EE-550

Image and video processing

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Cursus	Sem.	Type
Computer science	MA1, MA3	Opt.
Cybersecurity	MA1	Opt.
Digital Humanities	MA1, MA3	Opt.
Electrical and Electronical Engineering	MA1, MA3	Opt.
SC master EPFL	MA1, MA3	Opt.

Language of teaching	English
Credits	6
Session	Winter
Semester	Fall
Exam	Oral
Workload	180h
Weeks	14
Hours	**6 weekly**
Courses	4 weekly
Project	2 weekly
Number of positions	

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-dimensionnal signals and systems, Elementary signals, Properties of two-dimentional 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 filtres
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

Others	Students are encouraged to ask for appoitment 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

Prerequisite for

Semester projects , master thesis projects, doctoral thesis