UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Practical Class: Methods in Cognitive Neurosciences

2425-2-F5108P024

Learning area

Psychological functioning: models and methods for assessment.

Learning objectives

Structural and functional neuroimaging methods provide fundamental support to cognitive neuroscience research and in the neuropsychological practice. The main objective of this laboratory course is to impart a set of basic practical knowledge, useful for the design and analysis of experiments with neuroimaging techniques (structural and functional MRI). The course will guide students interactively through the processing and analysis procedures meeting the current consensus in the neuroimaging community, with practical applications in the field of cognitive neuroscience and neuropsychology. At the end of the course, students should have acquired a good knowledge of the main resources and routines for the processing of neuroimaging data.

Contents

Design and analysis of studies with structural MRI techniques.
Design and analysis of studies with functional MRI techniques.
Large-scale open science resources for inferential analysis and meta-analysis.

Detailed program

Students will individually receive practical excercises on processing and analyzing neuroimaging data, for which they will have to deliver short written reports of the activity carried out.
• Structural MRI: segmentation techniques and quantitative morphometric analysis
• Structural MRI: analysis by regions of interest
• Structural MRI: quantitative statistical analysis of lesion data
• Diffusion-weighted structural MRI: tensor indices and tractographic analysis
• Functional MRI (fMRI): planning and efficiency of experimental designs
• Functional MRI (fMRI): data processing and univariate statistical analysis
• Functional MRI (fMRI): multivariate statistical analysis
• Functional MRI (fMRI): functional connectivity analysis
• Meta-analysis of neuroimaging data

Prerequisites

Good knowledge of the foundations of cognitive neuroscience is required, as well as of the basic principles and applications of neurofunctional methods.

Teaching methods

The course will be interactive with laboratory activity, and will be held in Italian, using audio-visual materials in either Italian or English. The course will take place in the laboratory, with practical computer exercises, using either the personal laptop or the Unimib's LIBaaS VMware environment.

Assessment methods

The evaluation of the course (passed / failed) will be based on timely delivery of the practical exercises included in the program and of the written reports of the activity carried out.
Although this course is held in Italian, Erasmus students can contact the teacher to agree on the possibility of studying on course materials in English and/or on the possibility of taking the exam in English, if they wish to do so.

Textbooks and Reading Materials

The lecture handouts and other relevant teaching materials will be made available online on the e-Learning website of the course. The recommended textbook for the course is:

- Huettel SA, Song AW, McCarthy G. Functional Magnetic Resonance Imaging. Sinauer Associates, 3rd edition 2014, pp. 573, ISBN: 9780878936274. (optional)
  In preparation for the course, the students are adviced to equip themselves with the following software applications:
- Matlab (Mathworks): any versions between 2007a and 2023b, inclusive of "Image Processing Toolbox" and "Statistics and Machine Learning Toolbox" (https://it.mathworks.com/academia/tah-portal/universita-degli-studi-di-milano-bicocca-30566431.html).
- GingerALE, Sleuth, Scribe (http://brainmap.org/software.html)

- Trackvis (http://trackvis.org/download)

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING