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DEVELOPING A RELIABLE MONITORING FRAMEWORK TO DETECT ENVIRONMENTAL CHANGES NEAR MINING AREAS: A REMOTE SENSING APPROACH

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Agriculture and mining are two key industries that govern the growth of the socio-economic systems of a country. Detrimental effects on the socio-environment during mining activities are unavoidable. Hence, a proper balance between social, environmental, and economic aspects needs to be promoted in mining industries. Developing robust real-time monitoring systems will prevent overexploitation of resources, negative impact on the socio-environmental system, illegal mining activities, and abandoned mines without proper reclamation. This study aims to recommend utilising no-cost satellite data to assess effects on the environment due to mining. Further, the machine learning approach in this study is expected to lead to an autonomous real-time monitoring mechanism. Based on accessibility and stakeholder interest, a cluster of abandoned and operating quarry sites in the Anuradhapura District, Sri Lanka, was selected as the study area. Freely available high spatial resolution satellite images were obtained from Google Earth and Copernicus Open Access Hub (Sentinel 2 satellite data). Imageries acquired were subjected to object-based land cover classification. Machine learning algorithms, namely, Decision Tree, Random Forest, and Support Vector Machine, were used in the classification process. The best performing algorithm in land cover classification was chosen for multi-temporal analysis of the area of interest. In addition, false colour composites and spectral indices were generated using Sentinel 2 images to differentiate human-induced negative impacts and natural changes. The results show that Support Vector Machine outperformed other algorithms in classifying land cover near mining areas. Further, multitemporal analysis of land cover changes using this algorithm implies autonomous monitoring using satellite data was viable. Additionally, auxiliary information such as false colour composites and spectral indices confirmed that the increased proportion of water bodies in the area was due to leaving the abandoned mines without proper rehabilitation. This study provides evidence that the fusion of machine learning based classification with spectral indices helps develop robust monitoring systems.

Keywords: Machine Learning, Mining, Multitemporal analysis, Real-time monitoring, Satellite Data