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Remote sensing inversion of water quality in coastal sea area based on machine learning: a case study of Shenzhen bay, China

Xiaotong Zhu[1] and Jinhui Jeanne Huang[2]
[1]Nankai univeristy, college of environmental science and engineering, China (1120200205@mail.nankai.edu.cn)
[2]Nankai univeristy, college of environmental science and engineering, China(huangj@nankai.edu.cn)

Remote sensing monitoring has the characteristics of wide monitoring range, celerity, low cost for long-term dynamic monitoring of water environment. With the flourish of artificial intelligence, machine learning has enabled remote sensing inversion of seawater quality to achieve higher prediction accuracy. However, due to the physicochemical property of the water quality parameters, the performance of algorithms differs a lot. In order to improve the predictive accuracy of seawater quality parameters, we proposed a technical framework to identify the optimal machine learning algorithms using Sentinel-2 satellite and in-situ seawater sample data. In the study, we select three algorithms, i.e. support vector regression (SVR), XGBoost and deep learning (DL), and four seawater quality parameters, i.e. dissolved oxygen (DO), total dissolved solids (TDS), turbidity(TUR) and chlorophyll-a (Chla). The results show that SVR is a more precise algorithm to inverse DO (R^2 = 0.81). XGBoost has the best accuracy for Chla and Tur inversion (R^2 = 0.75 and 0.78 respectively) while DL performs better in TDS (R^2 =0.789). Overall, this research provides a theoretical support for high precision remote sensing inversion of offshore seawater quality parameters based on machine learning.