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APPLICATION OF ARTIFICIAL INTELLIGENCE IN ASSESSING HEAVY METAL POLLUTION IN PERUVIAN LAGOONS: AN INTEGRATED APPROACH WITH SATELLITE IMAGERY AND HEATMAP TECHNIQUES

Abstract

In this work, we introduce an innovative artificial intelligence (AI) model that integrates satellite image analysis and heatmap techniques to assess the concentration of heavy metals in lagoons near mining activities in Peru. Utilizing data collected from monitoring stations across various lagoons, this study focuses on the identification and quantification of various metallic compounds in the water, essential for understanding the environmental impact of mining operations on sensitive aquatic ecosystems.

By creating georeferenced heatmaps, based on periodic water quality measurements, this approach allows for the visualization of the distribution and concentration of metallic pollutants over time. The key innovation of our methodology lies in correlating these maps with high-resolution satellite images obtained from platforms such as Sentinel-2 and Landsat-8, covering all available bands for a comprehensive analysis.

We apply advanced machine learning techniques for cluster analysis, aiming to identify patterns and trends in the distribution of heavy metals. This process not only enhances accuracy in detecting critical areas affected by pollution but also facilitates the evaluation of temporal changes in water quality.

Preliminary results demonstrate the potential of our model to serve as a crucial tool in environmental management and decision-making, offering a detailed and updated perspective on heavy metal pollution in Peruvian lagoons. This study proposes a replicable and scalable methodology that can be applied in different geographical contexts, significantly contributing to conservation and environmental remediation efforts.