Image processing for Earth observation

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Summary
This course covers optical remote sensing from satellites and airborne platforms. The different systems are presented. The students will acquire skills in image processing and machine/deep learning to extract end-products, such as land cover or risk maps, from the images.

Content
Courses content:
1. Basic concepts of remote sensing and digital imaging
2. Platforms and sensors
3. Information extraction, filtering, visual information
4. Image classification, with machine and deep learning algorithms
5. Project: study a real problematic using remote sensing and image processing techniques.

Keywords
Imagery, remote sensing, image processing, signal processing, machine learning, deep learning, satellites

Learning Prerequisites
Recommended courses
Machine learning CS-433

Important concepts to start the course
Intermediate skills in Python programming are considered a pre-requisite. All the exercises will be in Python.

Learning Outcomes
By the end of the course, the student must be able to:
• Describe remote sensing systems
• Describe applications of remote sensing
• Select appropriately the relevant system for a given application
• Perform image classification
• Perform information extraction
• Implement a processing chain to solve a real problem
Transversal skills

- Use a work methodology appropriate to the task.
- Continue to work through difficulties or initial failure to find optimal solutions.
- Access and evaluate appropriate sources of information.
- Collect data.
- Make an oral presentation.
- Write a scientific or technical report.
- Assess progress against the plan, and adapt the plan as appropriate.
- Use both general and domain specific IT resources and tools.

Teaching methods

Lessons ex-cathédra (2/3)
Exercise sessions and group project (1/3)

Expected student activities

- Following classes
- exercises (individual or in small groups)
- preparing presentations
- reading club or research papers
- final projects in small groups

Assessment methods

- Mid-term written test (50% of the final mark)
- Project report (50% of the final mark)

Resources

Bibliography

- R. Caloz, C. Collet, Precis de Télédétection Volume 3: Traitements numériques d'images de télédétection, Presses Universitaires du Québec

  http://www.morganclaypool.com/doi/abs/10.2200/S00392ED1V01Y201107IVM012

Ressources en bibliothèque?

- Precis de Télédétection Volume 3 / Caloz
- Remote Sensing Image Processing, Morgan and Claypool / Camps-Valls

Ressources en bibliothèque

- Précis de télédétection. Vol. 3 / Calos
- Remote sensing image processing / Camps-Valls

Websites
• http://www.oneonta.edu/faculty/baumanpr/geosat2/RS-Introduction/RS-Introduction.html
• http://www.crisp.nus.edu.sg/~research/tutorial/process.htm
• http://earthexplorer.usgs.gov/
• https://scihub.copernicus.eu/dhus/
• http://apps.sentinel-hub.com eo-browser

Moodle Link
• https://go.epfl.ch/ENV-540