



## IDENTIFYING DATA

### Image processing and analysis

Subject	Image processing and analysis			
Code	V05G300V01931			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	1st
Teaching language	English			
Department				
Coordinator	Alba Castro, José Luis			
Lecturers	Alba Castro, José Luis			
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General description	This course follows "Fundamentals of Image Processing" (3rd year). The student will acquire knowledge and skills on high-level techniques to analyze and extract relevant information from images of different application field in computer vision, medical imaging and multimedia resources. The course is lectured and assessed in english. The documentation is also in english.			

## Competencies

Code	
B4	CG4: The ability to solve problems with initiative, to make creative decisions and to communicate and transmit knowledge and skills, understanding the ethical and professional responsibility of the Technical Telecommunication Engineer activity.
B9	CG9: The ability to work in multidisciplinary groups in a Multilanguage environment and to communicate, in writing and orally, knowledge, procedures, results and ideas related with Telecommunications and Electronics.
B10	CG10 The ability for critical reading of scientific papers and docs.
B12	CG12 The development of discussion ability about technical subjects
C73	(CE73/OP16) The ability to construct, exploit and manage artificial vision, medical imaging, and multimedia data base systems.
D2	CT2 Understanding Engineering within a framework of sustainable development.
D4	CT4 Encourage cooperative work, and skills like communication, organization, planning and acceptance of responsibility in a multilingual and multidisciplinary work environment, which promotes education for equality, peace and respect for fundamental rights.

## Learning outcomes

Expected results from this subject	Training and Learning Results		
	B10	B12	D2
Understand the foundations of standard techniques to analyze images	B10	B12	D2
Apply image analysis techniques in computers	B9	C73	D4
Understand the foundations of image description techniques in advanced standards	B10	B12	D2
Identify different analysis necessities for different imaging systems	B9	C73	D4
Design an image analysis and description system	B4	C73	D4
	B9		

## Contents

Topic
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Analysis of image.	Segmentation based in colour, textures, shapes and models. Extraction of descriptive and invariant characteristics. Examples in actual problems.
Description and classification of objects.	Clustering. Image descriptors. Classical and probabilistic decisors. Classification. Examples in actual problems.
Aplications	RGB image processing. Medical image processing. Real-time video processing

### Planning

	Class hours	Hours outside the classroom	Total hours
Master Session	10	10	20
Tutored works	24	82	106
Presentations / exhibitions	3	6	9
Introductory activities	3	0	3
Multiple choice tests	2	0	2
Reports / memories of practice	0	10	10

\*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

### Methodologies

	Description
Master Session	Each 3-hour class will include one hour of explanation of subject contents, encouraging critical discussion and assimilation through computer programming and visualization.
Tutored works	Each 3-hour session will include 2 hours of "hands-on" working to assimilate the explained concepts through problem-based learning (PBL). Every Problem/Task will take 4 or 5 weeks of the subject during which the student will have to discover, alone or with the professor guidance, what he needs to solve the problem effectively.
Presentations / exhibitions	The third and last task will be presented in front of the class mates. The students from the same group will have to split the presentation, so both of them explain one part of the work.
Introductory activities	In the first class of the course, concepts learned in FPI and the programming tools for the course will be reviewed: C/C++, QT, OpenCV

### Personalized attention

Methodologies	Description
Introductory activities	The introductory activities are related to motivation for learning how to to develop projects in real-life.
Master Session	During the master sessions, the teacher asks questions to the class and/or specific student to grab their attention about the current topic.
Tutored works	This methodology gives a lot of room for personalized attention. The teacher sits with each of the groups and guides every student through the step-by-step process of building a solution.
Presentations / exhibitions	Every time a student has to deliver a presentation (in the last guided task and also when challenged to beat another group in a specific subtask), the teacher explains him/them how to improve the impact of their presentation.

### Assessment

	Description	Qualification	Training and Learning Results
Multiple choice tests	Each part of the subject has theoretical concepts that are explained in class. The concepts are assessed through these tests, that are also formally linked to the delivery of each guided task. They are meant to grade each student individually. They help to assess general competence A82. The concepts are discussed in class and also individually through the e-learning platform and/or counseling hours.	15	B10 C73 B12
Reports / memories of practice	Each part of the subject is learnt through a hands-on guided task. Most of the teacher's time is devoted to discuss, both in group and individually, how to go step by step through the process of building a solution. The score of the guided task includes: the follow-up of each student, the techniques used, the results achieved, the quality of the report and the oral presentation of the last one. The guided tasks help to assess general competences A4, A82, B1 and B3.	85	B4 C73 D2 B9 D4

### Other comments on the Evaluation

Teaching and assessment is in english.

Attendance is compulsory in continuous assessment, unless special circumstances are alleged. Continuous assessment will be based on the student lab work and guided tasks related to contents of the subject.

There will be an official final exam scheduled by the "Junta de Escuela" that the students that didn't pass the continuous assessment will have to take if they want to pass the course. This final exam will be scored from 0 to 10 points and includes all the topics explained during the course and also concepts and techniques explained for the guided tasks. To pass this exam the student has to score, at least, 5 points. The students that are eager to improve their continuous assessment score can also take the final exam. In this case the final score of the course will be the maximum score of the final exam and continuous assessment.

Throughout the semester, the students will be receiving feedback about his performance on the continuous assessment, along with the scores obtained in the tests and guided tasks. Delivering any of the guided tasks or sitting any test will automatically mean that the student is following the course in the continuous assessment mode. That means that he will appear as "presented" in the records of the subject even if the final exam is not taken.

The continuous assessment contains the next milestones:

Guided task 1: linked to the image analysis topic (25%). 20% for the computer work and 5% for the test.

Guided task 2: linked both to the image analysis and classification topics (25%). 10% for the computer work and 5% for the test.

Guided task 3: linked to all topics (35%). 30% for the computer work an 5% for the test.

Report and public presentation of the 3rd guided task (15%).

The extraordinary final exam will only be held for students who failed the course both in continuous assesment mode or final exam. The score of the subject will be the score of this exam. The exam will be scored between 0 and 10. To pass the subject, at least 5 points are needed.

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## Sources of information

### Basic Bibliography

Rafael C. Gonzalez, Richard E. Woods, **Digital Image Processing**, 3ª (2008),

Robert Laganière, **OpenCV 2 Computer Vision Application Programming Cookbook**, 2011,

### Complementary Bibliography

Jasmin Blanchette, Mark Summerfield, **C++ GUI Programming with Qt 4**, 2008,

Richard O. Duda, Peter E. Hart, David G. Stork, **Pattern Classification**, 2ª (2001),

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## Recommendations

### Subjects that it is recommended to have taken before

Mathematics: Probability and Statistics/V05G300V01204

Programming I/V05G300V01205

Fundamentals of Sound and Image/V05G300V01405

Digital Signal Processing/V05G300V01304

Fundamentals of Image Processing/V05G300V01632

Imaging Systems/V05G300V01633

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