



## IDENTIFYING DATA

### (\*)Tecnoloxías de imaxe médica

Subject	(*)Tecnoloxías de imaxe médica			
Code	V04M192V01301			
Study programme	Máster Universitario en Ingeniería Biomédica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	4.5	Mandatory	2nd	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Martín Rodríguez, Fernando			
Lecturers	Martín Rodríguez, Fernando			
E-mail	fmartin@uvigo.es			
Web	<a href="http://https://moovi.uvigo.gal/">http://https://moovi.uvigo.gal/</a>			
General description				

## Training and Learning Results

Code	
A3	That students are able to integrate knowledge and handle complexity and formulate judgments based on information that was incomplete or limited, include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments.
A5	Students must possess the learning skills that enable them to continue studying in a way that will be largely self-directed or autonomous.
B3	Knowledge in basic and technological subjects that will enable students to learn new methods and theories, and provide them the versatility to adapt to new situations.
B6	Capacity for handling specifications, regulations and mandatory standards.
C7	Knowledge and ability to apply lead generation principles radiation, radiation-matter interaction and ultrasound.

## Expected results from this subject

Expected results from this subject	Training and Learning Results
Specify, compare, evaluate and operate commercial systems of acquisition, storage, exchange and processed of medical images.	A3 B13 B13 B6 C15 C15 C7 C15 D4

Implement simple systems for medical image processing.	A3 A5 B13 B13 B3 B13 B13 B13 B13 C15 C15 C7 C15 D4 D4 D4
Specify, direct and evaluate the development of complex systems of medical image processing.	A3 B6 C15 C15 C15 C15 C7 C15 C15 D4 D4 D4

## Contents

Topic	
Medical imaging fundamentals.	- Ultrasound (ultrasound), digital radiography, computed tomography, magnetic resonance, PET. - Medical image formats (and medical information standards): DICOM, HL7.
Medical images processing.	- Image transforms: 2D Fourier transform (application in MRI), Radon transform (application in CT). - Filtering and restoration of images. - Segmentation methods and application of unsupervised learning techniques (machine learning). - Other processing techniques.
Practical contents.	- Working with free tools for visualization (using real medical studies). Examples: MicroDicom, Invesalius, 3D-slicer. - Practical case 1: small image processing project using classical techniques. Examples: digitalization of scanned ECG's, compression of 3D medical studies using 3D-DCT... - Practical case 2: small image processing project using machine learning (ML) techniques. Examples: help in the diagnosis of breast cancer in mammograohies using CNN's (deep learning), detection of pneumonia in digital chest X-rays.

## Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	16	26	42
Problem solving	8	15	23
Practices through ICT	14	26	40
Report of practices, practicum and external practices	0.5	1	1.5
Report of practices, practicum and external practices	0.5	4	4.5
Essay questions exam	1.5	0	1.5

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

## Methodologies

	Description
Lecturing	Contents of the course are presented by lecturer, encouraging the critical discussion of the concepts. The theoretical bases of algorithms and procedures used in the practical part are established.
Problem solving	Working in practical cases. Discussion about decision making in real projects. Calculations.

Practices through ICT Small projects are presented. The student must obtain the appropriate solution in a reasoned way, correctly choosing the applicable methods and reaching a valid solution.

Personalized assistance	
Methodologies	Description
Lecturing	Answering questions in class and tutorials, if necessary. <a href="https://www.uvigo.gal/es/universidad/administracion-personal/pdi/fernando-martin-rodriguez">https://www.uvigo.gal/es/universidad/administracion-personal/pdi/fernando-martin-rodriguez</a>
Problem solving	Answering questions in class and tutorials, if necessary. <a href="https://www.uvigo.gal/es/universidad/administracion-personal/pdi/fernando-martin-rodriguez">https://www.uvigo.gal/es/universidad/administracion-personal/pdi/fernando-martin-rodriguez</a>
Practices through ICT	
Tests	Description
Report of practices, practicum and external practices	On-site help and, if necessary, tutorial by appointment. Query and answer via e-mail. <a href="https://www.uvigo.gal/es/universidad/administracion-personal/pdi/fernando-martin-rodriguez">https://www.uvigo.gal/es/universidad/administracion-personal/pdi/fernando-martin-rodriguez</a>
Report of practices, practicum and external practices	On-site help and, if necessary, tutorial by appointment. Query and answer via e-mail. <a href="https://www.uvigo.gal/es/universidad/administracion-personal/pdi/fernando-martin-rodriguez">https://www.uvigo.gal/es/universidad/administracion-personal/pdi/fernando-martin-rodriguez</a>
Essay questions exam	Clarifications during the exam, if necessary.

Assessment					
	Description	Qualification	Training and Learning Results		
Report of practices, practicum and external practices	Report of the first proposed project. Medical image processing problem of low-medium difficulty.	25	A3 A5	B3	C7
Report of practices, practicum and external practices	Report of the second proposed project. Medical image processing problem of medium-high difficulty.	35	A3 A5	B3	C7
Essay questions exam	Questions about theory and practical work done. Practical questions about the course. Practical case studies, decision making...	40	A5	B3 B6	C7

### Other comments on the Evaluation

There is the option of global evaluation. The decision made the same day of the final exam by signing a resignation of the qualifications of the practical deliverables. In that case it is necessary to answer a set of extra questions of a practical nature.

The extraordinary call works equally as the ordinary one.

### Sources of information

#### Basic Bibliography

Paul Suetens, **Fundamentals of Medical Imaging**, 9780511596803, 2, CAMBRIDGE UNIVERSITY PRESS, 2009

Rafael C. González, **Digital image processing using MATLAB**, 9780982085400, 2, Gatesmark Publishing, 2009

#### Complementary Bibliography

Oleg S. Pianykh, **Digital Imaging and Communications in Medicine (DICOM)**, 9783642108495, 2, Springer-Verlag, 2012

Arnulf Oppelt Ed., **Imaging Systems for Medical Diagnostics**, 9783895782268, 2, Wiley, 2006

R. Nick Bryan Ed., **Introduction to the Science of Medical Imaging**, 9780521747622, 1, CAMBRIDGE UNIVERSITY PRESS, 2010

Krzysztof Iniewski Ed., **MEDICAL IMAGING Principles, Detectors, and Electronics**, 9780470391648, 1, Wiley, 2009

W.R. Hendee, E.R. Ritenour, **Medical Imaging Physics**, 9780471382263, 4, Wiley, 2002

N.A. Diakides, J.D. Bronzino, **Medical Infrared Imaging**, 9780849390272, 1, CRC Press, 2007

Xujing Yao et al., **A comprehensive survey on convolutional neural network in medical image analysis**, 10.1007/s11042-020-09634-7, Vol 81 (8), Springer-Nature, 2020

D.R. Sarvamangala, Raghavendra V. Kulkarni, **Convolutional neural networks in medical image understanding: a survey**, 10.1007/s12065-020-00540-3, PubMed, 2022

Fahad Shamshad et al., **Transformers in medical imaging: A survey**, 10.1016/j.media.2023.102802, Vol 88., Elsevier (Medical Image Analysis), 2023

