### Summary

Introduction to the basic techniques of image processing. Introduction to the development of image-processing software and to prototyping using Jupyter notebooks. Application to real-world examples in industrial vision and biomedical imaging.

### Content

- **Introduction.** Image processing versus image analysis. Applications. System components.
- **Characterization of continuous images.** Image classes. 2D Fourier transform. Shift-invariant systems.
- **Morphological operators.** Binary morphology (opening, closing, etc.). Gray-level morphology.
- **Image-processing tasks.** Preprocessing. Matching and detection. Feature extraction. Segmentation.

### Learning Prerequisites

**Required courses**

Signals and Systems I & II (or equivalent)
Important concepts to start the course
1-D signal processing: convolution, Fourier transform, z-transform

Learning Outcomes
By the end of the course, the student must be able to:
• Exploit the multidimensional Fourier transform
• Select appropriately Hilbert spaces and inner-products
• Optimize 2-D sampling to avoid aliasing
• Formalize convolution and optical systems
• Design digital filters in 2-D
• Analyze multidimensional linear shift-invariant systems
• Apply image-analysis techniques
• Construct image-processing software

Transversal skills
• Use a work methodology appropriate to the task.
• Manage priorities.
• Use both general and domain specific IT resources and tools

Assessment methods
• 70% final exam
• 30% IP labs during semester

Resources
Moodle Link
• https://go.epfl.ch/MICRO-511