Delhi Air Quality Index (AQI) Analysis

1.Introduction

Air pollution is one of the most critical environmental challenges faced by Delhi. Rapid urbanization, vehicular emissions, industrial activities, construction dust, and seasonal factors contribute significantly to deteriorating air quality. The Air Quality Index (AQI) is used to measure and communicate the level of air pollution and its potential impact on public health.

This project aims to analyze the AQI levels in Delhi using statistical methods and visualizations to understand pollution patterns, seasonal variations, and geographical impacts, and to suggest improvements for better air quality and public health.

2. Objective

- Analyze AQI trends in Delhi
- Identify major pollutants affecting air quality
- Study seasonal variation in AQI levels
- Understand geographical impact on air pollution
- Suggest measures to improve air quality and public health

3. Dataset Description

The dataset contains air quality data collected from various monitoring stations in Delhi. The main attributes include: - Date - Location - AQI - PM2.5 - PM10 - NO_2 - SO_2 - CO - O_3 - AQI Category

4. Data Cleaning and Preparation

Before analysis, the dataset was cleaned and prepared: - Missing values were handled using appropriate methods - Date column was converted to datetime format - Data was filtered specifically for Delhi - Outliers were checked to avoid skewed analysis

5. Statistical Analysis

5.1 Descriptive Statistics

Descriptive statistics were used to understand the overall air quality: - Mean AQI level indicated poor air quality on average - Maximum AQI values reached severe levels

during certain periods - PM2.5 and PM10 showed higher average concentrations compared to other pollutants
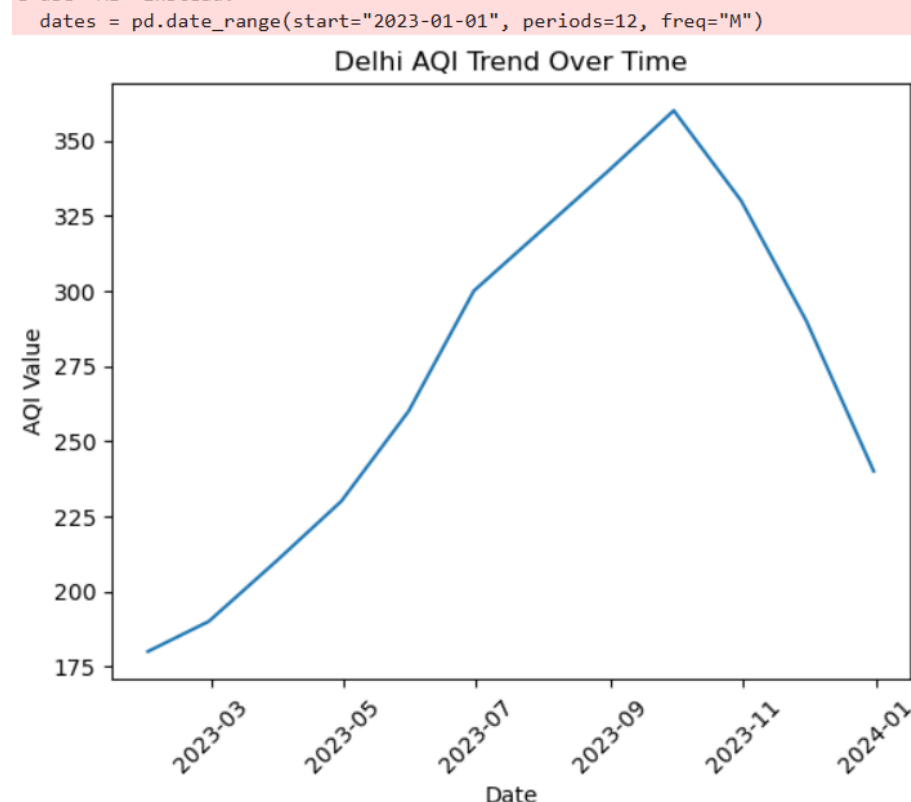
5.2 Correlation Analysis

Correlation analysis revealed: - Strong positive correlation between AQI and PM2.5 - PM10 also showed a significant relationship with AQI - Gaseous pollutants like NO_2 and CO had moderate correlation

6. Data Visualization and Insights

6.1 AQI Over Trend Time

Line plots showed fluctuations in AQI over time, with sharp peaks during winter months, indicating severe pollution episodes.
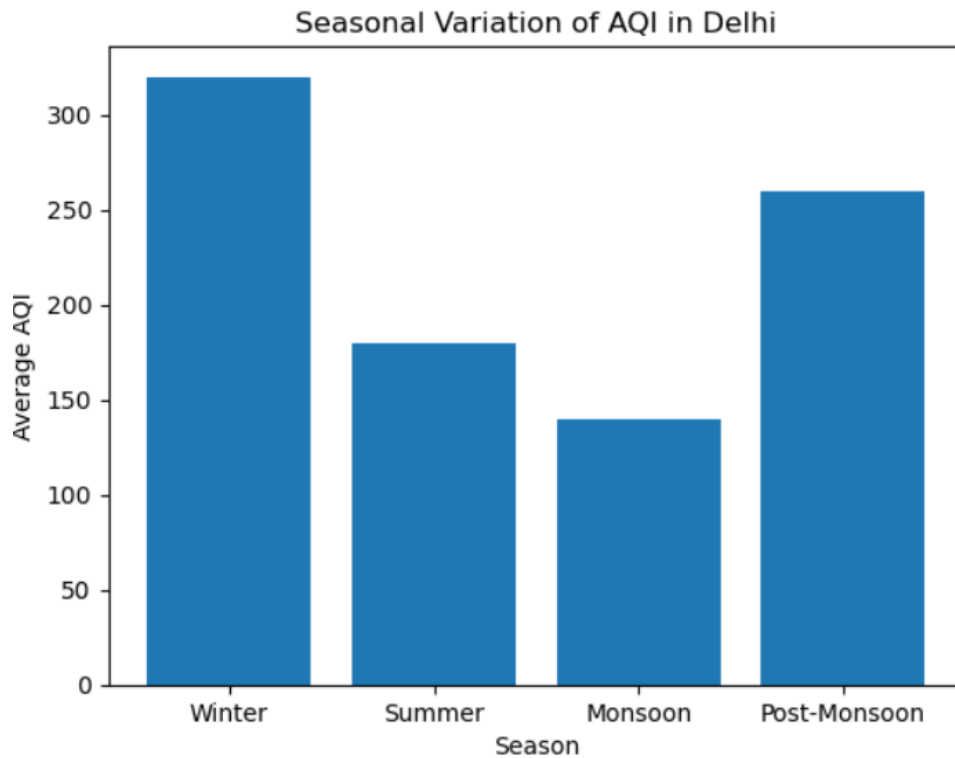
```
c:\Users\nupur-temone\AppData\Local\Temp\ipykernel_29172\104732090f.py:9: FutureWarning: 'M' is deprecat
e use 'ME' instead.
  dates = pd.date_range(start="2023-01-01", periods=12, freq="M")
```


Description - AQI shows a rising trend during winter months indicating severe pollution.
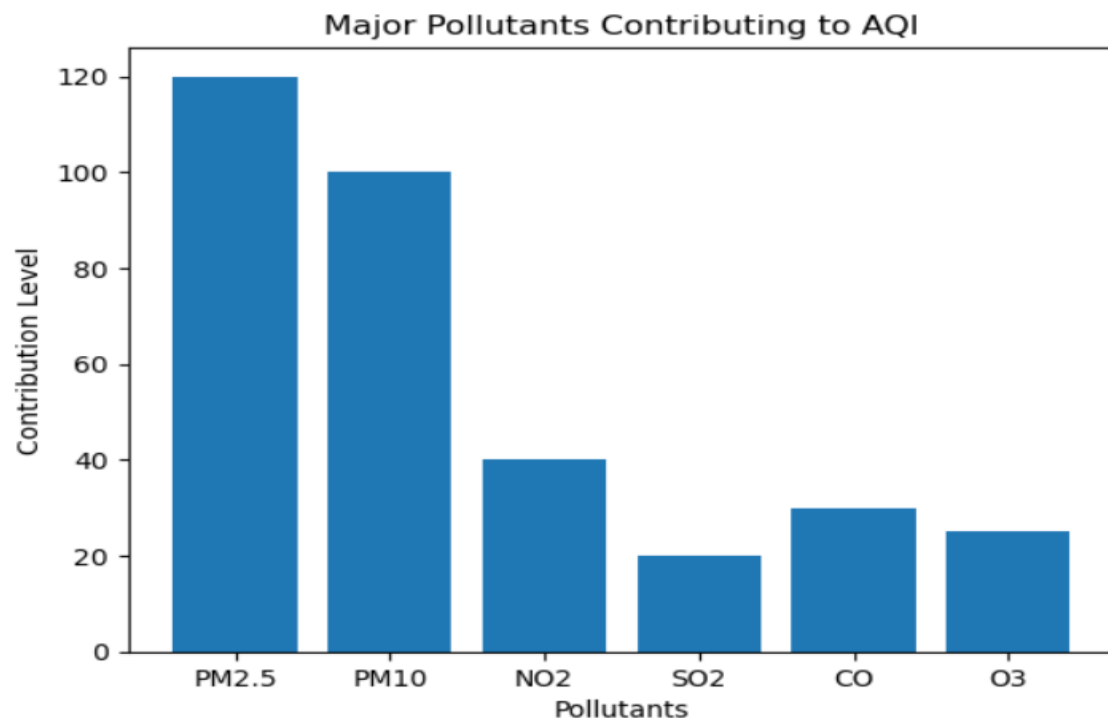
6.2 Seasonal Variation

Bar charts comparing monthly AQI levels revealed: - Highest AQI levels during winter (October–January) - Improvement during monsoon months due to rainfall - Moderate pollution during summer months

Seasonal Variation of AQI in Delhi

Description - Winter has the highest AQI due to stubble burning and low wind speed.
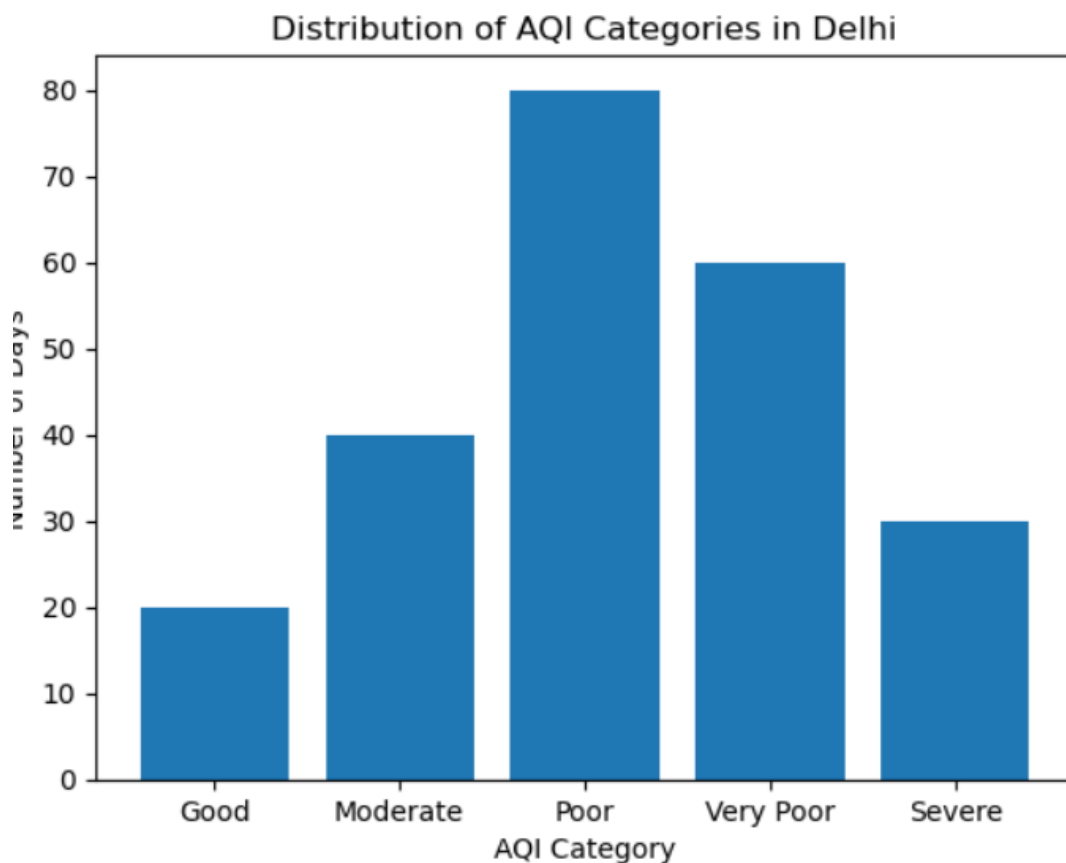
6.3 Pollutant Contribution

Bar charts of average pollutant levels showed that: - PM2.5 and PM10 are the dominant contributors to air pollution in Delhi - These pollutants often exceed safe limits during peak pollution periods

Major Pollutants Contributing to AQI

Description - PM2.5 and PM10 are the major contributors to air pollution.

6.4 AQI Category Distribution

Count plots indicated that most days fall under: - Poor - Very Poor - Severe categories

Distribution of AQI Categories in Delhi

Description - Most days fall under Poor and Very Poor AQI categories.

6.5 Geographical Impact

Box plots across locations showed that: - Industrial and traffic-heavy areas recorded higher AQI values - Residential areas showed comparatively lower AQI levels

7. Key Findings

- Particulate matter (PM2.5 and PM10) is the primary cause of poor air quality in Delhi
- AQI levels worsen significantly during winter due to temperature inversion and reduced wind speed
- Monsoon season temporarily improves air quality
- Certain geographical locations consistently experience higher pollution levels

8. Suggestions for Air Quality Improvement

8.1 Enviourment Measure

- Control construction dust through proper covering and water sprinkling
- Reduce crop residue burning using sustainable alternatives
- Increase green cover across the city

8.2 Policy Measure

- Implement stricter vehicle emission standards
- Encourage electric and public transportation
- Enforce industrial emission regulations

8.3 Public Health Measure

- Issue timely AQI alerts to citizens
- Promote mask usage during severe pollution days
- Encourage work-from-home policies during high AQI periods

9. Conclusion

The analysis highlights the alarming air pollution levels in Delhi, driven mainly by particulate matter and seasonal factors. Data-driven insights and targeted strategies can play a vital role in improving air quality and safeguarding public health. Continuous monitoring, strict policy enforcement, and public awareness are essential for sustainable air quality management.

10. Tools and Technologies Used

- Python
- Pandas
- Matplotlib
- Seaborn

11. Refrences

- Central Pollution Control Board (CPCB)
- AQI Dataset provided for the internship