Paper ID: 38857
student

EARTH OBSERVATION SYMPOSIUM (B1)
Interactive Presentations (IP)

Author: Mr. Josselin Aval
SUPAERO- Ecole Nationale Supérieure de l'Aéronautique et de l'Espace, France

URBAN TREE SPECIES CLASSIFICATION WITH AIRBORNE HYPERSPECTRAL VNIR AND SWIR, PAN AND DSM DATA BY FUSION AT THE OBJECT LEVEL

Abstract

For a given urban scene, the urban tree map can be defined as the knowledge for each tree of the scene over time of position, delineation, species, health, etc. This map allows regular monitoring of the trees and a consistent tree planting with existing and environmental issues. Indeed, tree infrastructures can locally decrease temperature and improve air quality in dense and polluted cities during heatwave (Yin et al., 2011). These properties are related to species making it an information of interest. Nowadays the operational procedure for species classification is based on field campaign which does not allow to cover large scales regularly. Remote sensing is a good candidate to automate this procedure (Alonzo et al., 2014).

We use airborne hyperspectral VNIR (Visible Near-Infrared) and SWIR (Short-Wavelength Infrared), PAN (panchromatic) and DSM (Digital Surface Model) data. Our study investigates the potential of a decision level fusion at the object level to classify 20 tree species in Toulouse, France. A species predictor was first built for each data whose physics and resolutions are different (VNIR (160 spectral bands, 0.4 m), SWIR (256 spectral bands, 1.6 m), PAN (14 cm) and DSM (12.5 cm)). The VNIR and SWIR predictors use spectral reflectance at the original resolution and SVM (Support Vector Machine) whereas the PAN and DSM predictors use respectively Haralick's and geometric features computed on sets of windows defined within a crown and RF (Random Forest). After the computation of a decision profile for each predictor at the object level based on the classifiers continuous outputs, they are stacked and a decision rule is applied to predict the species. The proposed method is general because it can integrate any predictor. In addition, it takes into account the performances of each predictor.

In our context, the main result is that the fusion does not improve significantly the overall accuracy with 67 % (kappa = 64.1) against 66.3 % (kappa = 63.6) for the VNIR predictor. Whereas the VNIR predictor is nearly the best for all the species and efficient for 14 species out of 20, the SWIR predictor classifies only one species as the best (Tilia x vulgaris) and is efficient for 7 common species with the VNIR predictor. The PAN and DSM predictors contribute marginally but are respectively the best for Platanus x hispanica and Taxus baccata.

Keywords: urban tree species classification, remote sensing, predictor, fusion