UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Medical Imaging & Big Data

2425-2-FDS01Q026-FDS01Q030M

Aims

Medical imaging is one of the fastest growing fields in healthcare. Currently, images are qualitatively analysed by specialised observers. Artificial intelligence techniques can enable quantitative operator independent analyses. Analysis algorithms face many issues intrinsic of the problem: observables not clearly defined, massive data, complex results validation (i.e.: due to the intrinsic characteristics of the pathologies under study, datasets might be very small and with low numerosity).

Artificial intelligence, especially with convolutional neural networks, has high potential to transform this field.

The course will show the basis of medical imaging, it will show objectives where it is already applied in the field and those where research is in active development. .

The course will include both some theory about image formation and medical application, and mostly laboratory experiences (programming).

Contents

Introduction of medical imaging, image pre-processing, common machine and deep learning applications in this field

Detailed program

- Medical imaging: most common techniques, fields of application, properties of the different images
- Image pre-processing: techniques to optimize inputs for subsequent applications

- Image segementation: recognition of structures or targets using Deep or machine learning
- Features extraction for machine learning
- Predictive models
- Analysis of real world application: medical literature related to AI/ML algorithms

Prerequisites

- Python programming language: most lab experiences will be on jupyter notebooks
- Statistics related to regression and classification, their metrics and the most common classifiers/regressors
- Basics of deep learning related to imaging

Teaching form

Lectures related to theory. Every lecture will be followed by a corresponding laboratory experience

Textbook and teaching resource

Slide decks and programming tutorials provided by the tutor

Book: Zhou, K., Greenspan, H., & Shen, D. (Eds.). (2017). Deep learning for medical image analysis. Academic Press.

Semester

Second semester

Assessment method

Final examination will be composed by a theoretical part and a laboratory project.

Laboratory project will be a group task. This will be evaluated according to the quality of the techniques used and on the presentation of the results.
Theoretical knowledge will be assessed in an oral examination. The student will present a scientific paper of its own choice. This will be the base for questions related to what was presented during the lectures.

Office hours

By email request

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | QUALITY EDUCATION | INDUSTRY, INNOVATION AND INFRASTRUCTURE