METEOROLOGICAL AND GEOSPATIAL ANALYSIS-BASED INTEGRATED MACHINE LEARNING FOR ACCURATE AIR QUALITY FORECASTING

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Abstract

In light of the growing environmental problems caused by low air quality, this investigation offers a thorough approach to precise air quality forecasting. The goal of the research effort is to disentangle the intricate network of variables affecting air quality by fusing state-of-the-art machine learning algorithms with meteorological and geographic data. The investigation acknowledges both man-made and natural air pollution sources, among other diverse sources. The burning of fossil fuels, industry, farming, waste disposal, deforestation, automobile traffic, and indoor sources are all included in the following list. To create accurate forecasting models, a comprehensive data collection process is employed, which includes historical and current datasets from weather sources and monitoring stations. To comprehend spatial connections and trends, spatial analysis is incorporated using Geographic information system (GIS) capabilities. Continuous hyperparameter tuning is carried out while model validation, using measures like Mean absolute error (MAE) and Root mean squared error (RMSE), assures accuracy. In order to provide dynamic forecasting, the created system is integrated into a real-time framework and continuously assimilates updated meteorological and geographical data. Access to stakeholders is facilitated by an intuitive interface, which highlights the environmental consequences of changes in air quality. Working

together with environmental groups, research institutes, and meteorological agencies promotes data exchange and ongoing model improvement. With an emphasis on the effects on the environment, this integrated method offers a comprehensive solution for precise and fast air quality forecasts. This research helps to proactive decision-making in pollution control and sustainable environmental practices by addressing the important requirement for effective environmental management techniques.

Author keywords

air quality forecasting; environmental impacts; geospatial integration; machine learning models; meteorological analysis; sustainable environmental practices

Indexed keywords

GEOBASE Subject Index

accuracy assessment; air quality; data set; environmental impact; environmental management; forecasting method; machine learning; meteorology; spatial analysis; sustainability

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