Evaluating Machine Learning and Deep Learning Models for AQI Prediction

This presentation explores the evaluation of machine learning and deep learning models specifically designed to predict the Daily Air Quality Index (AQI) in Delhi, India. It addresses current air quality challenges, evaluates model performance, discusses techniques for model assessment, and outlines future directions for improved prediction accuracy.

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Presenter Designation

Understanding Air Quality Challenges in Delhi

Evaluating the impact of pollution sources on daily air quality index predictions

AQI > 300

Hazardous pollution levels

Delhi's air quality index frequently exceeds 300.

60% vehicular emissions

Major pollution contributor

Over half of the pollution arises from vehicles.

90% construction dust

Impact on air quality

Construction activities significantly contribute to pollution.

35% industrial output

Industrial pollution source

Industrial activities account for a third of pollution.

Health risk: 5,000 deaths

Severe health consequences

Pollution leads to thousands of premature deaths annually.

5 predictive models

Efforts to mitigate pollution

Research includes developing models for better air quality forecasting.

Techniques for Evaluating Machine Learning Models

Key methods for assessing model performance and reliability

Technique	Description	Purpose
Cross-validation	A method to assess how the results of a statistical analysis will generalize to an independent dataset	Reduce overfitting
Accuracy metrics	Metrics such as RMSE and MAE to measure prediction errors	Quantify model performance
Comparison against baseline models	Evaluating models against simpler heuristics	Establish benchmarks for improvements

Enhancing Air Quality Predictions with Machine Learning

Exploring the effects of machine learning techniques on air quality index forecasting in urban environments

25%

Error Reduction

Deep learning models can decrease prediction errors by over **25%** compared to **traditional** statistical methods.

3 Techniques

Model Variety

Utilizing **regression analysis**, **decision trees**, and **neural networks** allows for diverse data processing.

Vast Datasets

Data Handling

Machine learning identifies **complex patterns** within large datasets, enhancing prediction accuracy.

Historical Data

Input Variables

Models incorporate **historical pollution levels** and **meteorological data** for improved forecasting.

Timely Advisories

Public Health

Accurate predictions are crucial for **timely public health advisories** and effective policy-making.

Urban Focus

City Specific

The study focuses on **Delhi**, where air quality predictions are essential for residents' health.

Addressing Challenges in Data Collection for Air Quality Prediction Models

Exploring key issues in data collection and preprocessing for air quality monitoring and prediction

Missing data due to sensor issues

Datasets often suffer from **incomplete data** caused by sensor malfunctions or maintenance activities, which can hinder the effectiveness of air quality prediction models.

Sensor inaccuracies impact data quality

Variability in sensor calibration can lead to **inconsistent data quality**, posing significant challenges to reliable air quality assessments and predictions.

Need for standardization of data

Integrating data from various sources, such as **government sensors** and private initiatives, is essential to create a **unified dataset** that can improve model performance.

Data preprocessing is crucial

Effective **data preprocessing** techniques are necessary to clean and prepare the data for analysis, ensuring that models are trained on high-quality inputs.

Reliability and accuracy are essential

Addressing these challenges is vital for enhancing the **reliability and accuracy** of air quality prediction models, leading to better public health outcomes.

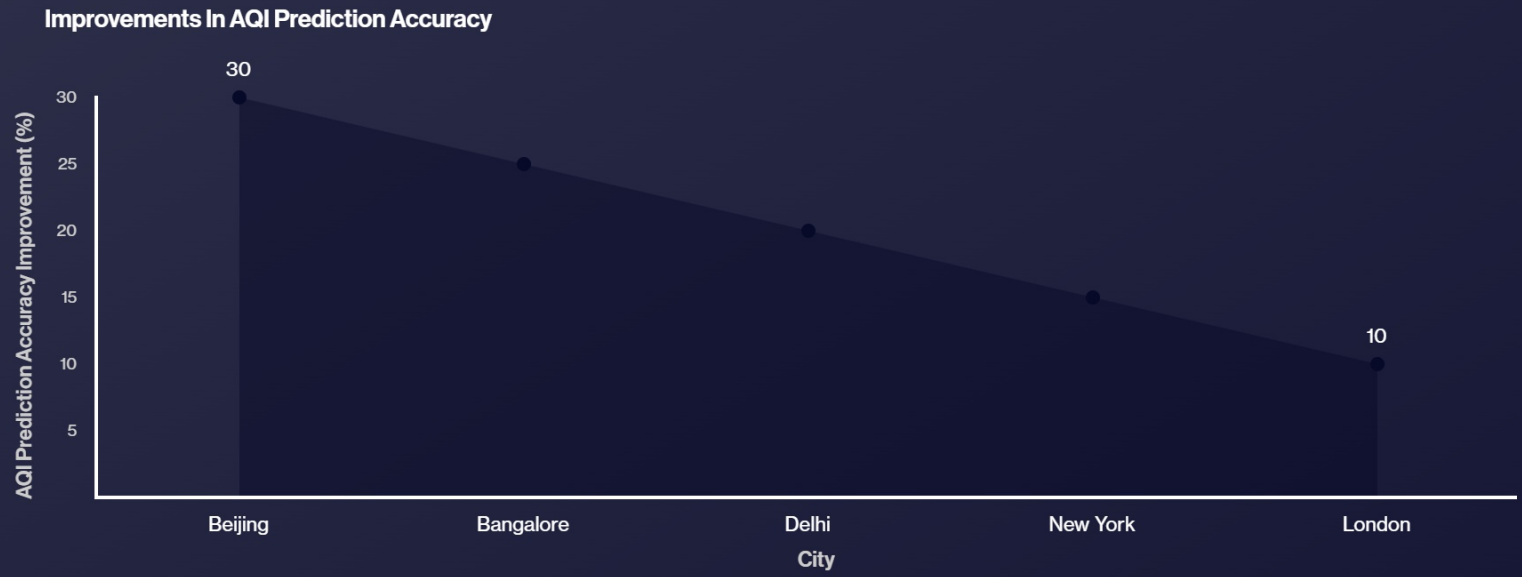
Evaluating Machine Learning Model Performance for Air Quality

Understanding metrics for effective air quality prediction

Metric	Definition	Importance
Root Mean Square Error (RMSE)	Measures average error magnitude	Indicates model prediction accuracy.
Mean Absolute Error (MAE)	Average of absolute differences between predictions and actual values	Provides clear measure of prediction accuracy.
	Represents the proportion of variance for the dependent variable that's explained by the model	Helps in understanding model fit.

Case Studies of Machine Learning for Air Quality Prediction

Successful implementations and their impact on air quality management



Various case studies

Innovative Approaches to Air Quality Prediction Models

Enhancing accuracy and robustness in air quality forecasting through advanced technologies

Real-time Data

Integrating **real-time data sources** like satellite imagery and IoT sensors can provide timely insights into air quality conditions.

AI Advancements

Exploring **advancements in artificial intelligence**, such as **reinforcement learning**, may offer new solutions for urban air quality issues.

Hybrid Models

Developing **hybrid models** that blend **machine learning** with traditional methods can enhance prediction accuracy and robustness.

Effective Strategies for Stakeholder Engagement in Air Quality Initiatives

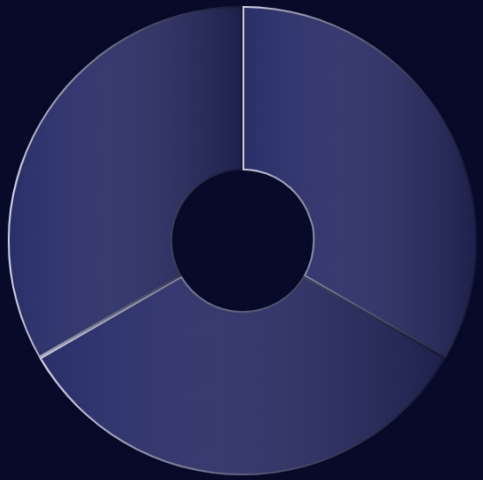
Engaging government, NGOs, and public for better air quality in Delhi

Public Awareness Campaigns

Implement campaigns to highlight the importance of **air quality monitoring** and its impact on health.

Utilizing Social Media and Apps

Leverage **social media** and mobile apps to provide real-time **air quality information** to the public.



Collaborations with Academic Institutions

Partner with academic institutions for **research and development** on air quality solutions.

Let's unite for cleaner air and healthier lives in Delhi

We invite all stakeholders to unite in improving air quality prediction models and executing actionable strategies against pollution in Delhi. By utilizing advanced analytics and engaging the community, we can greatly improve health outcomes and the quality of life for residents. Join us in this essential effort for a healthier environment.

Thank You for Your Attention and Support

We appreciate your engagement and interest in our discussion

Gratitude for participation

Thank you for being here.

Invitation for further questions

Feel free to ask questions.

Acknowledgment of support

Your support is invaluable.