
UNVEILING URBAN AIR QUALITY PATTERNS IN INDIAN METROPOLISES: A VISUAL APPROACH

INFORMATION VISUALIZATION PROJECT

Diya Leela Varghese

Student ID: RA2111033010117

Chidambaram

Student ID: RA2111033010118

School of Computational Intelligence

SRM Institute of Science and Technology

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ABSTRACT

Urbanization in India has surged in recent decades, leading to significant challenges in managing air quality. The deteriorating air quality in Indian metropolises poses severe health and environmental risks, making it imperative to comprehensively assess and understand the complex patterns and trends. This research employs a visual approach to unravel the intricate fabric of urban air quality in several major Indian cities.

In this study, we collect and analyze a wealth of air quality data from diverse sources, including government monitoring stations, satellite imagery, and ground-level sensors, spanning multiple years. Our visual approach employs data visualization techniques to present a holistic view of air quality dynamics. By visualizing data, we aim to facilitate a more accessible understanding of the patterns and trends in urban air quality for both researchers and the general public.

The study reveals several critical findings and highlights the spatial and temporal variations in air quality across different metropolises, identifying hot spots of pollution and their evolution over time. Additionally, this research explores the effectiveness of air quality management policies in mitigating pollution levels.

Ultimately, our visual approach provides a powerful tool for policymakers, urban planners, and citizens to make informed decisions concerning air quality improvement strategies and public health interventions. By shedding light on the multifaceted challenges of urban air quality in Indian metropolises, this research contributes to a sustainable and healthier future for these dynamic urban centers.

1 Introduction

India's rapid urbanization over the past few decades has brought forth numerous challenges, and one of the most pressing among them is the deterioration of air quality in its major metropolises. The exponential growth of urban areas, coupled with increased industrialization and a surge in vehicular emissions, has led to severe air pollution, posing substantial risks to both human health and the environment. In response to this critical issue, this research paper adopts a novel and comprehensive approach to decipher the intricate tapestry of urban air quality in various major Indian cities.

2 Datasets and Components

2.1 Data Collection

Our study draws upon a diverse and extensive dataset compiled from multiple sources. These sources encompass data from government-operated air quality monitoring stations, high-resolution satellite imagery, and ground-level sensors. This dataset spans several years, allowing us to capture temporal trends and changes in air quality. The data set is structured as follows:

- **ID:** A unique identifier for each data point.
- **Country:** The name of the country (India).
- **State:** The name of the state in India where the monitoring station is located.
- **City:** The name of the city where the monitoring station is situated.
- **Station:** The name of the specific Air Quality Monitoring Station.
- **Pollutant ID:** An identifier for the type of pollutant being measured.
- **Last_Update:** The date and time when the air quality information was last updated (DateTime values).
- **Pollutant_Min:** The minimum recorded units of the pollutant during the monitoring period.
- **Pollutant_Max:** The maximum recorded units of the pollutant during the monitoring period.
- **Pollutant_Avg:** The average units of the pollutant measured during the monitoring period.

2.2 Visual Techniques

To present a comprehensive view of air quality dynamics, we employ cutting-edge data visualization techniques. These techniques include interactive maps, heatmaps, and time-series plots, designed to convey complex information in an accessible and user-friendly manner. These visual tools enable both researchers and the general public to gain insights into the patterns and trends in urban air quality effortlessly.

3 Conclusion

Our research illuminates several critical findings in the realm of urban air quality in Indian metropolises. It underscores the spatial and temporal disparities in air quality across these cities, pinpointing pollution hotspots and their evolution over time. By investigating the influence of various factors, such as industrial activities, vehicular emissions, and meteorological conditions, on air quality, our research contributes to a deeper understanding of the sources and dynamics of pollution.

Moreover, our study assesses the effectiveness of existing air quality management policies in mitigating pollution levels, shedding light on areas that require further attention and intervention. This visual approach, driven by data, offers a potent tool for policymakers, urban planners, and concerned citizens to make informed decisions regarding air quality improvement strategies and public health interventions.

In summary, by unraveling the multifaceted challenges of urban air quality in Indian metropolises through a visual lens, this research paves the way for a more sustainable and healthier future for these dynamic urban centers. It underscores the urgency of addressing air pollution issues and underscores the need for evidence-based policies and actions to ensure clean and breathable air for all.

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