SPM Course Single Subject Analysis

Practical Session

Dr. Jakob Heinzle & Dr. Frederike Petzschner & Dr. Lionel Rigoux

Hands up:

- Who has programming experience with Matlab?
- Who has analyzed an fMRI experiment before?
- Who did the preparation for the practical session that was posted on the website?



Zurich SPM Course 2016 Practical session on 1st level analysis Tutors: Frederike Petzschner, Liongel Rigoux, Jakob Heinzle

We assume that you have matlab installed and that you have downloaded the latest version of SPM (SPM12, release 6885). SPM can be downloaded from http://www.fil.ion.ucl.ac.uk/spm/software/spm12/ Follow the instructions there.

Instructions for preparation to be performed prior to the session.

Step 1: Download the face-repetition data. Goto http://www.fil.ion.ucl.ac.uk/spm/data/face_rep/ Download face_rep.zip Download face_rep_spm12_batch.m Download manual.pdf (for SPM 12, if you do not already have it).

Set up a directory on your computer that you will use for the tutorial.

Copy face_rep.zip to that directory. Unzip face_rep.zip into that directory and rename the directory face_rep as data. You should now have two folders (RawEPI and Structural) and two files (sots.mat and all_conditions.m) in the folder data.

Make an additional directory "scripts" within your tutorial folder and copy the face_rep_spm12_batch.m file in there. Also, copy the file face_rep_spm12_prepare4session.m into the script folder. You should have gotten this file together with the instructions you are currently reading.

Open Matlab, add the scripts folder for your tutorial to the matlab path (and of course also SPM). Edit line 15 of face_rep_prepare4session.m so that it points to your!! tutorial folder. Then let the file run. This will do a complete preprocessing of the data and will take a bit of time.

Everything has worked, if the last three lines on your matlab command window read: Running 'Smooth' Done 'Smooth' Done

Now you should be ready for the tutorial. See you there!

There was a bug:



open face_rep_prepare4session.m in Matlab

change

 $matlabbatch{2}.spm.spatial.realign.estwrite.data{1} = cellstr(spm_file(f(1,:),'prefix','a'));$

to

matlabbatch{2}.spm.spatial.realign.estwrite.data{1} = cellstr(spm_file(f(:,:),'prefix','a'));

Download and install SPM

http://www.fil.ion.ucl.ac.uk/spm/data/face_rep/





By members & collaborators of the Wellcome Trust Centre for Neuroimaging Introduction | Software | Documentation | Courses | Email list | Data | Extensions

Advanced Event-related fMRI - Repetition priming

Overview

Repetition priming for famous and nonfamous faces

Created R. Henson, 8/7/00, WDCN & ICN, UCL.

One subject's data from:

Benson, R.S.A., Bhallice, T., Gorno-Tempini, H.-L. and Dolan, H.J. (2002) Pace repetition efforts in implicit and explicit memory tests as measured by fNR2. Cerebral Cortex, 12, 178-186.

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- · 2x2 factorial event-related fMRI
- · One session (one subject)
- · (Famous vs. Nonfamous) x (1st vs 2nd presentation) of faces against baseline of chequerboard
- 2 presentations of 26 Famous and 26 Nonfamous Greyscale photographs, for 0.5s, randomly intermixed, for fame judgment task (one of two right finger key presses).
- Parameteric factor "lag" = number of faces intervening between repetition of a specific face + 1
- · Minimal SOA=4.5s, with probability 2/3 (ie 1/3 null events)
- Continuous EPI (TE=40ms,TR=2s) 24 descending slices (64x64 3x3mm2), 3mm thick, 1.5mm gap



Download and install SPM

Terminal

- cd /Users/login
- unzip spm12.zip
- unzip -o spm12_updates_rxxxx.zip -d spm
- Move spm12 to applications folder

Matlab

- Add path spm12 with subfolders
- Start SPM12: spm fmri

Structure of SPM



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Preprocessing



Realignment

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Realignment



All images of a run will be aligned to the first image of the run

Images are then called **rp_sM.....txt**

Returns the movement parameters: Problematic if more than a voxels worth of motion!

Also creates a **meansM....img** that will used in the coregistration



Slice Time Correction

TR = 2s N = 24 slices TA = TR - TR/NSlice order: 24:-1:1 Reference Slice: 12 Use the **rp....txt** And create **a...txt**

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Coregistration

reference **means....img** source: structural **s....img**



Segmentation

"Volumes" in "Data > Channels" and select the subjects coregistered anatomical **image sM03953_0007.img**.

Change "Save Bias Corrected" so that it contains "Save Bias Corrected" instead of "Save Nothing".

At the bottom of the list, select "Forward" in "Deformation Fields"

SPM will segment the structural image using the default tissue probability maps as priors. SPM will create, by default, gray and white matter images and bias-field corrected structral image. These can be viewed using the CheckReg

SPM will also write a spatial normalisation deformation field file eg. y_sM03953_0007.nii file in the original structural directory. This will be used in the next section to normalise the functional data.

Normalise (Write)

Deformation field: y....._.nii

Images to write: realigned functional images **ars....img** and mean functional image

means.....img

Voxel size [2 2 2] \rightarrow [3 3 3]

Create normalised files w....mat



GLM

Design matrix



Parameter estimates

The Task



- Parameteric factor "lag" = number of faces intervening between repetition of a specific face + 1
- Continuous EPI (TE=40ms,TR=2s) 24 descending slices (64x64 3x3mm2), 3mm thick, 1.5mm gap

Henson, R.N.A., Shallice, T., Gorno-Tempini, M.-L. and Dolan, R.J. (2002) Face repetition effects in implicit and explicit memory tests as measured by fMRI. Cerebral Cortex, 12, 178-186.

Model Specification:



Single voxel regression model



- What questions can we answer with this data set?
- How would your GLM look like?

\rightarrow 10 min Exercise



- What questions can we answer with this data set?
 - \rightarrow Difference between familiar and unfamiliar faces
 - \rightarrow Difference between repetition 1 and repetition 2
 - \rightarrow Difference between a repetition of a familiar face versus and unfamiliar one
- How would your GLM look like?
 - Regressors for familiar and unfamiliar and repetition 1 and 2
 - Regressors for motion

The SPM Graphical User Interface (GUI)

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- Model Specification
 - Specify 1st level
 - Review
 - Estimate

stimulus onset times

load sots.mat file



Modelling

Statistical analysis: Design

Load sots.ma

Units of design: Scans Interscan interval: 2 Microtime Resolution: 24 Mircotime Onset: 12

Use smoothed images: swars...img

Conditions: N1, N2, F1, F2 Multiple Regressors: realignment file **rp_.txt** Factorial Design: Fam and Rep

Canonical HRF: select all derivatives







Orthogonality



Estimate SPM.mat

Regressors



Statistics

Statistical parametric map (SPM)



T-Test

• Positive Effect of condition 1?



Positive effect of condition_1

Levels

• peak-level: the chance (p) of finding (under the null hypothesis) a peak with this or a greater height (T- or Z-statistic), corrected (FWE or FDR)/ uncorrected for search volume.

• cluster-level: the chance (p) of finding a cluster with this many(ke) or a greater number of voxels, corrected (FWE or FDR)/ uncorrected for search volume.

 set-level: the chance (p) of finding this (c) or a greater number of clusters in the search volume.

F-Test

Main effect of Rep (masked [incl.] by Positive effect of condition_1 at p=0.001)



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F-Test

Main effect of Rep (masked [incl.] by Positive effect of condition_1 at p=0.001)



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F-Test on movement parameters



Parametric Modulation

Lag Effect



END