Personalized Medicine

Academic Year: (2023 / 2024)   **Review date: 30-01-2024**

Department assigned to the subject: Bioengineering Department

Coordinating teacher: MUÑOZ BARRUTIA, MARIA ARRATE

Type: Electives ECTS Credits : 3.0

Year : 1 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

It is advised to have completed:

- Biosignals & Bioimages
- Machine Learning
- Deep Learning

OBJECTIVES

Personalized medicine identifies elements that predict the individual's predisposition to disease and their response to treatment. The course aims to familiarize the students with the tools and methods of personalized medicine. Namely, how genomic and -omics information is integrated with clinical, imaging, and custom laboratory data to classify disease susceptibility, deliver improved diagnoses, earlier interventions, targeted and more efficient drug therapies, and customized treatments.

Regarding specific abilities, at the end of the course, the student will be able to:
- Demonstrate knowledge of diverse technologies to generate and analyze big data.
- Apply Machine Learning tools to the analysis of -omic data
- Integrate the information of clinical, imaging, and -omic data
- Insight into the future perspectives on personalized medicine

Finally, the student will achieve or enhance general capabilities to:
- Analyze problems and propose solutions
- Apply knowledge to engineering practice
- Decompose complex problems and tasks in a structured collection of simpler ones
- Integrates multidisciplinary knowledge
- Work autonomously and cooperatively

DESCRIPTION OF CONTENTS: PROGRAMME

- Definition, mission, and vision for personalized and precision medicine.
- Omics technologies: Instrumentation, what data are generated, and what information is carried out
- Information provided by the medical images and the associated -omic technology (radiomics)
- Application of Machine Learning and Deep Learning to -omic data
- Integration of -omics information with clinical, imaging, and custom laboratory data
- Lessons learned about personalized medicine in the research setting
- How to use personalized medicine in clinical practice?
- Future perspectives in personalized medicine

LEARNING ACTIVITIES AND METHODOLOGY

The teaching methodology will be mainly based on lectures, seminars, and practical sessions.

Students are required to read assigned documentation before lectures and seminars. Lectures will be used by the teachers to stress and clarify some challenging and exciting points from the corresponding lesson previously prepared by the student.

Seminars will be mainly dedicated to presentations given by specialists in the subject and to an interactive discussion with the students, presentations, and homework evaluation.

Grading will be based on continuous evaluation (including short exams, homework, group essays, practical sessions, and student participation in class and Aula Global).

Attendance to lectures, short exams, or submission of possible homework is not compulsory. However, failure to attend any exam or submit the exercises before the deadline will result in a grade of 0 in the corresponding exercise and influence the final continuous evaluation score.

The practical sessions may include laboratory work, research, or clinical center visits. A laboratory report will be required for each of them. Attendance to 80% of practical sessions is mandatory. Failure to hand in the laboratory reports on time or unjustified lack of attendance will result in 0 marking for that practice session.

ASSESSMENT SYSTEM
-        % end-of-term-examination: 25
-        % of continuous assessment (practical sessions, homework exercises, short exams, other activities): 75

% end-of-term-examination:	25
% of continuous assessment (assigments, laboratory, practicals…):	75

BASIC BIBLIOGRAPHY
 - A. Roy The emerging precision, personalized medicine and big data analytics approach in healthcare: Big data analytics in healthcare, ., 2017
 - D. Barh, D. Dhawan, N. K. Ganguly Omics for personalized medicine, Springer, 2016

ADDITIONAL BIBLIOGRAPHY
 - E. Topol Deep medicine: How artificial intelligence can make healthcare human again, ., 2019