assignment4

March 11, 2024

Importing Necessary Libraries

[140]:

```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
```

[141]:

```
boston = pd.read_csv("assignment4-dataset.csv")
```

[142]:

```
boston.head()
```

[142]:

```
      CRIM    ZN  INDUS  CHAS    NOX     RM   AGE     DIS  RAD  TAX  PTRATIO  \
0  0.00632  18.0   2.31   0.0  0.538  6.575  65.2  4.0900    1  296     15.3
1  0.02731   0.0   7.07   0.0  0.469  6.421  78.9  4.9671    2  242     17.8
2  0.02729   0.0   7.07   0.0  0.469  7.185  61.1  4.9671    2  242     17.8
3  0.03237   0.0   2.18   0.0  0.458  6.998  45.8  6.0622    3  222     18.7
4  0.06905   0.0   2.18   0.0  0.458  7.147  54.2  6.0622    3  222     18.7

        B  LSTAT  MEDV
0  396.90   4.98  24.0
1  396.90   9.14  21.6
2  392.83   4.03  34.7
3  394.63   2.94  33.4
4  396.90    NaN  36.2
```

Removing Missing Values

[143]:

```
boston.replace("?", np.nan, inplace=True)
boston.isnull().sum()
```

[143]:

```
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
```

[144]:

```
count_CRIM = boston["CRIM"].value_counts()
count_ZN = boston["ZN"].value_counts()
count_INDUS = boston["INDUS"].value_counts()
count_CHAS = boston["CHAS"].value_counts()
count_AGE = boston["AGE"].value_counts()
count_LSTAT = boston["LSTAT"].value_counts()
```

[145]:

```
boston["CRIM"].replace(np.NaN, count_CRIM.index[0], inplace=True)
boston["ZN"].replace(np.NaN, count_ZN.index[0], inplace=True)
boston["INDUS"].replace(np.NaN, count_INDUS.index[0], inplace=True)
boston["CHAS"].replace(np.NaN, count_CHAS.index[0], inplace=True)
boston["AGE"].replace(np.NaN, count_AGE.index[0], inplace=True)
boston["LSTAT"].replace(np.NaN, count_LSTAT.index[0], inplace=True)
```

```
C:\Users\aakas\AppData\Local\Temp\ipykernel_16324\973233367.py:1: FutureWarning:
A value is trying to be set on a copy of a DataFrame or Series through chained
assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work
because the intermediate object on which we are setting values always behaves as
a copy.

For example, when doing 'df[col].method(value, inplace=True)', try using
'df.method({col: value}, inplace=True)' or df[col] = df[col].method(value)
instead, to perform the operation inplace on the original object.


  boston["CRIM"].replace(np.NaN, count_CRIM.index[0], inplace=True)
C:\Users\aakas\AppData\Local\Temp\ipykernel_16324\973233367.py:2: FutureWarning:
A value is trying to be set on a copy of a DataFrame or Series through chained
assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work
because the intermediate object on which we are setting values always behaves as
a copy.

For example, when doing 'df[col].method(value, inplace=True)', try using
'df.method({col: value}, inplace=True)' or df[col] = df[col].method(value)
instead, to perform the operation inplace on the original object.


  boston["ZN"].replace(np.NaN, count_ZN.index[0], inplace=True)
```

```
C:\Users\aakas\AppData\Local\Temp\ipykernel_16324\973233367.py:3: FutureWarning:
A value is trying to be set on a copy of a DataFrame or Series through chained
assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work
because the intermediate object on which we are setting values always behaves as
a copy.

For example, when doing 'df[col].method(value, inplace=True)', try using
'df.method({col: value}, inplace=True)' or df[col] = df[col].method(value)
instead, to perform the operation inplace on the original object.


  boston["INDUS"].replace(np.NaN, count_INDUS.index[0], inplace=True)
C:\Users\aakas\AppData\Local\Temp\ipykernel_16324\973233367.py:4: FutureWarning:
A value is trying to be set on a copy of a DataFrame or Series through chained
assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work
because the intermediate object on which we are setting values always behaves as
a copy.

For example, when doing 'df[col].method(value, inplace=True)', try using
'df.method({col: value}, inplace=True)' or df[col] = df[col].method(value)
instead, to perform the operation inplace on the original object.


  boston["CHAS"].replace(np.NaN, count_CHAS.index[0], inplace=True)
C:\Users\aakas\AppData\Local\Temp\ipykernel_16324\973233367.py:5: FutureWarning:
A value is trying to be set on a copy of a DataFrame or Series through chained
assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work
because the intermediate object on which we are setting values always behaves as
a copy.

For example, when doing 'df[col].method(value, inplace=True)', try using
'df.method({col: value}, inplace=True)' or df[col] = df[col].method(value)
instead, to perform the operation inplace on the original object.


  boston["AGE"].replace(np.NaN, count_AGE.index[0], inplace=True)
C:\Users\aakas\AppData\Local\Temp\ipykernel_16324\973233367.py:6: FutureWarning:
A value is trying to be set on a copy of a DataFrame or Series through chained
assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work
because the intermediate object on which we are setting values always behaves as
a copy.

For example, when doing 'df[col].method(value, inplace=True)', try using
'df.method({col: value}, inplace=True)' or df[col] = df[col].method(value)
```

```
instead, to perform the operation inplace on the original object.


  boston["LSTAT"].replace(np.NaN, count_LSTAT.index[0], inplace=True)
```

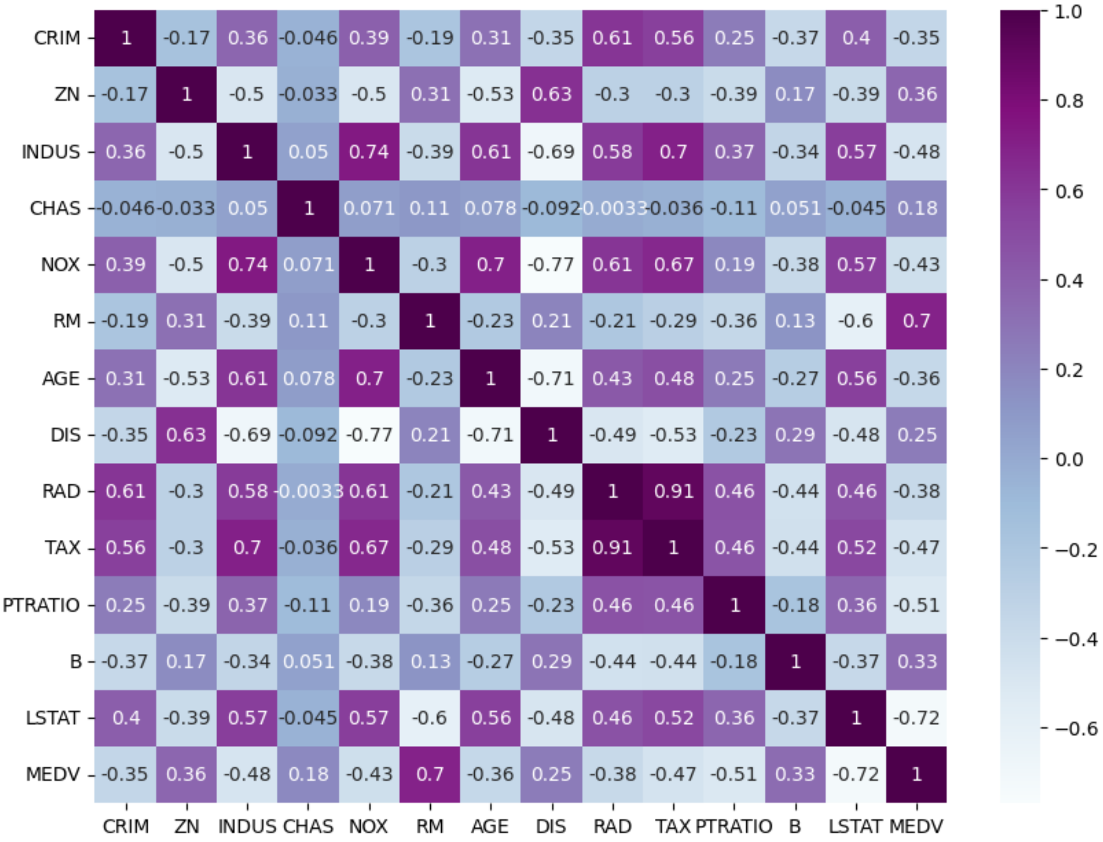
[146]:
```
boston.isnull().sum()
```

[146]:
```
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
```

[147]:
```
correlation = boston.corr()
plt.figure(figsize=(10, 7.5))

sns.heatmap(correlation, annot=True, cmap="BuPu")
```

[147]:
```
<Axes: >
```



Linear Regression using Sklearn

[148]:
```
from sklearn.linear_model import LinearRegression
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_squared_error,r2_score, accuracy_score
```

[149]:
```
x = boston.drop(columns=["MEDV"])
y = boston["MEDV"]
```

[150]:
```
x_train, x_test , y_train, y_test = train_test_split(x, y , test_size=0.28,␣
 ↪random_state=1)
```

[151]:
```
model = LinearRegression()
```

[152]:
```
model.fit(x_train, y_train)
```

[152]:
```
LinearRegression()
```

[153]:
```
y_pred = model.predict(x_test)
```

Find MSE and R2 Score

```
[154]: mse = mean_squared_error(y_test, y_pred)
       mse
```

```
[154]: 21.381490061054482
```

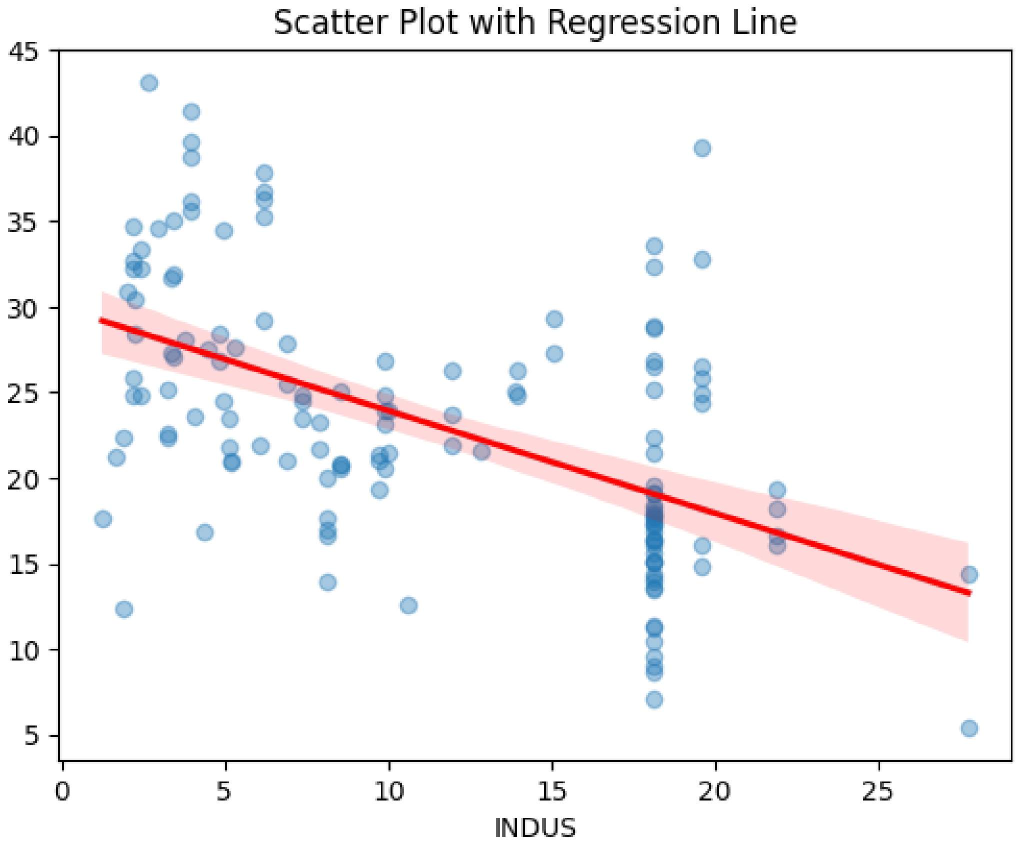
```
[155]: r2_score(y_test,y_pred)
```

```
[155]: 0.7775071683553145
```

Plotting Regressiong Line using Seaborn

```
[156]: sns.regplot(data = boston, x=x_test["INDUS"], y=y_pred, scatter_kws={"alpha":0.
        ↪4}, line_kws={"color":"red"})

       plt.title("Scatter Plot with Regression Line")
       plt.show()
```


Scatter Plot with Regression Line
INDUS