

Image acquisition and processing

Lecturer

Olivier DEBEIR (Coordinator)

Course mnemonic

INFO-H500

ECTS credits

5 credits

Language(s) of instruction

English

Course period

First term

Campus

Solbosch

- > Object description binary, image labelling, chain code, polygonal approximation, Fourier descriptors, invariant moments, convexity, fractal dimension, texture

Objectives (and/or specific learning outcomes)

Become familiar with basic numerical image processing

- > be able to recognize image properties
- > to apply basic filtering and denoising
- > to segment an image using classical methods
- > theoretical and practical skills are expected.

Pre-requisites and co-requisites

Course having this one as co-requisit

MEMO-H504 | Mémoire de fin d'études en Informatique | 20 crédits

Teaching method and learning activities

Ex cathedra + practical work

Contribution to the teaching profile

This teaching unit contributes to the following competences:

- > Traiter et analyser des signaux de toute nature, 1D, image, vidéo, en particulier ceux issus des dispositifs médicaux
- > Se représenter les mécanismes biologiques fondamentaux depuis la biochimie de la cellule jusqu'au fonctionnement des principaux systèmes de la physiologie humaine
- > Gérer, explorer et analyser les données médicales (dossier médical, imagerie, génomique, statistiques)
- > Communiquer en anglais dans le domaine de l'ingénierie

References, bibliography and recommended reading

- > Handbook of Image & Video Processing
- > Alan C. Bovik (Editor)
- > Digital Image Processing: Concepts, Algorithms, and Scientific Applications
- > Bernd Jahne (Author)
- > Digital Image Processing
- > Rafael C. Gonzalez (Author), Richard E. Woods (Author)
- > Image Processing, Analysis, and Machine Vision
- > Milan Sonka (Author), Vaclav Hlavac (Author), Roger Boyle (Author)

Course content

- > Introduction: examples of application of the image processing from several domains, medical applications, industry, HCI...
- > Human vision fundamentals
- > Acquisition
- > Definitions : the image processing chain
- > Quantification : spatial, spectral and intensity color representation different acquisition modalities sensor,sensor +source,...
- > Acquisition devices : CCD, CMOS, vidicon ultrasound light time-of-flight (TOF)
- > Notions of compression : run-length-coding, hierarchical decomposition, Jpeg lossy compression
- > Pre-processing - Histogram based image enhancement
- > Linear filtering Fourier transform
- > Fourier domain processing : e.g. interlaced image correction pattern matching
- > Image restoration : Wiener filtering rank filter
- > Morphomatematics definitions : ensemble, structuring element
- > Basic operators : erosion, dilation, duality combined operators : opening, closing
- > Hit-or-miss operator thinning and opening : skeleton, pruning,...
- > Gray-level morphology watershed transform
- > Segmentation/ object detection pixel based : threshold : optimal, Otsu
- > Color segmentation border based: gradient, Laplacian, LoG
- > Region based : split and merge, watershed(recall) mean-shift
- > Hough transform

- A Wavelet Tour of Signal Processing, Second Edition (Wavelet Analysis & Its Applications).. Stephane Mallat (Author)
- The Image Processing Handbook, Second Edition
- John C. Russ (Author)
- Handbook of Medical Imaging: Processing and Analysis Management (Biomedical Engineering)
- Isaac Bankman (Editor)
- Handbook of Medical Imaging, Volume 2. Medical Image Processing and Analysis
- J.Michael Fitzpatrick (Author), Milan Sonka (Author)
- Active Contours: The Application of Techniques from Graphics, Vision, Control Theory and Statistics to Visual Tracking of Shapes in Motion
- Andrew Blake (Author), Michael Isard (Author)
- Handbook of Computer Vision and Applications, Three-Volume Set
- Bernd Jahne (Editor), Horst Haussecker (Editor), Peter Geissler (Editor)
- Mathematical Methods and Algorithms for Signal Processing
- Todd K. Moon (Author), Wynn C. Stirling (Author)
- Pattern Recognition Engineering
- Morton Nadler (Author), Eric P. Smith (Author)
- Mathematical Morphology in Image Processing (Optical Science and Engineering) [Hardcover]

- Edward Dougherty (Author)
- Digital Image Processing Methods (Optical Science and Engineering)
- Dougherty (Author)

Other information

Place(s) of teaching

Solbosch

Contact(s)

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Programmes

Programmes proposing this course at the Brussels School of Engineering

MA-IRCB | **Master of science in Biomedical Engineering** | finalité Professional/unit 1 and MA-IRIF | **Master of science in Computer Science and Engineering** | finalité Professional/unit 1

Programmes proposing this course at the faculty of Sciences

MA-BINF | **Master in Bio-informatics and Modelling** | finalité Research/unit 2 and MA-GEOG | **Master in Geography : General** | finalité territorial Development/unit 2