



# UNIVERSITÀ DI PISA

## HUMAN FUNCTIONAL IMAGING

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**PAOLA BINDA**

Anno accademico

2021/22

CdS

NEUROSCIENCE

Codice

422EE

CFU

3

Moduli  
HUMAN FUNCTIONAL  
IMAGING

Settore/i  
BIO/09

Tipo  
LEZIONI

Ore  
28

Docente/i  
PAOLA BINDA  
MARIA CONCETTA  
MORRONE

### Obiettivi di apprendimento

#### *Conoscenze*

The course is organized in modules, dealing with the main techniques for the functional imaging of human brain. The student who completes the course successfully will be able to demonstrate a solid knowledge of the main issues related to EEG and MRI and their relative aptitude for measuring different physiological phenomena - due to different spatial/temporal resolution, duration, cost, etc. This is accompanied with the acquisition of two key mathematical concepts that underly the acquisition and the manipulation of the function signals: linear systems theory, and the general linear model approach to data analysis.

#### *Modalità di verifica delle conoscenze*

The acquisition of knowledge is a precondition for the delivery of the written report and it is directly tested in the oral examination.

#### *Capacità*

During the course, students will gain first-hand experience with the actual methodology used for functional brain imaging, acquiring the following specific skills

- to compare different methodologies of functional brain imaging and select the most appropriate for a specific physiological question
- to describe a dataset resulting from a functional imaging experiment
- to write custom Matlab scripts to read the dataset, display it and analyse it
- to use the general linear model approach to analyse time-varying signals (of any sort)
- to prepare a report summarizing the key features of a functional imaging dataset

#### *Modalità di verifica delle capacità*

The acquisition of skills is verified through the assignment of a project that the student works on at home and presents at the oral exams. The project is a combination of Matlab scripts implementing the analysis of a real dataset (provided by the instructor) and a paper (with figures) reporting the results of the analysis and drawing a physiological conclusion from them.

#### *Comportamenti*

The acquisition of the specific skills is accompanied by the enhancement of the following life-long learning (LLL) skills

- to contrast different methods of analysis, evaluating their aptitude for the problem at hand
- to debug code, self-checking one's work for mistakes
- to prepare a research report
- to formulate claims that are supported by the results

#### *Modalità di verifica dei comportamenti*

LLL skills will be evaluated both based on the research report and on oral questioning, verifying the student's ability to find errors/mistakes and correct them autonomously

#### *Prerequisiti (conoscenze iniziali)*

knowledge of core mathematical concepts is useful for the undertaking of this course



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### Indicazioni metodologiche

Delivery: online classes (the face to face delivery may be reinstated later in the year, if conditions permit)

Learning activities:

- Lectures and workshops, with (remote) practice of Matlab scripting
- Group discussions (through web platforms)

### Programma (contenuti dell'insegnamento)

MRI and EEG techniques. Designing an fMRI experiment on sensory cortex. Resting state correlation methods and algorithms. Diffusion Tensor Imaging and correlation with anatomical pathways. Comparison between fMRI, EEG and ECoGs studies in human. fMRI techniques for topographic mapping (retinotopy, tonotopy, somatotopy etc). Workshop of fMRI analysis. Workshop of VEP recording and analysis.

### Bibliografia e materiale didattico

Recommended reading includes the didactic materials available online for students. Further detailed bibliographic references will be indicated during lessons.

### Altri riferimenti web

class is held on the Teams platform, at the following address

[https://teams.microsoft.com/\\_#/school/conversations/Generale?threadId=19:88fdf1cf22e74290a10bd17cd61851e1@thread.tacv2&ctx=channel](https://teams.microsoft.com/_#/school/conversations/Generale?threadId=19:88fdf1cf22e74290a10bd17cd61851e1@thread.tacv2&ctx=channel)

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