UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Medical Imaging & Big Data

2122-2-F9101Q028-F9101Q029M

Aims

[Overview of the program of the course]

Medical images are one of the largest and fastest growing resources of information and present some of the biggest challenges for data science due to their volume, multimodality and complexity.
The explosion in data collection from different sources makes their unaided processing and interpretation by humans impossible, and requires the development of automated storage, management, processing and analysis algorithms.

Moreover, medical-imaging devices (such as magnetic resonance imaging or positron emission tomography) do not immediately provide physicians with the kind of information relevant to their needs, e.g. imaging biomarkers for diagnosis, prognosis and therapy. Image processing algorithms are needed to extract this information from the physical and statistical laws that relate the measurements with the image.

New image analyses, from theory and algorithm design to the development of advanced methods for feature extraction, selection and classification, are crucial to extract to the most informative features that can be used to support the clinical diagnostic process.

The course will present several image processing methods and their potential for managing big medical-imaging data, facing dimensionality problems by extracting image features relevant to clinical needs as candidate disease biomarkers.

Each topic will be addressed in two parallel sessions, i.e., academic lessons and laboratory activities.

Contents

- Segmentazione di immagini mediche
- Tecniche di estrazione e selezione di feature
- Modelli predittivi
- Dalle immagini mediche ai biomarcatori
- Texture Analysis
- Radiomica
- Statistical Parametric Mapping

Detailed program

Prerequisites

During the course (practical sessions) and the implementation of the final projects, we will make use of Matlab (The MathWorks). Because of this, students are required to download and install Matlab on their laptops.

A

A useful tool for neuroimage visualization is MRIcron, which is freely available for download on this webpage or ITK-SNAP

Teaching form

Each topic will be addressed in two parallel sessions, i.e., academic lessons and laboratory activities.

Attendance is mandatory for 100%.

Textbook and teaching resource

Semester

Second semester

Assessment method

The exam is composed of a practical session and a theoretical session.

The practical session consists in completing and presenting a project. For this task, students will be divided into groups, which will be evaluated based on the project development and implementation and on the final presentation. A score will be assigned to each group (not to each student individually).

The theoretical session consists in an oral examination with questions regarding the theoretical lessons of the

course and a scientific paper. The evaluation of this session will be individual.

A final score will be assigned to each student individually, considering both the evaluation of the practical session and the oral examination.

Office hours

On request by e-mail.

Please, leave any comment/suggestion about the course here.