

The Impact of Traffic Congestion on Air Quality in Turkey

1. Introduction

Air pollution is a major concern in urban areas of Turkey, particularly in cities like Istanbul, Ankara, and Izmir. Traffic congestion significantly contributes to deteriorating air quality. This project investigates how traffic congestion correlates with Air Quality Index (AQI) values, using synthetic data modeled after real-world patterns.

2. Data Sources and Methodology

Due to current limitations, synthetic data was generated based on real-world patterns observed in Turkish cities. Variables include hourly measurements of traffic congestion (%), wind speed (km/h), temperature (°C), and AQI. Exploratory data analysis (EDA) and hypothesis testing were applied to understand relationships and draw conclusions.

3. Dataset Overview

The dataset contains 721 hourly records for March 2024. Variables:

- Datetime
- Traffic_Congestion (%)
- Wind_Speed (km/h)
- Temperature (°C)
- AQI

4. Exploratory Data Analysis

Exploratory Data Analysis (EDA) included:

- Correlation matrix
- Scatter plot between Traffic Congestion and AQI
- AQI variation over time

EDA revealed a strong positive correlation between Traffic Congestion and AQI, and a negative correlation between Wind Speed and AQI.

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5. Hypothesis Testing

Hypotheses:

H0: High traffic congestion does not significantly affect AQI.

H1: High traffic congestion significantly increases AQI.

Results:

- t-statistic approximately 18.469

- p-value approximately 0.00000

Conclusion: Since the p-value is very small (<0.05), we reject the null hypothesis. High traffic congestion significantly worsens air quality.

6. Key Findings

- Traffic congestion and AQI are positively correlated.
- Wind speeds help reduce AQI levels.
- AQI levels fluctuate with daily traffic patterns.

7. Conclusion and Future Work

The results suggest that reducing traffic congestion could significantly improve air quality in Turkish cities. Future work could involve collecting real-time traffic and air quality data, applying machine learning techniques for predictive analysis, and examining additional factors like industrial emissions and public transport usage.