Air Quality Index (AQI) Analysis Report — Delhi

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Objective:

To analyze the Air Quality Index data of Delhi to observe pollutant behavior, seasonal patterns, and derive actionable insights using visual data analysis.

1. Introduction

Delhi, the capital of India, is often in the news for its deteriorating air quality. The city experiences dangerous levels of pollution, especially during winter. To better understand the contributing factors, this project analyzes AQI data—specifically focusing on PM2.5, PM10, NO☐, and SO☐ pollutants.

2. Dataset Description

Source: given by SHADOWFOX team

Format: CSV

Features:

date (datetime of observation)

pm2_5, pm10, no2, so2 (key pollutant levels)

3. Methodology

The analysis followed these key steps:

Data Preprocessing: Converted datetime to date, extracted month, and categorized into four Indian climatic seasons: Winter, Summer, Monsoon, and Post-Monsoon.

Daily Averages: Grouped data to calculate average pollutant levels for each day.

Visualization: Used matplotlib and seaborn to generate trend graphs, boxplots by season, and a correlation heatmap.

4. Visual Analysis

◈ PM2.5 and PM10 Trends Over Time

A dual-line graph displays daily trends of PM2.5 and PM10, revealing:

Sharp spikes during the winter months.

PM2.5 generally follows PM10 trends, suggesting a strong correlation.

◈ Seasonal Boxplots

Boxplots for PM2.5 and PM10 by season show:

- Highest pollution during Winter, confirming popular concern.
- Summer and Monsoon exhibit significantly lower pollutant levels.

◈ Pollutant Correlation Heatmap

The heatmap reveals strong relationships among pollutants:

- PM2.5 and PM10 show high positive correlation (~0.95).
- Moderate correlation observed with NO_x, while SO_x had weaker association.

5. Key Insights

Dominant Pollutants: PM2.5 and PM10 are the major contributors to poor air quality in Delhi.

Worst Season:

- PM2.5 levels peak during Winter.
- PM10 levels also spike significantly in Winter.

Strong Correlation: PM2.5 and PM10 move together, likely indicating common sources like vehicular emissions and construction dust.

Seasonal Relief: The Monsoon season provides natural pollution control due to rain and wind dispersion.

6. Suggestions & Actionable Recommendations

- Strict control on vehicular emissions, especially during the winter season.
- Encourage use of public transport or shared mobility to reduce individual car usage.
- Introduce air purification zones in critical hotspots across Delhi.
- Promote green infrastructure (urban forests, rooftop gardens) to help absorb pollutants.
- Launch awareness campaigns to discourage burning of garbage or crop residues.

7. Conclusion

The AQI analysis highlights a clear seasonal pattern in Delhi's air pollution, with the winter months being most hazardous. PM2.5 and PM10 are the key culprits, strongly correlated with each other and demanding aggressive policy action. Through continuous monitoring, seasonal insights, and public involvement, we can take informed steps to improve Delhi's air quality.