

PROCESSAMENTO DE IMAGEM BIOMÉDICA

Code: 16011

Main Scientific Area: Control, Automation and Robotics

Lecturer: José Henrique de Araújo Silveira de Brito

Language of Instruction: Portuguese

Regime: S2

Contact Hours: 60h Total Workload: 100h

ECTS: 6,0

Objectives

This course aims to give students knowledge about theoretical concepts and practical methodologies on the acquisition and processing of biomedical images.

Learning Outcomes

By the end of the course, students should be able to:

- Distinguish and understand the different medical imaging modalities, their physical principles and clinical applications
- Know, understand, implement, evaluate and select different methods and algorithms for biomedical image processing

Course Contents

1. Medical Imaging Modalities

1.1. Radiology

1.2. CT Scanning

1.3. Ultra-sound

1.4. RMI

1.5. PET

1.6. Video based modalities

2. Medical Image Processing

2.1. Digital Image: Spatial resolution, tonal resolution, connectivity, metrics

2.2. Image representation: Color spaces, color space transformations

2.3. Types of operations: point-to-point operations, local operations, global operations.

2.4. Histogram, histograma equalization

- 2.5. Noise filtering.
- 2.6. Segmentation: Binarization, Segmentatio, Region Extraction, Labeling
- 2.7. Morphological Operations.
- 2.8. Edge detection, line detection, circle detection
- 2.9. Region coding and representation: RLE, Chain code, polygonal approximations
- 2.10. Image registration

Recommended Bibliography

João Martins Pisco, Luís Aires de Sousa, "Noções Fundamentais de Imagiologia", Lidel, 2001

Richard Szeliski, Computer Vision: Algorithms and Applications, Springer, 2011

Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson, 2018

J.C. Russ, "The Image Processing Handbook", CRC Press, 2017

Arthur Ardeshir Goshtasby, "2-D and 3-D Image Registration: for Medical, Remote Sensing, and Industrial Applications", Wiley, 2005

Learning and Teaching Methods

The first part of the course syllabus covers all major modalities of biomedical imaging, fulfilling the first objective.

The second part focuses on the fundamental concepts of image processing, covering the second objective.

Assessment Methods

Grading has 2 components, theoretical and practical, each with 50% weight in the final grade.

Theoretical evaluation is done through 2 written tests.

Practical evaluation is done through 2 projects, throughout the semester. These projects will be done in groups of 2 students with individual grades. On each of these projects, the students will write a report.

Projects will focus on theoretical and practical aspects on the course syllabus.

The grade of the final exam only covers the theoretical component of the final grade.

Grades on the projects and reports will be given individually, following a discussion on the report with the teacher.

The minimum grade in every test and project is 8.