Improving detailed rule-based feature extraction of urban areas from WorldView-2 image and lidar data

ABSTRACT

Urbanization is commonly accepted as an important contributor to the growth of man-made structures and as a rapid convertor of natural environments to impervious surfaces. Roofs are one class of impervious surface whose materials can highly influence the quality of urban surface water. In this study, two data sources, WorldView-2 (WV-2) imagery and a combination of WV-2 and lidar data, were utilized to map intra-urban targets, with 13 classes. Images were classified using object-based image analysis. Pixel-based classifications using the support vector machine (SVM) and maximum likelihood (ML) methods were also tested for their abilities to use both lidar data and WV-2 imagery. ML and SVM classifications yielded overall accuracies of 72.46% and 75.69%, respectively. The results of these classifiers exhibited mixed pixels and salt-and-pepper effects. Spectral, spatial, and textural attributes as well as various spectral indices were employed in the object-based classification of WV-2 imagery. Feature classification of WV-2 imagery resulted in 85% overall accuracy. Lidar data were added to WV-2 imagery to assist in the spatial and spectral diversities of urban infrastructures. Classified image made from WV-2 imagery and lidar data achieved 92.84% overall accuracy. Rule-sets of these fused datasets effectively reduced the spectral variation and spatial heterogeneities of intra-urban classes, causing finer boundaries among land-cover classes. Therefore, object-based classification of WV-2 imagery and lidar data efficiently improved detailed characterization of roof types and other urban surface materials.

Keyword: WorldView-2; Lidar; Object based image analysis; Object-based classifications