

EE-451

**Image analysis and pattern recognition**

Bozorgtabar Behzad, Thiran Jean-Philippe

Cursus	Sem.	Type
Civil & Environmental Engineering		Opt.
Computational and Quantitative Biology		Opt.
Data Science	MA2, MA4	Opt.
Data science minor	E	Opt.
Electrical and Electronical Engineering	MA2, MA4	Opt.
Life Sciences Engineering	MA2, MA4	Opt.
Minor in Imaging	E	Opt.
Neuro-X minor	E	Opt.
Neuro-X	MA2, MA4	Opt.
Physics of living systems minor	E	Opt.
Robotics, Control and Intelligent Systems		Opt.
Robotics	MA2, MA4	Opt.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	During the semester
Workload	120h
Weeks	14
<b>Hours</b>	<b>4 weekly</b>
Lecture	2 weekly
Practical work	2 weekly
<b>Number of positions</b>	

**Summary**

This course gives an introduction to the main methods of image analysis and pattern recognition.

**Content****Introduction**

Digital image acquisition and properties.

Pre-processing: geometric transforms, linear filtering, image restoration.

Introduction to Mathematical Morphology

Examples and applications

**Segmentation and object extraction**

Thresholding, edge detection, region detection.

Segmentation by active contours. Applications in medical image segmentation.

**Shape representation and description**

Contour-based representation, region-based representation. Morphological skeletons

**Shape recognition**

Statistical shape recognition, Bayesian classification, linear and non-linear classifiers, perceptrons, neural networks and unsupervised classifiers.

Applications.

**Practical works and mini-project on computers****Keywords**

image processing, image analysis, image segmentation, feature extraction, introduction to machine learning, pattern recognition.

**Learning Outcomes**

- Use Image Pre-processing methods
- Use Image segmentation methods
- Choose shape description methods appropriate to a problem
- Use classification methods appropriate to a problem
- Use Image Pre-processing methods
- Use Image segmentation methods

- Choose shape description methods appropriate to a problem
- Use classification methods appropriate to a problem

### **Transversal skills**

- Use a work methodology appropriate to the task.
- Identify the different roles that are involved in well-functioning teams and assume different roles, including leadership roles.
- Summarize an article or a technical report.
- Assess one's own level of skill acquisition, and plan their on-going learning goals.
- Make an oral presentation.

### **Teaching methods**

Ex cathedra and practical work and oral presentation by the students

### **Assessment methods**

Continuous control : oral exam during the semester + graded reports and mini-project

### **Resources**

#### **Moodle Link**

- <https://go.epfl.ch/EE-451>

### **Prerequisite for**

Semester project, Master project, doctoral thesis