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

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
- 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-requisits and co-requisits

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)
- 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)

Course notes

Podcast and Université virtuelle

Other information

Place(s) of teaching

Solbosch

Contact(s)

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Evaluation method(s)

Oral examination and Written report

Evaluation method(s) (additional information)

- The evaluation of the practical work will be done on the basis of a series of assignments to be handed in during the term.
- Oral exam without note, depending on the circumstances, exam can be done remotely using Teams.

Determination of the mark (including the weighting of partial marks)

80% oral exam + 20% on the quality of Practice work

oral exam (2 questions without notes)

- 1 theory question 50%
- 1 problem based question 50%

Main language(s) of evaluation

English

Other language(s) of evaluation, if applicable

French

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