2EL5070 – Image processing

Instructors: Jean-Luc Collette
Department: CAMPUS DE METZ
Language of instruction: FRANCAIS
Campus: CAMPUS DE METZ
Workload (HEE): 60
On-site hours (HPE): 35,00
Elective Category : Fundamental Sciences
Advanced level : Yes

Description

Image processing meets many areas of activity, such as medical imaging, satellite or robotics for localization in an environment. The preliminary step to image processing is its acquisition. The modeling of image sensors is therefore crucial to make the best use of the information that can be extracted. The images can also come from a reconstruction process such as that implemented in a scanner. The transmission and the compression of the images intervene in the quality of the results of their analyzes. We must understand its principles to take them into account in these analyzes. The different treatments that can be considered are then presented. Many applications will illustrate this course to have an overview on how to exploit the information in the image.

Quarter number

SG6

Prerequisites (in terms of CS courses)

- Signal Processing : 1CC4000
- Programmation and Information System : 1CC1000

Syllabus

1. Photometry, colorimetry, visual perception
1.1. Radiometric and photometric quantities
1.2. Perceptual models of the eye
1.3. Additive and subtractive synthesis
2. Color image sensors and rendering devices
2.1. Physical modeling
2.2. Geometric modeling
2.3. Calibration
2.4. Gamma correction

3. Other types of image
3.1. Multi and hyper spectral imaging
3.2. SAR imaging
3.3. LIDAR imaging
3.4. Overview of tomographic reconstruction techniques (scanner)
4. Coding and compression
4.1. Overview of orthogonal transformations
4.2. Overview of wavelet transformations
4.3. Still image coding
4.4. Image sequence coding
5.Improvement, image restoration
5.1. Improved contrast
5.2. Noise attenuation
5.3. Filtering from Wiener
6. Elements of mathematical morphology
6.1. Basic operators
6.2. Watershed
7. Geometric transformations and image registration
7.1. Nature of transformations
7.2. Metrics for registration
7.3. Specific optimization methods
8. Image segmentation and characterization of shapes
8.1. Region or edge approach
8.2. Extraction of features
8.3. Unsupervised classification

Class components (lecture, labs, etc.)

15h of lecture, 6h of tutorials and 14h of labs.
35 students for tutorial/labs groups

Grading

A written report will be requested on Laboratory Work (TP) and an oral presentation on this activity will also be organized (scheduled during labs). Any unjustified absence from a TP session will result in a zero mark. The final mark will be the equal average of the individual mark of the oral presentation and the mark of the laboratory work report.
The catch up exam will take place in the same way as the initial examination, with additional work requested in TP and an oral presentation of this work.

Course support, bibliography

"Digital Image Processing", William K. Pratt

Resources

Lectures will be given to present the main concepts.
Applications will be tested on computer during tutorial courses.

Learning outcomes covered on the course

• Knowing how to identify imperfections and limitations of operation of an image acquisition system.
• Knowing how to model and characterize this system in the optical domain.
• Knowing how to program or use basic processing algorithms (filtering, transformations) on digital images by mastering their complexity.
• Having an overview of how to use the information in the image.

Description of the skills acquired at the end of the course

C1 : Analyze, design, and build complex systems with scientific, technological, human, and economic components
C2 : Develop in-depth skills in an engineering field and a family of professions
C7 : Know how to convince