Optimal Machine Learning Techniques to Predict Air Quality Index

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Abstract:

The rapid growth in various sectors has resulted in increasing concern over air pollution in the modern world. Monitoring pollutant levels is crucial for regulating concentrations and taking prompt actions when pollution rises, allowing authorities to maintain control over environmental quality. To maintain ambient air quality, regular monitoring and forecasting of air pollution is necessary and this can be achieved by predicting the Air Quality Index (AQI). The AQI is a numerical scale that communicates the quality of air in a specific location based on the concentrations of various air pollutants. Manual monitoring stations to gather pertinent data entails significant expenses for both installation and maintenance. Since regular monitoring and prediction of the AQI are critical for combating air pollution. To accomplish this objective, machine learning (ML) has emerged as a promising approach for predicting the AQI when compared to traditional methods. In this work, to predict the AQI different ML algorithms are used such as ensemble methods based Bagging and Boosting. The open-source data from the Central Pollution Control Board (CPCB), covering a certain period of time in a region is going to be analysed. The contaminants like Particulate Matter, gaseous pollutants and key meteorological parameters that contribute to the AQI are considered for analysis. The available dataset is pre-processed and subjected to Exploratory Data Analysis with required transformations, before splitting it into Training and Testing sets. The primary focus of this work is to figure out the most effective ML framework that is scalable and reusable for any city of choice with the data from CPCB. To arrive at this, the various performance metrics (like correlation coefficient, MAE, MSE, RMSE) of the different models used in predicting the AQI values and other factors like generalization ability, robustness to outliers, flexible model customization and reusability are going to be analysed.

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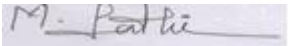

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