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Title: Exploring the Digital Frontier of Environmental Data Analysis: Using Models to Identify and Control River Pollution
Abstract:
The expanding urbanization, growing population, and industrial development are threatening global surface water quality. With increasing concern about surface water quality, it is crucial to deeply understand the evolution of surface-water quality problems and comprehensively determine their fundamental driving forces. Digital technologies, such as advanced data analytics, numerical models, and even machine learning, have revolutionized environmental analysis by enabling the processing and analysis of large volumes of data. This provides an opportunity to gain new deep insights into complex hydro-environmental systems and make more informed decisions about how to manage them.

In this work, several advanced analytical methods and models have been applied to determine the source-receptor relationships in surface water pollution and to identify their primary driving forces. Firstly, receptor-based models, including Self-Organizing Map, Positive Matrix Factorization receptor model, and Bayesian multivariate receptor model, based on monitoring surface water pollution data were used to identify and apportion the source contributions to spatiotemporal-distributed metal pollution in rivers. Secondly, source-based dynamic models were used to estimate the unmonitored SARS-CoV-2 and COVID-19 risk transmissions from patients' excrement to water receptors. Lastly, the contributions of various factors to the source-receptor relationships in surface water pollution were analyzed using Wavelet analysis and Bayesian Network. These factors included anthropogenic impacts, environmental disturbances, and even data uncertainties.

This work herein explores the feasibility of digital technologies in environmental analysis and is expected to contribute to a better understanding of surface water pollution and its underlying drivers.