ENV-540

Image processing for Earth observation

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Cursus	Sem.	Type
Civil & Environmental Engineering		Opt.
Digital Humanities	MA1, MA3	Opt.
Environmental Sciences and Engineering	MA1, MA3	Opt.
Minor in Imaging	H	Opt.
Space technologies minor	H	Opt.
Territories in transformation and climate minor	H	Opt.
Urban Planning and Territorial Development minor	H	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	During the semester
Workload	120h
Weeks	14
Hours	**3 weekly**
Lecture	2 weekly
Exercises	1 weekly
Number of positions	

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

- G. Camps-Valls, D. Tuia, L. Gomez-Chova, S. Jmenez, J. Malo, Remote Sensing Image Processing, Morgan and Claypool, available (on EPFL site)
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 / Caloz, Collet
-
- 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