Images: Formation, Perception & Representation

Semester
Fall

In brief

Course langage: French

Presentation

Learning objectives

The objective of this module is to present the essential links of an imaging chain: from the fundamentals of image formation to the hardware technologies to acquire and then restore the image to humans, through the processing and analysis of images by a machine to extract information. It will provide the basic knowledge of each of the technological bricks of this chain and the fundamental elements concerning human and machine vision.

This knowledge can be used to understand, dimension, develop and integrate applications in the field of imaging.

Description of the programme

Whether in the industrial, medical or scientific fields or in our daily lives, images are at the heart of many systems and applications:
- Medical imaging, which plays a key role in the diagnosis, monitoring and treatment of human diseases

- Augmented reality and 3D display technologies that transform the way humans interact with their environment

- Autonomous systems based on the integration of artificial intelligence and data processing algorithms with vision systems

- Observation, risk prevention, and environmental monitoring sources from on-board (UAV) or satellite imagery

- Industrial vision for quality control, observation in hostile environments, robotics...

The course is structured in several parts:

- Physical basis of imaging

- Image sensors

- Visual perception

- Display systems

- Noise, estimation and learning,

-Image processing

The courses will be complemented by practical work, experimental on the Photonics platform, and digital on PC.

Generic central skills and knowledge targeted in the discipline

Engineers capable of working on complex systems based on imagery, whether it be to set up an imagery chain for an application, process digital images, or follow up on business or projects involving complex image and multimedia acquisition and processing systems.

How knowledge is tested

CC1 = Writing = 25 %

CC2 = Reports = 75 %

Bibliography

Handbook of Visual Display Technology, Springer, 2016 (https://link.springer.com/referencework/10.1007/978-3-319-14346-0).

Raphël C. Gonzalez and Richard E. Woods, Digital Image processing, Third edition Pearson 2007.

1. Saporta « Probabilité Analyse des données et statistique » - Editions Technip 1990.
P.H. Garthwaite, I.T. Jolliffe and B. Jones « Statistical Inference » - Prentice Hall 1995.

Ph. Réfrégier « Noise theory and application to physics » - Springer 2003.

Teaching team

- Caroline Fossati

- Laurent Gallais-During

- Frédéric Lemarquis

- Muriel Roche (responsable)

- Philippe Réfrégier

Total des heures		**100h**
CM	Master class	70h
TD	Directed work	2h
TP	Practical work	28h

Useful info

Name responsible for EU

Lead Instructor

Muriel Roche
muriel.roche@centrale-med.fr