FUSION OF HYPERSPECTRAL AND LIDAR DATA FOR TREE SPECIES CLASSIFICATION

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Abstract: Tree species classification is one of the most important applications in remote sensing. Since hyperspectral sensors have a lot of observation bands and high spectral resolution, we can obtain a continuous spectrum that enables more detailed analysis. The information of heights and shapes derived from LiDAR data is very useful as well. In this study, we propose a novel method to classify tree species using hyperspectral and LiDAR data. The method consists of shadow correction, individual tree crown delineation and classification by kernelized support vector machine (SVM). There are many shadows in forests and they affect classification results. Therefore, we modify shadows in hyperspectral data by unmixing. Individual tree crown delineation is achieved by a local maxima and region growing method after smoothing for a LiDAR derived canopy height model (CHM). The input variables of SVM classifiers are principal components of hyperspectral data and the canopy height, namely, the highest value of CHM in the canopy including the pixel. We applied this method to the hyperspectral and LiDAR dataset taken over Tama Forest Science Garden in Tokyo. There are more than 90 species of trees in the test site. After eliminating some classes in which few pixels exist, we classified the data into 18 classes. As a result, shadow correction increased the classification accuracy by 3%, and the accuracy was 5% higher than that of the method using hyperspectral data only. We showed that our method was effective in tree species classification.

Keyword: classification, data fusion, hyperspectral image processing, LiDAR