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OAT-MRI coregistration protocol

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Simultaneous functional magnetic resonance and optoacoustic imaging of brain-wide sensory responses in mice

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OAT-MRI Co-registration Steps

Images to be used:

- Functional scan (*EPI*, mouseXX_EPI.nii)
- T1-weighted anatomical scan (*T1*, same orientation as the EPI image, mouseXX_T1.nii)
- 3D MR angiogram (*MRA*, mouseXX_MRA.nii)
- OAT image (*OAT*, mouseXX_OAT.nii)

Toolboxes to be used:

- SPM, version 12

Note: All the images have x10 dimensions.

1) Use the 'Check Reg' function of SPM to check the co-registration between *EPI* and *T1* (Fig. 1). If there appears to be a mismatch, use 'Coregister (estimate)' function of SPM to align the images.

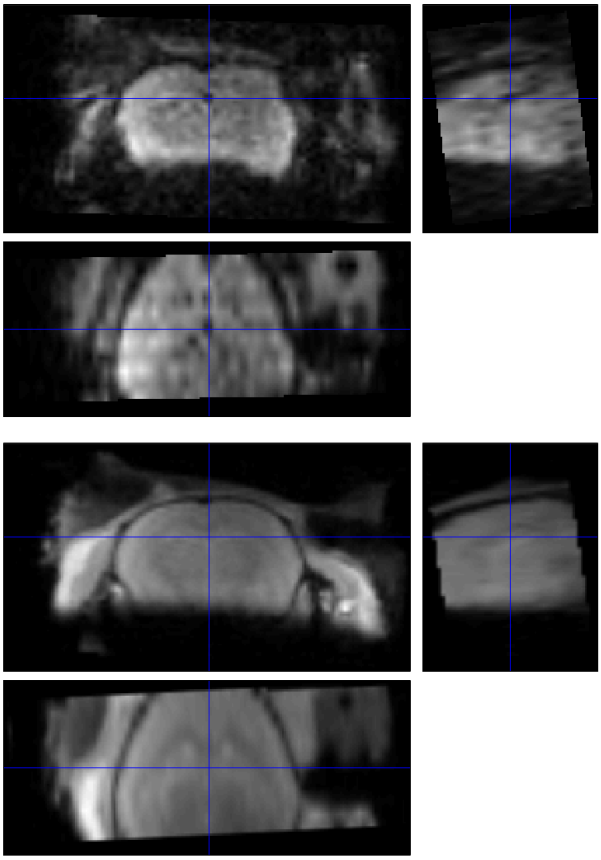

Figure 1 Co-registration of *EPI* (top) and *T1* (bottom)

2) Manually align *MRA* with *T1*. For this purpose, set origin of images at a landmark that is visible in both, and use affine transformations to reduce mismatch. After the images are coarsely aligned, use 'Coregister (estimate)' function to finetune the alignment (Fig. 2).

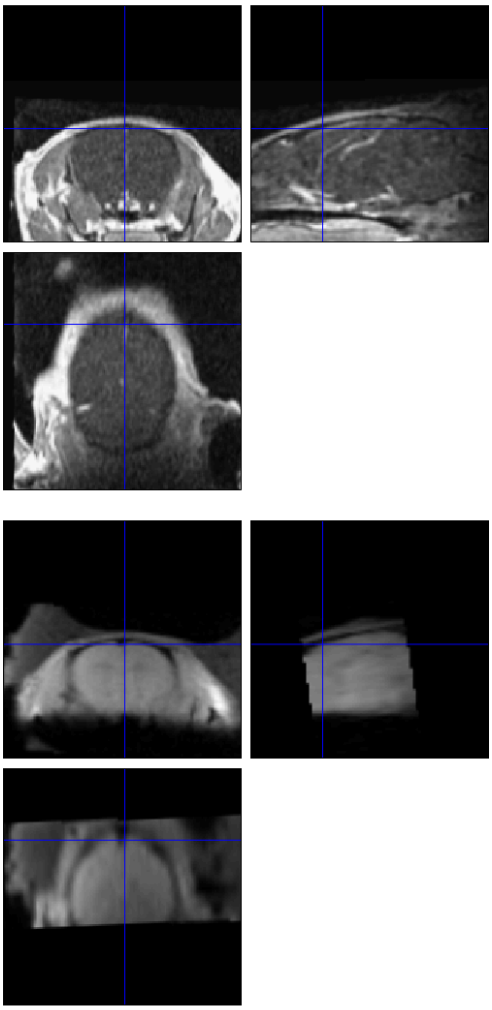

Figure 2 Successful co-registration of *MRA* (top) and *T1* (bottom)

3) Manually align *OAT* with *MRA*, as in Step 2. Skull stripping of *MRA* is needed before using the 'Coregister (estimate)' function to ensure successful co-registration (Fig. 3). Normalised mutual information is used as the objective function.

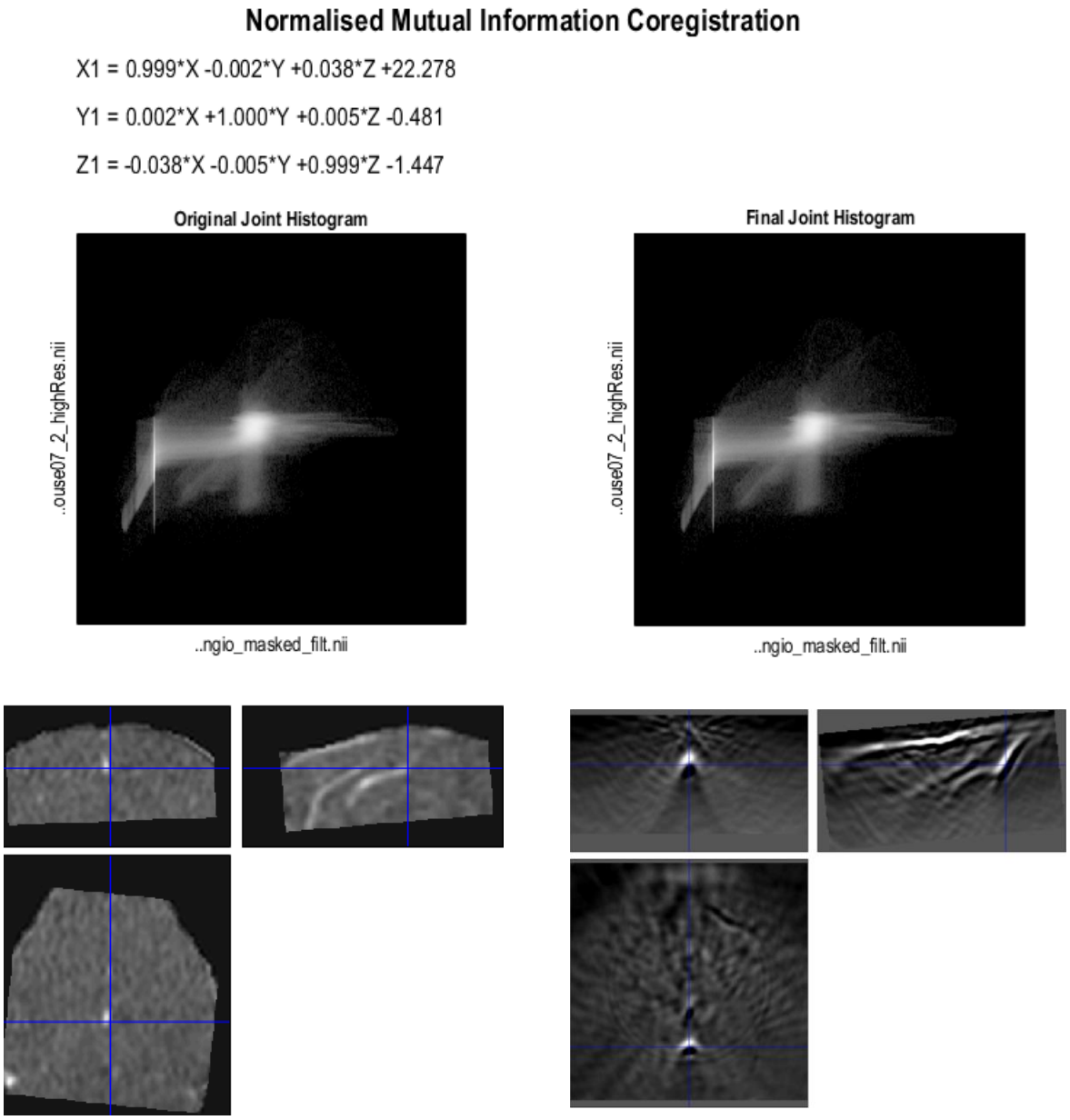

Figure 3 Output image of the 'Coregister (estimate)' function of SPM showing the co-registration of *MRA* and *OAT*

4) Subsequent co-registration of *EPI* with *T1*, *MRA* with *T1*, and *OAT* with *MRA* results in all images being co-registered with each other (Fig. 4).

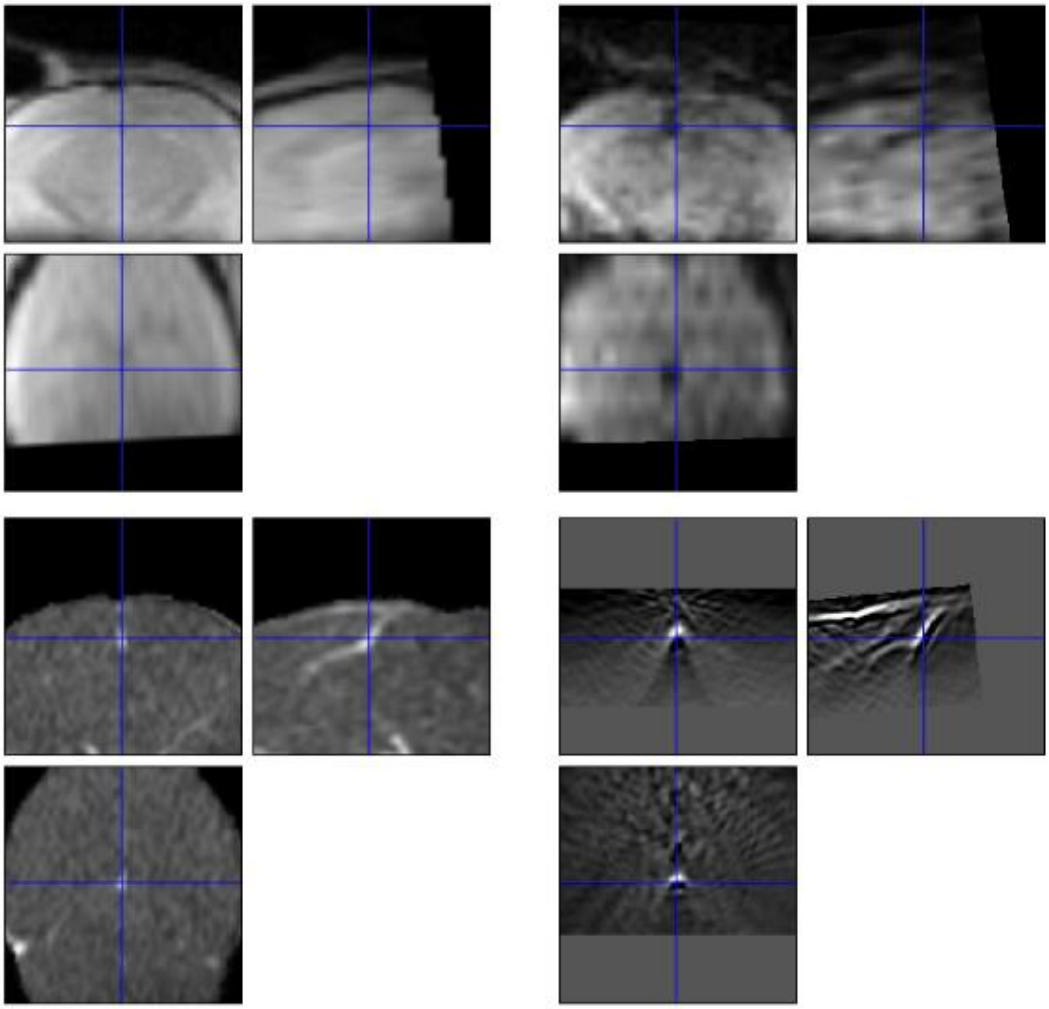

Figure 4 Successive co-registrations of *T1* (top left), *EPI* (top right), *MRA* (bottom left) and *OAT* (bottom right)