69319 - Analysis of medical images

Syllabus Information

Academic Year: 2019/20
Subject: 69319 - Analysis of medical images
Faculty / School: 110 -

Degree: 547 - Master's in Biomedical Engineering

ECTS: 3.0
Year: 1
Semester: Second semester
Subject Type: Optional
Module: ---

1.General information

1.1.Aims of the course

1.2.Context and importance of this course in the degree

1.3.Recommendations to take this course

2.Learning goals

2.1.Competences

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives. It is based on a practical orientation where all methodologies employed during the course will be illustrated with real examples. In some cases, the same examples 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 topics:

1. Segmentation of medical images. Brain tumor segmentation from multimodal MRI images.
2. Registration of medical images. Computational anatomy and brain morphometry; motion correction artificats on time-series of medical images and brain perfusion.
3. Statistical shape analysis. Statistical inference for clinical trials and disease understanding.

4.2.Learning tasks

The course includes the following learning tasks:

A01 Lectures (28 hours). The set of lectures will be devoted to introduce the concepts as well as to show illustrating examples. During these lectures both teacher and students will make use of the computer during the class.

A03 Projects. Each individual student will make three projects, one for each of the main topics of the course: segmentation, registration and statistical shape analysis. These projects will be evaluated with a short document and with eventually 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 per week.

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

4.3.Syllabus

The course will address the following topics:

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. Segmentaion of medical images.

    1. Thresholding. Morphological filtering

    2. Probabilistic models for image segmentation

    3. ITK-SNAP tool.

3. Registration of medical images.

    1. Rigid and non-rigid registration. Deformation models: parametic and non-parametric.

    2. Toolbox FAIR. Applications: Computational anatomy and brain morpholometry. Analysis of brain perfusion from DSC-MRI and correcction of motion artifacts.

4. Statistical shape analysis.

    1. Shape description. Pose definition

    2. Statistical inference. Multiple comparison correction and spatial correlation.

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        ○ Toolbox FAIR. Applications: Computational anatomy and brain morphometry. Analysis of brain perfusion from DSC-MRI and correction of motion artifacts.

        1. Statistical shape analysis.

        ○ Shape descriptors. Pose definition

        ○ Statistical inference. Multiple comparison correction and spatial correlation.

4.4.Course planning and calendar

This course is planned for the spring semester. Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the EINA website and Moodle https://moodle.unizar.es/.

4.5.Bibliography and recommended resources

http://biblos.unizar.es/br/br_citas.php?codigo=69319&year=2019