



## IDENTIFYING DATA

### Fundamentals of Image Processing

Subject	Fundamentals of Image Processing			
Code	V05G300V01632			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Martín Herrero, Julio			
Lecturers	Martín Herrero, Julio			
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General description	Introduces to the student the basics of digital image processing			

## Competencies

Code	
B3	CG3: The knowledge of basic subjects and technologies that enables the student to learn new methods and technologies, as well as to give him great versatility to confront and adapt to new situations
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.
B10	CG10 The ability for critical reading of scientific papers and docs.
C34	CE34/SI1 The ability to construct, exploit and manage telecommunication services and applications, such as receiving, digital and analogical treatment, codification, transporting and representation, processing, storage, reproduction, management and presentation of audiovisual and multimedia information services.
C38	CE38/SI5 The ability to create, modify, manage, broadcast and distribute multimedia contents taking into account the use and accessibility criteria to audiovisual, broadcasting and interactive services.
D2	CT2 Understanding Engineering within a framework of sustainable development.
D3	CT3 Awareness of the need for long-life training and continuous quality improvement, showing a flexible, open and ethical attitude toward different opinions and situations, particularly on non-discrimination based on sex, race or religion, as well as respect for fundamental rights, accessibility, etc.

## Learning outcomes

Expected results from this subject	Training and Learning Results		
Understand the nature and organisation of digital images	B3 B10	C34 C38	
Learn to process digital images	B3 B4 B10	C34 C38	D2 D3
Learn how to program a computer to process a digital image	B3 B4 B10	C34 C38	D2 D3
Understand how the fundamental technics of image processing work	B3 B10	C34 C38	
Apply fundamental processing technics to solve specific problems with images or groups of images	B3 B4	C34 C38	

## Contents

Topic	
Basic preprocessing.	Histogram. Brightness and contrast.
Global and local operators.	Linear and nonlinear filters.
Binary and greyscale mathematical morphology.	Erosion. Dilatation. Opening. Closing.
Geometrical transformations. Image transforms.	Affine transformations.
Image compression.	JPEG. JPEG 2000.
Image restoration.	Linear and nonlinear filters.

## Planning

	Class hours	Hours outside the classroom	Total hours
Practice in computer rooms	12	23.5	35.5
Tutored works	7	43	50
Master Session	21	41.5	62.5
Practical tests, real task execution and / or simulated.	2	0	2

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

## Methodologies

	Description
Practice in computer rooms	Handling and tuning analytic tools and algorithms, identifying which ones to use in different scenarios. All learning aims are addressed.
Tutored works	Groupwork developing the contents dealt with in the classroom, with personalised attention. All learning aims are addressed.
Master Session	Master talks by the teacher on central topics, promoting critical discussion of concepts. All learning aims are addressed.

## Personalized attention

Methodologies	Description
Practice in computer rooms	Implementation of image processing methods within an image processing and visualization framework with graphic user interface, programming in C and C++.
Tutored works	Construction of an image processing chain able to fulfill a high level task by means of a succession of low level methods chosen and tuned by the students from among those explained along the course.

## Assessment

	Description	Qualification	Training and Learning Results		
Practice in computer rooms	Personalised monitoring of the student's work in the laboratory, with feedback. All teaching aims specified in the corresponding section of this guide are evaluated.	50	B3 B4 B10	C34 C38	D2 D3
Tutored works	Assessment of the work done, its contents and its presentation, and the knowledge about it that each student individually has. All teaching aims specified in the corresponding section of this guide are evaluated.	50	B3 B4 B10	C34 C38	D2 D3
Practical tests, real task execution and / or simulated.	Real programming and problem solving. All teaching aims specified in the corresponding section of this guide are evaluated.	0	B3 B4 B10	C34 C38	D2 D3

## Other comments on the Evaluation

The assistance to class under continuous evaluation is compulsory, unless exceptional circumstances concur. Continuous evaluation is used for assessment, based in the work of the student in the classroom and at home. There is a final exam in the official date marked by the Board of School in May, for those students that have not passed the continuous evaluation. This final exam will be marked between 0 and 10 points. It covers all the subjects seen during the semester. To approve, the student has to obtain, at least, five points. Students wishing to improve their continuous evaluation marks can also attend the final exam: in this case the mark of this exam will be the final mark. The students that have passed the continuous evaluation and are satisfied with their mark do not need to attend the final exam. Along the semester the students will receive feedback on their progress, and the final mark of continuous evaluation will be communicated to the students well before the final exam. The delivery of the personal work the last week of class will imply the official participation in continuous evaluation.

The extraordinary evaluation of July will be an extraordinary final exam, for those students that have not passed neither the continuous evaluation neither the final exam in May. The final mark will be the mark of the extraordinary final exam in both

cases. This extraordinary final exam will be marked between 0 and 10 points, and covers all the subjects. To approve, the student has to obtain, at least, five points.

Note that there are two final exams, but both correspond to a single and the same call ("convocatoria").

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### **Sources of information**

#### **Basic Bibliography**

Rafael C. Gonzalez, Richard E. Woods, **Digital Image Processing**, 3ª, Prentice Hall,

#### **Complementary Bibliography**

Robert Laganière, **OpenCV Computer Vision Application Programming Cookbook**, Packt Publishing, 2014

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

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### **Recommendations**

#### **Subjects that continue the syllabus**

Image processing and analysis/V05G300V01931

#### **Subjects that are recommended to be taken simultaneously**

Imaging Systems/V05G300V01633

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

Programming I/V05G300V01205

Fundamentals of Sound and Image/V05G300V01405

Digital Signal Processing/V05G300V01304