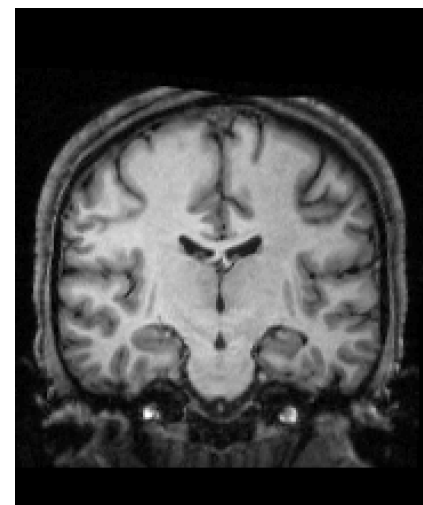
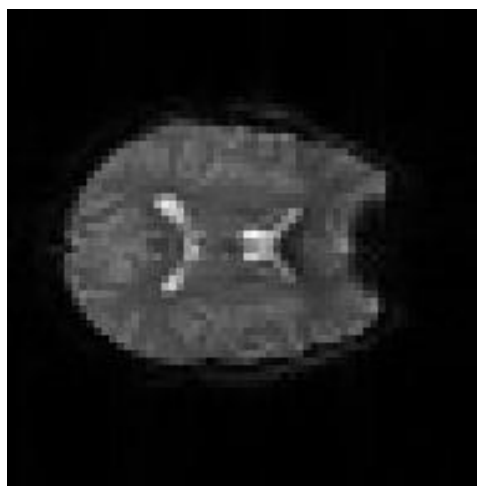
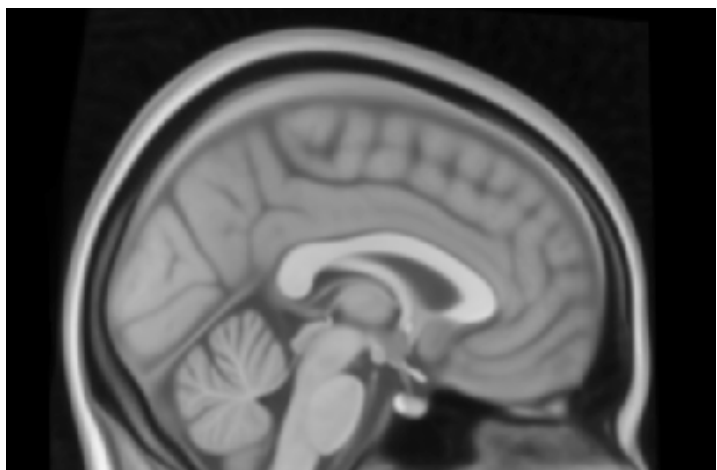
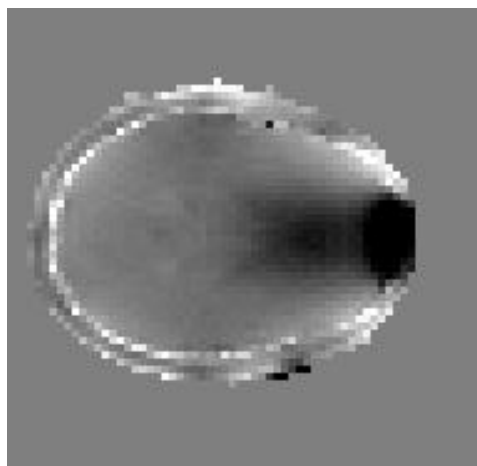
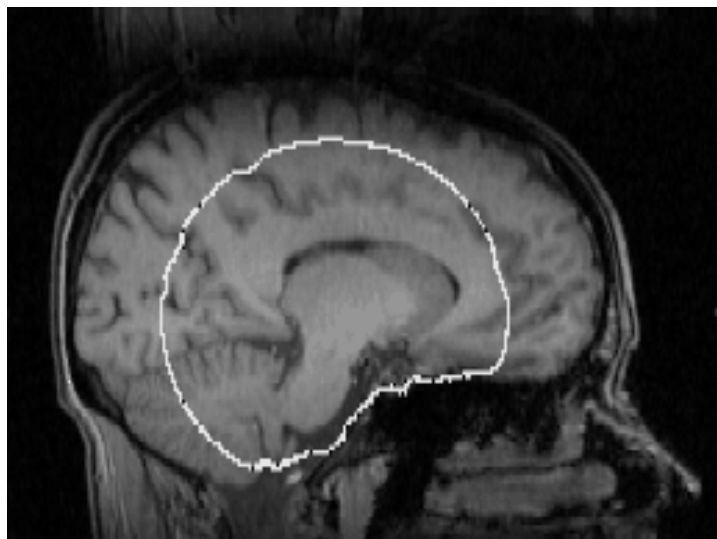


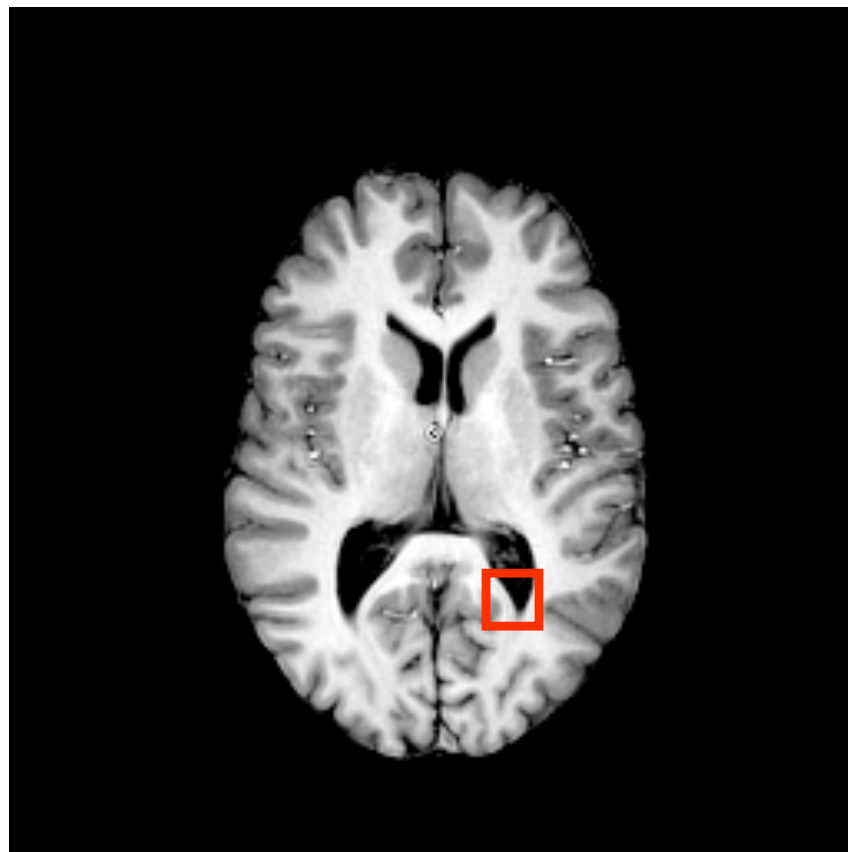
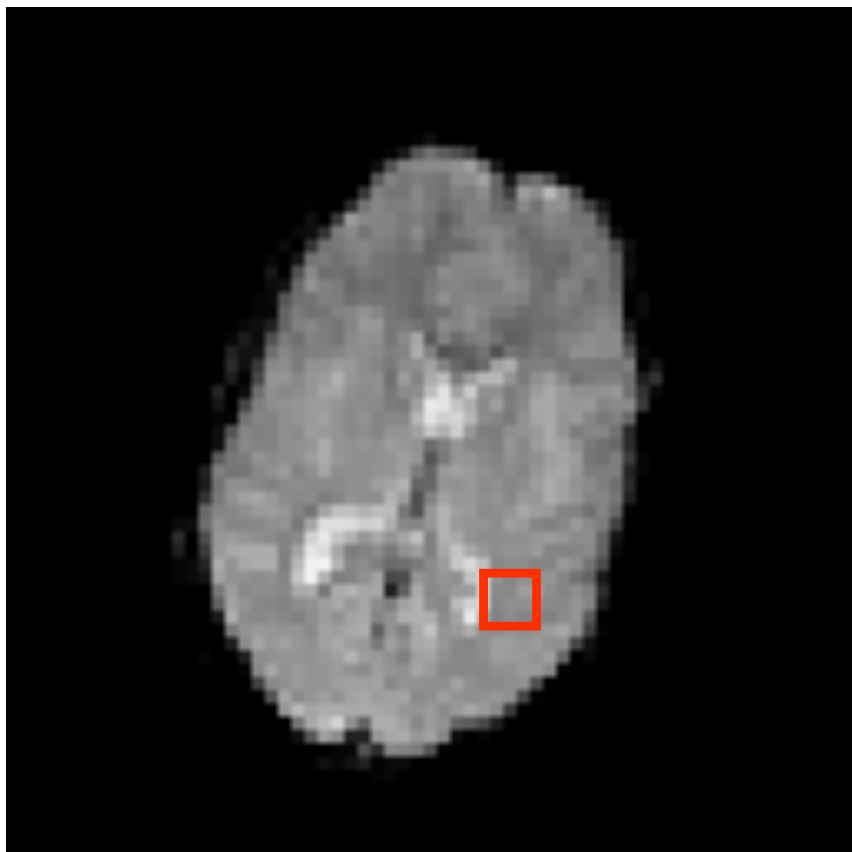


Introduction to Brain Extraction and Registration



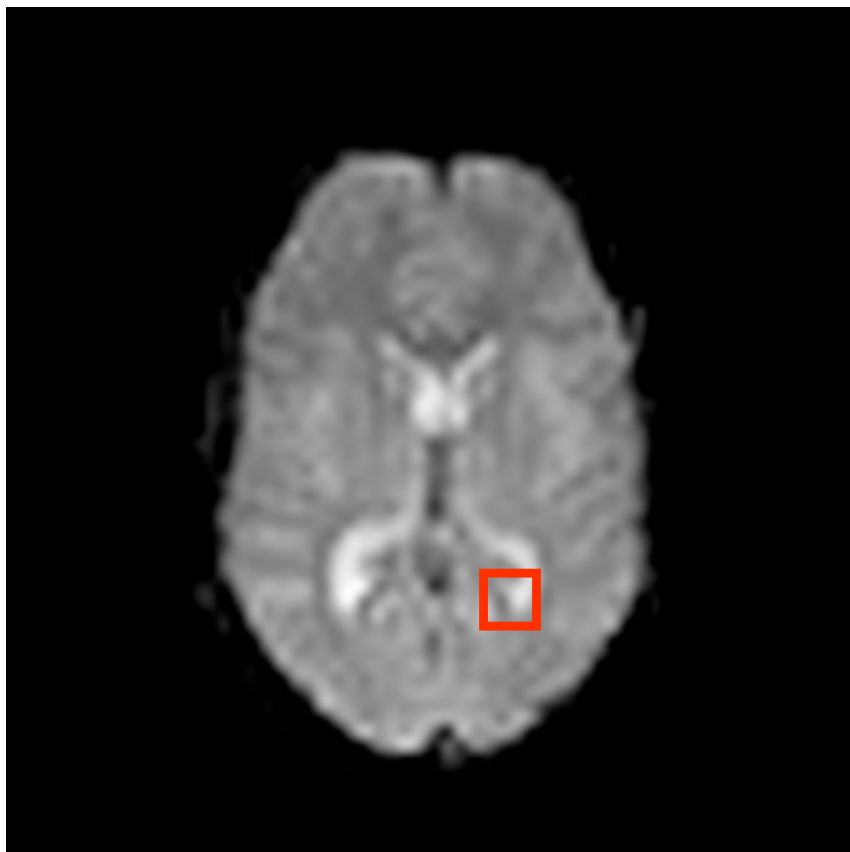


What is Registration?





What is Registration?



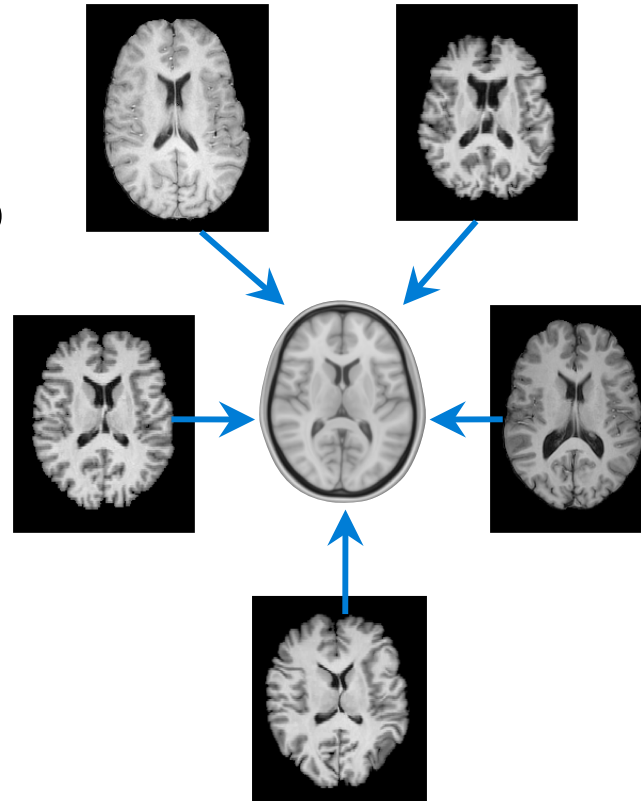
Align images so that
voxel location = anatomical location
with accurate intensity values



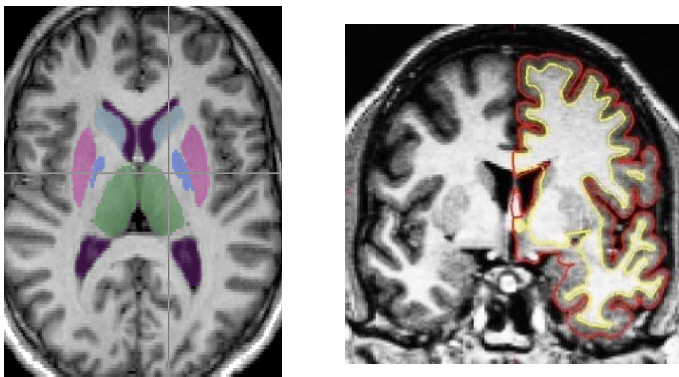
What use is Registration?

Some common uses of registration:

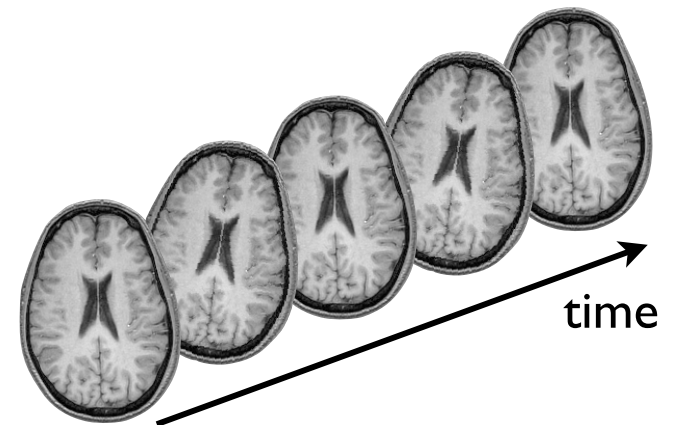
Combining across individuals in group studies: including fMRI & diffusion



Quantifying structural change



Correcting for motion





BET: Brain Extraction Tool

Brain / non-brain segmentation

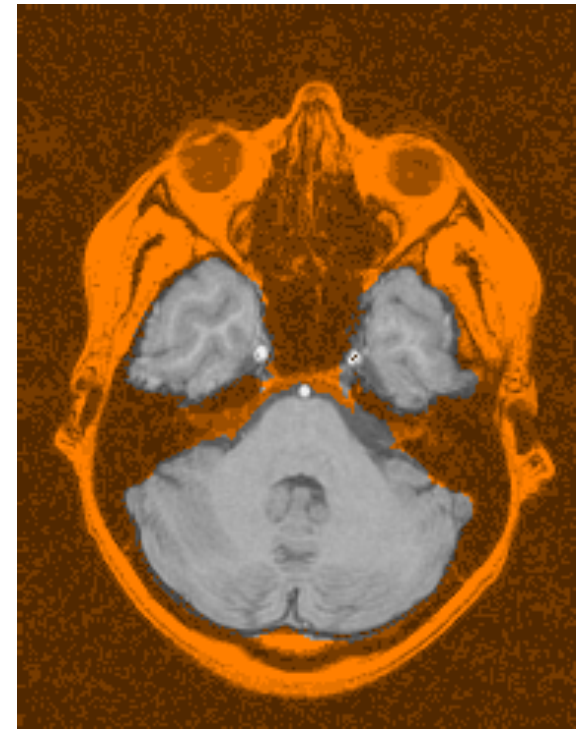
Preparation step for registration and segmentation

Eliminates non-brain tissues with highly variable contrast and geometry (e.g. scalp, marrow, etc.)

- works best if some fat sat is used

Robust to bias fields (by using local intensity changes)

Works with a wide range of MRI sequences (T1, T2, etc.) and resolutions

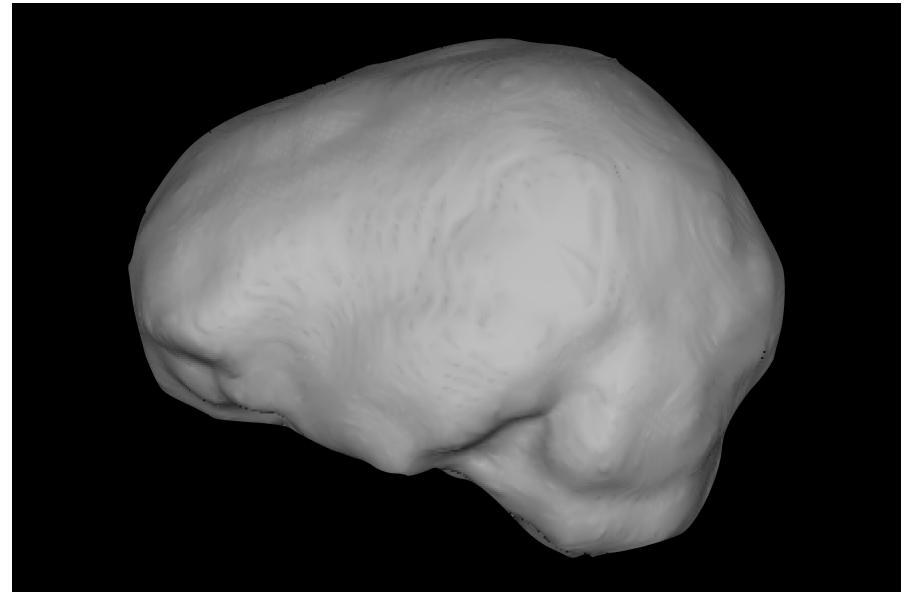


S.M. Smith; Fast robust automated brain extraction; HBM 17(3), 2002.



Example Results

Brain Surface Model

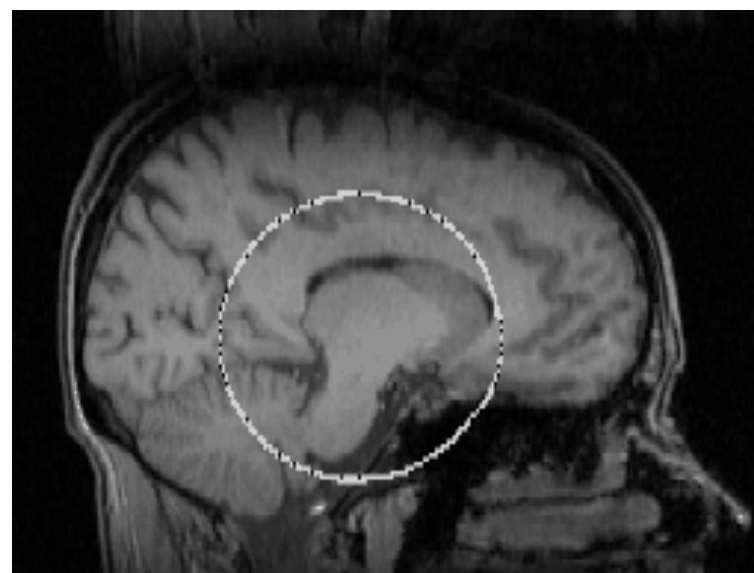
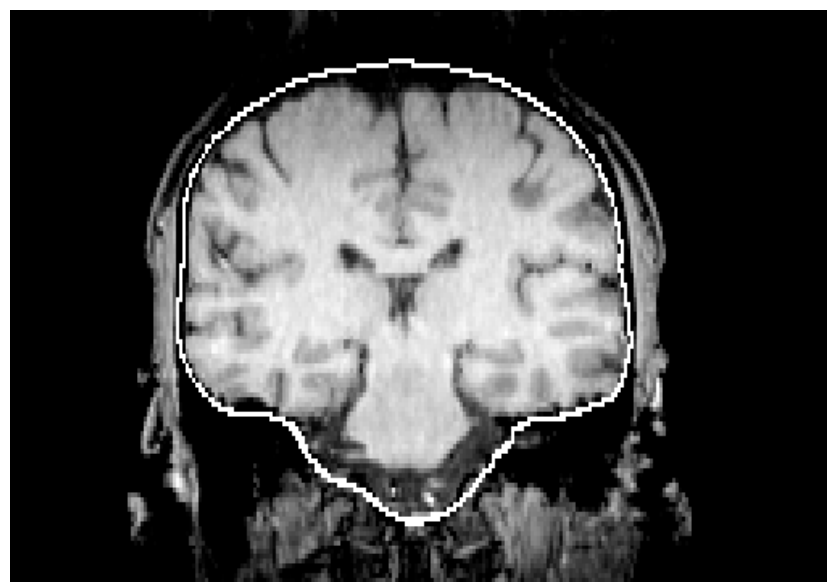
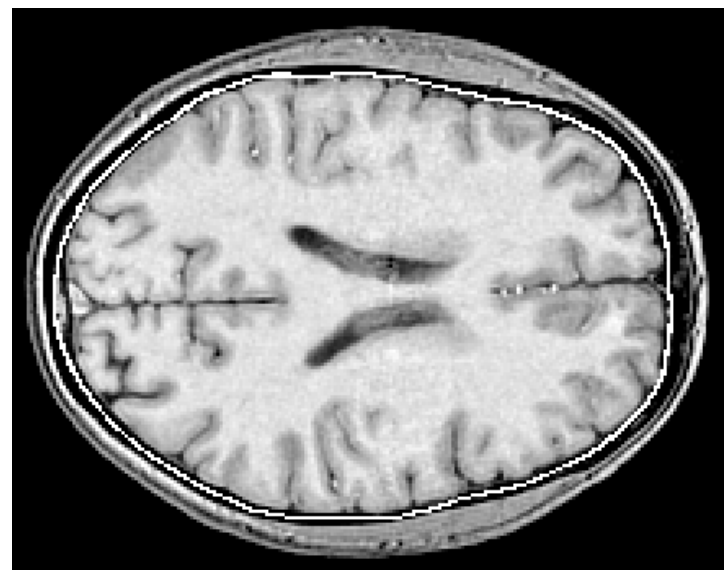
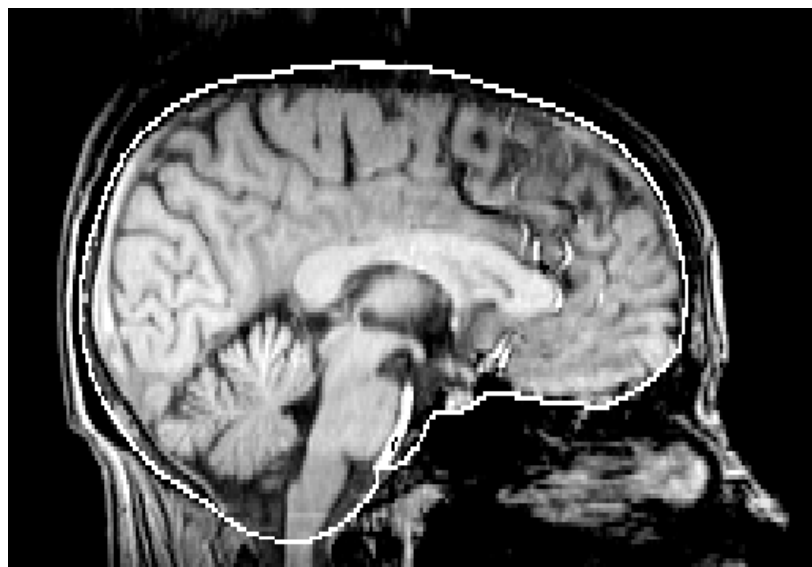


Extracted Brain Surface
(not what we aim for here)





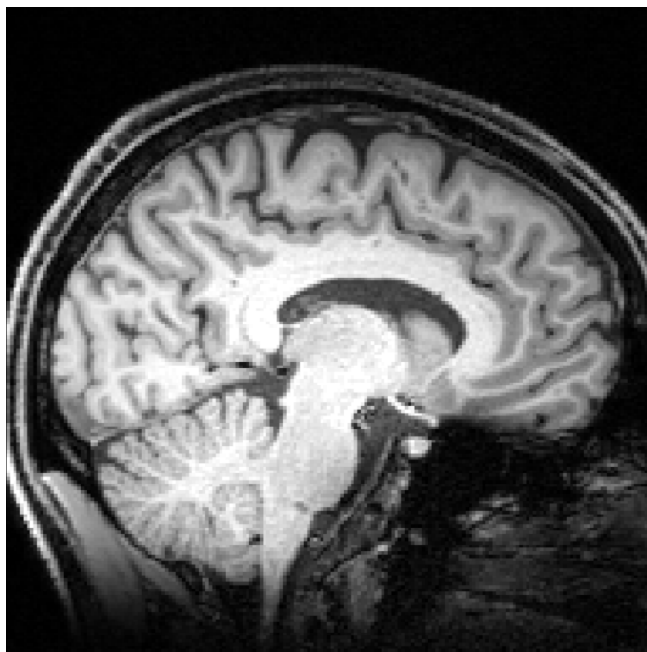
Example Results



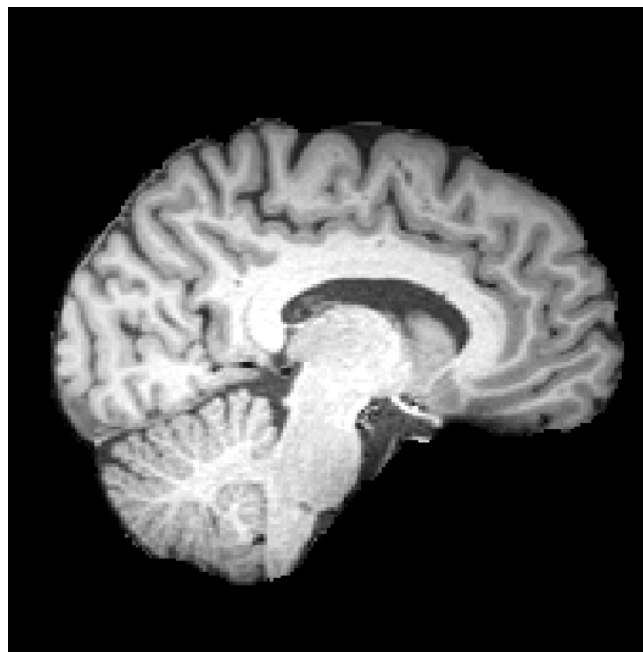


Example Results

Original



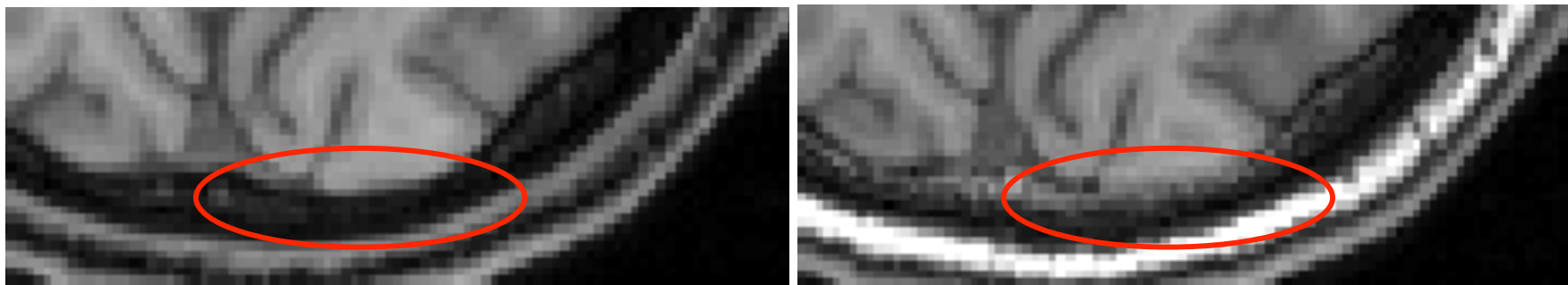
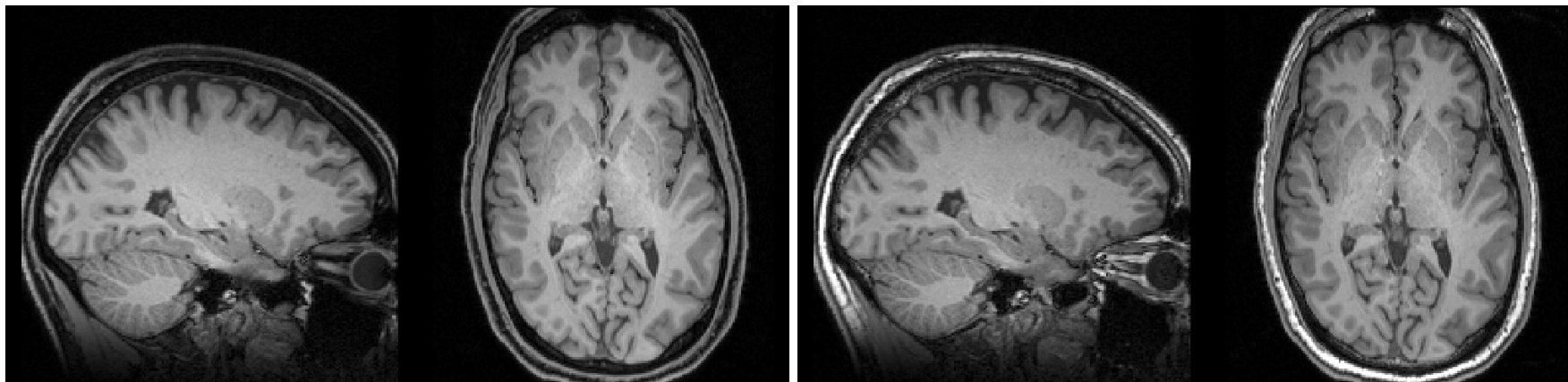
Brain Extracted



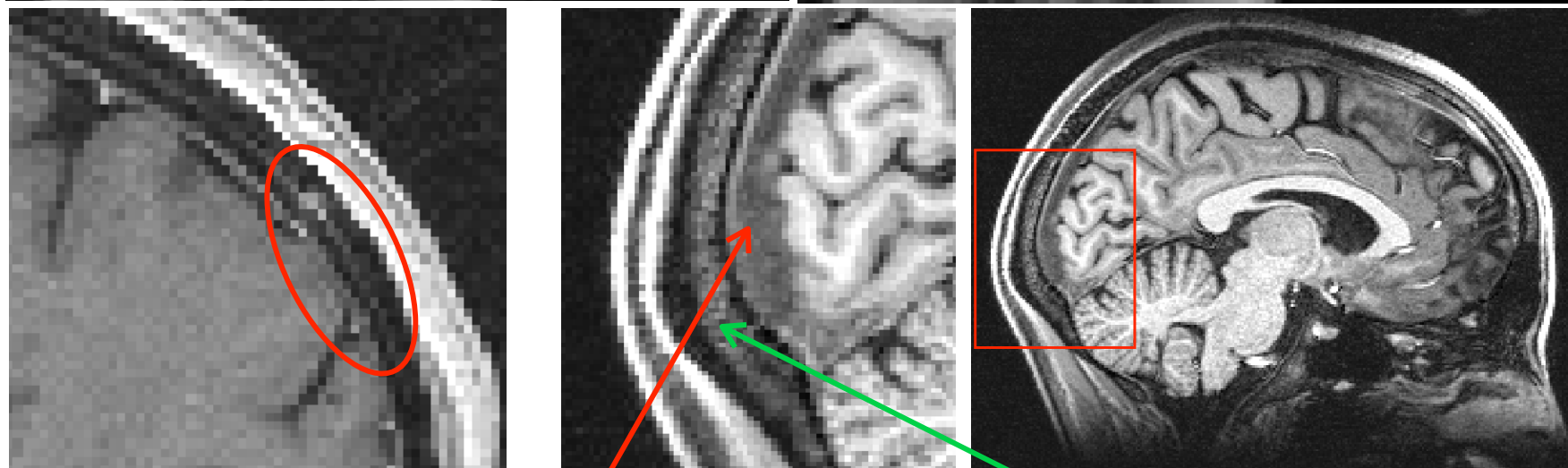
Brain Mask



Difficulties



Marrow



Membranes

Blood (sinus)

Marrow

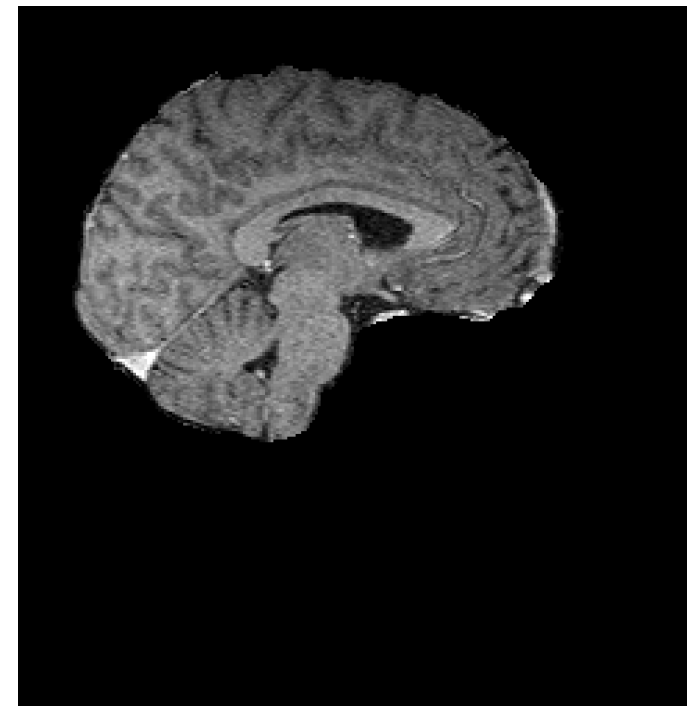


Example Results



Want to remove the majority of non-brain structures, leaving all the brain intact.

Leaving small pieces of non-brain is *unimportant for linear registration*, but it is important for segmentation.

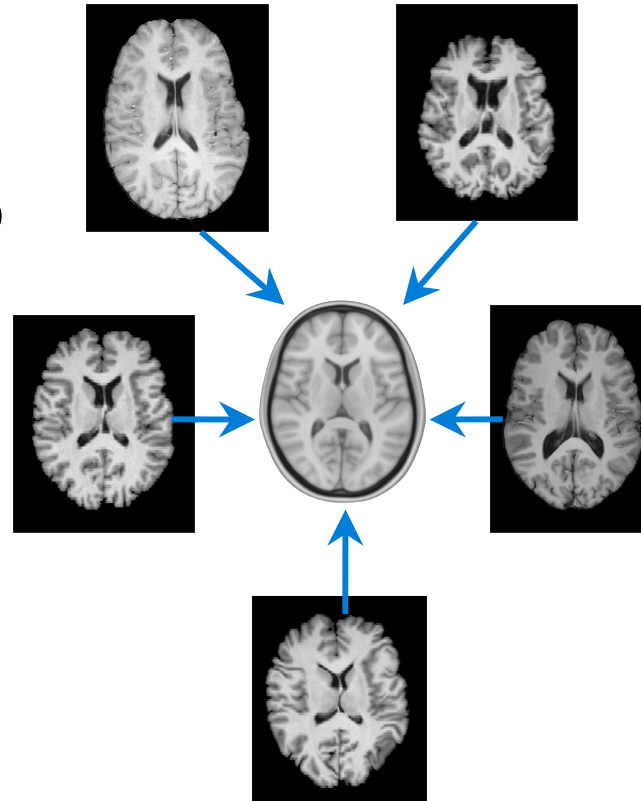




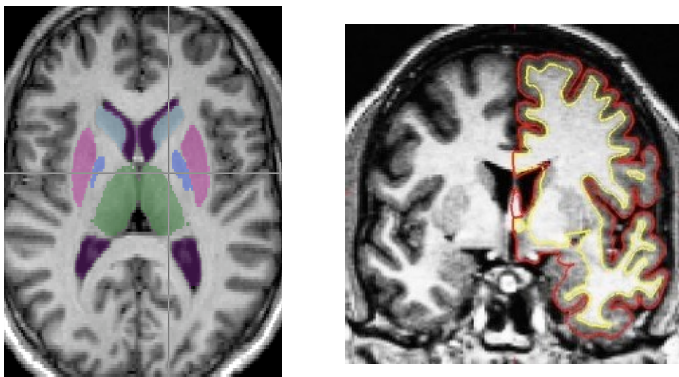
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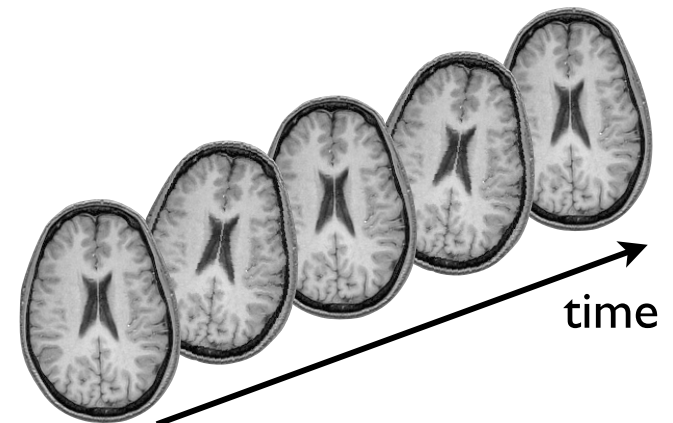
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Brain Extraction and Registration

Summary:

- Registration aims to align images/structures
- Can transform the image to match others
- Important component in *all* group studies
- Can measure motion or anatomical change
- Brain extraction removes bulk of non-brain
- Some errors are to be expected
- Small, isolated errors are not a problem *for registration (but would be for segmentation)*