OKACOGNET Project

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First Steps in SPM Preprocessing

1 subject {Session}+ {scan}+ {slices}

1. Realignment
2. CoRegister
3. Normalise
4. Smooth

Realignment Estimate

***Procedure (1 for each subject)***

Delete the first four scans, that is delete files \*001, \*002, \*003 and \*004

Data :

Add new sessions for this subject. Select All .img and .hdr files (\*005 to \*n)

Session:

Select scans for this session

**Estimation Options:**

**Quality**:

Quality vs speed trade-off. This parameter adjusts the number of voxels used in the estimation, as there are voxels that they may have no impact in the estimation of the realignment parameters, choosing lower quality you get a fast realignment.

**Separation**:

In mm. between the points sampled in the reference image. Smaller sampling distances gives smaller errors but slower.

Smoothing (FWHM)

MRI images typically use a 5 mm kernel. (applied to the images before estimating the realignment of parameters)

**Num Passes**

MRI images are typically registered to the first image. PET images are typically registered to the mean. This is because PET data are more noisy. The more accurate way with MRI would be to use a two pass procedure, but this probably wouldn't improve the results so much and would take twice as long to run.

**Interpolation**

The method by which the images are sampled when estimating the optimum transformation. Higher degree interpolation methods provide the better interpolation, but they are slower because they use more neighbouring voxels.

**Wrapping**

No wrapping - for PET or images that have already been spatially transformed. Also the recommended option if you are not really sure

**Weighting**

The option of providing a weighting image to weight each voxel of the reference image differently when estimating the realignment parameters. The weights are proportional to the inverses of the standard deviations. This would be used, for example, when there is a lot of extra-brain motion - e.g., during speech, or when there are serious artifacts in a particular region of the images.

*What is SPM doing?*

*This routine realigns a time-series of images acquired from the same subject using a least squares approach and rigid body (a 6 parameter) spatial transformation.*

*Important, the first img, in our case \*005 is the “representative scan”, so it works as the reference scan to which all subsequent scans are realigned, so make sure it is fine (that is what we try to do by deleting the first four scans).*

*The aim is primarily to remove movement artefact in fMRI and PET time-series*

*Output: A set of realignment parameters are saved for each session, named rp \*.txt.*

CoRegister ***(1 for each subject)***

Registration involves finding parameters that either maximise or minimise some objective function. At the end of coregistration, the voxel-to-voxel affine transformation matrix is displayed, along with the histograms for the images in the original orientations, and the final orientations.

**Procedure:**

**Reference Image**

This is the image that is assumed to remain stationary (sometimes known as the target or template image), while the source image is moved to match it.

**Source Image**

This is the image that is jiggled about to best match the reference.

Objective Function

*rst chronologically and it may be wise to chose a*

*"representative scan" in this role.*

III Normalise (1 for all subjects)

*This module spatially (stereotactically) normalises MRI, PET or SPECT images*

*into a standard space defined by some ideal model or template image. Generally, the algorithms work by minimising the sum of squares difference between the image which is to be normalised, and a linear combination of one or more template images. The registration simply searches for an optimum solution. If the starting estimates are not good, then the optimum it. The first step of the normalisation is to determine the optimum 12-parameter affine transformation. A Bayesian framework is used,* *searches for the solution that maximises the a posteriori probability of it being correct.*

*Objective: to facilitate inter-subject averaging and precise characterisation of functional anatomy.*

*Output: All normalised \*.img scans are written to the same subdirectory as the original \*.img, prefixed with a 'w' (i.e. w\*.img). The details of the transformations are displayed in the results window, and the parameters are saved in the "\*\_ sn.mat" file.*

*Data*

*List of subjects. Images of each subject should be warped differently.*

*Subject*

*Data for this subject. The same parameters are used within subject.*

*Source Image The image that is warped to match the template(s).*

IV Smooth

Smooth is a preprocessing step to suppress noise and effects due to residual differences in functional and gyral anatomy during inter-subject averaging.

**Procedure:**

**Images to Smooth**

Specify the images to smooth. The smoothed images are written to the same subdirectories as the original \*.img and are preffixed with a 's' (i.e. s\*.img).