UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Professional Training

2627-3-I0303D018

Aims

1. Knowledge and understanding

By the end of the course, the student will be able to:

understand the basic methodologies for the correct acquisition and processing of medical images obtained using radiological, magnetic resonance, and nuclear medicine equipment.

2. Applying knowledge and understanding

By the end of the course, the student will be able to:

interpret the role of biomedical image acquisition and processing techniques in radiology (CT and MRI) and nuclear medicine, and recognize the main indications for specific image processing procedures.

3. Making judgments

By the end of the course, the student will be able to:

critically evaluate the accuracy of results obtained through acquisition procedures tailored to specific clinical questions (e.g., 4D acquisition techniques for radiotherapy treatments, methods to improve imaging system resolution); understand the importance of customizing acquisition based on patient and disease treatment needs; and identify—within the image processing workflow—any artifacts in the processed image that might compromise the result and the subsequent image interpretation.

4. Communication skills

By the end of the course, the student will be able to:

use appropriate scientific terminology regarding various biomedical image acquisition modalities and describe the rationale behind key processing strategies within multidisciplinary teams.

5. Learning skills

By the end of the course, the student will be able to:

independently update their knowledge by consulting scientific literature and national and international guidelines; understand the evolution of biomedical digital image processing techniques and their impact on clinical practice; develop an approach oriented towards continuous learning and evidence-based medicine.

Contents

The laboratory provides students with the knowledge of the methods of acquisition, processing and analysis of medical images obtained from the instruments used in diagnostic radiology, MRI and nuclear medicine-not invasive. In particular the laboratory explains the procedures for the extraction of useful information through the use of appropriate techniques.
So this laboratory provides students with the knowledge of biomedical imaging processing for their effective application in work activities

Detailed program

- A/D image conversion: spatial sampling and color and gray level coding, dithering.
- Quality improvement techniques: histogram construction, brightness correction, contrast and gamma, threshold, histogram equalization, look-up table.
- Logical and bit-plane slicing operators.
- The two-dimensional convolution. Low pass and high pass mask filters.
- Exaltation and extraction of the contours: Prewitt and Sobel filters, gradient algorithm.
- Non convolutive filters: the median filter.
- The spatial frequency domain: the two-dimensional Fourier transform. 3D image processing: geometric transformations, surface extraction and reconstruction, 3D visualization models, multimodal image integration.
- Axial tomography: projections, sinogram, analytical and iterative methods of reconstruction.
- Reorientation of SPET and PET tomographic images in cardiac studies: short axis, horizontal long axis, vertical long axis.
- Biomedical image analysis methods - visual analysis of static and dynamic images in nuclear medicine - quantitative analysis of static, dynamic and gating images in nuclear medicine - regions of interest (ROI) - time/activity curves - Standardized uptake value (SUV))
- compartmental model FDG with plasma and tissue sampling - parametric images
- Application of the main methods of image analysis in oncology, cardiology and neurology - CT-SPET and CT-PET integration in oncology with applications in radiotherapy.

Prerequisites

None

Teaching form

36 hours divided into 9 meetings in mixed teaching, in-person workshops and exercises and video recordings of the activities available on the site

Textbook and teaching resource

Slides and videos of lectures

Semester

II semester

Assessment method

There isn't final assessment but the frequency is recorded in the laboratories.

Office hours

By appointement

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | QUALITY EDUCATION | GENDER EQUALITY