

EE-550 **Image and video processing**

Cursus	Sem.	Type
Digital Humanities	MA1, MA3	Opt.
Electrical and Electronical Engineering	MA1, MA3	Opt.

Language of teaching	English
Credits	6
Session	Winter
Semester	Fall
Exam	Oral
Workload	180h
Weeks	14
<b>Hours</b>	<b>6 weekly</b>
Lecture	4 weekly
Project	2 weekly
<b>Number of positions</b>	

**Remark**

pas donné en 2023-24

**Summary**

This course covers fundamental notions in image and video processing, as well as covers most popular tools used, such as edge detection, motion estimation, segmentation, and compression. It is composed of lectures, laboratory sessions, and mini-projects.

**Content****Introduction, acquisition, restitution**

Two-dimensional signals and systems, Elementary signals, Properties of two-dimensional Fourier transform, Discretization (spatial and spatio-temporal artefacts), Two-dimensional digital filters, Two-dimensional z-transform, Transfer function. Captors, monitors, printers, half-toning, color spaces.

**Multi-dimensional filters**

Design of Infinite Impulse Response and Finite Impulse Response filters, Implementation of multi-dimensional filters, Directional decomposition and directional filters, M-D Sub-band filters, M-D Wavelets.

**Visual perception**

Neural system, Eye, Retina, Visual cortex, Model of visual system, Special effects, Mach phenomena and lateral inhibition, Color, Temporal vision.

**Contour and feature extraction, segmentation**

Local methods, Region based methods, Global methods, Canny, Mathematical morphology. Segmentation, Motion estimation

**Visual information coding**

Overview of the information theory and basics of rate-distortion, Conventional techniques : predictive coding, transform coding, subband coding, vector quantization, Advanced methods : multiresolution coding, perception based coding, region based coding, directional coding, fractals, Video coding : motion compensation, digital TV, High definition TV. Standards: JPEG, MPEG, H.261, H.263

**Keywords**

Contour detection, motion estimation, segmentation, human visual system, image compression, video compression

**Learning Prerequisites****Required courses**

Fundamental notions of signal processing

**Recommended courses**

Signal processing for communication

**Important concepts to start the course**

Sampling, quantization, transforms, programming, algorithms, systems

**Learning Outcomes**

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

- Create simple image processing systems
- Create simple video processing systems
- Compare image processing tools
- Compare video processing tools
- Select appropriately optimal image and video processing tools

**Transversal skills**

- Make an oral presentation.
- Write a scientific or technical report.

**Teaching methods**

Ex cathedra, laboratory sessions, mini-projects

**Expected student activities**

Written report of laboratory sessions, oral presentation of mini-projects, comprehension of various notions presented during the course, resolve simple problems of image and video processing.

**Assessment methods**

Laboratories, mini-project, oral exam

**Supervision**

Office hours	No
Assistants	Yes
Forum	Yes
Others	Students are encouraged to ask for appointment with the professor any time outside of teaching hours

**Resources****Bibliography**

handouts of image and video processing course  
Fundamentals of Digital Image Processing, A. K. Jain

**Ressources en bibliothèque**

- [Fundamentals of Digital Image Processing / Jain](#)

**Moodle Link**

- <https://go.epfl.ch/EE-550>

**Prerequisite for**

Semester projects , master thesis projects, doctoral thesis