Maximizing urban features extraction from multi-sensor data with Dempster-Shafer theory and HSI data fusion techniques

ABSTRACT

This paper compares two multi-sensor data fusion techniques – Dempster-Sharfer Theory (DST) and Hue Saturation Intensity (HSI). The objective is to evaluate the effectiveness of the methods interm in space and time and quality of information extraction. LiDAR and hyperspectral data were fused using the two methods to extract urban land scape features. First, digital surface model (DSM), LiDAR intensity and hyperspectral image were fused with HSI. Then the result was classified into five classes (metal roof building, non-metal roof building, tree, grass and road) using supervised classification (minimum distance) and the classification accuracy assessment was done. Second, Dempster Shafer Theory (DST) utilized the evidences available to fuse normalized DSM, LiDAR intensity and hyperspectral derivatives to classify the surface materials into five classes as before. It was found out that DST perform well in the ability to discriminate different classes without expert information from the scene. Overal accuracy of 87% achieved using DST. While in HSI technique, the overal accuracy obtained was 74.3%. Also, metal and non-metal roof types were clearly classified with DST which, does not have a good result with HSI. A fundamental setback of HSI is its limitation to fusion of only two sensor data at a time whereas we could integrate different sensor data with DST. Besides, the time required to select trainimg site for supervised classificition, the accuracy of feature classification with HSI fused data is dependent on the knowledge of the analyst about the scene with the other one. This study shows DST to be an accurate and fast method to extract urban features and roof types. It is hoped that the increasing number of remote sensing technology transforming to era of redundant data will make DST a desired technique available in most commercial image processing software packages.

Keyword: Data fusion; Feature extraction; Urban mapping; Hyperspectral; LiDAR