Master 2 Internship Topic

# Large-Scale Remote Sensing Image Classification

**Context:** The latest generation of satellite-based imaging sensors (Pleiades, Sentinel, etc.) acquires ***big volumes of Earth's images*** with high spatial, spectral and temporal resolution (up to 50cm/pixel, 50 bands, twice per day, covering the full planet!). These data open the door to a large range of important applications, such as the planning of urban environments and the monitoring of natural disasters, but also present new challenges, related to the ***efficient processing of high volumes of data with large spatial extent***.

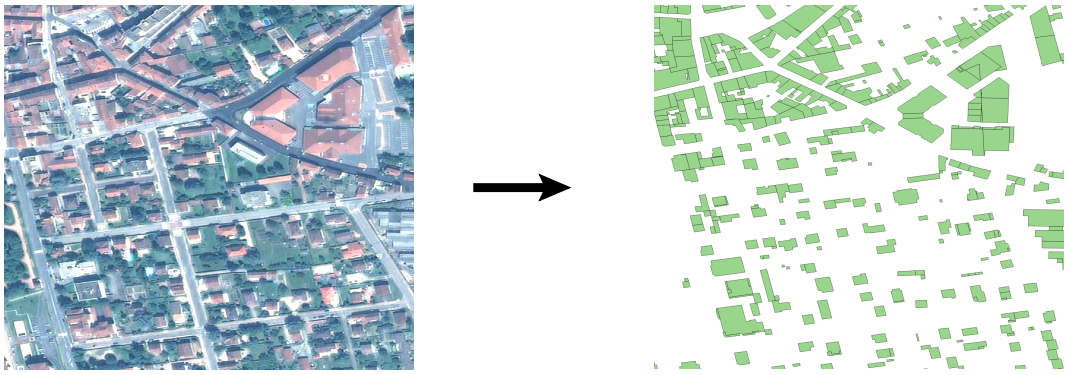

**Fig. 1**: Example of a satellite high-resolution image (©CNES) and building segmentation.

**Subject:** In this project, we focus on multi-scale segmentation of ***large-scale remote sensing images*** into meaningful regions, i.e. delineating the contours of the objects in the image (*segmentation*) and estimating to which category they belong (*classification*), as in Fig. 1 above. In the state-of-the-art, graph-based techniques such as **B**inary **P**artition **T**rees (BPTs) and graph-cut have proven to be very efficient to segment high-resolution images. On the other side, convolutional neural networks (deep learning) have been proven to perform extremely well for object classification. We will use the most recent advancements in computer vision for accurate segmentation of satellite images.

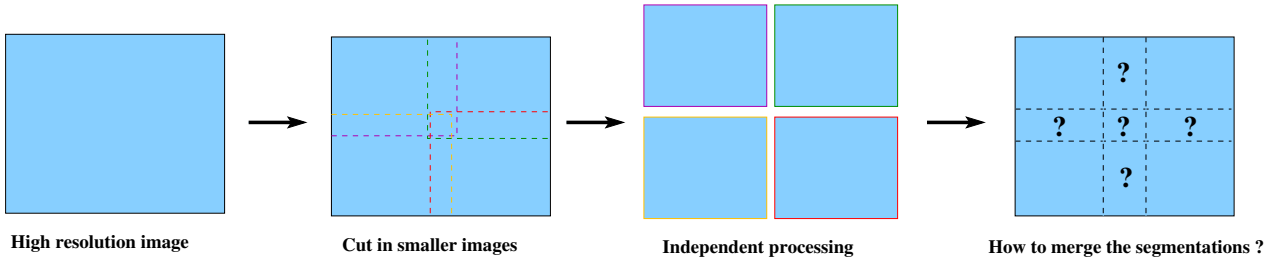


**Fig. 2**: Example of scheme for large-scale image processing.

The current approach to segment large-scale remote sensing images of the Earth consists in splitting the Earth surface into small tiles and processing the image of each tile separately from other tiles (as in Fig. 2 e.g.). The aim of the internship is to find the most ***efficient way*** (from accuracy, computational and memory points of view) to apply ***a hierarchical segmentation and classification for large-scale remote sensing data***. The work will thus consist in

designing new graph-based models and algorithms, which would enable processing of very large images by blocks. Fig. 2 illustrates one of several possible schemes for large-scale image processing.

**Validation:** The developed algorithms will then be validated for analysis of Pleiades multispectral remote sensing images with very high spatial resolution.

**Requirements** for the Master 2 student:

- Good knowledge of image processing, optimization and algorithms
- Very good C++ coding skills
- Fluency in English

**Location:** Inria Sophia-Antipolis Méditerranée, Sophia-Antipolis, France

**Duration:** 6 months

**Research teams:** TITANE, Inria Sophia-Antipolis Méditerranée, in collaboration with TAO, Inria Saclay

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