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Automated classification of a tropical landscape infested by Parthenium weed (Parthenium hyterophorus)

Zolo Kiala

University of KwaZulu-Natal, Pietermaritzburg, South Africa

Abstract

The invasive Parthenium weed (Parthenium hyterophorus) adversely affects animal and human health, agricultural productivity, rural livelihoods, local and national economies, and the environment. Its fast spreading capability requires consistent monitoring for adoption of relevant mitigation approaches, potentially through remote sensing. To date, studies that have endeavoured to map the Parthenium weed have commonly used popular classification algorithms that include Support vector machines and Random forest classifiers, which do not capture the complex structural characteristics of the weed. Furthermore, determination of site or data specific algorithms, often achieved through intensive comparison of algorithms, is often laborious and time consuming. Also, selected algorithms may not be optimal on datasets collected in other sites. Hence, this study adopted the Tree-based Pipeline Optimization Tool (TPOT), an automated machine learning approach that can be used to overcome high data variability during the classification process. Using Sentinel-2 and Landsat 8 imagery to map Parthenium weed, wee compared the outcome of the TPOT to the best performing and optimized algorithm selected from sixteen classifiers on different training datasets. Results showed that the TPOT model yielded a higher overall classification accuracy (88.15%) using Sentinel-2 and 74 % using Landsat 8, accuracies that were higher than the commonly used robust classifiers. This study is the first to demonstrate the value of TPOT in mapping Parthenium weed infestations using satellite imagery. Its adoption would therefore be useful in limiting human intervention while optimising classification accuracies for mapping invasive plants. Based on these findings, we propose TPOT as an efficient method for selecting and tuning algorithms for Parthenium discrimination and monitoring, and indeed general vegetation mapping.

Biography:

Zolo Kiala received the M.Sc. degree (cum laude) in Science from the University of KwaZulu-Natal, Pietermaritzburg, South Africa, and is currently pursuing the Ph.D. degree specializing in mapping and monitoring invasive alien plants. His research interests include hyper and multispectral remote sensing applications in range land ecology, natural vegetation and field crops

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