Research position in hyperspectral Remote Sensing and image processing

Projet TOSCA-CNES URBHYP

Partners: LIVE, ONERA

Duration : 12 months

Description of the position

The improvement of Earth observing-instruments capabilities enables the study of urban environment, especially for urban planning purposes. In fact, urban environment requires a high spatial resolution configuration (better than 5 m) to identify the scene elements (buildings, streets…) and a rich spectral configuration to differentiate between natural and manmade materials, which are specific of urban areas.

The future space borne mission HYPXIM combines a high spectral resolution instrument between 0.4 and 2.5 µm (hyperspectral camera, 8m) and a high spatial resolution instrument (panchromatic camera, 2m). Thus it can be used to study objects smaller than 5 m and to differentiate the between materials present in urban areas.

However, in order to reinforce the HYPXIM mission, its contribution to the study of urban planning should be analyzed in comparison to the capabilities of other future and current space borne missions. So, the objective of the proposed work is to compare the performance of a hyperspectral sensor, like HYXIM, with the performance of the following sensors: Pleiades, Sentinel-2 and WorldView-3. These instruments have been chosen because of their different spectral and spatial configurations. Pleiades has a high spatial resolution (2 m for its multispectral mode) and a coarse spectral response covering the VNIR region. The spatial resolution of Sentinel-2 bands varies between 10 m to 60 m, covering the VNIR and SWIR regions. Finally, WorldView-3 has 8 bands in the VNIR (ground sample distance –GSD– of 1m) and 8 in the SWIR (GSD of 3.7 m).

Because of urban planning purposes, the study will focus on the classification of urban surfaces. Nevertheless, the classification performance is highly influenced by the presence of shade and an appropriate atmospheric compensation over this area is needed to improve the results. Three methods of atmospheric correction both at sunny and at shaded areas, have been developed by the ONERA lab and can be used to improve urban classification. Different assumptions are considered for each compensation method: flat surface hypothesis (COCHISE code); consideration of the 3D effect from a known digital surface model (ICARE code); and empirical differences according to the sunlight level.

This work is part of the URBHYP project (TOSCA-CNES action) and it is organized into several tasks:

- Simulation of the spaceborne images from airborne data using the Comanche code, developed by the ONERA lab,
- Evaluation of the three atmospheric correction methods for each instrument configuration,
- Classification of the urban area from the different sensors reflectance images.

The data available to carry out the study are hyperspectral airborne images over Toulouse (France) acquired during 2012 and 2014 experiments.

Required qualification: PhD in radiative transfer, remote sensing data processing
Start date: June 2015
Place: ONERA DOTA, Toulouse (France)
Contacts: Christiane Weber (christiane.weber@live-cnrs.unistra.fr, phone : +33 368850966) or Xavier Briottet (Xavier.Briottet@onera.fr, phone : + 33 562252605)