Experimental Methods 2

Semester plan spring 2019

Lecture Venue: 1441 – 113 (Aud. 3); Mondays 10.15-12.00
Class Venue: 1485 – 240; Wednesdays 13.15-15.00 & 15.15-17.00
Course lecturer: Mikkel Wallentin
Instructors: Isa Lykke Hansen

1. 4/2: Lecture: Introduction to the general linear model (with perhaps a bit of repetition from 1st semester)

1b. 6/2: Class: Linear regression exercise (1) (ISH, MW)

2. 11/2: A brief introduction to the fun of matrices and linear algebra (Højsgaard & Carstensen, 2015)

2b. 13/2: Class: Matrix and Linear algebra exercise (2) (ISH, MW)

3. 18/2: Lecture: Analysis of covariance (Field chapter 11, p. 462-497*)

3b. 20/2: Class: One voxel fMRI exercise (3) (ISH, MW)

4. 25/2: Lecture: The GLM in neuroimaging (Flandin & Novak 2013, SPM12 manual)

4b. 27/2: Class: fMRI preprocessing exercise (4) (ISH, MW)

5. 4/3: Lecture: Factorial ANOVA (Field chapter 12, p. 498- 548*)

5b. 6/3: Class: fMRI design matrix exercise (5) (ISH, MW)

NB. No teaching in week 11.

6. 18/3: Lecture: Repeated measures design (Field chapter 13, p. 549-603*)

6b. 20/3: Class: fMRI GLM inference exercise (6) (ISH, MW)

7. 25/3: Lecture: Mixed designs – (Field chapter 14, p. 604-652*)

7b. 27/3: Class: Mixed effects exercise (7) (ISH, MW)

8. 1-3/4: Lab work at CFIN – EEG-ERP (event-related potentials – with MW and post doc Andreas Højlund)

9. 8/4: Lecture: ERP preprocessing and analysis (Andreas Højlund)

9b. 10/4: Class: ERP analysis exercise (group) (8) (Andreas Højlund Nielsen, MW)

EASTER BREAK

10. 23/4 (NB. Date change due to easter): Lecture: Understanding an ERP experiment (Luck 2014)

10b. 24/4: Class: Analyses of fMRI data (9) (ISH, MW)

11. 29/4-1/5: Lab work at CFIN – fMRI data collection (with MW and Roberta Rocca)

12. 6/5: Lecture: Principal component analysis & Factor analysis – (Field chapter 17, p. 749-811)

12b. 8/5: Class: Analyses of fMRI data again (9) (ISH, MW)

13. 13/5: Lecture: Summary

13b. 15/5: Class: Principal component analysis and Factor analysis exercises (10). (ISH, MW)

EXAM
3/6: Final portfolio assignment deadline

Literature

Ashburner, J., Barnes, G., Chen, C.-C., Daunizeau, J., Flandin, G., Friston, K., et al. (2014). *SPM12 Manual*. London: fil.ion.ucl.ac.uk.

Field, A., Miles, J., Field, Z. (2012): *Discovering Statistics Using R*, London: Sage Publications (*We will not focus on robust analyses)

Flandin, G, Novak, M.J.U. (2013) fMRI Data Analysis Using SPM, in: Ulmer, S., & Jansen, O. (Eds.). *fMRI: Basics and Clinical Applications* (2nd ed., pp. 51–76). Heidelberg: Springer.

Højsgaard, S., Carstensen, B. (2015): *Introductory linear algebra with R*, course notes, version 5.2.

Luck, S. J. (2014). *An Introduction to Event-Related Potentials and Their Neural Origins*. Chapter 1 in An Introduction to the Event-Related Potential Technique. Cambridge MA: MIT Press.

Portfolio assignments

1. Linear regression exercise
2. Matrix and linear algebra exercise
3. One voxel fMRI exercise (ANCOVA)
4. fMRI preprocessing exercise
5. fMRI GLM design matrix exercise
6. fMRI GLM inference exercise
7. Mixed-effects exercise
8. ERP analysis
9. fMRI: experimental analysis
10. Principal component analysis (PCA) exercise /Factor analysis exercise

From the study regulations:

Experimental methods 2

Knowledge:
After completing the course, students will have gained knowledge of:
- How the general linear model (GLM) is used for the analysis of brain scan data
- Basic assumptions about multivariate statistics
- Various types of multivariate analyses, such as principal component analysis, canonical correlation and linear discriminant analysis

Skills:
After completing the course, students will be able to:
- Understand, develop and carry out complex experiments
- Assist in analyses of brain scan data that use the general linear model
- Analyse multiple types of data using multivariate statistics

Competences:
After completing the course, students will be able to:
- Explain what multivariate analysis includes and when this kind of analysis is suitable
- Compare univariate and multivariate statistics and identify strengths and weaknesses of the two methods
- Identify the potential for further learning in relation to analyses of brain data using the general linear model
- Identify the potential for further learning in relation to multivariate analyses

Exam details

Description of qualifications:
In the assessment of exam performance, emphasis is placed on the extent to which the student:
- Can carry out analyses of brain data using the GLM
- Can analyse cognitive science data with multivariate methods
- Can argue for his/her choice of analytical strategy

Contents:
This course builds on the knowledge acquired by the student in the course called 'Experimental methods 1'. The course consists of two main parts: During the first part of the course, students are introduced to how the general linear model is used in the analysis of brain scan data, for example those deducted from an fMRI and EEG/MEG scan. The range of methods of analysis is increased in the second part of the course to include multivariate analyses. The methods are used in the analysis of data collected during the 'Introduction to neuroscience' course.

Forms of instruction:
Comments on form of instruction:
Lectures and computer exercises.

Exam language:
English

Exam options:

1. Class participation, Take-home assignment

Form of co-examination: Internal co-examination

Assessment form: Passed /failed

Comments:
The ordinary form of examination is passed through active classroom participation (active, regular and satisfactory classroom participation in at least 75% of the teaching), which also includes a portfolio containing ten sets of assignments identified by and submitted to the course instructor on the date that he/she specifies. The portfolio must be handed in at the end of the course on a specified submission date.

2. Set home assignment

Form of co-examination: Internal co-examination

Assessment form: Passed /failed

Requirements for sitting the exam: This type of examination requires that the student has used one examination attempt

Comments:
If the student fails to meet the requirements regarding active classroom participation, he/she will have used one examination attempt and will automatically be registered for re-examination in the re-examination period. The re-examination takes the following form:

A set written take-home assignment consisting of the same ten assignments, plus two additional set method assignments
Exam duration: 1 week(s)