Cluster Innovation Centre
University of Delhi

Spatial prediction of PM2.5 for Delhi using ML algorithms

Semester Long Project submitted for the paper of **"Project in Industry, Society and Villages"**

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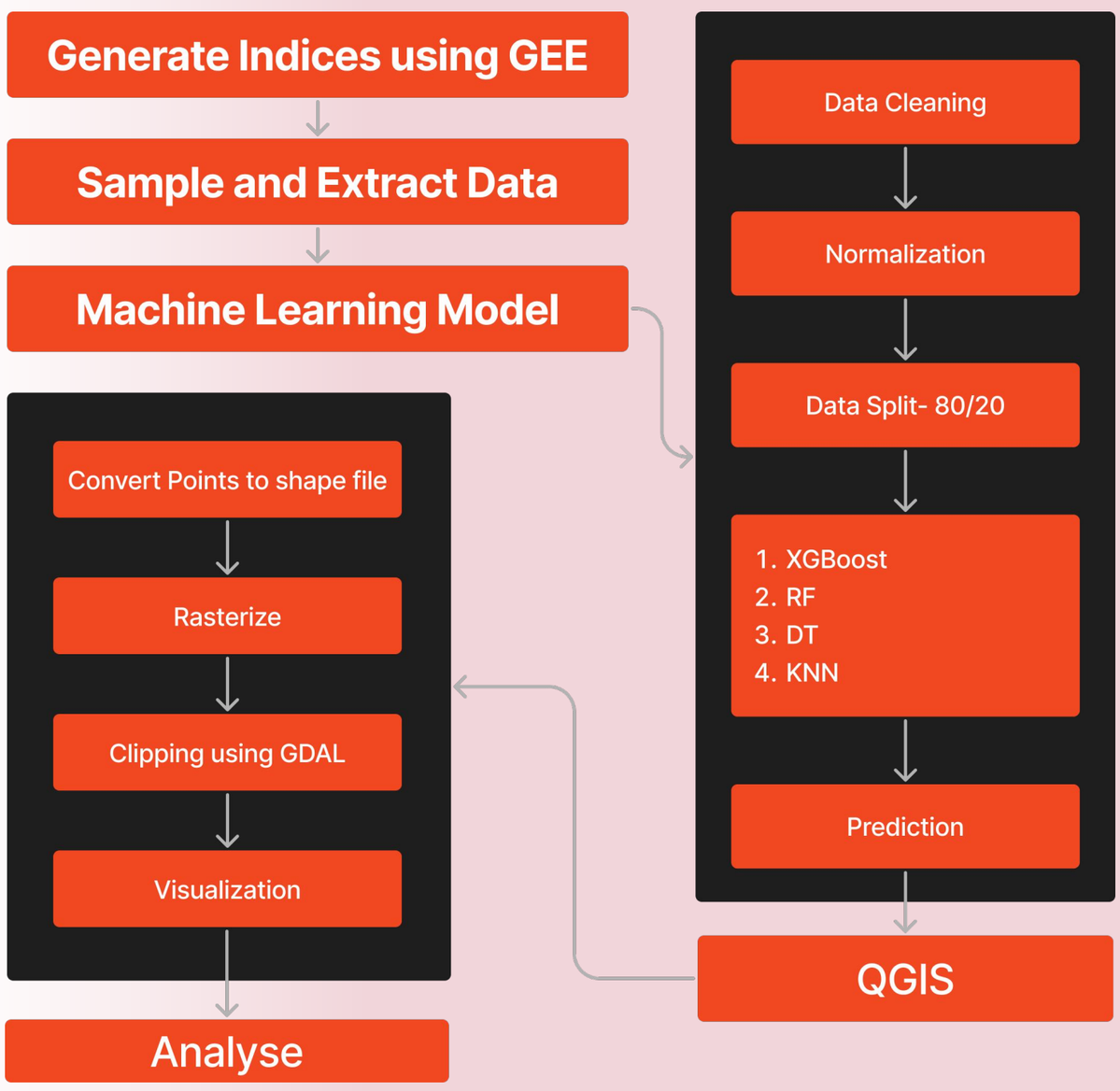
Abstract

This study examines the impact of COVID-19 on PM2.5 levels in Delhi using GIS for spatiotemporal analysis. Data from 2018 to 2023 reveal significant variations in PM2.5 concentrations across the pre-COVID, during COVID lockdown, and post-COVID periods. During the lockdown, PM2.5 levels dropped by approximately 61.40%, highlighting the impact of reduced human activities. Post-lockdown, PM2.5 levels remained lower than pre-lockdown levels, indicating lasting improvements. Predictive models are also employed to forecast future PM2.5 levels, considering weather, industrial activity, and policies. Results emphasize the need for sustainable urban planning and air quality regulations to mitigate health risks. This research provides insights into environmental changes due to the pandemic and offers a framework for future air quality management, aiding in the development of effective pollution control measures.

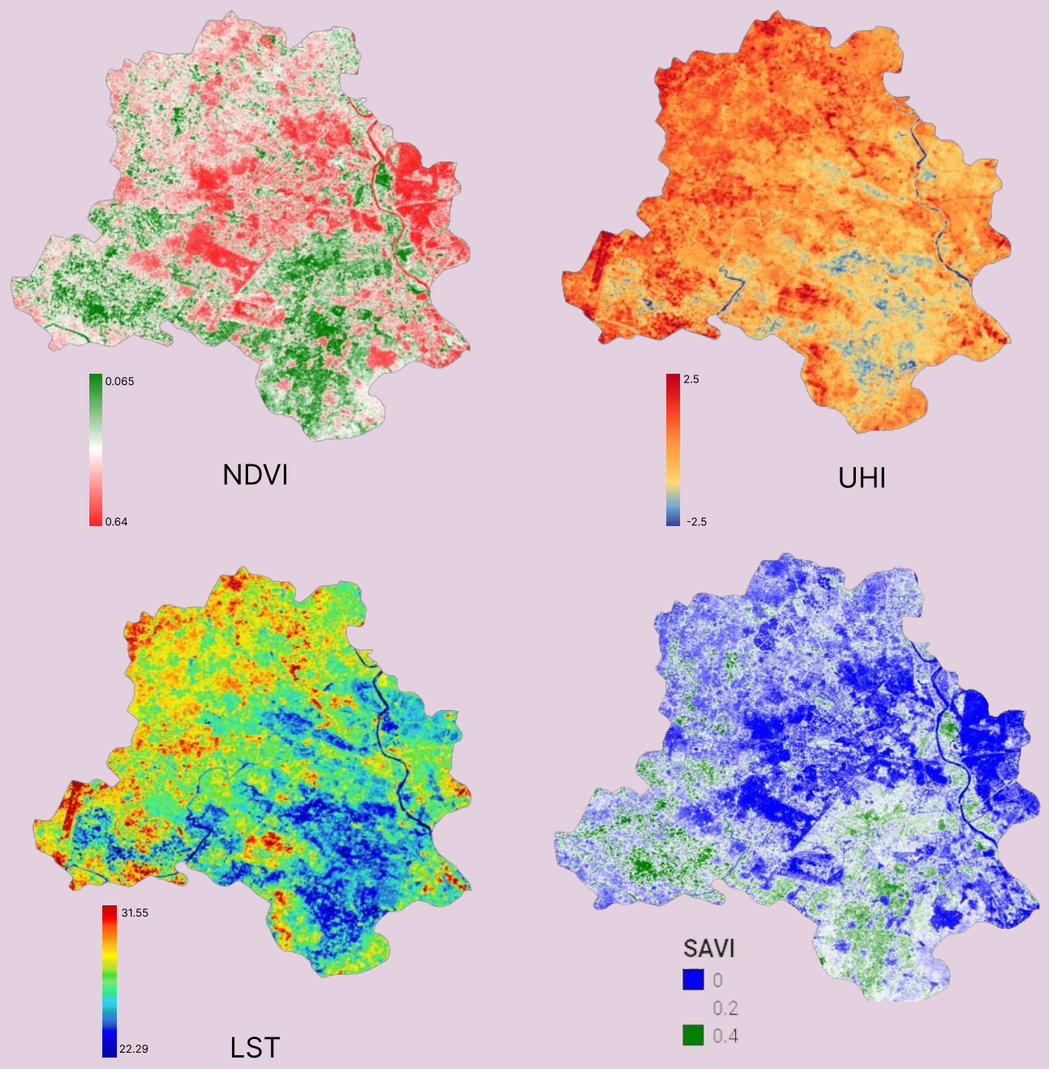
Introduction

Air pollution, especially PM2.5, is a severe issue in Delhi, leading to significant health problems. The COVID-19 pandemic provided a unique opportunity to study the impact of reduced human activity on air quality. This project analyzes PM2.5 levels in Delhi before, during, and after the pandemic using GIS to identify trends and patterns. Our analysis revealed significant variations, with PM2.5 levels dropping drastically during the lockdown and remaining lower than pre-lockdown levels post-pandemic, highlighting the long-term effects of reduced human activities and improved public behavior. Additionally, we employ predictive models to forecast future PM2.5 levels, providing valuable insights for policymakers and public health officials. This comprehensive analysis aims to inform effective pollution control strategies and sustainable urban planning.

Methodology

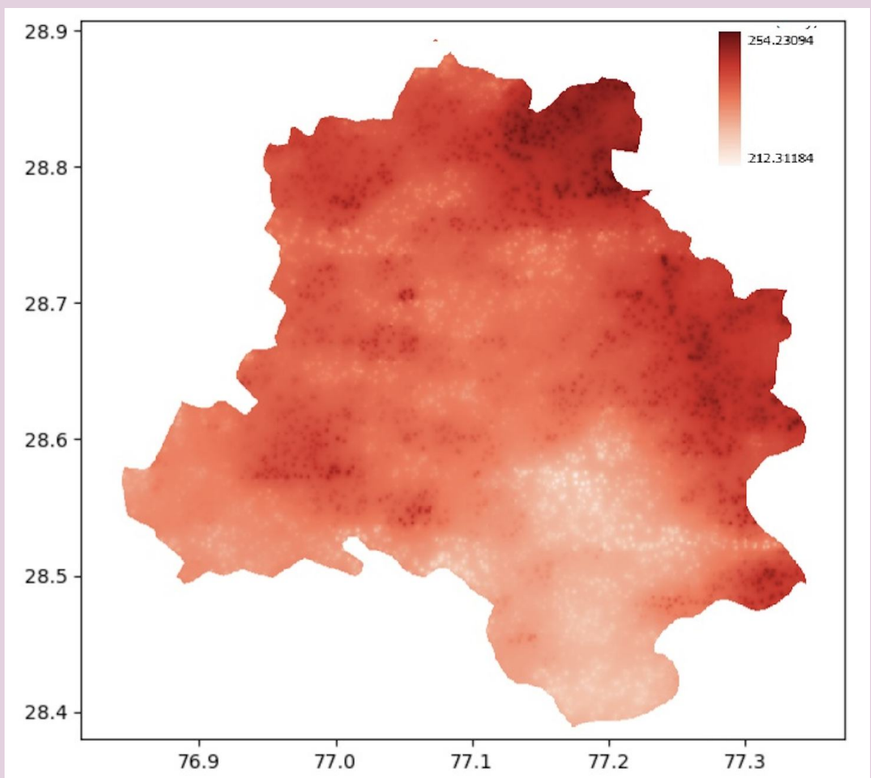


Geospetial Parameters



Results

NOISE REDUCTION ALGOTIHM	MSE ERROR
Random Forest	6.46
XG Boost	8.20
K Neighrest Neiug	41.58
Decision Tree	11.36



The analysis of PM2.5 levels in Delhi revealed significant variations across the pre-COVID, during COVID lockdown, and post-COVID periods. Before the pandemic, PM2.5 concentrations were alarmingly high, primarily due to vehicular emissions, industrial activities, and seasonal factors. During the lockdown, PM2.5 levels dropped drastically by approximately 61.40%, highlighting the substantial impact of reduced human activities and emissions. This period also saw slight improvements in NDVI, indicating healthier vegetation. As restrictions eased, a gradual increase in PM2.5 levels was observed, yet they remained lower than pre-lockdown levels, suggesting the lasting effects of the lockdown and possible improvements in public behavior and pollution control measures. Post-lockdown, PM2.5 levels continued to stay relatively low, reinforcing the importance of sustained environmental policies and the potential for maintaining better air quality through ongoing efforts.

Conclusion

In conclusion, this study underscores the profound impact of the COVID-19 pandemic on PM2.5 levels in Delhi, demonstrating significant reductions during the lockdown and sustained lower levels thereafter. The approximately 61.40% drop in PM2.5 concentrations during the lockdown period highlights the effectiveness of reduced human activities and enhanced pollution control measures. Post-lockdown, while PM2.5 levels showed a slight increase, they remained notably lower than pre-pandemic levels, suggesting lasting improvements. Integrating GIS for spatiotemporal analysis and predictive modeling provided critical insights into pollution dynamics, aiding future forecasting and policy formulation. Moving forward, sustainable urban planning efforts should prioritize stringent emission regulations, green infrastructure expansion, and public transport enhancement to maintain air quality gains. Continued investment in monitoring technologies and public awareness campaigns will be essential in sustaining these improvements and fostering healthier urban environments globally.

Referances

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