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
› Morphomathematics 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-requisites 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)
  Bernd Jahne (Author)
› Digital Image Processing
  Rafael C. Gonzalez (Author), Richard E. Woods (Author)
Contact(s)
oedgeir@ulb.ac.be

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