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| Biomedical Image Processing |
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**Academic Year: ( 2023 / 2024 )**  **Review date: 16-01-2024**

**Department assigned to the subject: Signal and Communications Theory Department**

**Coordinating teacher: DIAZ DE MARIA, FERNANDO**

**Type: Electives  ECTS Credits : 6.0**

**Year : 1 Semester : 1**

## OBJECTIVES

The objective of this course is that the student knows what a digital image is (sampling and quantification) and the basic image processing techniques (point-to-point operations, filtering, segmentation, morphological processing, etc). Additionally, it will deepen in the particular case of medical imaging, emphasizing on visualization techniques and multimodal image analysis and registration. On the other hand, students will not only study the techniques, but will also implement them in the laboratory, solving practical problems.

## DESCRIPTION OF CONTENTS: PROGRAMME

1.- Digital images. Sampling, quantization and color representation.
2.- Fundamentals of bioimages
3.- Basic image processing techniques
  3.1. Pixel-wise transformations
  3.2. Filtering
  3.3. Fourier transform
  3.4. Interpolation
  3.5. Edge detection
  3.6. Restoration
4.- Segmentation
5.- Morphological processing
6.- Feature extraction for image classification
7.- Multimodal image visualization and analysis
8.- Wavelets and multiresolution
9.- Keypoint detectors and descriptors
10.- Multidimensional image registration
11.- Advanced segmentation

## LEARNING ACTIVITIES AND METHODOLOGY

AF3    Theoretical practical classes
AF4    Laboratory practices
AF6    Team work
AF7    Student individual work
AF8    Partial and final exams

METODOLOGY
MD1: Class lectures by the professor with the support of computer and audiovisual media, in which the main concepts of the course are developed and complemented with bibliography.
MD3: Resolution of practical cases, problems, etc. .... posed by the teacher individually or in groups.
MD4: Presentation and discussion in class, under the moderation of the professor, of topics related to the content of the course, as well as case studies.
MD5: Elaboration of works and reports individually or in groups

## ASSESSMENT SYSTEM

SE2 Individual or team works made during the course
SE3 Individual partial exams

Specifically:
Partial exams/quizzes: 40%
Projects: 60%


The evaluation of the extraordinary call will be made on the basis of the projects (which the student must do in any case). The continuous evaluation exams and questionnaires will be taken into account only if they contribute positively to the final grade.

**% end-of-term-examination:** 0

**% of continuous assessment (assigments, laboratory, practicals…):** 100

BASIC BIBLIOGRAPHY

- G. Dougherty Digital Image Processing for Medical Applications, Cambridge University Press, 2009

- Mark A. Haidekker Advanced Biomedical Image Analysis, John Willey and Sons, 2011

- Rafael C. González and Richard E. Woods Digital Image Processing, Fourth Edition, Pearson, 2018

ADDITIONAL BIBLIOGRAPHY

- P. Suetens Fundamentals of Medical Imaging, Cambridge University Press, 2009

- Wilhelm Burger and Mark J. Burge Principles of Digital Image Processing: Fundamental Techniques, Springer-Verlag, 2009
- Wilhelm Burger and Mark J. Burge Principles of Digital Image Processing: Core Techniques, Springer-Verlag, 2009