Pattern recognition and image analysis

Lecturers
Olivier DEBEIR (Coordinator) and Christine DECAESTECKER

Course mnemonic
INFO-H501

ECTS credits
5 credits

Language(s) of instruction
English

Course period
Second term

Campus
Solbosch

Course content

> Low level image processing, linear/non linear filtering, morphomathematics.
> Image segmentation.
> Object feature extraction from digital images.
> Supervised and unsupervised classification methods.
> Image processing techniques applied to industrial and biomedical problems.

Objectives (and/or specific learning outcomes)

> The lecture recalls the basics in digital image processing and analysis, ranging from principles of image acquisition to object recognition.
> Several automatic segmentation techniques are explained and compared with respect to practical implementation issues.
> Morphomathematic methods are introduced, in particular the watershed technique. Image feature descriptors are defined (texture, shape, color,...) and serve as the input to recognition systems.
> Classical machine learning methods are explained and analysed in terms of their application conditions for pattern recognition.
> The objective of the course is to give to the students notions of the analytic approach to image segmentation and pattern recognition problems through both theory and application motivated examples.

Pre-requisits and co-requisits

Required knowledge and skills

INFO-H-500 Image acquisition and processing or equivalent

Teaching method and learning activities

lectures and practical works

Contribution to the teaching profile

This teaching unit contributes to the following competences:

> 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)

Duda, Hart et Stork, Pattern classification, John Wiley et Sons.

Theodoridis S, Koutroumbas K: Pattern recognition, Academic Press (on-line acces from the ULB network)

Course notes

Université virtuelle and Podcast

Other information

Place(s) of teaching

Solbosch

Contact(s)

Olivier.Debeir@ulb.be , Christine.Decaestecker@ulb.be

Evaluation method(s)

Oral examination and Written report

Evaluation method(s) (additional information)

> Questions are asked for each of the two parts of the course.

> There is a preparation period, without notes.

> Depending on the circumstances, the exam can be done remotely using Teams.

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

The grade is constructed according to a mean (identical weighting for the two parts of the course).

Main language(s) of evaluation

English and French

Programmes

Programmes proposing this course at the Brussels School of Engineering

MA-IRCB | Master of science in Biomedical Engineering | finalité Professional/unit 2, MA-IREL | Master of science in Electrical Engineering | finalité electronics and information technologies/unit 2, MA-IRIF | Master of science in Computer Science and Engineering | finalité Professional/unit 2 and MS-BGDA | Specialized Master in data science, Big data | unit U

Programmes proposing this course at the Solvay Brussels School of Economics and Management

MS-BGDA | Specialized Master in data science, Big data | unit U

Programmes proposing this course at the faculty of Sciences

MA-BINF | Master in Bio-informatics and Modelling | finalité Research/unit 2 and MS-BGDA | Specialized Master in data science, Big data | unit U