Teaching Guide					
Identifying Data					2021/22
Subject (*)	Analysis of biomedical images			Code	614522010
Study programme	Mestrado Universitario en Bioinformática para Ciencias da Saúde				
Descriptors					
Cycle	Period	Year		Type	Credits
Official Master's Degree	2nd four-month period	First		Obligatory	6
Language	Spanish				
Teaching method	Face-to-face				
Prerequisites					
Department	Ciencias da Computación e Tecnoloxías da InformaciónComputación				
Coordinador	Barreira Rodriguez, Noelia		E-mail	noelia.barreira@udc.es	
Lecturers	Barreira Rodriguez, Noelia Gonzalez Penedo, Manuel Novo Bujan, Jorge Ramos García, Lucia		E-mail	noelia.barreira@udc.es manuel.gpenedo@udc.es j.novo@udc.es l.ramos@udc.es	
Web					
General description	This course presents introductory medical image processing and analysis techniques. It presents basic concepts about image processing. Topics include data acquisition, imaging, filtering, image segmentantion and registration. The focus of the course is to provide a global perspective and practical experience in the field.				

Contingency plan	1. Modifications to the contents - There are no changes 2. Methodologies *Teaching methodologies that are maintained - Laboratory practice - Guest lecture/keynote speech - Objective test - Practical test - Research project If the situation changes, lectures, tests and practices will be online. *Teaching methodologies that are modified 3. Mechanisms for personalized attention to students - Email: daily to answer questions, schedule virtual meetings and do a follow-up of the assignments - Moodle: daily, depending on the needs of the students - Teams: one weekly session in group to assess the learning progress and the development of the assignments. 4. Modifications in the evaluation - There are no changes *Evaluation observations: 5. Modifications to the bibliography or webgraphy - There are no changes

Study programme competences	
Code	Study programme competences
A1	CE1 - Ability to know the scope of Bioinformatics and its most important aspects
A2	CE2 ? To define, evaluate and select the architecture and the most suitable software for solving a problem in the field of bioinformatics
A4	CE4 - Ability to acquire, obtain, formalize and represent human knowledge in a computable form for the resolution of problems through a computer system in any field of application, particularly those related to aspects of computing, perception and action in bioinformatics applications
A6	CE6 - Ability to identify software tools and most relevant bioinformatics data sources, and acquire skill in their use
B1	CB6 - Own and understand knowledge that can provide a base or opportunity to be original in the development and/or application of ideas, often in a context of research
B2	CB7 - Students should know how to apply the acquired knowledge and ability to problem solving in new environments or little known within broad (or multidisciplinary) contexts related to their field of study
B5	CB10 - Students should possess learning skills that allow them to continue studying in a way that will largely be self-directed or autonomous.
B6	CG1 -Search for and select the useful information needed to solve complex problems, driving fluently bibliographical sources for the field
B7	CG2 - Maintain and extend well-founded theoretical approaches to enable the introduction and exploitation of new and advanced technologies

C3	CT3 - Use the basic tools of the information technology and communications (ICT) necessary for the exercise of their profession and lifelong learning
C6	CT6 - To assess critically the knowledge, technology and information available to solve the problems they face to.

Learning outcomes			
Learning outcomes	Study programme competences		
Understand the medical imaging modalities and their significance	AJ1	BJ1	
Understand the basic concepts of image processing	AJ4 AJ6	BJ5 BJ6	CJ3
Design and evaluate medical analysis techniques	AJ2	BJ2 BJ7	CJ6

Contents	
Topic	Sub-topic
Introduction to digital imaging.	Adquisition models. Quality metrics. Color spaces. Histograms.
Image processing.	Enhancement. Edge detection. Segmentation. Morphological operators.
Image registration and fusion.	Intensity vs features. Similarity measures. Multimodal methods.
Validation of medical image analysis methodologies	Measures for quality assessment Training and testing methods Statistical tests

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A1 A4 B1	16	16	32
Laboratory practice	A2 A6 B2 B7 C3	16	32	48
Research (Research project)	A2 B2 B5 B6	16	32	48
Practical test:	A6 A2	0	16	16
Objective test	A1 A2 B1 B2 C6	3	0	3
Personalized attention		3	0	3
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Guest lecture / keynote speech	Lectures with the use of audiovisual aids. Questions will be raised in order to transmit the knowledge and enforce the learning.
Laboratory practice	The aim is to solve common problems in medical imaging using the methods explained in the lectures.
Research (Research project)	Proposal of a biomedical imaging problem in which learner is tasked with identifying problem, articulating specific nature of problem, analysing it, interpreting results, and reaching appropriate conclusion.
Practical test:	Practical application of specific techniques or procedures already studied in the keynote lectures during the semester.

Objective test	Test with questions about the theoretical contents of the subject as well as practical problems.

Personalized attention	
Methodologies	**Description**
Research (Research project) Practical test: Laboratory practice Objective test	Teachers will answer the doubts during the laboratory practice and they will provide personal advising for the supervised projects.

Assessment			
Methodologies	**Competencies**	**Description**	**Qualification**
Research (Research project)	A2 B2 B5 B6	Suitability of the proposed solutions to the problems. Quality of the obtained results. Comprehension of the employed techniques.	30
Practical test:	A6 A2	Suitability of the solutions to the practical excercises proposed during the semester.	20
Laboratory practice	A2 A6 B2 B7 C3	Suitability of the proposed solutions to the problems. Quality of the obtained results. Comprehension of the employed techniques.	20
Objective test	A1 A2 B1 B2 C6	Written test with theoretical questions and practical problems to be solved.	30

Assessment comments
In order to pass this subject, students have to get, at least, 50% of the mark in laboratory practice, supervised projects and objective test.ACADEMIC EXEMPTION For all those students with half time dedication and academic exemption specific considerations will be taken.

Sources of information	
Basic	- Rafael C. González, Richard E. Woods (2010). Digital image processing. Upper Saddle River (New Jersey) : Pearson-Prentice Hall, [2010] - Milan Sonka, Vaclav Hlavac, Roger Boyle (2014). Image processing, analysis and machine vision. Pacific Grove, California : Brooks/Cole Publishing Company,
Complementary	- David A. Forsyth, Jean Ponce (2012). Computer vision : a modern approach. Boston : Pearson - Richard Szeliski (2010). Computer Vision: Algorithms and Applications. Springer (draft online)

Recommendations
Subjects that it is recommended to have taken before
Introduction to programming/614522001
Subjects that are recommended to be taken simultaneously
Probability. statistics and elements of biomathematics/614522007 Foundations of Artificial Intelligence/614522003
Subjects that continue the syllabus
Advanced medical visualization/614522019
Other comments

(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.