University of Reading

Modules

PYM0FM-fMRI Data Analysis

Module Provider: Psychology
Number of credits: 10 [5 ECTS credits]
Level: 7
Terms in which taught: Autumn term module
Pre-requisites:
Non-modular pre-requisites:
Co-requisites: PYM0S1 Data Collection and Analysis 1
Modules excluded:
Current from: 2022/3

Module Convenor: Dr Etienne Roesch
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Type of module:

Summary module description:

The purpose of this module is to provide students with working knowledge about the brain in the field of cognitive neuroscience, and practical experience of analysing fMRI data. The module interweaves lectures and hands-on experience of data processing, using the University cloud computing infrastructure. Students will familiarise themselves with each step of a typical processing pipeline, learn how to script and automate analyses, and be introduced to the best practices in reproducible neuroimaging. Students enrolling on this module should be confident and competent with Undergraduate level statistics, and possess general computing skills (for more information see Outline Content).

Aims:

To introduce recent ideas, techniques and current state of knowledge about the brain, in the field of cognitive neuroscience, and develop practical expertise in the tools and methods used in the analysis of fMRI data. Students will develop a critical appreciation of neuroimaging, with a view to understanding current directions and methodological debates, and supporting a career in the field.

Assessable learning outcomes:

By the end of the course, students should be able to:

1. use common neuroanatomical nomenclatures to describe the brain
2. understand the main mechanisms underlying brain functioning, including the electrical properties of neurons, neurotransmisters, and vascular coupling mechanisms underlying blood oxygenation level dependent signal

blood-oxygenation level dependent signal

3. understand theoretical issues in fMRI data analysis (e.g., haemodynamic response, motion and other artefacts in the time series, the multiple statistical comparisons problem)

4. understand and perform preprocessing of fMRI time series (e.g., realignment, registration to standard space, spatial smoothing)

5. set up a general linear model capturing experimental and nuisance effects in data and try out one or more ways of fitting the model to the data

6. understand and navigate coordinate system for reporting activations (stereotaxic space)

7. make statistical comparison of activation level across the brain between two experimental conditions (contrasts, t-test) for a single subject

8. compare activation in two experimental conditions at the group level.

Additional outcomes:

This module will provide a valuable introduction to methods of analysis in brain imaging research. It will thus serve as a suitable foundation for students looking to carry out brain imaging experiments in postgraduate studies, or seeking research-based positions in brain imaging laboratories.

Outline content:

This module covers the main mechanisms of brain functioning and current debates, the analysis of FMRI data at both the theoretical and practical levels. Topics covered include neuroanatomy, cognitive neuroscience, MRI Physics, what FMRI is actually measuring, pre-processing of FMRI data, and modelling of FMRI data.

PYM0FM "fMRI Analysis" is designed to provide students with working knowledge of the statistical analysis of fMRI data, for students who are likelyto want to analyse such complex dataset in future. We strongly advise you to only select this module if you are confident and competent with Undergraduate level statistics, and possess general computing skills: specifically, the module reviews the steps required to process and analyse fMRI-BOLD data, the theory and application of inferential statistics (i.e. GLM, t-tests) and the scripting of reproducible analytical pipelines. If you are unsure, please carefully review the module description and/or contact the Module Convenor for guidance.

Brief description of teaching and learning methods:

Theoretical content about the brain and the statistical analysis of neuroimaging data is delivered by a lecture at the start of each session. In the second part of each session students learn to use the main tools to analyse fMRI data. Example data sets and the final coursework relate to typical

brain functioning.

Contact hours:

	Autumn	Spring	Summer
Seminars	20		
Tutorials	40		
Guided independent study:			
Preparation for seminars	40		
Total hours by term	100	0	0
Total hours for module	100		

Summative Assessment Methods:

Method	Percentage
Report	100

Summative assessment- Examinations:

Summative assessment- Coursework and in-class tests:

Students will be provided with a data set to independently analyse and report on. The reported analysis should include systematic variation of some processing stages (e.g. degree of spatial smoothing, or comparing different methods of model fitting), and some reporting of relevant methodological literature.

Formative assessment methods:
Students will be able to improve their performance through practical components of the module.

Penalties for late submission:

The below information applies to students on taught programmes except those on Postgraduate Flexible programmes. Penalties for late submission, and the associated procedures, which apply to Postgraduate Flexible programmes are specified in the policy "Penalties for late submission for Postgraduate Flexible programmes", which can be found here: https://www.reading.ac.uk/cqsd/-/media/project/functions/cqsd/documents/cqsd-old-site-documents/penaltiesforlatesubmissionpgflexible.pdf
The Support Centres will apply the following penalties for work submitted late:

where the piece of work is submitted after the original deadline (or any formally agreed extension to the deadline): 10% of the total marks available for that piece of work will be deducted from the mark for each working day (or part thereof) following the deadline up to a total of five working days;
where the piece of work is submitted more than five working days after the original deadline (or

any formally agreed extension to the deadline): a mark of zero will be recorded.

The University policy statement on penalties for late submission can be found at:
https://www.reading.ac.uk/cqsd/-/media/project/functions/cqsd/documents/cqsd-old-site-documents/penaltiesforlatesubmission.pdf
You are strongly advised to ensure that coursework is submitted by the relevant deadline. You should note that it is advisable to submit work in an unfinished state rather than to fail to submit any work.

Assessment requirements for a pass:
50%

Reassessment arrangements:

If a student fails the assignment, an alternative, equivalent assignment can be submitted. The assignment and date of submission will be by arrangement with the Module Convenor and/or Programme Director. Students should note however that, given the University regulations on failing credits, it may not be in their interests to resubmit the coursework.

Additional Costs (specified where applicable):

1) Required text books:

2) Specialist equipment or materials:

3) Specialist clothing, footwear or headgear:

4) Printing and binding:

5) Computers and devices with a particular specification:

6) Travel, accommodation and subsistence:

Last updated: 22 September 2022

THE INFORMATION CONTAINED IN THIS MODULE DESCRIPTION DOES NOT FORM ANY PART OF A STUDENT'S CONTRACT.

Things to do now

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