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Integration of artificial intelligence techniques, remote sensing data and field data for simulation of chlorophyll-a concentration in Gorgan Bay

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Chlorophyll-a is an essential component for assessing nutrient content in water resources. Its concentration is influenced by various parameters, including Total Phosphorus (TP), Total Nitrogen (TN), Turbidity (TB), Total Suspended Solids (TSS), temperature, pH and so on. Accurate estimation of chlorophyll-a concentration across different spatial and temporal variations is crucial for assessing the condition of surface water bodies, concerning bacterial and nutrient levels. High chlorophyll-a concentration may compromise aquatic animal health, leading to disease due to increased bacterial concentrations in water.

This study aims to develop an estimation model for chlorophyll-a concentration by integrating artificial intelligence models, remote sensing data and field data. The study area includes Gorgan Bay and its contributing rivers. Initially, field data, including water quality parameters, from the water bodies and nearby rivers is analyzed. In addition to field data, remote sensing data, including chlorophyll-a concentration in the Bay, is obtained from the MODIS satellite sensors. As an artificial intelligence technique, the Random Forest (RF) is selected. The input data of the RF model are, therefore, the climate data, water quality data of the incoming rivers and the Bay and the flow of the incoming rivers. The model output is the chlorophyll-a concentration in the Gorgan Bay. The performance of the model is evaluated using different statistical measures. The different techniques are applied to find the most influential input variables for simulating the chlorophyll-a concentration in the Bay. The developed model is capable of predicting chlorophyll-a concentration, supporting improved water quality management of reservoirs (like bays). It can be utilized in locating optimal natural fish farming areas, managing, preserving aquatic ecosystems and enhancing reservoirs water quality.

Key words: Chlorophyll-a concentration, Artificial intelligence, Random forest, Remote sensing data, Field data.