A new approach to 24/7 air quality monitoring using cameras

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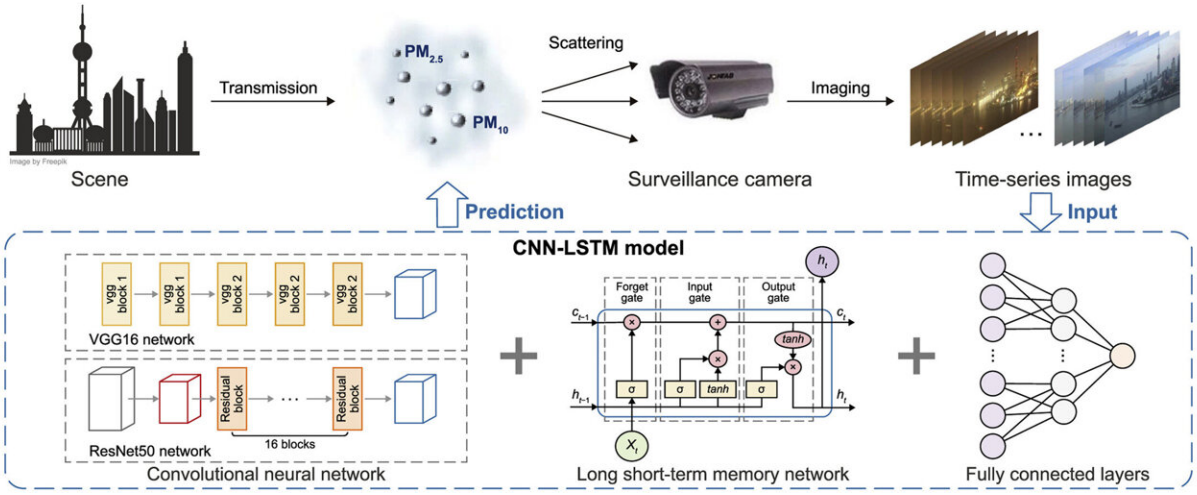

Graphical abstract. Credit: *Environmental Science and Ecotechnology* (2023). DOI: 10.1016/j.ese.2023.100319

Air pollution is a critical global health issue, demanding innovative monitoring solutions. Traditional methods, reliant on ground stations, are expensive and geographically limited, hindering comprehensive coverage. Recent strides in technology have spotlighted the potential of using visual data from surveillance cameras as a cost-effective alternative for air quality assessment.

A new study published in *Environmental Science and Ecotechnology* innovates a hybrid deep learning model that significantly improves

outdoor air quality monitoring using surveillance camera images. This approach enhances air quality estimations, including $PM_{2.5}$ and PM_{10} concentrations and the Air Quality Index (AQI), irrespective of the time of day.

The research team combined Convolutional Neural Networks (CNN) with Long Short-Term Memory (LSTM) networks, creating a model that intelligently captures both the spatial details present in individual images and the temporal dynamics across a sequence of images. This innovative approach is particularly adept at overcoming the longstanding challenge of accurately estimating air quality during nighttime, a period when traditional image-based methods typically falter due to low light conditions.

By analyzing the visual cues in surveillance footage, such as haze and visibility, the model can predict concentrations of particulate matter ($PM_{2.5}$ and PM_{10}) and the AQI effectively, both day and night.

Dr. Xuejun Liu, lead researcher and corresponding author, says, "Our model's ability to accurately estimate air quality from images, regardless of day or night, marks a significant step forward in utilizing technology for environmental monitoring. It opens up new avenues for comprehensive air quality assessment in regions lacking infrastructure."

This research signifies a substantial leap forward in environmental monitoring, showcasing the potential to enhance air quality assessments significantly. It opens the door to more dynamic, cost-effective monitoring solutions that could vastly improve our understanding and management of air pollution on a global scale.

More information: Xiaochu Wang et al, Surveillance-image-based outdoor air quality monitoring, *Environmental Science and Ecotechnology* (2023). DOI: 10.1016/j.ese.2023.100319

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