Specialty area: Analyze This! Practicalities of fMRI and Diffusion Data Analysis

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Highlights

- SPM is an open-source, multimodal, platform-independent program containing a wide range of extensively validated tools for fMRI analysis.
- The core SPM functions are complemented by over 100 user-contributed toolboxes and utilities.
- SPM is extensively documented through a collection of peer-reviewed articles, technical reports, books, and tutorials.

TALK TITLE fMRI Analysis using SPM

- The target audience for this presentation includes investigators wishing to become familiar with the capabilities of SPM for preprocessing, analysis and visualization of fMRI data.
- Following the presentation, attendees will be able to begin the process of learning to use SPM for fMRI preprocessing, statistical modeling, visualization and results reporting. Pointers to relevant websites will be provided for further self-study.
- The purpose of this presentation is to introduce attendees to the capabilities, architecture and user interface of SPM.
- SPM is a multi-modal program including tools for processing structural MRI, functional MRI, PET, SPECT, EEG and MEG data. It supports multimodal studies by providing facilities for integrating data from different modalities in a common anatomical space. This presentation focuses on using SPM to combine structural and functional MRI data in the service of analyzing task-related and functional connectivity effects.
- SPM is open-source. Instructions for downloading and installing it can be found at www.fil.ion.ucl.ac.uk/spm/software/spm12/
- SPM contains a wide range of tools for preprocessing, including: 1) slice time correction, 2) within-subject, within-modality realignment to reduce head motion effects, 3) within-subject between-modality registration, 4) spatial normalization to MNI anatomical space, and 5) spatial smoothing.
- SPM allows multiple regression modeling of a wide range of single-subject task-related experimental designs, including event-related designs, block designs and mixed designs. Parametric modulatory effects can be included at the trial or block level. Nuisance variables such as head motion can be added in the form of covariates of no interest. In addition, task-related functional connectivity modulations can be explored with the psychophysiological or physiophysiological interaction tools.

- The contrast images resulting from the single-subject models are linearly weighted sums of the parameter estimate images. They can be combined in a wide range of group models, allowing exploration of average condition effects at the group level, between group effects and group by condition interactions.

- The results of both the single-subject and group models can be visualized in a number of ways, including montage displays, multiplanar views or surface views of structure/function overlays.

- There are now over 100 user-contributed SPM extensions, greatly extending the program capabilities. More information about them can be found at www.fil.ion.ucl.ac.uk/spm/ext/

One of these extensions, CONN: the functional connectivity toolbox, significantly extends the SPM capabilities with respect to the analysis of intrinsic functional connectivity. It can be found at http://www.nitrc.org/projects/conn

Another of these extensions, the SPM Anatomy Toolbox, provides anatomical labeling based on cytoarchitectonically defined cortical fields. It can be found here -> http://www.fz-juelich.de/SharedDocs/Downloads/INM/INM-1/DE/Toolbox/Toolbox_20.html

- There are over 100 other user-contributed SPM extensions, greatly extending the program capabilities. More information about them can be found at www.fil.ion.ucl.ac.uk/spm/ext/

- CONCLUSION SPM is a mature, open-source toolset that provides a highly flexible environment for fMRI data processing.

- REFERENCES Further information about SPM can be found at www.fil.ion.ucl.ac.uk/spm/ . A step-by step tutorial, including the sample data shown in the lecture can be found here -> www.neurometrika.org/fMRI_Analysis_SPM . A guide to the SPM reference library can be found here -> http://www.fil.ion.ucl.ac.uk/spm/doc/ .