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Predicting Locations of Pollution Sources using Convolutional Neural Networks

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ABSTRACT

Pollution is a severe problem today, and the main challenge in water and air pollution controls and eliminations is detecting and locating pollution sources. This research project aims to predict the locations of pollution sources given diffusion information of pollution in the form of array or image data. These predictions are done using machine learning. The relations between time, location, and pollution concentration are first formulated as pollution diffusion equations, which are partial differential equations (PDEs), and then deep convolutional neural networks are built and trained to solve these PDEs. The convolutional neural networks consist of convolutional layers, reLU layers and pooling layers with chosen parameters. This model is able to solve diffusion equations with an error rate of 2.192 percent. With this model, the inverse problem can be solved and pollution sources can be predicted with an error rate of 2.18 percent. This model of convolutional neural network can be applied to locate pollution sources and is thus helpful for pollution analysis and control.

KEYWORDS

Machine learning, convolutional neural network, partial differential equation, pollution diffusion