Getting Started with FSL

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Introduction

Tools Accessing Data

Preprocessing

Preparing Images for Analysis Specifying Events for Analysis

FEAT

Prestats

Tools Accessing Data

FMRIB Software Library (FSL)



FSL

- http://www.fmrib.ox.ac.uk/fsl/
- http://www.fmrib.ox.ac.uk/fsl/feat5/
- BIAC Wiki
 - http://fourier.biac.duke.edu/wiki/ doku.php/biac:fsl:guide

Tools Accessing Data

FMRI Expert Analysis Tool (FEAT)

FEAT - FMRI Expert Analysis Tool v5.98 First-level analysis - Pre-stats -
Misc Data Pre-stats State Post-state Registration
Number of inputs 1 👮 Select 4D data
Output directory
Total volumes 0 🚖 Delete volumes 0 🝨
TR (s) 3.0 🚔 High pass filter cutoff (s) 60 🚔
ISU
Go Save Load Exit Help Utils

"a software tool for high quality model-based FMRI data analysis, with an easy-to-use graphical user interface (GUI)."

Tools Accessing Data

Connect to Cluster

Secure Shell (SSH) via Terminal in OS X, F-Secure in XP



Tools Accessing Data

Access Data

- Login to Einstein:
 - \$ ssh -X Username@einstein.biac.duke.edu

Login to Node4:

- \$ qinteract
- Mount experiment directories:
 - \$ lnexp Exp.01
- Navigate to experiment:
 - $cd \sim /experiments/Exp.01$

Preparing Images for Analysis Specifying Events for Analysis

Reorient Raw Data

- BIAC images must be reoriented from LPS (Left,Posterior,Superior) to LAS (Left,Anterior,Superior)
- Functional:

\$ bxhreorient --orientation LAS run004.bxh
reoriented_run01.bxh

Anatomical:

\$ bxhreorient --orientation LAS series002.bxh
reoriented_anat.bxh

Repeat for every functional image

Preparing Images for Analysis Specifying Events for Analysis

Generate NIFTI-formatted Images

- Functional:
 - \$ bxh2analyze --nifti -s -v run001_01.bxh run01
- This will create one large file (run01.img) that contains the functional data in 4D format and a NIFTI-formatted header (run01.hdr)
- Anatomical:
 - \$ bxh2analyze --niftihdr -s -v series003.bxh anat

Preparing Images for Analysis Specifying Events for Analysis

Brain Extraction Tool



- BET deletes non-brain tissue from an image of the whole head
- http://www.fmrib.ox.ac.uk/analysis/research/bet/

Preparing Images for Analysis Specifying Events for Analysis

Generate Anatomical Brain Mask

00	🔀 BET –	Brain Extraction To	ol – v2.1
Input image	ceLkNwTt8W19JV	3/Data/Anat/20060405_3	1632/series300/anat 🔄
Output image	wTt8W19JV3/Data	a/Anat/20060405_31632/s	eries300/anat_brain 🔄
Fractional inte	nsity threshold; sm	ıaller values give larger brai	n outline estimates 0.5 🌻
Run standar	d brain extraction u	using bet 2 🛁	
> Advanced	d options		
	i0	Exit	Help
_			

- Use GUI or CLI to generate 'anat_brain.nii.gz'
- Anatomical:
 - \$ bet anat anat_brain -f 0.5 -g 0
- Functional: Perform later in 'Prestats'

Preparing Images for Analysis Specifying Events for Analysis

Time-series of Events

3-column tab-delimited text files

Onset	Duration	Weight
30	1	1
60	1	1
90	1	1
120	1	1

- One file for each condition of each run for each subject
- Example: 3 conditions X 6 runs X 20 subjects = 360 text files

Prestats

Data

\varTheta 🔿 🕤 📉 FEAT – FMRI Expert Analysis Tool v5.98
First-level analysis 🥣 Pre-stats 🛁
Miss Data Deviated Cost Destantia
Misc Pierstats Registration
Number of inputs 1 曼 Select 4D data
Output directory
Total volumes 0 🚔 Delete volumes 0 🚔
TR (s) 3.0 🚔 High pass filter cutoff (s) 60 🚔
18
Go Save Load Exit Help Utils

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Prestats

😝 🖯 🗑 🔀 FEAT - FMRI Expert Analysis Tool v5.98
First-level analysis -
Misc Data Pre-stats Stats Post-stats Registration
Motion correction: MCFLIRT
B0 unwarping 🔲
Slice timing correction: Interleaved (0, 2, 4 1, 3, 5)
BET brain extraction F
Spatial smoothing FWHM (mm) 5 🚔
Intensity normalization
Temporal filtering 🛛 Perfusion subtraction 💷 Highpass 📕 Lowpass 🗐
MELODIC ICA data exploration 📃
Go Save Load Exit Help Utils

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Registration

😝 😁 💮 🔀 FEAT – FMRI Expert Analysis Tool v5.98		
	First-level analysis -	
Misc	Data Pre-stats State Post-state Registration	
	Initial structural image Main structural image	
F		
	Linear Normal search - 6 DOF -	
	Standard space	
	/usr/local/fsl-4.1.0-centos4_64/data/standard/MNI152_T1_	
	Linear Normal search - 12 DOF -	
	Nonlinear 🔟	
'		
Go	Save Load Exit Help Utils	

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Output

Output placed in run01.feat/



Prestats

Conclusion

- Prepared the functional and anatomical images (reoriented, converted to NIFTI, and created brain mask from hi-res image)
- Specified event time-series for conditions
- Preprocessed and checked
- Now ready to setup model...