Degree competences to which the subject contributes

Basic:
CB5. That the students have developed those learning skills necessary to undertake later studies with a high degree of autonomy

Specific:
CE5. Design and apply techniques of signal processing, choosing between different technological tools, including those of Artificial vision, speech recognition and multimedia data processing.

Generical:
CG1. To design computer systems that integrate data of provenances and very diverse forms, create with them mathematical models, reason on these models and act accordingly, learning from experience.
CG2. Choose and apply the most appropriate methods and techniques to a problem defined by data that represents a challenge for its volume, speed, variety or heterogeneity, including computer, mathematical, statistical and signal processing methods.
CG5. To be able to draw on fundamental knowledge and sound work methodologies acquired during the studies to adapt to the new technological scenarios of the future.

Transversal:
CT6. Autonomous Learning. Detect deficiencies in one's own knowledge and overcome them through critical reflection and the choice of the best action to extend this knowledge.

Teaching methodology
The subject is based on classroom theory classes and laboratory. The theory classes follow the program defined in this teaching guide. Within the lectures, the dialogue between professors and students is promoted by proposing exercises and activities to be carried out jointly based on particular aspects of the topic being dealt with. The laboratory classes exemplify the contents developed in the theory classes.

Learning objectives of the subject
1. Acquire basic knowledge of frequency representation and advanced image filters.
2. Understand the use of tools for geometric processing.
3. Understand how to use object segmentation and detection techniques.
4. Acquire the basic knowledge of motion estimation and tracking.
# Study load

| Total learning time: 150h | Hours large group: 45h (30.00%) | Hours small group: 15h (10.00%) | Guided activities: 0h (0.00%) | Self study: 90h (60.00%) |
### Filtering and Frequency Analysis

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

**Description:**
- Frequency representation: FT, DFT
- Advanced filters: linear, non-local, bilateral
- Multiscale image analysis I: Downsampling / Upsampling, Interpolation, pyramid, wavelets & CNNs

### Geometrical Processing

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

**Description:**
- Mathematical morphology and lattice
- Filters by reconstruction
- Variational model and level sets

### Region-based model

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

**Description:**
- Transition-based segmentation: Edge detection, Active contour
- Homogeneity-based segmentation: Classification, Region growing & Watershed

### Object-based model

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

**Description:**
- Object recognition: Local features, Bag of words Region proposals, Regression

### Video Analysis

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

**Description:**
- Motion estimation, Optical flow
- Tracking
## Planning of activities

| Unit 1 | Hours: 29h 42m  
Theory classes: 9h  
Practical classes: 0h  
Laboratory classes: 3h  
Guided activities: 1h 12m  
Self study: 16h 30m |
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory, exercise and laboratory classes corresponding to Unit 1</td>
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<td><strong>Specific objectives:</strong></td>
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| Unit 2 | Hours: 29h 42m  
Theory classes: 9h  
Practical classes: 0h  
Laboratory classes: 3h  
Guided activities: 1h 12m  
Self study: 16h 30m |
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<td><strong>Specific objectives:</strong></td>
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| Unit 3 | Hours: 29h 42m  
Theory classes: 9h  
Practical classes: 0h  
Laboratory classes: 3h  
Guided activities: 1h 12m  
Self study: 16h 30m |
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<td><strong>Specific objectives:</strong></td>
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| Unit 4 | Hours: 29h 42m  
Theory classes: 9h  
Practical classes: 0h  
Laboratory classes: 3h  
Guided activities: 1h 12m  
Self study: 16h 30m |
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<td><strong>Specific objectives:</strong></td>
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Description:
Theory, exercise and laboratory classes corresponding to Unit 4

Specific objectives:
3

Unit 5
Hours: 29h 42m
Theory classes: 9h
Practical classes: 0h
Laboratory classes: 3h
Guided activities: 1h 12m
Self study: 16h 30m

Description:
Theory, exercise and laboratory classes corresponding to Unit 5

Specific objectives:
4

Qualification system

Final mark is obtained from:
- Parcial exam: P (20%)
- Final exam: F (50%)
- Laboratory: L (30%)

Grade = max (0.5F+0.2P+0.3L ; 0.7F+0.3L)

With the re-evaluation (R) , the final mark is:

Grade = 0.7R+0.3L

Bibliography

Basic: