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Retrieval of Water Quality Parameters in Lake Ontario Based on Hyperspectral Remote Sensing Data and Intelligent Algorithms

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With the increasingly prominent ecological and environmental problems in lakes, the monitoring water quality in lakes by satellite remote sensing is becoming more and more high demanding. Traditional water quality sampling is normally conducted manually and are time-consuming and labor-costly. It could not provide a full picture of the waterbodies over time due to limited sampling points and low sampling frequency. A novel attempt is proposed to use hyperspectral remote sensing in conjunction with machine learning technologies to retrieve water quality parameters and provide mapping for these parameters in a lake. The retrieval of both optically active parameters: Chlorophyll-a (CHLA) and dissolved oxygen concentration (DO), as well as non-optically active parameters: total phosphorous (TP), total nitrogen (TN), turbidity (TB), pH were studied in this research. A comparison of three machine learning algorithms including Random Forests (RF), Support Vector Regression (SVR) and Artificial Neural Networks were conducted. These water parameters collected by the Environment and Climate Change Canada agency for 20 years were used as the ground truth for model training and validation. Two set of remote sensing data from MODIS and Sentinel-2 were utilized and evaluated. This research proposed a new approach to retrieve both optically active parameters and non-optically active parameters for water body and provide new strategy for water quality monitoring.

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