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Editorial

Special Issue on Air Quality Prediction Based on Machine Learning Algorithms

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Atmospheric pollution is one of the major causes of premature mortality and climate change, as nearly all urban areas fail to comply with the air quality guidelines of the World Health Organization (WHO). This threat could be better managed and eventually tackled by developing accurate models with which to forecast air pollution and warn citizens about the potential risks of elevated pollution episodes.

The traditional predictive approach is based on deterministic models that calculate physical processes and the transport within the atmosphere, also known as chemical transport models (CTMs); however, CTMs are computationally expensive and do not always meet the expected accuracy, especially in regions with complex terrains.

Therefore, machine learning algorithms are increasingly used in the data-driven modeling of pollutant concentrations in nonlinear dynamic urban environments. Although these statistical models do not explicitly simulate chemical processes and transportation, they generally exhibit higher and less costly performance than CTMs for prediction at fine spatiotemporal scales.

This Special Issue is composed of a selection of five recent advanced studies on empirical models with which to estimate the concentration of air contaminants in the atmosphere in addition to technical solutions for improving air quality.

Zainab et al. [1] propose an innovative method using satellite-based white-sky albedo (WSA) to estimate the concentration of black carbon in the Himalaya region. Additionally, the second study makes use of satellite data and combines them with ground-based measurements for predicting air pollution. Zaman et al. [2] built a national-scale model of PM2.5 concentrations via mixing satellite aerosol retrievals, the ground monitoring of meteorological as well as pollutant parameters, and machine learning techniques. The proposed method allows for an estimation of the concentration of atmospheric pollutants through a scattered monitoring network. Both spatial and temporal forecasting are addressed in the third paper. Peralta et al. [3] developed a long short-term memory (LSTM) deep artificial neural network, which is able to forecast the concentrations of fine particulate matter up to 24 h ahead. In a fourth study, Zalakeviciute et al. [4] extend the prediction to the main urban pollutants. The authors investigated the effect of public protests on urban air quality. The impact of an event is precisely quantified thanks to an accurate estimation of the pollution for business-as-usual, based on a weather-normalized and gradient boosting machine methods. Finally, the last paper is not limited to a predictive model, but a potential solution with which to reduce atmospheric pollution. Vaišis et al. [5] present an original study on the properties of an eco-friendly material for filtering air pollutants. In their work, a theoretical model is built to predict air flow purification from a mycelium-based filter.

Even if the development of machine learning algorithms with which to forecast air quality is constantly progressing, this Special Issue covers quite comprehensive and trendy research on a fundamental topic for a sustainable world.

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