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Machine-learning algorithms for mapping LULC of the uMngeni catchment area, KwaZulu-Natal

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Abstract: Analysis of land use/land cover (LULC) in the catchment areas is the first action toward safeguarding the freshwater resources. The LULC information in the watershed has gained popularity in the natural science field as it helps water resource managers and environmental health specialists develop natural resource conservation strategies based on available quantitative in-formation. Thus, remote sensing is the cornerstone in addressing environmental-related issues at the catchment level. In this study, the performance of four machine learning algorithms (MLAs), such as Random Forests (RF), Support Vector Machine (SVM), Artificial Neural Networks (ANN), and Naïve Bayes (NB) was investigated to classify the catchment into nine rele-vant classes of the undulating watershed landscape using Landsat 8 Operational Land Imager (L8-OLI) imagery. The assessment of the MLAs were based on the visual inspection of the analyst and the commonly used assessment metrics, such as user's accuracy (UA), producers' accuracy (PA), overall accuracy (OA), and kappa coefficient. The MLAs produced good results, where RF (OA= 97.02%, Kappa= 0.96), SVM (OA= 89.74 %, Kappa= 0.88), ANN (OA= 87%, Kappa= 0.86), and NB (OA= 68.64 Kappa= 0.58). The results show the outstanding performance of the RF model over SVM and ANN with a small margin. While NB yielded satisfactory results, which could be primarily influenced by its sensitivity to limited training samples. In contrast, the robust per-formance of RF could be due to an ability to classify high-dimensional data with limited train-ing data.
Keywords: uMngeni River Catchment; Machine learning; LULC; Landsat 8; Remote sensing

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