Medical Image Reconstruction

Academic Year: (2023 / 2024) **Review date: 01/02/2024 14:17:59**

Department assigned to the subject: Bioengineering Department

Coordinating teacher: ABELLA GARCIA, MONICA

Type: Electives ECTS Credits : 6.0

Year : 1 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Image processing, programming, statistics.
Advanced programing skills in Matlab are essential to follow the sessions, which will have a high practical content based on algorithm programing in Matlab.

OBJECTIVES

The objective of this course is to allow the students to understand the main image reconstruction techniques used in the CT, PET, SPECT and MRI medical imaging systems, not only from a theoretical point of view, but also in a practical way through the implementation of the algorithms in Matlab. At the same time, the student will become familiar with the data acquired in each type of system, which is essential to be able to correctly approach the reconstruction problem.

DESCRIPTION OF CONTENTS: PROGRAMME

This course covers the main image reconstruction techniques used in the tomographic imaging systems TAC, PET, SPECT and MRI.
It will allow the student to get familiar with the acquired data in each system that enable the generation of the tomographic image, basic to be able to approach the reconstruction problem.
The contents can be sumarized in (see more details in the weekly planning):
1. Introduction to tomographic image reconstruction.
2. Imaging basics: spatial resolution, noise/artefifact, Fourier transform, Radon transform.
3. Acquisition geometries: parallel beam, fan beam beam and cone beam.
4. Analytical algorithms.
5. Iterative algorithms.
6. Advanced methods.
5. Practical applications in different image modalities.

LEARNING ACTIVITIES AND METHODOLOGY

The course will be mostly in computer room to put in practice all the concepts.

ASSESSMENT SYSTEM

% end-of-term-examination/test:	0
% of continuous assessment (assigments, laboratory, practicals…):	100

Both for the ordinary and the extraordinary call, the course evaluation will be based on:
- Participation during the classes: 5% of the final grade.
- Tests and works done individually or in groups during the course: 95% of the final grade.

BASIC BIBLIOGRAPHY

- Aninash C. Kak, Malcolm Slaney Principles of Computerized Tomographic Imaging (Classics in Applied Mathematics), Society for Industrial and Applied Mathematics, 1987

ADDITIONAL BIBLIOGRAPHY

- Frank Natterer The Mathematics of Computerized Tomography, SIAM, 2001