## Micro-512 Image processing II

Liébling Michael, Sage Daniel, Unser Michaël, Van De Ville Dimitri

<table>
<thead>
<tr>
<th>Cursus</th>
<th>Sem.</th>
<th>Type</th>
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<tbody>
<tr>
<td>Biocomputing minor</td>
<td>E</td>
<td>Opt.</td>
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<tr>
<td>Computational Neurosciences minor</td>
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<tr>
<td>Computational science and Engineering</td>
<td>MA2, MA4</td>
<td>Opt.</td>
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<td>Computer science</td>
<td>MA2, MA4</td>
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<td>Imaging minor</td>
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<td>Microtechnics</td>
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<td>Neuro-X</td>
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<td>Neuroprosthetics minor</td>
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<td>Robotics, Control and Intelligent Systems</td>
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<td>Robotics</td>
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<td>SC master EPFL</td>
<td>MA2, MA4</td>
<td>Opt.</td>
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### Language
English

### Credits
3

### Session
Summer

### Semester
Spring

### Exam
Written

### Workload
90h

### Hours
14

#### Lecture
3 weekly

#### Number of positions

### Summary
Study of advanced image processing; mathematical imaging. Development of image-processing software and prototyping in Jupyter Notebooks; application to real-world examples in industrial vision and biomedical imaging.

### Content

- **Directional image analysis.** Mathematical foundations. Structure tensor. Steerable filters.
- **Computational imaging.** Imaging as an inverse problem. Iterative reconstruction methods. Elements of convex analysis. Regularization & sparsity constraints.

### Learning Prerequisites

#### Required courses
Image Processing I

#### Recommended courses
Signals and Systems I & II, linear algebra, analysis

#### Important concepts to start the course
Basic image processing and related analytical tools (Fourier transform, z-trafo, etc.)

### Learning Outcomes
• Construct interpolation models and continuous-discrete representations
• Analyze image transforms
• Design image-reconstruction algorithms
• Formalize multiresolution representations using wavelets
• Perform image analysis and feature extraction
• Design image-processing software
• Design image reconstruction algorithms

Transversal skills
• Plan and carry out activities in a way which makes optimal use of available time and other resources.
• Manage priorities.
• Access and evaluate appropriate sources of information.
• Use both general and domain specific IT resources and tools

Assessment methods
The objectives of the course will be assessed as follows:
• 70% final exam
• 30% IP labs

Resources
Moodle Link
• https://go.epfl.ch/MICRO-512