IDENTIFYING DATA
Real-Time Signal Processing

Subject	Real-Time Signal Processing				
Code	V05M145V01301				
Study programme	Máster Universitario en Ingeniería de Telecomunicación				
Descriptors	ECTS Credits		Choose	Year	Quadmester
	5		Optional	2nd	1st
Teaching language	English				
Department					
Coordinator	Martín Rodríguez, Fernando				
Lecturers	Martín Rodríguez, Fernando				
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General description	In this subject we deal with several architectures and techniques for real-time signal and video processing. Our main focus will be on hands-on, practical work and the capability to adapt to new, emerging, constantly evolving technologies and tools.				

Training and Learning Results

Code	
B1	CG1 Ability to project, calculate and design products, processes and facilities in telecommunication engineering areas.
B8	CG8 Ability to apply acquired knowledge and to solve problems in new or unfamiliar environments within broader and multidiscipline contexts, being able to integrate knowledge.
C21	CE21/PS1 Manage implementation of signal processing systems options to accelerate computationally complex algorithms.

Expected results from this subject

Expected results from this subject	Training and Learning Results
Understanding the basic principles of real time signal and video processing.	B1 B8 C21
Handling advanced programming tools for real-time signal and video and applications.	B1 B8 C21
Understanding the design and implementation of computationally complex models generated from data (machine learning) and their use in real applications.	B1 B8 C21
Knowing how to design the suitable software-hardware solution for a problem of signal processing with real-time restrictions.	B1 B8 C21

Contents

Topic	
Fundamentals of real-time signal and video processing	Real-time definitions Real-time processing platforms Software methods and algorithm simplifications
Design and implementation of real-time signal and video processing applications	Real-time constraints: from research to implementation. Practical examples for signal processing Practical examples for video processing

Highly demanding computational models learned from data	Machine learning principles
	Artificial neural networks and deep learning
	Typical DNN models and implementation
	Examples of highly demanding signal and video processing applications.
Practical content.	Work on three practical cases related to theory units.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	12	0	12
Practices through ICT	8	25	33
Case studies	5	70	75
Report of practices, practicum and external practices	1	0	1
Report of practices, practicum and external practices	1	0	1
Report of practices, practicum and external practices	1	0	1
Presentation	1	0	1
Objective questions exam	1	0	1

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

Methodologies

	Description
Lecturing	Description of the fundamental concepts and practical considerations for signal and video processing applicactions with real-time constraints. CG1
Practices through ICT	Individual practice work using computing platforms and/or simulators to implement and compare sotware solutions. CG1, CG8, CE21. Software: Matlab, Simulink, Python/OpenCV.
Case studies	Individual or group practice work using computing platforms and/or simulators to study and implement specific applications. CG1, CG8, CE21

Personalized assistance

Methodologies	Description
Practices through ICT	The instructor will propose practical exercises to grasp the concepts explained in class and related to the case studies. The professor will review with the student the design and the code of the student in each session. https://www.uvigo.gal/es/universidad/administracion-personal/pdi/fernando-martin-rodriguez
Case studies	The instructor will propose a couple of case studies and the students will need to study them and implement different solutions. The students will need to make a written report and present the results to their classmates. The professor will guide the students but the work is mainly done by them. https://www.uvigo.gal/es/universidad/administracion-personal/pdi/fernando-martin-rodriguez

Assessment

	Description	Qualification	Training and Learning Results	
Report of practices, practicum and external practices	CASE 1, REAL TIME PROGRAMMING. Report on the study of the practical case and solution adopted.	25	B1 B8	C21
Report of practices, practicum and external practices	CASE 2, REAL TIME PROGRAMMING AND MACHINE LEARNING. Report on the study of the practical case and solution adopted.	25	B1 B8	C21
Report of practices, practicum and external practices	CASE 3, ADVANCED MACHINE LEARNING, DEEP LEARNING. Report on the study of the practical case and solution adopted.	25	B1 B8	C21
Presentation	The students will present, individually, their work related to the case studies	10	B8	C21
Objective questions exam	Multiple choice test about course theory.	15	B1 B8	

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 short answer tests, case study reports and presentations.

There will be an ordinary call exam in the official date scheduled by the "Xunta de Escola" that the students that didn't pass the continuous assessment will have to take to pass the course (global assessment). 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. That means that he/she will appear as "presented" in the records of the subject even if assessment is not completed.

There will be a extraordinary exam at the end of the course for students who failed both in the continuous assesment mode and/or at ordinary 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.

Sources of information

Basic Bibliography

Nasser Kehtarnavaz and Mark Gamadia,, **Real-Time Image and Video Processing: From Research to Reality**, 1, Morgan & Claypool publishers, 2006

Gerassimos Barlas, **Multicore and GPU Programming: An Integrated Approach**, 1, Elsevier, 2015

Complementary Bibliography

Nasser Kehtarnavaz, Shane Parris,Abhishek Sehgal, **Smartphone-Based Real-Time Digital Signal Processing**, 1, Morgan & Claypool publishers, 2015

Nasser Kehtarnavaz, Fatemeh Saki, **Anywhere-Anytime Signals and Systems Laboratory: From MATLAB to Smartphones**, 1, Morgan & Claypool publishers, 2016

Recommendations

Subjects that it is recommended to have taken before

Signal Processing in Audiovisual Systems/V05M145V01205

Signal Processing in Communications/V05M145V01102