MASTER OF SCIENCE
IN ENGINEERING

Module Description, available in: EN

Digital Image Processing

General Information

Number of ECTS Credits

3

Module code

FTP_DigImPro

Valid for academic year

2021-22

Last modification

2021-01-12

Coordinator of the module

Olivier Hüsser (HES-SO, olivier.huesser@he-arc.ch)

Explanations regarding the language definitions for each location:

- Instruction is given in the language defined below for each location/each time the module is held.
- Documentation is available in the languages defined below. Where documents are in several languages, the percentage distribution is shown (100% = all the documentation).
- The examination is available 100% in the languages shown for each location/each time it is held.

	Lausanne			Lugano	Zurich		
Instruction	**X** E 100%				**X** E 100%		
Documentation	**X** E 100%				**X** E 100%		
Examination	**X** E 100%				**X** E 100%		

Module Category

FTP Fundamental theoretical principles

Lessons

2 lecture periods and 1 tutorial period per week

Entry level competences

Prerequisites, previous knowledge

Math : basic calculus, linear algebra, probability, derivatives, matrix & vector product, orthogonal bases, eigenvalues, eigenvectors

Programming : good command of any structured programming language (e.g., Python, Matlab, R, Java, C, C++)

Statistics : mean, standard deviation, variance, co-variance, histograms, normal (gaussian) distribution

Signal Processing : Linear&invariant systems, Convolution, 1D-filtering, Sampling, Fourier Transform

Brief course description of module objectives and content

The goal of this module is to teach the fundamentals of image processing, while putting emphasis on their mathematical and algorithmic principles. In addition, specific 2D and 3D industrial and biomedical applications will be treated.

Aims, content, methods

Learning objectives and acquired competencies

Upon completion of this lecture, the students should be able to formulate an image processing problem and to propose and pursue alternative ways to it's solution. They can discuss and compare different algorithms and their implementations with regard to robustness, speed and complexity.

Contents of module with emphasis on teaching content

1. Digital Image Fundamentals
- Linear and nonlinear systems
- Coordinate systems
- Geometric transformations
- Statistics: mean, standard deviation, histograms

2. From 2D to 3D
- Camera model
- Epipolar geometry

3. Linear and nonlinear filtering
- Convolution
- Correlation
- Spatial and frequency domain filtering

4. Morphological Image Processing
- Erosion & Dilatation, Opening and Closing
- Hit-or-Miss-Transformation (HMT)
- Connected Filtering

5. Image Segmentation
- Edge based
- Region based
- Intensity based

6. Image description
- Boundary descriptors
- Regional descriptors
- Texture descriptors
- Salient points

7. Object Recognition
- Model based
- Bayesian classifier
- Modern methods

Teaching and learning methods

Classroom teaching and exercises (paper & with computer)

Literature

Digital Image Processing (Gonzalez & Woods) 4th edition

Assessment

Certification requirements

Module does not use certification requirements

Basic principle for exams

As a rule, all the standard final exams for modules and also all resit exams are to be in written form

Standard final exam for a module and written resit exam

Kind of exam

written

Duration of exam

120 minutes

Permissible aids

Aids permitted as specified below:

Permissible electronic aids
No electronic aids permitted

Other permissible aids
open book

Special case: Resit exam as oral exam

Kind of exam

oral

Duration of exam

30 minutes

Permissible aids

Aids permitted as specified below:

Permissible electronic aids
No electronic aids permitted

Other permissible aids
open book