UNIVERSITÀ DI PISA

HUMAN FUNCTIONAL IMAGING

PAOLA BINDA

Anno accademico	2019/20
CdS	NEUROSCIENCE
Codice	422EE
CFU	3

Moduli	Settore/i	Tipo	Ore	Docente/i
HUMAN FUNCTIONAL IMAGING	BIO/09	LEZIONI	28	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 methodoogy used for functional brain imaging, acquiring the following specialsitc 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 instructore) 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: face to face
Learning activities:

- Lectures and workshops, with in-class practice of Matlab scripting
- Group discussions

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 analysys.

Bibliografia e materiale didattico

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

Ultimo aggiornamento 11/01/2020 15:19