Data Fusion of Airborne Hyperspectral and Full Waveform LiDAR Data for Land Cover Classification

Kuei-Chia Chen[1], Chun-Yu Liu[1], Chi-Kuei Wang[1*], Hone-Jay Chu[1], Guo-Hao Huang[1]

[1]Department of Geomatics, National Cheng Kung University, No. 1, University Road, Tainan City 701, Taiwan

*Corresponding author: chikuei@mail.ncku.edu.tw

ABSTRACT

Land use classification is vital in understanding ecosystems and evaluating nature sources. Substantial studies have been done on employing the reflectance spectra from hyperspectral images to classify land cover. It is known that the full waveform LiDAR system can obtain the high-precision 3D elevation information, and the shape of the waveform packet describes the characteristics of the surface. In this study, we present an efficient approach that integrates hyperspectral images and full waveform Lidar data for detecting land use clusters.

Our study area is located in upper stream of Tsengwen Reservoir watershed in Taiwan. The 72-band hyperspectral data were obtained by an Itres CASI-1500 with a pixel resolution of 2 m. The spectrum range of Itres CASI-1500 is between 362.8 and 1051.3 nm, and the spectral resolution is 9.6 nm. The Lidar data were acquired by an ALTM Pegasus with a point density of 2 points/m^2.

We employed Minimum Noise Component (MNF) and Principal Components Analysis (PCA) for data fusion of multivariate statistical models. Based on fused data, Maximum Likelihood was applied to image classification. The classification results showed that fusing the full waveform LiDAR data and the hyperspecrtal data can slightly increase the classification accuracy.

Keywords：Full waveform lidar systems, Hyperspectral imaging, Image fusion, Principal component analysis, Minimum noise fraction