COURSE DESCRIPTION
BIOMEDICAL IMAGING

SSD: BIOINGEGNERIA ELETTRONICA E INFORMATICA (ING-INF/06)

DEGREE PROGRAMME: BIOINGEGNERIA INDUSTRIALE (P16)
ACADEMIC YEAR 2024/2025

COURSE DESCRIPTION

TEACHER: ANDREOZZI EMILIO
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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: U1591 - BIOMEDICAL IMAGING AND COMPUTER INTERFACE FOR BIOLOGICAL SYSTEMS
MODULE: U1592 - BIOMEDICAL IMAGING
TEACHING LANGUAGE: INGLESE
CHANNEL: FG A-Z
YEAR OF THE DEGREE PROGRAMME: II
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER II
CFU: 6

REQUIRED PRELIMINARY COURSES

None.

PREREQUISITES

Basic knowledge of physics and computer science.

LEARNING GOALS

The course aims to provide the fundamentals of bioimaging techniques, such as radiography, computed tomography, ultrasound imaging, magnetic resonance imaging, nuclear imaging, as well as basic methods for bioimage processing analysis. The course also aims to provide basic operational skills for bioimage processing in various applications.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The student will acquire knowledge and skills to understand issues related to the acquisition, processing, and analysis of bioimages, and their use to investigate the structure and function of biological systems.

Applying knowledge and understanding

The student will be able to analyze and process bioimages, and identify the most appropriate imaging techniques for various application purposes.

COURSE CONTENT/SYLLABUS

General characteristics of images. Characteristics of digital images. Main techniques for image enhancement. Main filtering operations. Edge extraction. Binary maps. Image segmentation and morphological operations. Physical principles of X-ray imaging. Conventional radiography and applications. Computed tomography (CT): acquisition, image reconstruction methods, and applications. Physical principles and applications of Magnetic Resonance Imaging (MRI). Functional MRI and applications. Nuclear imaging techniques. Physical principles and applications of ultrasound imaging.

READINGS/BIBLIOGRAPHY

Raphael C. Gonzalez, Richard E. Woods, "*Digital Image Processing*", Prentice Hall
Al Bovik, "*The Essential Guide to Image Processing*", Academic Press
D.R. Dance, S. Christofides, A.D.A. Maidment, I.D. McLean, K.H. Ng, "Diagnostc Radiology Physics. A Handbook for Teachers and Students", International Atomic Energy Agency
Nadine Barrie Smith and Andrew Webb, "*Introduction to Medical Imaging: Physics, Engineering and Clinical Applications*", Cambridge University Press
Jerrold T. Bushberg, J. Anthony Seibert, Edwin M. Leidholdt Jr, John M. Boone, "*The Essential Physics of Medical Imaging*", Wolters Kluwer Health

Lecture notes.

TEACHING METHODS OF THE COURSE (OR MODULE)

Frontal lectures and practicals.

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- [x] Written
- [x] Oral
- [ ] Project discussion
- [ ] Other

In case of a written exam, questions refer to

- [x] Multiple choice answers
- [ ] Open answers
- [ ] Numerical exercises

b) Evaluation pattern