Structural and functional brain MRI: overview of image analysis methods

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1.5 ECTS

Course dates and locations in 2022

1) 17th November – MBC ([CHUV Lausanne, Main building, BH08 - Charlotte Olivier](#))
2) 22nd November - YAG & AG ([CHUV, BT03 – Hop. Beaumont](#))
3) 24th November - AG & YAG ([CHUV, Main building BH08 - Auguste Tissot](#))
4) 29th November - YAG & EF ([CHUV, Main building BH08 - Charlotte Olivier](#))
5) 1st December - EF& YAG ([CHUV, Hop. Orthopedique - Placide Nicod](#))
6) 6th December – MBC ([Rue Bugnon, BU19 -Pierre Decker](#))
7) 15th December - Journal club sessions – ALL ([CHUV, Main building BH08 - Charlotte Olivier](#))

>>> Always from 9h-11h30

Objectives

- Overview on structural and functional brain image analysis methods
- Understanding of what one can "derive" from brain MR acquisition towards the application of interest.
- Identify several tools to go from neuroimaging (observations) to meaningful maps of biomarkers
- Be able to identify the major steps and pitfalls in the design of a prospective MR brain study.

Pre-requirements

We encourage students who are curious to better understand the image processing methods behind widely used structural and functional image analysis methods to participate to this course.

Content of course sessions

- **Session 1**
    - Introduction to the course & Image Registration – 45 min
    - Segmentation (atlas-based, machine learning) - 45 min
    - Q/A – 30 min

- **Session 2**
    - Diffusion MRI (basics, reconstruction and scalars) – 45min
    - Intro to functional MRI (I) - 45 min
    - Q/A – 30 min

- **Session 3**
    - Intro to functional MRI (II) - 45 min
    - Brain morphometry (I) – 45min
    - Q/A – 30 min

- **Session 4**
    - Brain morphometry (II) – 45min
    - Group-wise analysis: voxel-based analysis structural & functional (I) – 45 min
    - Q/A – 30 min

- **Session 5**
    - Group-wise analysis: voxel-based analysis structural & functional (II) – 45 min
    - Group wise morphometry – 45 min
    - Q/A – 30 min

- **Session 6**
    - Group wise - machine learning: classification / diagnosis - 45 min
    - Q/A – Assignments of the journal club – 45 min

- **Session 7**
    - Journal club sessions (Evaluation)

Course materials	Slides (+ voice), papers, websites, included in MOODLE - go to "https://moodle2.unil.ch" - log in with your institutional address (unil, chuv, epfl) - click on "Faculté de Biologie et de Médecine" > "Ecole doctorale / doctoral school" > "Lemanic Neuroscience Doctoral School" - course materials and papers will be stored under " Structural and functional brain MRI: overview of image analysis methods " (Enrollment key: SF-MRI2021) - in case of Moodle enrollment problems please contact Ulrike.toepel@unil.ch
Evaluation	Journal Club on a paper the students chose related to the methods explained during the course. One student per paper (if requested groups of two). Presentation of approx. 10 min + 5 min questions.
Registration	The course is limited to 16 participants. Register before October 1 by writing a mail to lndscourses@gmail.com (with your supervisor in copy) and stating the course title as subject.