VNIVERSITAT DE VALÈNCIA

Course Guide
43081 Digital analysis of signals and images in physiology

COURSE DATA

Data Subject	
Code	43081
Name	Digital analysis of signals and images in physiology
Cycle	Master's degree
ECTS Credits	3.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
2141 - M.U. en Fisiología 12-V.2	Faculty of Medicine and Odontology	1	First term
3127 - Physiology	Doctoral School	0	First term

Subject-matter

Degree	Subject-matter	Character
2141 - M.U. en Fisiología 12-V.2	1 - Methodology for research in physiology	Obligatory
3127 - Physiology	1 - Complementos Formación	Optional

Coordination

Name	Department
SALVADOR PALMER, MARIA ROSARIO	190 - Physiology

SUMMARY

This course shows the possibilities offered by the extraction of information represented graphically, both in images and in signs of biomedical interest. Students are introduced to the techniques of capturing, processing and treating images and signals, so that they can obtain information of interest from them. The applicability to digital radiology and cytogenetics, thermography, and electromyography and electrocardiography is discussed theoretically and practically.

Thus, the general objectives of the subject are as follows:

- Know the techniques for capturing, storing and processing images and signals of medical interest.

- Apply the techniques of processing, treatment and analysis of images and signals to digital radiography, cytogenetics, thermography, electromyography and electrocardiography.

- Use the analysis tools of the software associated with the treatment of biomedical images and signals.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

There are no prerequisites for taking the subject.

OUTCOMES

2141 - M.U. en Fisiología 12-V.2

- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.
- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.
- Be able to integrate new technologies in their professional and/or research work.
- Be able to access to information tools in other areas of knowledge and use them properly.
- To acquire a critical attitude that allows you to make reasoned judgments and defend them with rigor and tolerance.
- Assess the need to complete the scientific training, in languages, computer science, ethics, etc., attending conferences or courses and/or carrying out complementary activities, self-evaluating the contribution that the performance of these activities implies for their comprehensive training.
- Handle the different techniques for processing digital images to obtain information of scientific interest in the image in question.

LEARNING OUTCOMES

Work with information sources, both traditional and through Internet technologies.

Synthesize and communicate scientific information.

Know a basic level of the chain of devices necessary to obtain biomedical signals and images.

Know at a basic level the ways of storing data in a digital memory. Data compression concept.

Know the basic computer language applied to signal and image analysis.

Select among the signal analysis and training techniques the most appropriate for the problem in question.

Use image management software: in radiography, in cytogenetics, in thermographic analysis, and in electromyography and electrocardiography.

DESCRIPTION OF CONTENTS

1. Image overview

-The eye: sensor of human vision.
-Image formation: object, lens and sensor.
-Sampling and quantification.
-Monochrome and color images.
-Storage of images. Formats.

2. Digital image processing

-Contrast and shine.
-The histogram. Histogram modification.
-Image filters.
-Segmentation by areas of interest.

3. Morphological imaging systems

-Introduction.
-Visible image: Photography, optical fiber: endoscopy.
-Microscopy: optical, confocal and scanning.
-X-ray image: radiography, fluoroscopy and CT.
-Ultrasound.

4. Functional imaging systems

-Introduction.
-Thermography.
-Nuclear magnetic resonance.
-Images in Nuclear Medicine: Scans, SPECT, PET.

5. Practical applications of treatment of medical imaging

-Introduction.
-Multimodality medical images co-registration: rigid fusion and deformable fusion.
-Segmentation of medical images. Manual segmentation and automatic segmentation. Examples.
-Display of medical images: with of window and level.
-Practical examples of applications of filters to medical images.

6. Practice: Thermographic images

-Basis.
-Applicability.

7. Practice: Acquisition and treatment of bioelectric signals

-Electromyography.
-Electrocardiography.

8. Practice: Medical imaging treatment I

-Color, color depth and RGB channels.
-Level and window in a digital medical image.
-Image resolution.

9. Practice: Treatment of medical images II

-Measurement of distances and angles.
-Improvement of the image by manipulation of the histogram.
-Subtraction of images. Its application in medical images.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	14,00	100
Laboratory practices	4,00	100
Tutorials	2,00	100
Other activities	2,00	100
Development of individual work	12,00	0
Study and independent work	10,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	11,00	0
Preparing lectures	3,00	0
Preparation of practical classes and problem	2,00	0
Resolution of case studies	10,00	0
TOTAL	**75,00**	

TEACHING METHODOLOGY

- Theoretical classes with active alumni participation.

- Practical laboratory classes, including introductory seminars, conducting internships with the teacher follow-up and support, and redaction of a written memory or written test.

- Conferences of experts in the different subjects.

- Face-to-face and electronic tutoring with teachers.

EVALUATION

Evaluation system:

- Written exam consisting of 6 short answer questions: evaluation up to 6 points.

- Memories of the practices of Thermography and Biosignals: evaluation up to 4 points.

Attendance at 80% of the practices is compulsory.

Minimum passing grade: 5 points.

REFERENCES

Basic

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- GIBSON R. Essential medical imaging. Ed. Cambridge University Press (2009). ISBN: 9780521709118.

Additional

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- DOWSETT DJ. The physics of diagnostic Imaging. Ed. Taylor & Francis. CRC Press (2006). ISBN: 9780340808917.
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- LEONDES CT ed. Medical Imaging Systems Technology. Ed. World Scientific (2005). ISBN: 9812563644.
- METTLER F. Medical effects of ionizing radiation. Ed. Saunders (2008). ISBN: 978072160.
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