a block of houses (measured in tens of thousands of US Dollars)
9. medianHouseValue: Median house value for households within a block (measured in US Dollars)

In [4]:
```
#Check for missing values
df.isnull().sum()
```

Out[4]:
```
MedInc         0
HouseAge       0
AveRooms       0
AveBedrms      0
Population     0
AveOccup       0
Latitude       0
Longitude      0
MedHouseVal    0
dtype: int64
```

In [11]:
```
# Correlation heatmap
plt.figure(figsize=(10, 8))
sns.heatmap(df.corr(), annot=True, cmap='coolwarm')
plt.title("Correlation Heatmap")
plt.show()
```



In [5]:
```
#  Train-Test Split
X = df.drop("MedHouseVal", axis=1)
y = df["MedHouseVal"]

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, ran
```

In [6]:
```
#  Train the Model
model = LinearRegression()
model.fit(X_train, y_train)
```

Out[6]:
```
LinearRegression()
```

In [7]:
```
# Predictions
y_pred = model.predict(X_test)
y_pred
```

Out[7]:
```
array([0.71912284, 1.76401657, 2.70965883, ..., 4.46877017, 1.18751119,
       2.00940251])
```

In [8]:
```
#  Model Evaluation
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
r2 = r2_score(y_test, y_pred)

print(f"RMSE: {rmse}")
print(f"R-squared: {r2}")
```

```
RMSE: 0.7455813830127761
R-squared: 0.5757877060324511
```

In [11]:
```
# Coefficients of the Model
coefficients = pd.DataFrame({
    "Feature": X.columns,
    "Coefficient": model.coef_
})
coefficients
```

Out[11]:

	Feature	Coefficient
0	MedInc	0.448675
1	HouseAge	0.009724
2	AveRooms	-0.123323
3	AveBedrms	0.783145
4	Population	-0.000002
5	AveOccup	-0.003526
6	Latitude	-0.419792
7	Longitude	-0.433708

In [10]:
```
model.intercept_
```

Out[10]:
```
-37.02327770606416
```

In [ ]:
```

```