Evaluation of Machine Learning Algorithms in Classifying Multispectral Imagery on Waterbody Extraction

K Brinthan, T Thanujan*, S Thiruchittampalam and CL Jayawardena
Department of Earth Resources Engineering, University of Moratuwa, Sri Lanka
*thanujan@agaram.lk

A comprehensive study for utilizing multispectral satellite imagery to enhance novel environmental monitoring techniques is crucial in terms of accuracy, processing time, and cost for a sustainable triple bottom. The accurate classification of water bodies from other features optimizes spatiotemporal analysis to address global challenges. Therefore, this study emerges as the new research frontier in proposing an apt algorithm for recognizing water resources and coastline in Sri Lanka. This study explores the potential of using classification algorithms for geospatial assessments and applications with their accuracy and reliability. The acquired Collection 2 Level 2 Landsat 8 imagery was geometrically and radiometrically pre-processed, and a false-colour composite was produced from the bands: short-wave infrared, red and near-infrared. A total of 280 training samples were created with the reference pixels of 50.13 percent for water bodies and 49.87 percent for other features. The confusion matrix was generated using a distinct set of 500 random points for each classification technique, and the F-score and kappa coefficient were calculated for the accuracy assessment. The study depicts that the supervised algorithms: Support Vector Machine, Maximum Likelihood and Random Trees, and unsupervised algorithm: ISO Cluster performs equally in classifying water bodies and other features with higher kappa coefficient exceeding 0.95. Out of these, ISO Cluster was efficient than other algorithms due to reduced handling time. The findings enhance the decision-making ability on extracting surface water bodies using freely available 30 m spatial resolution imagery.

Keywords: *Classification Algorithms, Kappa Statistics, Multispectral Imagery, Waterbody Extraction*