

Methods & models for fMRI data analysis – HS 2016

Eduardo Aponte
Justin Chumbley
Andreea Diaconescu
Stefan Frässle
Jakob Heinzle

Sandra Iglesias
Lars Kasper
Frederike Petzschner
Dario Schöbi
Klaas Enno Stephan



Translational Neuromodeling Unit



Universität
Zürich^{UZH}



Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Program

Room: ETZ F91, Time: Tue, 08:15 – 12:00

20.09.	Foundations of functional MRI: neurophysiology and physics (Jakob Heinzle)	UZH Med & Econ / ETH
27.09.	Spatial preprocessing of fMRI images (Lars Kasper)	
04.10.	The General Linear Model for fMRI analyses (Frederike Petzschner)	
11.10.	Classical (frequentist) inference and multiple comparison correction (Justin Chumbley)	
18.10.	Experimental design and Resting state fMRI analysis (Sandra Iglesias)	
25.10.	Event-related fMRI and design efficiency (Klaas Enno Stephan)	
01.11.	Group level analysis (Sandra Iglesias)	
08.11.	Noise models in fMRI and noise correction (Lars Kasper)	UZH Econ / ETH
15.11.	Multivariate models and machine learning for fMRI (Jakob Heinzle)	
22.11.	Bayesian inference and Bayesian model selection (Klaas Enno Stephan)	
29.11.	Computational Neuroimaging (model-based fMRI) (Andreea Diaconescu)	
06.12.	Approximate Bayesian inference: Variational Bayes & MCMC (Eduardo Aponte)	
13.12.	Basics of Dynamic Causal Modelling (Dario Schöbi)	
20.12.	Advanced aspects of Dynamic Causal Modelling (Stefan Frässle)	

FAQs

Homepage: <https://www.tnu.ethz.ch/en/teaching/hs2016.html>

Credits: 6 points (ETH), 3 points (UNI, Neuroeconomics)

Attendance requirements: 12/14 presentations

Contact: Sandra Iglesias - iglesias@biomed.ee.ethz.ch

Jakob Heinzle - heinzle@biomed.ee.ethz.ch

!!! Check the rules of the program you have signed up for !!!

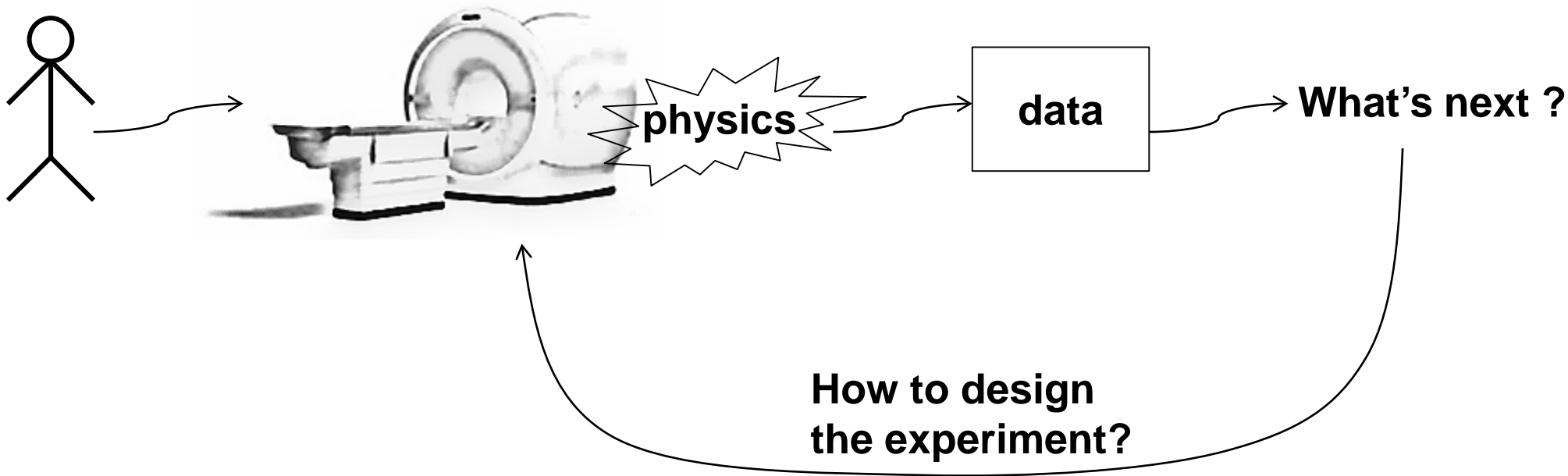
UZH students are enrolled for the course through the Department of economics → Enrolment for course = sign up for exam!!! Withdraw your official enrolment if you do not want to take the exam!

Exam

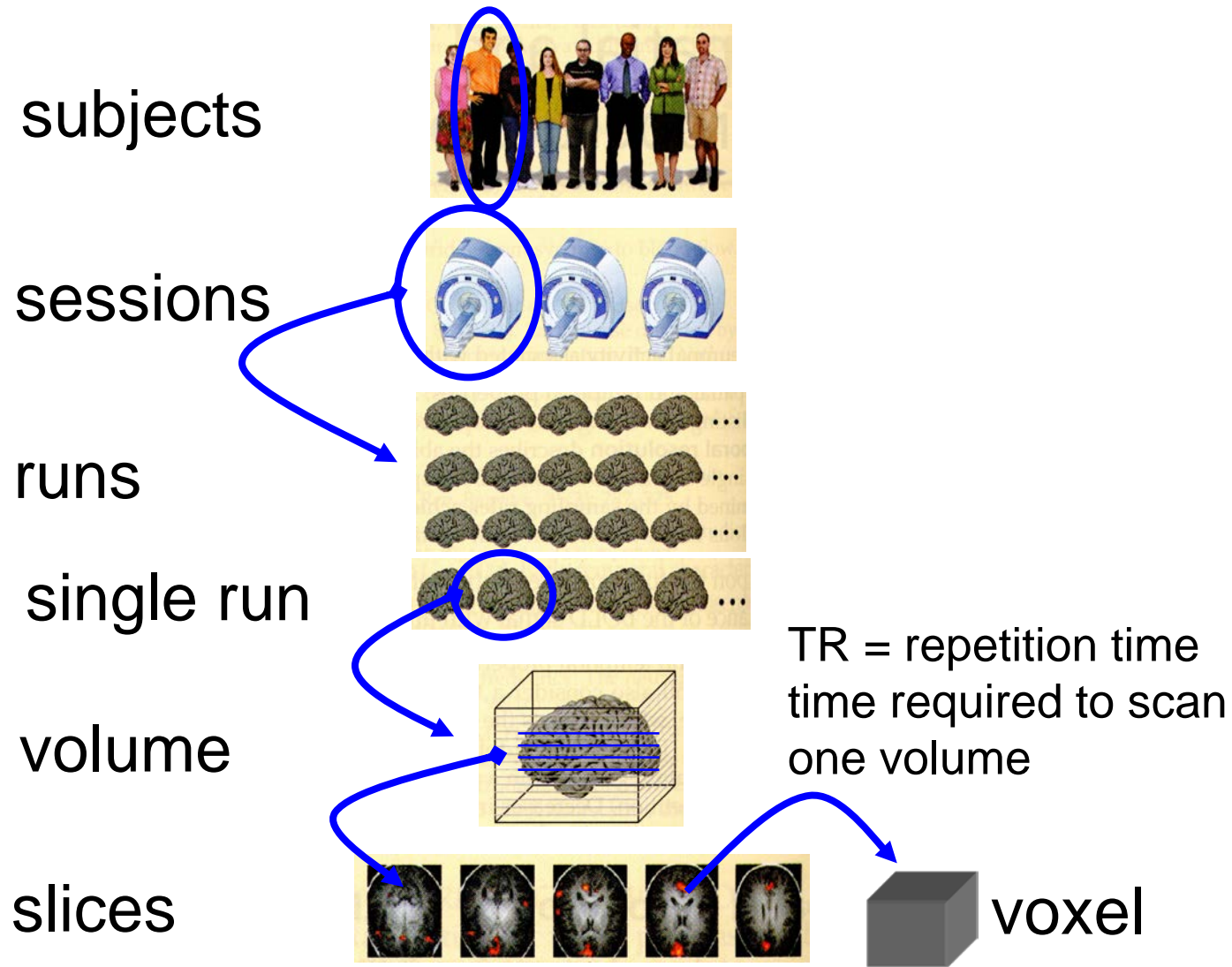
- Exam for medical students (first half of course):
 - 15.11.2016: 10:00– 11:30
 - (36 MC questions, 90 min time)
 - Pass is required to get credit points
- Exam for all other students:
 - 10.01.2017: 13:00– 14:30
 - (36 MC questions, 90 min time)
 - Pass is required to get credit points

!!! Check the rules of the program you have signed up for !!!

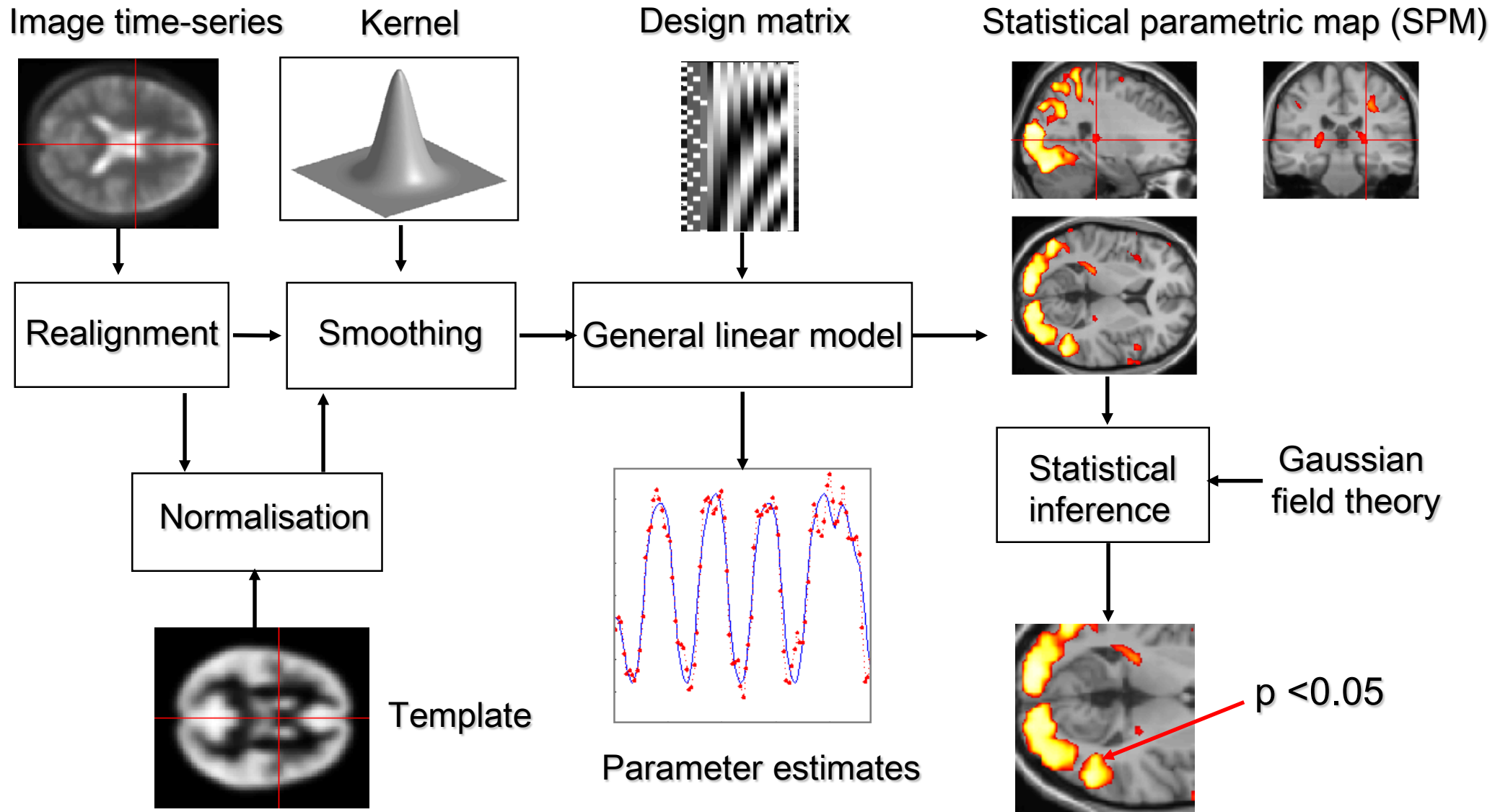
UZH students are enrolled for the course through the Department of economics → Enrolment for course = sign up for exam!!! Withdraw your official enrolment if you do not want to take the exam!



Terminology of fMRI



Statistical Parametric Mapping (SPM)



SPM12

- the history
- the program
- the spirit

The image shows a screenshot of the SPM5 software interface. On the left, a menu tree is visible under the title "SPM5 (john): Graphics". The menu items are:

- SPM Jobs
 - Spatial
 - Segment
 - Data <-X
 - Output Files
 - Grey Matter
 - White Matter
 - Cerebro-Spinal Fluid
 - Bias Corrected
 - Custom
 - Tissue probability maps
 - Gaussians per class
 - Affine Regularisation
 - Warping Regularisation
 - Warp Frequency Cut
 - Bias regularisation
 - Bias FWHM
 - Sampling distance

Below the menu tree, a yellow box contains the text: "Various spatial and other pre-processing functions."

On the right, a help window titled "SPM5 (john): SPMhelp" is open. The window has a "MenuWin" tab selected. The content of the help window is:

MenuWin
SPM5 : Statistical Parametric Mapping

SPM functions are called from the main SPM Menu window. Click the buttons in the representation below for help on that topic...

Click on "Help" for information on SPM documentation, and instructions on using the SPM help system.

The FIL methods group

The help window also contains a graphical representation of the SPM GUI. On the left is a sidebar with buttons for "Data format", "Templates", "Variables", "SPM GUI", "Graphics", "Random FX", and "SPM motd". The main area is titled "About SPM5" and contains several sections of buttons:

- temporal pre-processing**: Convert, Filter, Averaging, Epoching, Artefacts, Other...
- spatial normalisation**: 2D interpolation, 3D source reconstruction
- Model specification & parameter estimation**: Basic models, EEG/MEG, Review design, Estimate, --> Bayesian
- Results**: Results
- SPM for EEG/MEG**: Display..., Check Reg, Render..., PET, Toolboxes..., PPIs, ImCalc, DICOM Import, Help, Utils..., Defaults, Quit

At the bottom of the help window, there is a copyright notice: "(c) 1991,1994-2003,2005".

SPM online bibliography

<http://www.fil.ion.ucl.ac.uk/spm/>

Publications about 'RFT' - Netscape

File Edit View Go Bookmarks Tools Window Help

Back Forward Reload Stop <http://www.fil.ion.ucl.ac.uk/spm/doc/biblio/Keyword/RFT.html> Print

Home Neuro ML-Stats Journals Technical Imaging Software Conferences World Me

Netscape Enter Search Terms Search Highlight Pop-Up Block Off Form Fill

New Tab Publications about 'RFT'

SPM Menu:

- ▶ Introduction
- ▶ Software
- ▶ Documentation
- ▶ Courses
- ▶ Email list
- ▶ Data sets
- ▶ Extensions

This page:

- ▶ Bibliography

Publications about 'RFT'

Thesis

1. [A.P. Holmes](#). **Statistical Issues in Functional Brain Mapping**. PhD thesis, University of Glasgow, December 1994. Keyword(s): [RFT](#), [PET](#), [GLM](#). [[bibtex-entry](#)]

Articles in journal or book chapters

1. D. Pantazis, [T.E. Nichols](#), S. Baillet, and R.M. Leahy. **A comparison of random field theory and permutation methods for the statistical analysis of MEG data.** *NeuroImage*, 25:383-394, 2005. Keyword(s): [RFT](#), [MEG](#), [nonparametric](#). [[bibtex-entry](#)]
2. S. Hayasaka, K.L. Phan, I. Liberzon, [K.J. Worsley](#), and [T.E. Nichols](#). **Non-Stationary Cluster Size Inference with Random Field and Permutation Methods.** *NeuroImage*, 22:676-687, 2004. Keyword(s): [Cluster](#), [RFT](#), [nonparametric](#). [[bibtex-entry](#)]
3. M. Brett, [W.D. Penny](#), and [S.J. Kiebel](#). **Introduction to Random field theory.** In R.S.J. Frackowiak, K.J. Friston, C. Frith, R. Dolan, K.J. Friston, C.J. Price, S. Zeki, J. Ashburner, and W.D. Penny, editors, *Human Brain Function*. Academic Press, 2nd edition, 2003. Keyword(s): [introduction](#), [RFT](#). [[bibtex-entry](#)]
4. [T.E. Nichols](#) and [A.P. Holmes](#). **Nonparametric approaches.** In

SPM web site



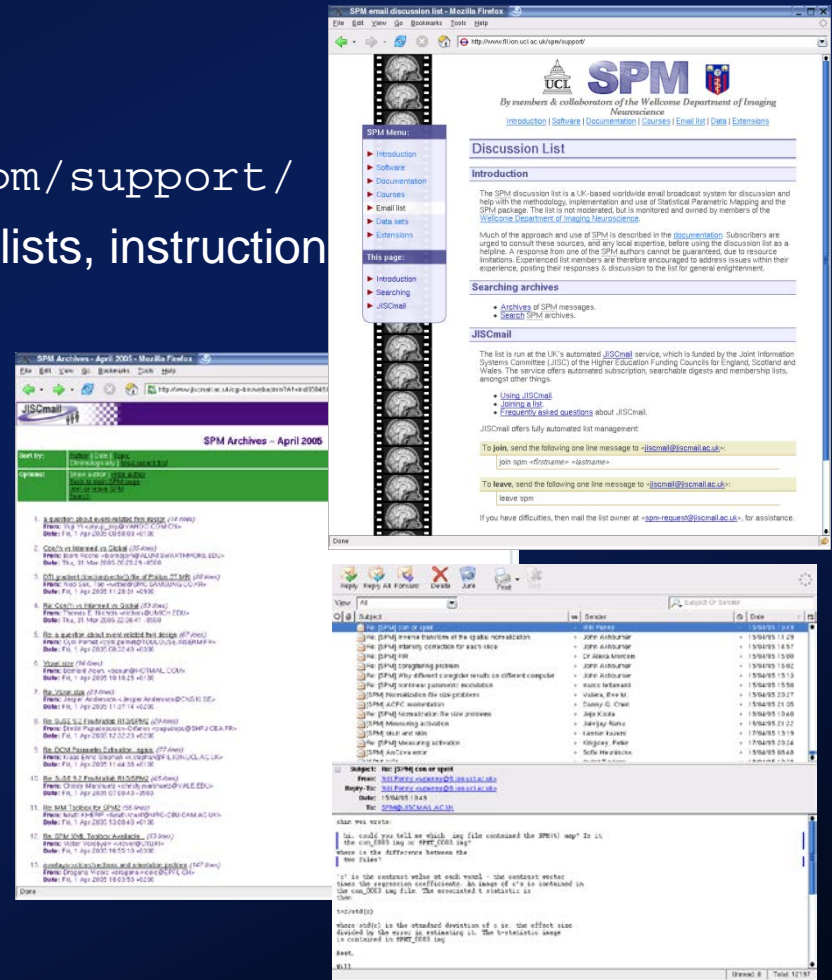
- Introduction to SPM
- SPM distribution: SPM99, SPM2, SPM5, SPM8, SPM12
- Documentation & Bibliography
- SPM email discussion list
- SPM short course
- Example data sets
- SPM extensions



<http://www.fil.ion.ucl.ac.uk/spm/>

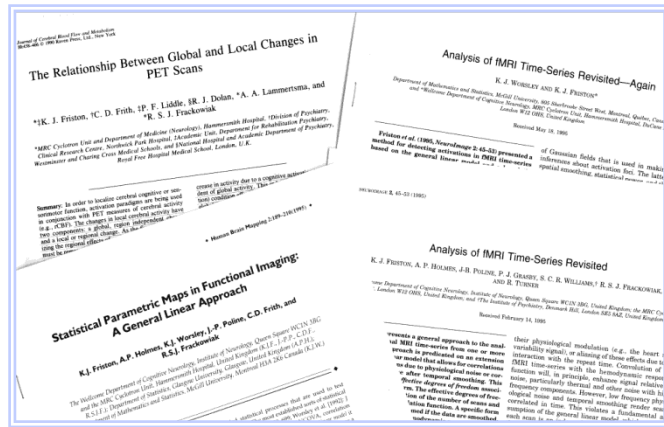
SPM email list

- `spm@jiscmail.ac.uk`
 - Web home page
 - `http://www.fil.ion.ucl.ac.uk/spm/support/`
 - Archives, archive searches, membership lists, instruction
 - Subscribe
 - `http://www.jiscmail.ac.uk/`
 - email `jiscmail@jiscmail.ac.uk`
 - join `spm Firstname Lastname`
 - Participate & learn
 - email `spm@jiscmail.ac.uk`
 - Monitored by SPMauthors
 - Usage queries, theoretical discussions, bug reports, patches, techniques, &c...

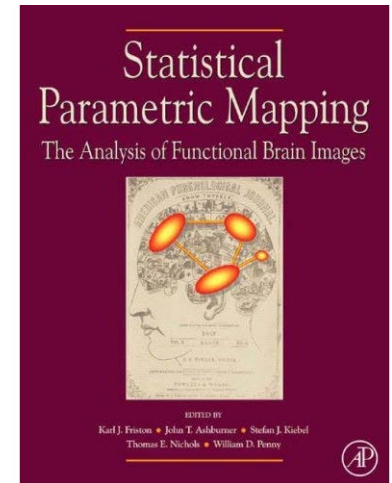
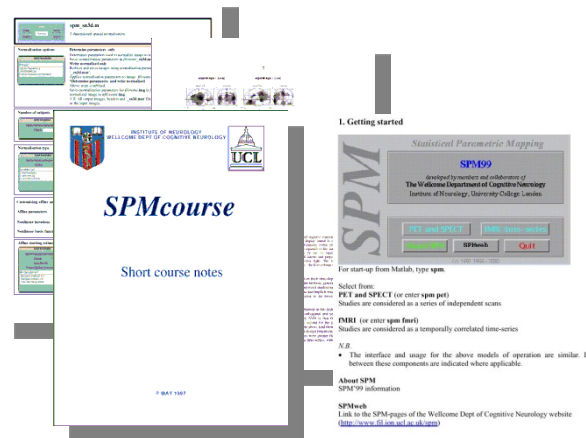


SPM documentation

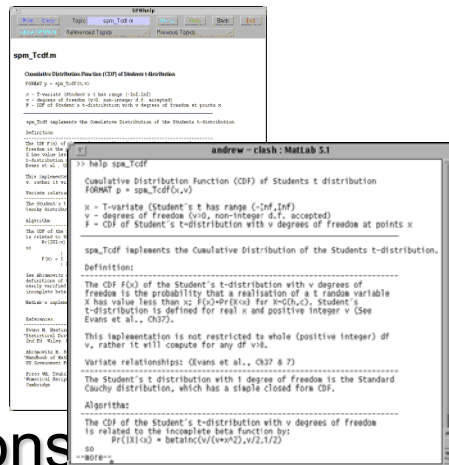
peer reviewed literature



SPM course notes,
SPM book & SPM manual



online help &
function descriptions



algorithm descriptions,
code annotations,
pseudo-code

