

Ph.D. topic 2014
Deep-Learning for Satellite Imagery

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Presentation of the Ph.D. topic

We are inundated by a huge amount of satellite image data such as optical images, hyperspectral images, and synthetic aperture radar (SAR) that are captured every day at different places. Geospatial information needs to be extracted from these “big data” timely and accurately before they can become more valuable and sellable for different applications and services, whereas it is nearly an impossible task for humans to manually extract the geospatial information from such big data. This PhD project aims to develop novel visual semantic mining technologies that automatically and efficiently extract geospatial information from the satellite imagery with as little human intervention as possible.

Expected deliverables

Different algorithms will be developed to tackle the challenge of automatic identification of different features like vegetation coverage or land parcel usage from satellite images. Novel visual features will be designed to extract discriminative color, intensity, and texture information. Advanced deep learning and semantic segmentation techniques will be investigated for various land coverage classification problems. In addition, relevant applications will be investigated based on the land coverage classification results, specifically in the detection of different types of anomalies and changes in the vegetation coverage and land parcel usage aspects.

Two specific types of geospatial information will be investigated. The first is **Vegetation Coverage** which quantifies the



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amount of vegetation coverage as well as the type and quality of vegetation coverage. Such information is very useful to answer questions like, “What is the extent of green coverage in land region X?”, “What is the breakdown of vegetation coverage in land region X in terms of actively managed and spontaneous vegetation?”, etc. The second is **Land Parcel Usage** which aims to understand how each land parcel is being used, e.g., reflecting the status of development, such as “forested”, “vacant”, “under construction” or “developed” as well as the actual usage, such as “residential”, “commercial”, “industrial”. Such information can answer questions like “What percentage of land parcels are undergoing construction?”, “Is there any deviation from the Master Plan in land parcel X?”, etc.

Two types of research results are expected at the end of this PhD project. One is at technical side in novel visual feature design, new deep learning algorithm design, and semantic segmentation algorithm design. The other is at application side which focuses more on the application of the developed algorithms for specific tasks such as anomaly detection and change detection. All research results need to be recorded and written in reports and papers, targeting possible publications in international conferences and journals.

Keywords

Satellite Imagery, Land Coverage, Deep Learning, Anomaly/Change Detection

Applicant profile

- Master Degree or Engineer Student (last year of studies)
- Skills in programming in Matlab, Java, or C++
- Notions in neural network classification.
- Strong motivation for research
- Open to work with both French and Singaporean scientists
- Availability for starting October 2014

Gratification: Compliant to French Regulation on Ph.D. students (Contrat doctoral)

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