Teaching Guide				
Identifying Data				2022/23
Subject (*)	Advanced Image Processing and Analysis		Code	614535002
Study programme	Máster Universitario en Visión por Computador			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	2nd four-month period	First	Obligatory	6
Language	English			
Teaching method	Hybrid			
Prerequisites				
Department	Ciencias da Computación e Tecnoloxías da Información			
Coordinador	Barreira Rodriguez, Noelia	E-mail	noelia.barreira@udc.es	
Lecturers	Barreira Rodriguez, Noelia Ramos García, Lucia	E-mail	noelia.barreira@udc.es l.ramos@udc.es	
Web				
General description	This curricular unit addresses the most advanced topics in image processing and analysis and presents itself as a sequence of a curricular unit where the fundamental topics are presented. It is designed to provide the essential foundation for students wishing to pursue research in this area. In addition to the study and application of advanced techniques of image processing and analysis, applications in this area are studied that aim to solve real problems. This approach gives students the necessary tools to apply the algorithms studied in practical cases, as well as the basis for developing new algorithms.			

Study programme competences	
Code	Study programme competences
A1	CE1 - To know and apply the concepts, methodologies and technologies of image processing
A3	CE3 - To know and apply the concepts, methodologies and technologies of image and video analysis
A4	CE4 - To conceive, develop and evaluate complex computer vision systems
A5	CE5 - To analyze and apply methods of the state of the art in computer vision
B1	CB6 - To possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context
B5	CB10 - That students possess the learning skills to enable them to continue studying in a largely self-directed or autonomous manner
B7	CG2 - Ability to analyze a company's needs in the field of computer vision and determine the best technological solution for it
B8	CG3 - Ability to develop computer vision systems depending on existing needs and apply the most appropriate technological tools
B10	CG5 - Ability to identify unsolved problems and provide innovative solutions
B12	CG7 - Ability to learn autonomously for specialization in one or more fields of study

Learning outcomes			
Learning outcomes	Study programme competences		
Study and application of advanced digital image processing techniques.	AC1	BC5 BC12	
Study and application of advanced techniques of digital image analysis.	AC3	BC5 BC12	
Analysis of real problems, and design and development of solutions based on advanced image processing and analysis technologies.	AC4 AC5	BC1 BC5 BC7 BC8 BC10 BC12	
Evaluation of the adequacy of the methodologies applied in specific problems.	AC4		

Contents	
Topic	**Sub-topic**
Advanced denoising	Total variation
Advanced edge detection	Bilateral filter Anisotropic diffusion Phase congruence
Advanced segmentation	Deformable models Level-set methods Markov Random Fields Graph cuts
Learning-based segmentation	Active shape/appearance models
Salience and attention models	
Selected topics on advanced image processing and analysis	Semantic segmentation Multi-view enhancement Superresolution Inpainting Coloring Photo stitching Background removal

Planning				
Methodologies / tests	**Competencies**	**Ordinary class hours**	**Student?s personal work hours**	**Total hours**
Laboratory practice	A1 A3 A4 A5 B5 B7 B8 B10 B12	24	80	104
Objective test	B1 B8 B10	3	0	3
Short answer questions	A1 A4 A5	0	5	5
Guest lecture / keynote speech	A1 A3	14	24	38
Personalized attention		0		0
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	**Description**
Laboratory practice	Analysis and resolution of practical cases using techniques learned in the lectures.
Objective test	Test with questions about the theoretical contents of the subject as well as practical problems.
Short answer questions	Online quizzes with short answer questions about the topics learned in the lectures that will be used to assess the acquisition of knowledge.
Guest lecture / keynote speech	Oral presentation (using audiovisual material and student interaction) designed to transmit knowledge and encourage learning.

Personalized attention	
Methodologies	**Description**
Laboratory practice	Teachers will answer the doubts during the laboratory practice and they will provide personal advising for the supervised projects.

Assessment			
Methodologies	**Competencies**	**Description**	**Qualification**
Objective test	B1 B8 B10	Written test with theoretical questions and practical problems to be solved.	0

Laboratory practice	A1 A3 A4 A5 B5 B7 B8 B10 B12	Practical exercises about the topics learned in the lectures. It will be assessed the suitability of the proposed solutions and the quality of the obtained results.	80
Short answer questions	A1 A4 A5	Online quizzes with short answer questions about the topics learned in the lectures that will be used to assess the acquisition of knowledge.	20

Assessment comments
The objective test is 100% of the final grade. However, students can achieve this percentage of the final grade with the laboratory exercises and the short answer questions during the year. This way, if the laboratory exercises and the short answer questions are presented, the exam is optional. If a student submits the laboratory exercises and the short answer questions and attends the objective test, the grade obtained in the objective test will prevail over the grade achieved in the laboratory exercises and the short answer questions.

Sources of information	
Basic	- Gary Bradski, Adrian Kaehler (2008). Learning OpenCV. O'Reilly - David A. Forsyth, Jean Ponce (2002). Computer vision: a modern approach. Prentice - Hall - Richard Szeliski (2010). Computer vision: algorithms and applications. Springer - Simon J.D. Prince (2012). Computer Vision: Models, Learning, and Inference. Cambridge University Press - Ian Goodfellow, Yoshua Bengio, Aaron Courville (2016). Deep learning. MIT Press - M. Sonka, V. Hlavac, R. Boyle. (2015). Image Processing, Analysis, and Machine Vision. 4th edition. Cengage Learning
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Fundamentals of Machine Learning for Computer Vision /614535007 Fundamentals of Image Processing and Analysis /614535001 Image Description and Modeling/614535004
Subjects that are recommended to be taken simultaneously
Visual Recognition/614535005 Advanced Machine Learning for Computer Vision/614535008
Subjects that continue the syllabus
Other comments