ENV-408

Sensing and spatial modeling for earth observation

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Cursus	Sem.	Type
Civil & Environmental Engineering		Opt.
Environmental Sciences and Engineering	MA2, MA4	Opt.
Minor in Imaging	E	Opt.
Minor in statistics	E	Opt.
Statistics	MA2, MA4	Opt.
Systèmes urbains	MA2, MA4	Opt.

Language of teaching	English
Credits	5
Session	Summer
Semester	Spring
Exam	Written
Workload	150h
Weeks	14
Hours	**5 weekly**
Courses	2 weekly
Exercises	2 weekly
Lab	1 weekly
Number of positions	

Summary

Students get acquainted with the process of mapping from images (orthophoto and DEM), as well as with methods for monitoring the Earth surface using remotely sensed data. Methods will span from machine learning to geostatistics and model the spatiotemporal variability of processes.

Content

The course is organized in three main parts.
1. 3D reconstruction from images
- Processes of image creation
- Image matching, orientation and camera calibration
- Construction of digital elevation models (DEM) and orthophotos

2. Environmental monitoring with machine learning
- Extracting features from elevation or image data
- Prediction with linear and nonlinear regression

3. Geostatistics:
- Definitions and spatial context
- Structural analysis
- Interpolation using kriging

Keywords

Geostatistics, spatial variability, variograms, kriging interpolation

Learning Prerequisites

Recommended courses

Basic statistics

Important concepts to start the course

Good Python programming skills are required

Learning Outcomes

By the end of the course, the student must be able to:

- Explain pipelines of image acquisition and their conversion to 3D models
- Assess / Evaluate problems related to spatial correlation
- Design solutions to address those
- Implement state of the art geostatistical and machine learning approaches in Python
- Establish 3D model from captured imagery.
- Analyze various properties of obtained 3D model.
- Plan relavant aspects in drone & airborne mapping.

Transversal skills

- Demonstrate the capacity for critical thinking
- Access and evaluate appropriate sources of information.

Teaching methods

Ex-cathedra lectures and exercice sessions

Assessment methods

Final exam (80%) + 2 graded exercises (20%)

Supervision

Office hours	No
Assistant.e.s	Yes
Forum	No

Resources

Virtual desktop infrastructure (VDI)

Yes

Moodle Link

- https://go.epfl.ch/ENV-408