

MICRO-513

Signal processing for functional brain imaging

Van De Ville Dimitri

Cursus	Sem.	Type
Bioengineering	MA4	Opt.
Computational Neurosciences minor	E	Opt.
Electrical and Electronical Engineering	MA2, MA4	Opt.
Life Sciences Engineering	MA2, MA4	Opt.
Microtechnics	MA2, MA4	Opt.
Neuroprosthetics minor	E	Opt.
Neuroscience		Opt.
Robotics	MA2, MA4	Opt.
Sciences du vivant	MA4	Opt.

Language of teaching	English
Credits	3
Session	Summer
Semester	Spring
Exam	Written
Workload	90h
Weeks	14
Hours	3 weekly
Courses	2 weekly
Exercises	1 weekly
Number of positions	

Summary

Computational methods for the analysis of human brain imaging data

Content

Human brain imaging such as magnetic resonance imaging (MRI) and electroencephalography (EEG) allows non-invasive investigation of the human brain in health and disease. Datasets are large, noisy, and richly structured, thus their analysis needs to rely on a broad range of mathematical and signal processing tools. Students will learn to understand, implement, and tailor general tools including linear regression (mass univariate models), multivariate models (principal components analysis, partial least squares, independent component analysis), pattern recognition (machine learning), and graphical models. Exercises and lab exercises (in Python) provide insights into the analysis of brain imaging data. A journal club emphasizes application of brain imaging tools in fundamental and clinical neuroscience. Students will read, present and critique original research papers.

Keywords

neuroimaging, functional MRI, EEG, brain mapping, systems-level neuroscience

Teaching methods

Weekly lectures (2h) following by an exercise session (1h)
 Three lab exercises during the semester
 Journal club at the end of the semester

Assessment methods

Attendance and completion of three lab exercises during the semester
 Written exam