GSN: Practical Methods in NeuroImaging WS2019/2020
20.01 – 31.01.2020

Goal: The goal of this practical course is to give students the tools, knowledge and hands-on experience needed to plan, conduct and analyze predominantly task-based fMRI experiments.

Course objectives: At the end of the course the students should be able to:

- Critically evaluate the methodological quality of scientific work involving task-based fMRI

- Work safely in an MRI environment

- Describe in their own words the relevant parameters of an fMRI sequence

- List the steps to prepare (f)MRI data for scientific analysis

- Describe the limitations in interpreting fMRI data based on the nature of the signal measured with fMRI

- Correctly design an fMRI study

- Choose the appropriate analysis for neuro-scientific and psychological research questions of the student's choosing

- Perform a basic task-based fMRI analysis using the toolbox Statistical Parametric Mapping (SPM) (version 12) for Matlab

- Defend their choice of procedure for incidental findings in fMRI

Concept: In the first week of the course, there will be theoretical lectures on the topics listed below. In addition, there will be guided tutorials on how to analyse fMRI and structural MRI data with SPM12. The tutorials are self-paced. In the second week, you will have to analyze a data set on your own (although we will be available if you have questions). You will be graded on a final report on this data set to be handed in by 18:00 on Friday the 31.01.2020 (details on the next page).

Lecture & tutorial topics:

Lectures topics
- MRI data acquisition theory
- Principles of MRI
- Task-based fMRI analysis
- Advanced analyses and connectivity analyses
- Multimodal imaging methods

Guided tutorials:
In the first week of the class you will have tutorials that will show you how to work on the MRI machine and guide you through a task-based fMRI analysis. These are self-paced.

T1. (TS) Introduction to Matlab and SPM12
T2. (TS) Preprocessing
T3. (PzE) BIDS & MRIQC
T4. (RB) Single subject analysis
T5. (VF) Group analysis
T6. (VF) Scripting with SPM and Matlab
T7. (PzE) VBM

List of lecturers

Lecturer	Affiliation	Contact
RB: Rainer Boegle	Neurology, LMU	(089) 4400 7 7825
OD: Olaf Dietrich	Clinical Radiology, LMU	
MD: Marco Düring	ISD, LMU	
JH: Judita Huber	RTG, DSGZ, LMU	
VF: Virginia Flanagin	DSGZ, LMU	(089) 4400 7 4819
TS: Thomas Stephan	Neurology & DSGZ, LMU	(089) 4400 7 4819
CV: Christian Vollmar	Neurology, LMU	
PzE: Peter zu Eulenburg	DSGZ&Neurology, LMU	(089) 4400 74822

The organizers of the course are highlighted in orange.

Grading:

Students will be graded based upon participation and attendance in the first week of class as well as a final report on the data that the students will analyse in the second week of class. We expect students to be active and ask questions, and complete the tutorials in the first week, as the knowledge that students gain from those tutorials will be useful for the final project.

All of the computer work will be done on the GSN laptops. Each student will be assigned a laptop in the first tutorial and they should continue to use the same laptop throughout the course. The laptops must remain in the Biocenter and because of data privacy issues, all data from the course must be analysed on the laptop computers given and not on any personal computers.

Final project

For the final project students will be given raw data from a group of subjects that they should analyse. The theoretical knowledge and tools to do this will have been given in the first week of the course. The methods and results will be written up in the form of a 3-page (no smaller than 11 pt font and single line spacing) report to be handed in at the end of the week. Students will be evaluated on more on goal-oriented creativity and trying out new techniques in designing their preprocessing and analyses than they will be on the results themselves. A detailed description of the data set will be given during the course.

GSN: Practical Methods in NeuroImaging WS2019/2020, 20.01 – 31.01.2020: 11:00 a.m. – 6:00 p.m. WEEK 1

This week is a combination of lectures and guided tutorials as well as time on the MRI machines. Attendance is mandatory this week for credit.

Hours/Day	Mon. 20.01 (principles of MRI)	Tues. 21.01 (principles of fMRI)	Wed. 22.01 (Applications)	Thurs. 23.01 (Design and statistics)	Fri. 24.01 (Advanced techniques)
11:00	1. General intro & MR basics (TS)	5. Preprocessing (TS)	9. Structural MRI (VBM) (PzE)	12. Experimental design (VF)	17. Interpreting & visualizing results (PzE)
11:30					
12:00	2. MR image types T1, T2, etc (OD)	6. BOLD basics (RB)	10. Preoperative imaging (CV)	13. Statistics, multiple comparisons (VF)	Lunch
12:30					
13:00	Lunch	Lunch	Lunch	Lunch	19. Additional analysis techniques (VF)
13:30					
14:00	3. MR image creation: problems and pitfalls (RB)	7. Single subject analysis (PzE)	11. Diffusion imaging & tractography (MD)	14. Incidental findings (VF)	20. Graph theoretical analysis (JH)
14:30					
15:00	4. MR Safety (RB)	8. Group analysis (TS)	Computer tutorial: (TS/VF)	Computer tutorial: (VF/RB)	MR-Scanner: fMRI Experiment (Prisma) (TS/PzE/ VF -subject)
15:30					
16:00	MR-Scanner: Intro to MRI machine (Prisma) (VF/RB/PzE – subject)	Computer tutorial: (PzE/TS)			
16:30					
17:00					
17:30					

GSN: Practical Methods in NeuroImaging WS2019/2020, 20.01 – 31.01.2020: 11:00 a.m. – 6:00 p.m. WEEK 2

This week students will work on the research project. A lecturer (TS, VF, PzE, RB) will be present for to answer questions students may have. In this week attendance is not mandatory, however 1) for data privacy reasons the data must be analysed on the GSN laptops and 2) the GSN laptops must not leave the Biocenter and 3) Your final report is due at 18:00 on Friday, 31.01.2020 by e-mail, but the computers must be given back at 13:00.

Hours/Day	Mon. 27.01	Tues. 28.01	Wed. 29.01	Thurs. 30.01	Fri. 31.01
11:00-14:30	Final report (VF/RB)	Final report (TS/PzE)	Final report (Pze/VF)	Final report (RB/TS)	Final report (TS/VF)
14:30-18:00	Final report (VF/RB)	Final report (RB/TS)	Final report (PzE/VF)	Final report (PzE/TS)	Final report to be handed in by18:00, computers given back at 13:00!!!