Advanced Processing of UPM-APSB's AISA Airborne Hyperspectral Images for Individual Timber Species Identification and Mapping

ABSTRACT

UPM-APSB's AISA airborne hyperspectral imaging offers the possibility of identifying and characterizing commercial and non-commercial individual timber species in the Malaysian tropical high mountain forests on the basis of the unique reflectance patterns that result from the interaction of solar energy with the molecular structure of the tree crowns. In this paper, a seminal view on recent advances in techniques for hyperspectral data processing was provided. It examines the performance of image processing techniques specifically developed for hyperspectral data in the context of individual timber species inventory mapping applications. The area chosen, located in Berangkat Forest Reserve, Kelantan near the locality of Kompleks Perkayuan Kelantan sawmill, had relatively virgin dense forest stand density at the time of imagery acquisition (dry month). The main focus is on the development of approaches able to naturally integrate the spatial and spectral information available from the hyperspectral data. Special attention is paid to techniques that circumvent the curse of dimensionality introduced by high-dimensional data spaces. Image processing was carried out in two steps, namely data conversion from radiance units to reflectance using a radiative transfer method and application of the mapping algorithm, specifically designed for identifying superficial materials based on similarities between image pixels and spectra from a spectral library of timber species. Experimental results, focused in this work on a specific case-study of individual timber species data analysis, demonstrate the success of the considered techniques. The results show that UPM-APSB's AISA airborne hyperspectral imaging can identify 22 individual species in Block 53, Berangkat F.R and separated damar from non-damar group of species. Kelat constituted the highest count of species (1,402) mapped followed by Kedondong (1,185 trees), Medang (1,116 trees) and others out of the total 13,861 trees. It is therefore a valuable tool for mapping and quantification of individual tree in tropical dense virgin forested regions. This paper represents a first step towards the development of a quantitative and comparative assessment of advances in UPM-APSB's AISA airborne hyperspectral data processing techniques.

Keyword: Hyperspectral, Individual tree, Mapping, Advance processing