

Real-Time Air Quality Prediction Web Application

Overview

This web application provides real-time air quality data and 12-hour ahead forecasts for Alipur, Delhi. It combines seasonal autoregressive integrated moving average (SARIMAX) and long short-term memory (LSTM) models into a hybrid approach that leverages both traditional time series analysis and deep learning for enhanced accuracy. An interactive dashboard allows easy interpretation of current and predicted levels of key pollutants.

Approach

- Retrieves real-time air quality data from open API endpoints
- Preprocesses data by filling missing values and normalizing distributions
- Feeds data into SARIMAX model to capture seasonal cycles and trends
- Uses LSTM neural network to recognize intricate spatial-temporal patterns
- Ensembles SARIMAX and LSTM outputs for 12-hour ahead forecasts
- Displays current readings and predictions visually via a Flask dashboard
- Incorporates a virtual assistant using a pre-trained LLM to answer queries

Key Components

- Data collection and preprocessing pipelines
- SARIMAX for time series forecasting
- LSTM for spatial-temporal modeling
- Flask for user interface and visualizations
- LLM virtual assistant for personalized guidance

Considerations

- Requires consistent access to real-time air quality data feeds
- Computation constraints limit model complexity
- Data quality impacts accuracy of predictions
- Further improvements possible via RAG and model optimization

Impact

This hybrid modeling approach coupled with an intuitive interface enables data-driven decision making to mitigate air pollution. It provides actionable insights through current conditions and expected trends. The solution is scalable to other urban regions facing similar challenges.

Enhancements

- Incorporate additional data sources
- Expand to predict other environmental factors
- Add user accounts and permissions
- Notify users of threshold exceedances