DS-phase4

October 26, 2023

DATE:26-10-2023

TEAM ID:3886

PROJECT TITLE:Air Quality Analysis in TamilNadu 4

IMPORTING LIBRARIES

[489]:
```
import numpy as np
import pandas as pd
import os
import matplotlib.pyplot as plt
%matplotlib inline
import seaborn as sns
import warnings
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, r2_score
```

LOADING THE DATASET

[490]:
```
dataset= pd.read_csv("C:\\Users\\SANTH\\Downloads\\cpcb_dly_aq_tamil_nadu-2014. ↪csv")
```

DATA EXPLORATION:

[491]:
```
dataset
```

[491]:
```
Stn Code Sampling Date State City/Town/Village/Area \ 0 38 01-02-2014 Tamil
                                                    Nadu Chennai
1 38 01-07-2014 Tamil Nadu Chennai
2 38 21-01-2014 Tamil Nadu Chennai
3 38 23-01-2014 Tamil Nadu Chennai
4 38 28-01-2014 Tamil Nadu Chennai
… … … … …
```



```
2874 773 12-03-2014 Tamil Nadu Trichy 2875 773 12-10-2014 Tamil Nadu
Trichy 2876 773 17-12-2014 Tamil Nadu Trichy 2877 773 24-12-2014
```

Tamil Nadu Trichy 2878 773 31-12-2014 Tamil Nadu Trichy

Location of Monitoring Station \
0 Kathivakkam, Municipal Kalyana Mandapam, Chennai 1
Kathivakkam, Municipal Kalyana Mandapam, Chennai 2
Kathivakkam, Municipal Kalyana Mandapam, Chennai 3
Kathivakkam, Municipal Kalyana Mandapam, Chennai 4
Kathivakkam, Municipal Kalyana Mandapam, Chennai … …
2874 Central Bus Stand, Trichy 2875 Central Bus Stand, Trichy
2876 Central Bus Stand, Trichy 2877 Central Bus Stand, Trichy
2878 Central Bus Stand, Trichy

Agency \
0 Tamilnadu State Pollution Control Board
1 Tamilnadu State Pollution Control Board
2 Tamilnadu State Pollution Control Board
3 Tamilnadu State Pollution Control Board
4 Tamilnadu State Pollution Control Board
… …
2874 Tamilnadu State Pollution Control Board
2875 Tamilnadu State Pollution Control Board
2876 Tamilnadu State Pollution Control Board
2877 Tamilnadu State Pollution Control Board
2878 Tamilnadu State Pollution Control Board

Type of Location SO2 NO2 RSPM/PM10 PM 2.5
0 Industrial Area 11.0 17.0 55.0 NaN 1 Industrial Area 13.0 17.0 45.0 NaN 2 Industrial Area 12.0 18.0 50.0 NaN 3 Industrial Area 15.0 16.0 46.0 NaN 4 Industrial Area 13.0 14.0 42.0 NaN … … … … … …
2874 Residential, Rural and other Areas 15.0 18.0 102.0 NaN 2875 Residential, Rural and other Areas 12.0 14.0 91.0 NaN 2876 Residential, Rural and other Areas 19.0 22.0 100.0 NaN 2877 Residential, Rural and other Areas 15.0 17.0 95.0 NaN 2878 Residential, Rural and other Areas 14.0 16.0 94.0 NaN

[2879 rows x 11 columns]

2

[492]:
```
dataset.drop('Stn Code', axis=1, inplace=True)
dataset.drop('Sampling Date', axis=1, inplace=True)
dataset.drop('City/Town/Village/Area', axis=1, inplace=True)
dataset.drop('Location of Monitoring Station', axis=1, inplace=True)
dataset.drop('Agency', axis=1, inplace=True)
dataset.drop('Type of Location', axis=1, inplace=True)
dataset.drop('PM 2.5', axis=1, inplace=True)
dataset
```

[492]: State SO2 NO2 RSPM/PM10
0 Tamil Nadu 11.0 17.0 55.0
1 Tamil Nadu 13.0 17.0 45.0
2 Tamil Nadu 12.0 18.0 50.0
3 Tamil Nadu 15.0 16.0 46.0
4 Tamil Nadu 13.0 14.0 42.0
… … … … …
2874 Tamil Nadu 15.0 18.0 102.0
2875 Tamil Nadu 12.0 14.0 91.0
2876 Tamil Nadu 19.0 22.0 100.0
2877 Tamil Nadu 15.0 17.0 95.0
2878 Tamil Nadu 14.0 16.0 94.0

[2879 rows x 4 columns]

[493]: dataset.info()

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

RangeIndex: 2879 entries, 0 to 2878

Data columns (total 4 columns):

Column Non-Null Count Dtype

--- ------ -------------- -----

0 State 2879 non-null object

1 SO2 2868 non-null float64

2 NO2 2866 non-null float64

3 RSPM/PM10 2875 non-null float64

dtypes: float64(3), object(1)

memory usage: 90.1+ KB

[494]: dataset.describe()

[494]: SO2 NO2 RSPM/PM10 count 2868.000000
2866.000000 2875.000000
mean 11.503138 22.136776 62.494261
std 5.051702 7.128694 31.368745

```
min 2.000000 5.000000 12.000000
25% 8.000000 17.000000 41.000000
50% 12.000000 22.000000 55.000000
75% 15.000000 25.000000 78.000000
max 49.000000 71.000000 269.000000
```

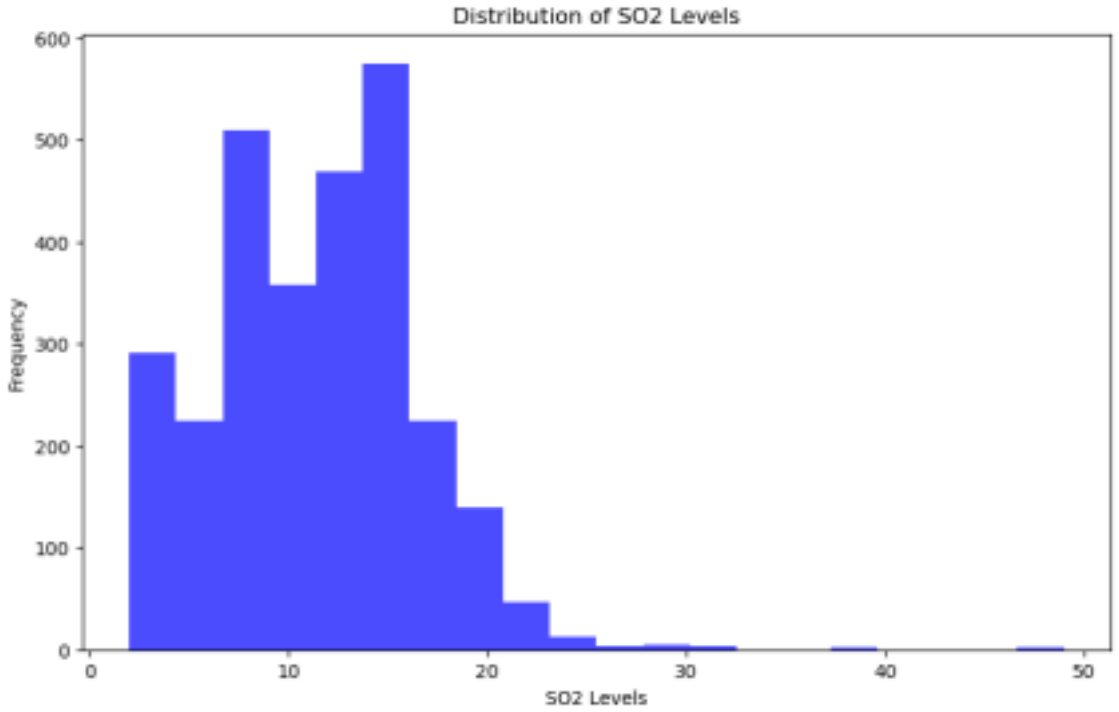
[495]:
```
dataset.columns
```

[495]:
```
Index(['State', 'SO2', 'NO2', 'RSPM/PM10'], dtype='object')
```

DATA VISUALIZATION:

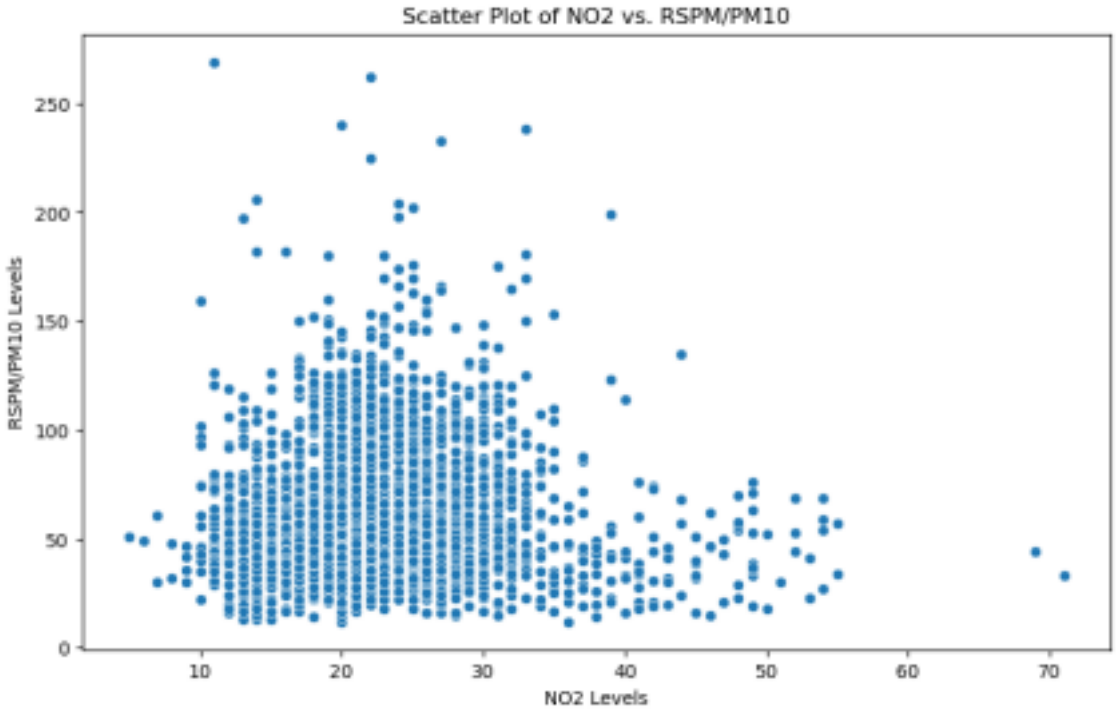
1.Histogram for SO2 levels

[496]:
```
plt.figure(figsize=(10, 6))
plt.hist(dataset['SO2'], bins=20, color='blue', alpha=0.7)
plt.title('Distribution of SO2 Levels')
plt.xlabel('SO2 Levels')
plt.ylabel('Frequency')
plt.show()
```



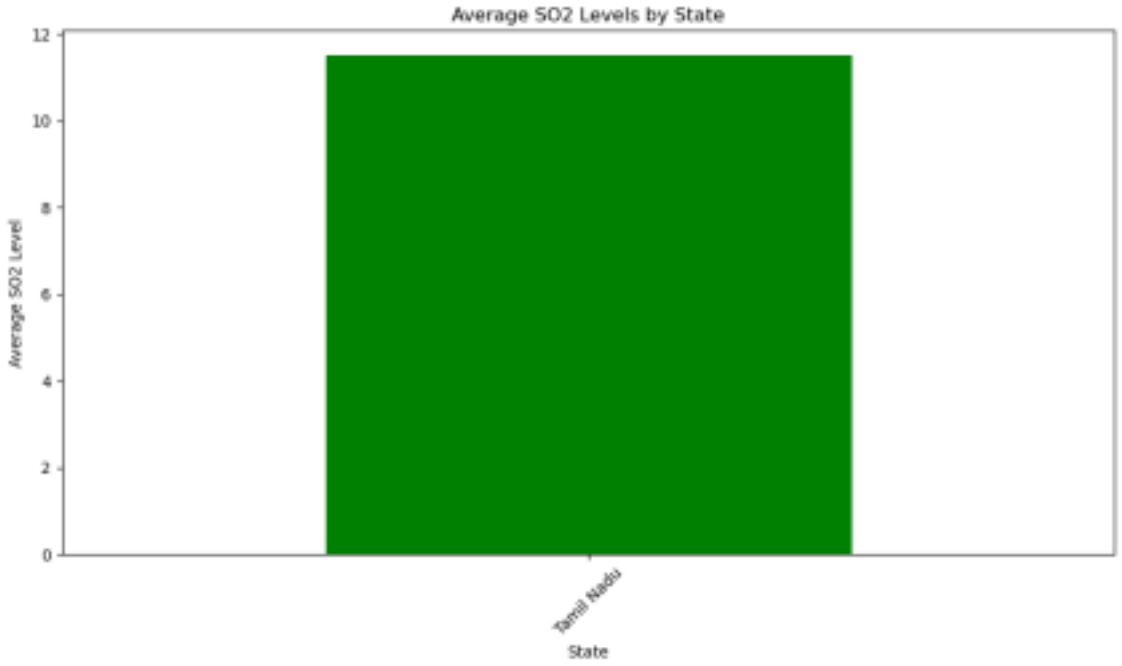
2.Scatter plot of NO2 vs. RSPM/PM10

[497]:
```
plt.figure(figsize=(10, 6))
sns.scatterplot(x='NO2', y='RSPM/PM10', data=dataset)
plt.title('Scatter Plot of NO2 vs. RSPM/PM10')
plt.xlabel('NO2 Levels')
plt.ylabel('RSPM/PM10 Levels')
plt.show()
```



3.Bar chart for State-wise SO2 levels

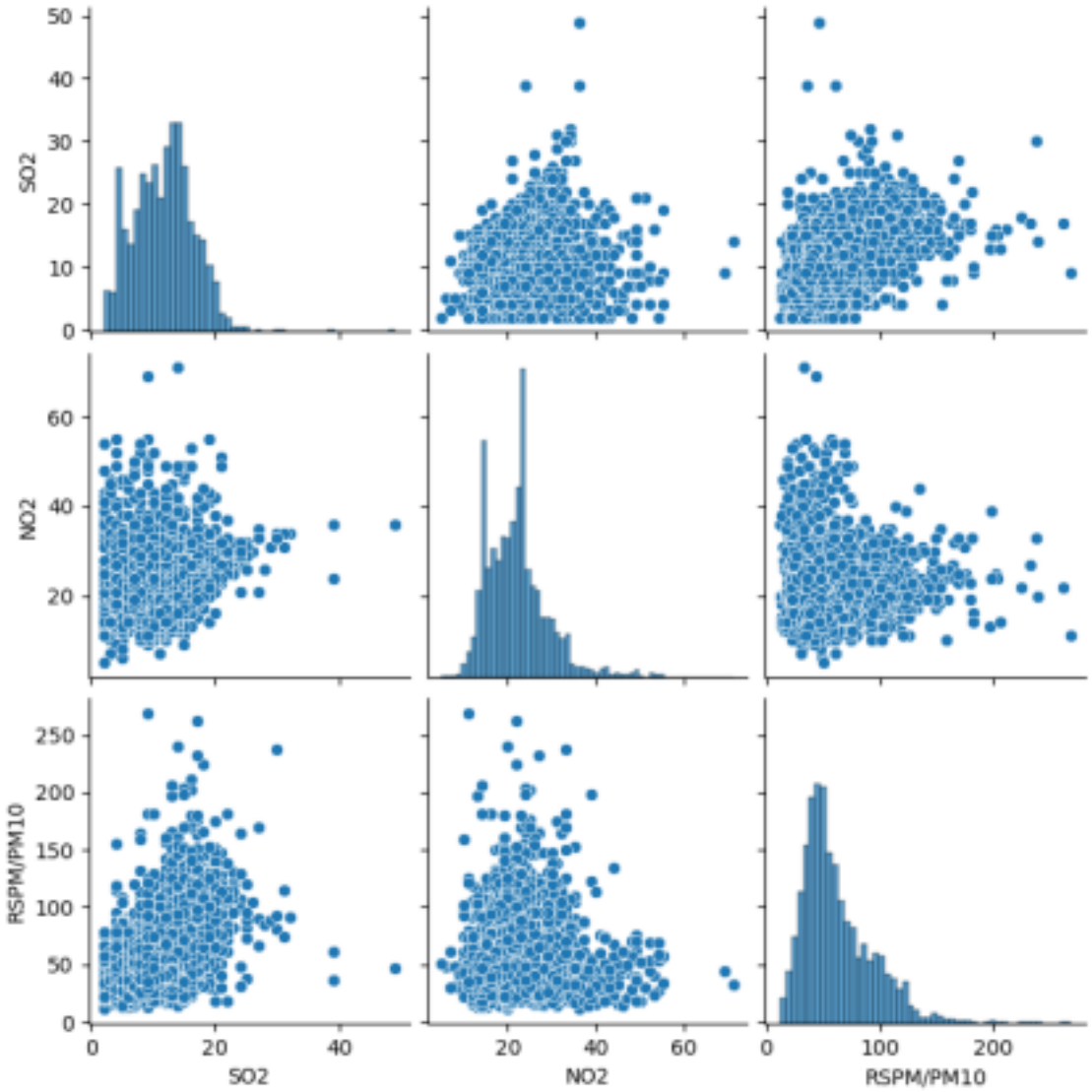
```
[498]: statewise_so2 = dataset.groupby('State')['SO2'].mean().
         ↪sort_values(ascending=False)
       plt.figure(figsize=(12, 6))
       statewise_so2.plot(kind='bar', color='green')
       plt.title('Average SO2 Levels by State')
       plt.xlabel('State')
       plt.ylabel('Average SO2 Level')
       plt.xticks(rotation=45)
       plt.show()
```



[499]:
```
plt.figure(figsize=(12,8))
sns.pairplot(dataset)
```

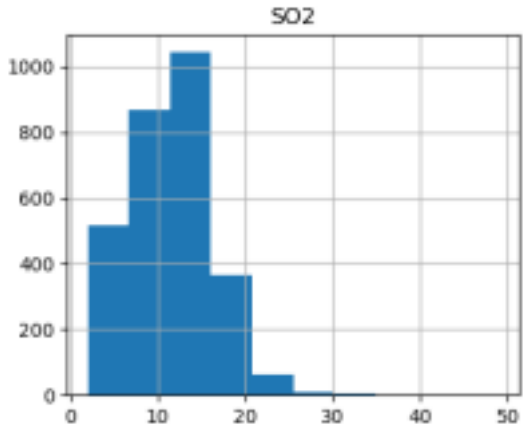
[499]: <seaborn.axisgrid.PairGrid at 0x20e627e3bb0>

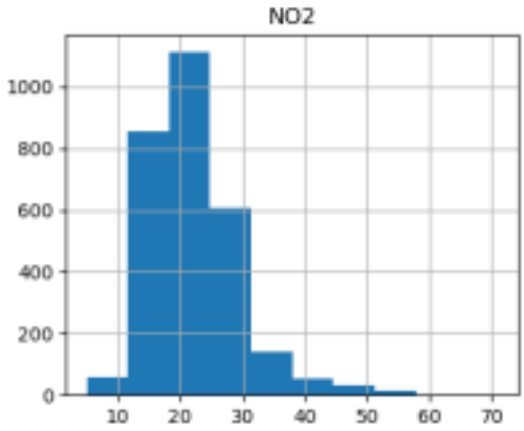
<Figure size 1200x800 with 0 Axes>

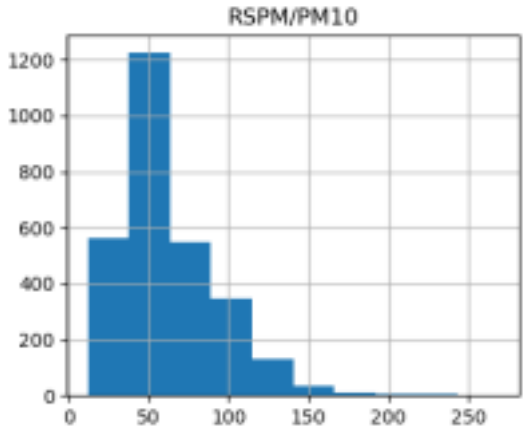


[500]: dataset.hist(figsize=(10,8))

[500]: array([[<AxesSubplot:title={'center':'SO2'}>,
<AxesSubplot:title={'center':'NO2'}>],
[<AxesSubplot:title={'center':'RSPM/PM10'}>, <AxesSubplot:>]],
dtype=object)







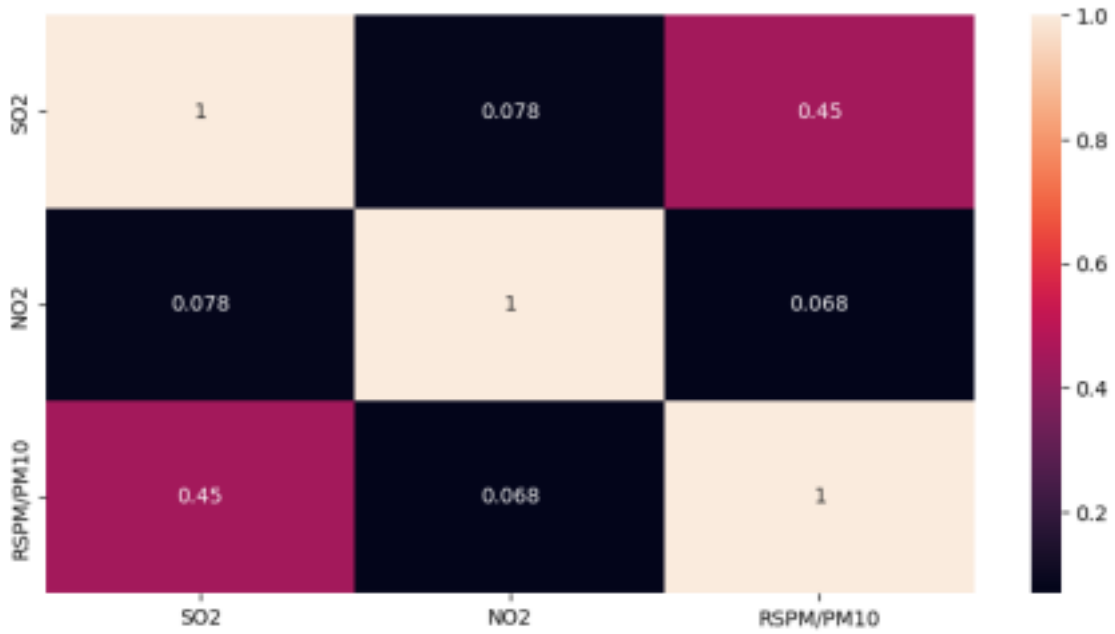
Visualising Correlation

[501]: dataset.corr()

[501]: SO2 NO2 RSPM/PM10
SO2 1.000000 0.078246 0.445152
NO2 0.078246 1.000000 0.068277
RSPM/PM10 0.445152 0.068277 1.000000

[502]: plt.figure(figsize=(10,5))
sns.heatmap(dataset.corr(), annot=**True**)

[502]: <AxesSubplot:>



Training model:1_LINEAR REGRESSION

FEATURE ENGINEERING:

[503]:
```
dataset.drop('State', axis=1, inplace=True)
dataset.fillna(0,inplace=True)
s=dataset['RSPM/PM10']
X_train, X_test, y_train, y_test = train_test_split(dataset, s, test_size=0.2,␣
↪random_state=42)
```

Model Training:

[504]:
```
model = LinearRegression()
model.fit(X_train, y_train)
```

[504]: LinearRegression()

Model Evaluation:

[505]:
```
y_pred = model.predict(X_test)
mse = mean_squared_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)
print(f"Mean Squared Error (MSE): {mse}")
print(f"R-squared (R2) Score: {r2}")
```

Mean Squared Error (MSE): 1.7858417732467776e-28

R-squared (R2) Score: 1.0

Training Model:2_DECISION TREE REGRESSOR Model

Training:

[506]:
```
from sklearn.tree import DecisionTreeRegressor
regressor = DecisionTreeRegressor(max_depth=5, min_samples_split=2)
regressor.fit(X_train, y_train)
```

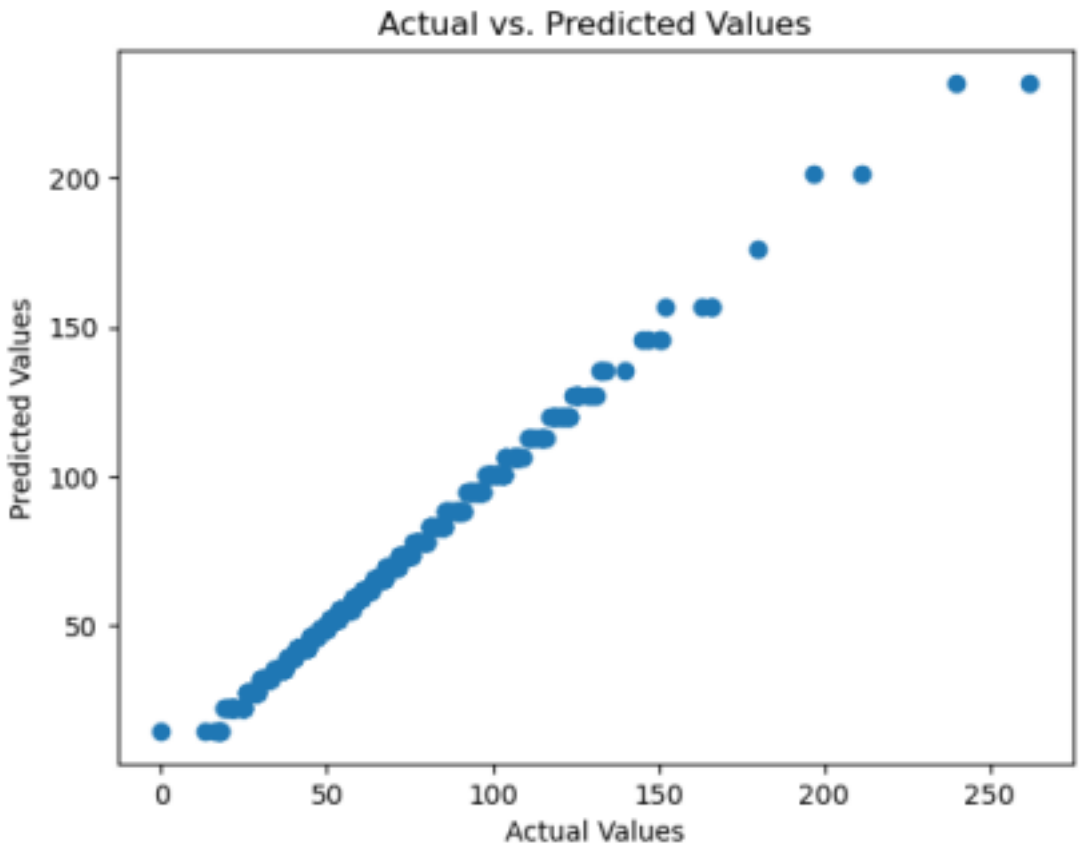
[506]: DecisionTreeRegressor(max_depth=5)

Model Evaluation:

[507]:
```
from sklearn.metrics import mean_squared_error, r2_score
 import matplotlib.pyplot as plt
y_pred = regressor.predict(X_test)
mse = mean_squared_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)
print("Mean Squared Error:", mse)
print("R-squared:", r2)
plt.scatter(y_test, y_pred)
plt.xlabel("Actual Values")
plt.ylabel("Predicted Values")
plt.title("Actual vs. Predicted Values")
plt.show()
```

Mean Squared Error: 4.396006397635617

R-squared: 0.9957863451133371



TRAINING MODEL:3_K-NEAREST NEIGHBORS Model Training:

[508]:
```
from sklearn.neighbors import KNeighborsRegressor
knn_model = KNeighborsRegressor(n_neighbors=5) # You can adjust 'n_neighbors' as needed
knn_model.fit(X_train, y_train)
```

[508]: KNeighborsRegressor()

Model Evaluation:

[509]:
```
from sklearn.metrics import mean_absolute_error, mean_squared_error, r2_score y_pred = knn_model.predict(X_test)
mae = mean_absolute_error(y_test, y_pred)
mse = mean_squared_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)
print(f"Mean Absolute Error: {mae}")
print(f"Mean Squared Error: {mse}")
```



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

Mean Absolute Error: 0.5847222222222227

Mean Squared Error: 2.134861111111112

R-squared: 0.997953695436381