69319 - Analysis of medical images

Información del Plan Docente

Academic Year	2016/17
Academic center	110 - Escuela de Ingeniería y Arquitectura
Degree	547 - Master's in Biomedical Engineering
ECTS	3.0
Course	1
Period	Second semester
Subject Type	Optional
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

5.Activities and resources

5.1.General methodological presentation

This course has a practical orientation and design: all methodologies that will be covered during the course will be exemplified with real examples. In some cases, the same example will be used to present and compare the performance of several methodologies. Therefore, the learning process will be driven by projects and examples, which will cover the following domains:

1. Representation and visualization of medical images. MRI, CT, ultrasound images.
2. Segmentation of medical images. Voxel-wise methods. Regions of interest methods. Model-based methods. Brain tumor segmentation.
3. Registration of medical images. Rigid and non-rigid registration. Computational anatomy. Brain morphometry.

4. Statistical shape analysis. Group-level inference for clinical trials and disease undertanding. Individual-level inference for image-based diagnosis.

5.2.Learning activities

The program of this subject was designed in order to offer the students a practical path to achieve the learning outcomes. This program contains the following activities:

A01 Lectures (18 hours) The set of lectures will be devoted to introduce the concepts, to show illustrating examples. During these lectures both teacher and students will make use of the computer during the class.

A04 Laboratory sessions (4 hours) A minimum of two sessions (two hours each) will be performed in a computer room. The students will have to ellaborate a short project will be previously announced and available through the Moodle platform https://moodle.unizar.es/ .

A03 Projects Each individual student will make a project under mentoring of the teacher. This project will be evaluated with a short document and with an oral presentation.

A06 Tutorials The teacher will be available to the students for helping them in their learning process, either in small groups or individually. A minimum of six hours will be offered during each week of the course.

A08 Evaluation A set of tests will be performed during the course, with either a theoretical or practical orientation. These activities are described in more detail in the Evaluation Section. These activities will help to monitor and to assess the quality of the individual learning process for each student.

5.3.Program

1. Basic concepts of medical imaging. Imaging modalities. Representation and visualization of medical images. Image formats: DICOM, Analyze, Nifty. Pipelines of medical image analysis.
2. Segmentation of medical images.
   - Thresholding. Morphological filtering.
   - Probabilistic models for image segmentation
   - ITK-SNAP tool.
3. Registration of medical images.
   - Rigid and non-rigid registration.
   - Deformation models: parametric and non-parametric.
   - Toolbox FAIR
4. Statistical shape analysis.
   - Shape descriptors. Pose definition
   - Hypothesis testing. Multiple comparison correction.

5.4.Planning and scheduling

The timetable of the subject, including lectures and laboratory sessions, will be given by EINA center. This timetable will be given to the students during the first day and it will be available in the Moodle platform https://moodle.unizar.es/ .

5.5.Bibliography and recomended resources

BC	Dhawan, A. Medical image analysis / A Dhawan. J. Wiley & Sons Inc, New Jersey, 2011.
BC	Hajnal, J. Medical image registration / J.

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	Hajnal, D. Hill, D. Hawkes CRC Press, Florida, 2001.
BC	Handbook of medical image processing and analysis [Recurso electrónico] / edited by Issac N. Bankman. . 2nd ed. Academic Press, San Diego, 2000.
BC	Moderstizki, J. FAIR, Flexible algorithms for image resgistration / J. Moderstizki . SIAM, Philadelphia, 2009.
BC	Toennies, K . Guide to medical image analysis, methods and algorithms / K. Toennies . Springer, London, 2012.