



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	Signal Theory and Communications			
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 and videos for different applications. 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		
Understand the foundations of standard techniques to analyze images	B10 B12		D2
Apply image analysis techniques in computers	B9 B12	C73	D4
Understand the foundations of image description techniques in advanced standards	B10 B12		D2
Identify different analysis necessities for different imaging systems	B9 B12	C73	D4
Design an image analysis and description system	B4 B9	C73	D4

Contents

Topic

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. Classification. Examples and developments over actual problems.
Applications	RGB image processing. Medical image processing. Real-time video processing

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	3	0	3
Lecturing	10	10	20
Computer practices	24	82	106
Presentation	3	6	9
Objective questions exam	2	0	2
Practices report	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
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
Lecturing	Each 3-hour class will include one hour of explanation of subject contents, encouraging critical discussion and assimilation through computer programming and visualization.
Computer practices	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.
Presentation	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.

Personalized attention

Methodologies	Description
Introductory activities	The introductory activities are related to motivation for learning how to develop projects in real-life.
Lecturing	During the master sessions, the teacher asks questions to the class and/or specific student to grab their attention about the current topic.
Computer practices	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.
Presentation	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
Objective questions exam	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 competences CG10 and CG12, and specific competence CE73. The concepts are discussed in class and also individually through the e-learning platform and/or counseling hours.	20	B10 C73 B12
Practices report	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 CG4 and CG9, specific competence CE73, and transversal competences CT2 and CT4.	80	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 short answers test, case studies work and presentation.

There will be an official first-chance exam, officially scheduled, 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 covers all the topics explained during the course and also concepts and techniques explained for the case studies. To pass this exam the student has to score, at least, 5 points.

Delivering any of the reports or sitting at any test will automatically mean that the student is following the course in the continuous assessment mode, and he/she will appear as "presented" in the records of the subject even if the first-chance exam is not taken.

The continuous evaluation is composed by the following parts:

Work 1: Associated to the subject of image analysis(25%). 20% for the work and 5% for the test.

Work 2: Associated to the subjects of analysis and classification (25%). 20% for the work and 5% for the test.

Work 3: Associated to all the subjects (40%). 30% for the work and 10% for the test.

Public presentation of the work 3 (10%).

There can be a second-chance exam at the end of the course for students who failed the course both in continuous assesment mode and/or first-chance 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. The same applies to any other chance that the student had to take, including the extraordinary one.

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),

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
