22p-9295-amber-task11

May 1, 2024

[1]:
```
# Importing necessary libraries
import numpy as np
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.preprocessing import StandardScaler # For data preprocessing
from sklearn.metrics import mean_squared_error
from sklearn.impute import SimpleImputer  # For handling missing values
from sklearn.impute import SimpleImputer  # For handling missing values
import matplotlib.pyplot as plt  # For plotting
```

[2]:
```
data='HousingData.csv'
df=pd.read_csv(data)
df
```

[2]:
```
        CRIM    ZN  INDUS  CHAS    NOX     RM   AGE     DIS  RAD  TAX  \
0    0.00632  18.0   2.31   0.0  0.538  6.575  65.2  4.0900    1  296
1    0.02731   0.0   7.07   0.0  0.469  6.421  78.9  4.9671    2  242
2    0.02729   0.0   7.07   0.0  0.469  7.185  61.1  4.9671    2  242
3    0.03237   0.0   2.18   0.0  0.458  6.998  45.8  6.0622    3  222
4    0.06905   0.0   2.18   0.0  0.458  7.147  54.2  6.0622    3  222
..       …     …     …     …      …      …     …       …   …   …
501  0.06263   0.0  11.93   0.0  0.573  6.593  69.1  2.4786    1  273
502  0.04527   0.0  11.93   0.0  0.573  6.120  76.7  2.2875    1  273
503  0.06076   0.0  11.93   0.0  0.573  6.976  91.0  2.1675    1  273
504  0.10959   0.0  11.93   0.0  0.573  6.794  89.3  2.3889    1  273
505  0.04741   0.0  11.93   0.0  0.573  6.030   NaN  2.5050    1  273

     PTRATIO       B  LSTAT  MEDV
0       15.3  396.90   4.98  24.0
1       17.8  396.90   9.14  21.6
2       17.8  392.83   4.03  34.7
3       18.7  394.63   2.94  33.4
4       18.7  396.90    NaN  36.2
..       …       …     …     …
501     21.0  391.99    NaN  22.4
502     21.0  396.90   9.08  20.6
```

```
503      21.0  396.90   5.64  23.9
504      21.0  393.45   6.48  22.0
505      21.0  396.90   7.88  11.9

[506 rows x 14 columns]
```

[3]:

```python
df.isnull().sum()
```

[3]:

```
CRIM       20
ZN         20
INDUS      20
CHAS       20
NOX         0
RM          0
AGE        20
DIS         0
RAD         0
TAX         0
PTRATIO     0
B           0
LSTAT      20
MEDV        0
dtype: int64
```

[4]:

```python
df.drop_duplicates(inplace=True)
```

[5]:

```python
df.dropna
```

[5]:

```
<bound method DataFrame.dropna of          CRIM    ZN  INDUS  CHAS    NOX     RM
AGE     DIS  RAD  TAX  \
0    0.00632  18.0   2.31   0.0  0.538  6.575  65.2  4.0900    1  296
1    0.02731   0.0   7.07   0.0  0.469  6.421  78.9  4.9671    2  242
2    0.02729   0.0   7.07   0.0  0.469  7.185  61.1  4.9671    2  242
3    0.03237   0.0   2.18   0.0  0.458  6.998  45.8  6.0622    3  222
4    0.06905   0.0   2.18   0.0  0.458  7.147  54.2  6.0622    3  222
..       …     …     …    …     …     …    …      …   …   …
501  0.06263   0.0  11.93   0.0  0.573  6.593  69.1  2.4786    1  273
502  0.04527   0.0  11.93   0.0  0.573  6.120  76.7  2.2875    1  273
503  0.06076   0.0  11.93   0.0  0.573  6.976  91.0  2.1675    1  273
504  0.10959   0.0  11.93   0.0  0.573  6.794  89.3  2.3889    1  273
505  0.04741   0.0  11.93   0.0  0.573  6.030   NaN  2.5050    1  273

     PTRATIO       B  LSTAT  MEDV
0       15.3  396.90   4.98  24.0
1       17.8  396.90   9.14  21.6
2       17.8  392.83   4.03  34.7
3       18.7  394.63   2.94  33.4
```

```
4        18.7  396.90     NaN  36.2
..        …      …    …     …
501      21.0  391.99     NaN  22.4
502      21.0  396.90    9.08  20.6
503      21.0  396.90    5.64  23.9
504      21.0  393.45    6.48  22.0
505      21.0  396.90    7.88  11.9

[506 rows x 14 columns]>
```

[6]:
```python
# Replace all occurrences of '-' with NaN (Not a Number) in the dataframe
df.replace('-', np.nan, inplace=True)
```

[7]:
```python
# Impute missing values in the dataframe using the mean strategy
# handling missing values
imputer = SimpleImputer(strategy='mean')
df = pd.DataFrame(imputer.fit_transform(df), columns=df.columns)
```

[8]:
```python
# Scale the dataframe to have zero mean and unit variance

scaler = StandardScaler()
scaler.fit(df)
normalized_data = scaler.transform(df)
```

[ ]:
```python

```

[9]:
```python
Q1 = df.quantile(0.25)
Q3 = df.quantile(0.75)
IQR = Q3 - Q1
IQR
```

[9]:
```
CRIM         3.528639
ZN          11.211934
INDUS       12.910000
CHAS         0.000000
NOX          0.175000
RM           0.738000
AGE         47.650000
DIS          3.088250
RAD         20.000000
TAX        387.000000
PTRATIO      2.800000
B           20.847500
LSTAT        9.340000
MEDV         7.975000
dtype: float64
```

[10]:
```
lower_bound = Q1 - 1.5 * IQR
upper_bound = Q3 + 1.5 * IQR
```

[11]:
```
# data_clean = df.loc[(df >= lower_bound) & (df <= upper_bound)]
data_clean = df[(df >= lower_bound) & (df <= upper_bound)]
data_clean
```

[11]:
```
        CRIM    ZN  INDUS  CHAS    NOX     RM        AGE     DIS  RAD    TAX  \
0    0.00632  18.0   2.31   0.0  0.538  6.575  65.200000  4.0900  1.0  296.0
1    0.02731   0.0   7.07   0.0  0.469  6.421  78.900000  4.9671  2.0  242.0
2    0.02729   0.0   7.07   0.0  0.469  7.185  61.100000  4.9671  2.0  242.0
3    0.03237   0.0   2.18   0.0  0.458  6.998  45.800000  6.0622  3.0  222.0
4    0.06905   0.0   2.18   0.0  0.458  7.147  54.200000  6.0622  3.0  222.0
..       …    …     …     …     …     …          …      …   …      …
501  0.06263   0.0  11.93   0.0  0.573  6.593  69.100000  2.4786  1.0  273.0
502  0.04527   0.0  11.93   0.0  0.573  6.120  76.700000  2.2875  1.0  273.0
503  0.06076   0.0  11.93   0.0  0.573  6.976  91.000000  2.1675  1.0  273.0
504  0.10959   0.0  11.93   0.0  0.573  6.794  89.300000  2.3889  1.0  273.0
505  0.04741   0.0  11.93   0.0  0.573  6.030  68.518519  2.5050  1.0  273.0

     PTRATIO       B      LSTAT  MEDV
0       15.3  396.90   4.980000  24.0
1       17.8  396.90   9.140000  21.6
2       17.8  392.83   4.030000  34.7
3       18.7  394.63   2.940000  33.4
4       18.7  396.90  12.715432  36.2
..       …       …        …    …
501     21.0  391.99  12.715432  22.4
502     21.0  396.90   9.080000  20.6
503     21.0  396.90   5.640000  23.9
504     21.0  393.45   6.480000  22.0
505     21.0  396.90   7.880000  11.9

[506 rows x 14 columns]
```

[12]:
```
df.isnull().sum()
```

[12]:
```
CRIM       0
ZN         0
INDUS      0
CHAS       0
NOX        0
RM         0
AGE        0
DIS        0
RAD        0
TAX        0
```

```
PTRATIO    0
B          0
LSTAT      0
MEDV       0
dtype: int64
```

Apply linear regression

[13]:
```
# Splitting the data into training and testing sets
X=df[['CRIM','ZN','INDUS','CHAS','NOX','RM','AGE','DIS','RAD','TAX','PTRATIO','B','LSTAT']]
y=df['MEDV']
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
↪random_state=3)
```

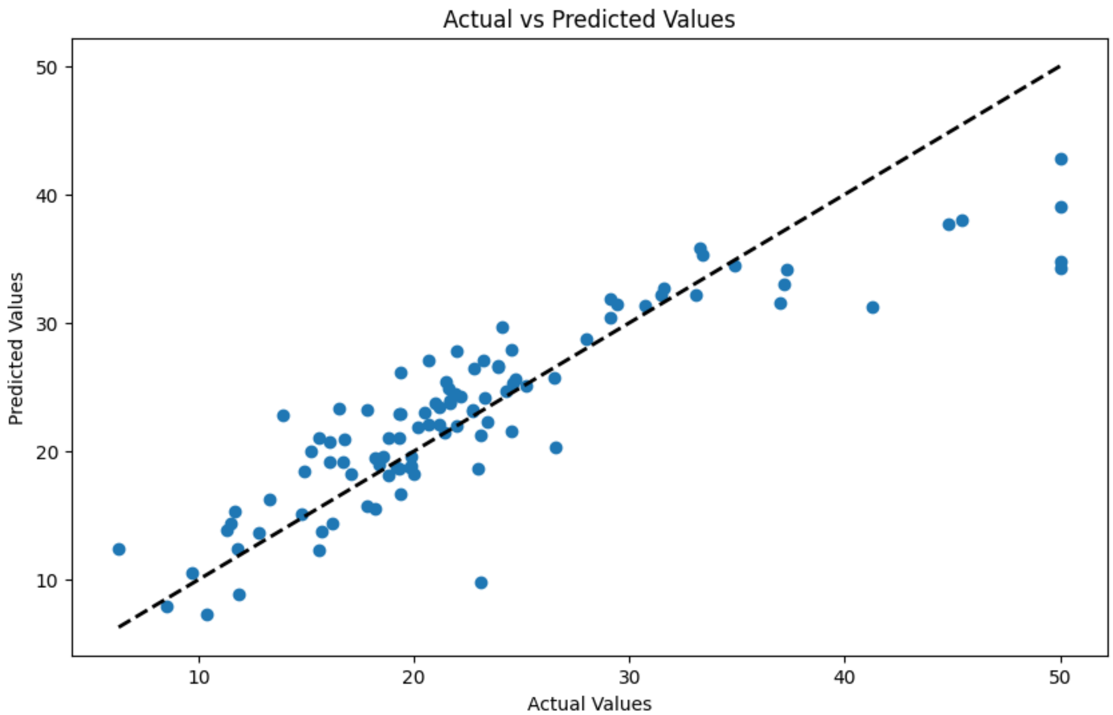
[14]:
```
# Creating and fitting the model
model = LinearRegression()
model.fit(X_train, y_train)

# Making predictions
y_pred = model.predict(X_test)

# Model evaluation
mse = mean_squared_error(y_test, y_pred)

print("Mean Squared Error:", mse)
```

```
Mean Squared Error: 18.87752321223317
```

[15]:
```
# Display y-intercept and slope of the best-fitted line
print("Intercept:", model.intercept_)
print("Coefficients:", model.coef_)
```

```
Intercept: 33.634988832069666
Coefficients: [-1.23268721e-01  4.10001063e-02 -1.20207669e-01  3.88952323e+00
 -1.45850020e+01  3.86231179e+00 -2.15704858e-02 -1.49021254e+00
  2.68592239e-01 -8.69350285e-03 -8.85239259e-01  1.02280165e-02
 -4.22936632e-01]
```

[16]:
```
# Step 4: Visualization
plt.figure(figsize=(10, 6))
plt.scatter(y_test, y_pred)
plt.plot([y_test.min(), y_test.max()], [y_test.min(), y_test.max()], 'k--',␣
↪lw=2)
plt.xlabel("Actual Values")
plt.ylabel("Predicted Values")
plt.title("Actual vs Predicted Values")
plt.show()
```


Actual vs Predicted Values
Predicted Values
Actual Values
10
20
30
40
50
10
20
30
40
50