Machine Learning-based Framework for Management of Water Contamination from Abandoned Mines

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ABSTRACT

Following mine closure, mineral exposure to the environment increases, posing a threat to aquatic life as contaminants migrate to surface water through runoff. Managing mining-affected water resources is a complex process, requiring a multidisciplinary approach due to site-specific variations. The limited water quality monitoring infrastructure intensifies contamination risks in Australia's expansive catchments. It is essential to develop an advanced technology-based framework for effectively managing river catchments polluted by mining activities.

Machine Learning (ML) has gained widespread attention in environmental studies, particularly for water resources management. ML-based models offer cost-effective solutions in areas lacking monitoring stations, optimizing the available ones, aiding informed catchment management decisions. While many ML-based water quality models focus on various contexts, few address mining-polluted rivers, and a distinct research void persists in the Australian context, specifically concerning the management of rivers near abandoned mining areas.

This research proposes the development of a ML-driven comprehensive framework for managing mining-impacted catchments in Australia, with a focus on the Loddon River catchment, considering watershed characteristics and climate patterns. The primary objective of the planned framework is to pre-empt the impact of abandoned mines on rivers through a systematic approach encompassing essential steps such as establishing water quality monitoring in the catchment, measurement, collection, prediction, validation, location optimization, and remediation. This multi-faceted approach is designed to enhance the resilience and sustainability of river ecosystems facing the ongoing challenges posed by abandoned mining legacies.