Medical Image Reconstruction

Academic Year: (2021 / 2022) **Review date: 09-06-2021**

Department assigned to the subject:

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

CB6 Having and understanding the knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context
CB7 Students know how to apply their acquired knowledge and problem-solving skills in new or unfamiliar settings within broader (or multidisciplinary) contexts related to their field of study.
CB8 Students are able to integrate knowledge and to face the complexity of making judgments based on information that, being incomplete or limited, includes reflections on the social and ethical responsibilities linked to the application of their knowledge and judgments.
CB9 Students know how to communicate their conclusions and the knowledge and ultimate reasons behind them to specialised and non-specialised audiences in a clear and unambiguous way.
CB10 Students have the learning skills that will enable them to continue studying in a way that will be largely self-directed or autonomous.

General competences

CG2 Ability to apply the knowledge of skills and research methods related to engineering.
CG3 Ability to apply the knowledge of research skills and methods related to Life Sciences.
CG4 Ability to contribute to the widening of the frontiers of knowledge through an original research, part of which merits publication referenced at an international level.
CG5 Ability to perform a critical analysis and an evaluation and synthesis of new and complex ideas.
CG6 Ability to communicate with the academic and scientific community and with society in general about their fields of knowledge in the modes and languages commonly used in their international scientific community.

Specific competences

CE6 Ability to understand the basis of the main technologies involved in biomedical imaging systems.
CE7 Ability to solve a biomedical problem from an engineering perspective based on the acquisition and processing of biomedical images

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

The course evaluation will be based on:
- Participation during the classes: 5% of the final grade.
- Tests and works done individualy or in groups during the course: 95% of the final grade.

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

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