Universida_de_Vigo

IDENTIFYING DATA
(*)Sinais biomédicas

Subject	(*)Sinais biomédicas
Code	V04M192V01201
Study programme	Máster Universitario en Ingeniería Biomédica

Descriptors	ECTS Credits	Choose	Year	Quadmester
	4.5	Mandatory	1st	2nd

Teaching language	Spanish
Department	
Coordinator	Torres Guijarro, María Soledad
Lecturers	Torres Guijarro, María Soledad
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Web	
General description	In this course we will learn how to process encephalograms, electromyograms and electrocardiograms, extract their characteristics and classify them automatically using machine learning techniques. The learning methodology is "hands-on" using Matlab from the first day. Students must bring their laptop to all classroom sessions.

Skills

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.
C11	Ability to analyze and interpret signals and images from the biomedical field.

Learning outcomes

Expected results from this subject	Training and Learning Results
To know the signal processing techniques, and to apply them to biomedical signals.	A3 A5 B3 B6 C11
To know the techniques of feature extraction and signal dimension reduction, and to apply them to biomedical signals	A3 A5 B3 B6 C11
To know the methods automatic classification systems, and to apply them to biomedical signals	A3 A5 B3 B6 C11

Contents

Topic

Biomedical signals	Electroencephalogram. Electromyogram. Electrocardiogram. Other biomedical signals
Biomedical signal processing techniques	Introduction to spectral analysis. Power spectral density. Model-based parametric methods. Subspace-based methods for spectral analysis. Time-frequency analysis
Feature extraction and dimension reduction	Feature extraction methods Dimension reduction/feature selection methods. Electrocardiogram pre-processing.
Biomedical signal classification methods	Performance evaluation metrics. Linear discriminant analysis. Naïve Bayes. K-Nearest Neighbour. Artificial Neural Networks. Support Vector Machines. Decision Trees. Deep Learning

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	14.5	23	37.5
Problem solving	7.5	15	22.5
Laboratory practical	13.5	27	40.5
Essay questions exam	1	0	1
Problem and/or exercise solving	1	0	1
Report of practices, practicum and external practices	0	10	10

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

Methodologies

	Description
Lecturing	Presentation by the teacher of the contents of the subject, fostering the critical discussion of the concepts. The theoretical grounds of algorithms and procedures used to resolve problems are given. With this methodology they work the competences CB3, CB5, CG3, CG6 and CE11.
Problem solving	Theoretical content is complemented by problem solving using the Matlab programme. With this methodology they work the competences CB3, CB5, CG3, CG6 and CE11, individually or in couples.
Laboratory practical	Programming analysis tools and algorithms, identifying which one should be used in each situation. Software to be used: Matlab. With this methodology they work the competences CB3, CB5, CG3, CG6 and CE11, individually or in couples.

Personalized assistance

Methodologies	Description
Lecturing	Doubts can be solved in the rests of the classes and in the teacher tutorial sesions. These tutorial sessions will be done individually or in short groups (with a maximum of 2-3 students). The tutorial sessions are typically agreed with the professor. The meetng requests can be done personally or by email. The tutorial sessions are preferably done in the schedules and place officially reserved for them.
Problem solving	Problems sessions are a good moment to consult doubts with the professor. The professor moves between the tables and some students take advantage of the proximity of the professor to consult doubts.
Laboratory practical	Practical sessions are a good moment to consult doubts with the professor. The professor moves between the tables and some students take advantage of the proximity of the professor to consult doubts.

Assessment

	Description	Qualification	Training and Learning Results		
Essay questions exam	Written assessment tests, with long developmental questions.	20	A3 A5	B3 B6	C11
Problem and/or exercise solving	Written evaluation tests, with brief questions and problems.	20	A3 A5	B3 B6	C11
Report of practices, practicum and external practices	Assessment of a written report that describes the work of practical sessions.	60	A3 A5	B3 B6	C11

Other comments on the Evaluation

Sources of information
Basic Bibliography

Abdulhamit Subasi, **Practical Guide for Biomedical Signals Analysis Using Machine Learning Techniques - A MATLAB based approach**, 978-0-12-817444-9, 1, Academic Press, 2019

Complementary Bibliography

Rangaraj M. Rangayyan, **Biomedical signal analysis. A case-study approach**, 0-471-20811-6, 1, Wiley-IEEE Press, 2002

Recommendations

Subjects that continue the syllabus

(*)Análise cronobiolóxico de sinais biomédicas/V04M192V01306

(*)Bioinstrumentación. Sistemas de monitorización/V04M192V01305

(*)Tecnoloxías de imaxe médica/V04M192V01301

Subjects that it is recommended to have taken before

(*)Estatística avanzada para a enxeñaría biomédica/V04M192V01101

(*)Métodos matemáticos aplicados á enxeñaria biomédica/V04M192V01102