Decision Tree Regression Approach for Detecting Spatiotemporal Changes of Vegetation Cover in Surface Water Bodies

[*]Dassanayake[1] SM, Jayawardena[2] CL and Dissanayake[2] DMDOK

[1]School of Engineering, Monash University, Malaysia

[2]Department of Earth Resources Engineering, University of Moratuwa, Sri Lanka

*Corresponding author – sandund@ieee.org

Surface water bodies in urban areas, such as Bolgoda lake, show complex vegetation dynamics, typically noticeable by the fluctuating vegetation cover throughout the year. Primary factors governing these fluctuations include wastewater discharge, anthropogenic activities (e.g., surface mining), invasive plant growth, and climate change. It is exceptionally challenging to physically measure and monitor these dynamics over the spatial extent of these waterbodies consistently over many years. Recent studies have explored the potentials of employing satellite imagery to quantitatively detect spatiotemporal changes of surface water vegetation cover. Such attempts have utilised vegetation detection indices, such as the normalised vegetation index (NDVI), to classify the vegetation cover with significant statistical accuracy. However, these conventional geospatial analyses require substantial computational power. They are limited to small timescales and spatial extents. This study employs the computational power of the google earth engine to address this limitation. Moreover, it integrates a machine learning classification approach, namely decision tree regression, to monitor the vegetation cover change over coarser and finer temporal resolutions using Landsat 8 hyperspectral imagery. Initially, NDVI classification was performed on 390 Landsat 8 images acquired throughout 2013-2021. Five locations, which represent different vegetation cover characteristics on the lake, were selected to generate the time series of the NDVI classified values. The results show that the vegetation cover varies at two temporal frequencies. The annual variation of the water, vegetation, and non-vegetation classes are undetectable. However, vegetation dynamics fluctuate rapidly at a finer temporal resolution (i.e., on monthly cycles). The statistically significant results claimed in this study will be further explored to support policymakers in optimising environmental resource management strategies and prioritising eco-preservation that can enhance the health and productivity of urban surface water bodies.

Keywords: Google Earth Engine, Decision Tree Regression, Invasive plants, Surface water bodies