The objective of this course is to present the basic set of techniques used for digital image processing. The program of the course was designed to avoid the traditional "two-step" approach used in most image processing courses: the first part of the course is generally devoted to the theoretical aspects of image processing whereas the second (and later) one deals with applications. In this course, the program was structured to combine theory and applications. To this end, several levels of image interpretation have been defined. At each level, the program presents the major theoretical aspects, algorithms, techniques and applications corresponding to this interpretation of the image. Naturally, the program starts by the simplest interpretation: "an image as a set of pixel" and progressively builds on more complex representations (and material) to end with "the image as a set of regions".

Prior skills

Basic course on Signal and Systems (Analog and Digital)

Teaching methodology

Lectures
Lab sessions

Learning objectives of the subject

The objective of this course is to present the basic set of techniques used for digital image processing. The program of the course was designed to avoid the traditional "two-step" approach used in most image processing courses: the first part of the course is generally devoted to the theoretical aspects of image processing whereas the second (and later) one deals with applications. In this course, the program was structured to combine theory and applications. To this end, several levels of image interpretation have been defined. At each level, the program presents the major theoretical aspects, algorithms, techniques and applications corresponding to this interpretation of the image. Naturally, the program starts by the simplest interpretation: "an image as a set of pixel" and progressively builds on more complex representations (and material) to end with "the image as a set of regions".

Study load

<table>
<thead>
<tr>
<th>Total learning time: 125h</th>
<th>Hours large group: 39h</th>
<th>31.20%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Self study: 86h</td>
<td>68.80%</td>
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</table>
## Content

### 1. Images and Vision

**Degree competences to which the content contributes:**

### 2. The low level representation: the Pixel

**Degree competences to which the content contributes:**

**Description:**
- (ENG) Representation of luminance and color information
- Pixel-based processing

### 3. The space-frequency representation of images

**Degree competences to which the content contributes:**

**Description:**
- (ENG) Acquisition and sampling
- Fourier analysis and 2D LTI systems
- Restoration
- Image transforms and wavelet
- Image compression

### 4. Shape and image: geometric structures

**Degree competences to which the content contributes:**

**Description:**
- (ENG) Hough transform
- Lattices and mathematical morphology
- Morphological filters and image analysis
- Processing images with Partial Differential Equations

### 5. The image as a set of regions

**Degree competences to which the content contributes:**

**Description:**
- (ENG) Image segmentation and classification
- Gradient-based techniques, Snakes,
- Spit & merge, Region growing, watershed
6. Moving images

**Degree competences to which the content contributes:**

**Description:**
- (ENG) Motion: analysis and estimation
- Moving image coding
- Segmentation of sequences

**Qualification system**

<table>
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<tr>
<th>Control:</th>
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<tbody>
<tr>
<td>Laboratory:</td>
<td>40%</td>
</tr>
<tr>
<td>Final Exam:</td>
<td>40%</td>
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</table>

**Regulations for carrying out activities**

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**Bibliography**

**Basic:**
