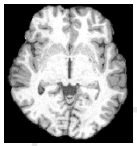
DMRI data processing steps

ATR Neural Information Analysis Laboratories(Jan 11, 2017)

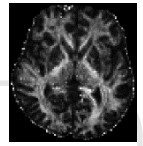
batch files for fiber tracking



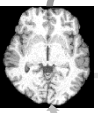
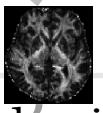
MRI

dmri_process_T1_dicom_convert.m
dmri_process_T1_bias_correct.m
dmri_process_T1_brain_extract.m

dMRI



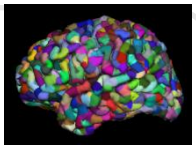
dmri_process_DWI_import.m
dmri_process_DWI_motion_correct.m
dmri_process_DWI_brain_mask_extract.m
dmri_process_FA_image_coreg_create.m

Coregistration

dmri_process_T1_freesurfer.m
dmri_process_images_coregister.m
dmri_process_FA_image_clean.m

Parcellation & ROI generation

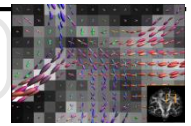


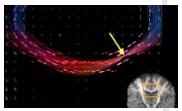
dmri_process_cortex_import.m
dmri_process_cortex_parcel.m
dmri_process_FA_parcel_volume_files_create.m
dmri_process_fiber_tracking_mask_create.m

Preprocess

Fiber tracking

dmri_process_fodf_calc.m





dmri_process_fiber_tracking_execute.m
dmri_process_connection_calc.m

MRI data preprocessing

dmri_process_T1_dicom_convert.m
dmri_process_T1_bias_correct.m
dmri_process_T1_brain_extract.m

dmri_process_T1_dicom_convert.m

DICOM → NifTI(.nii)

On a VBMEG basis.

dmri_process_T1_bias_correct.m

Bias correction by SPM8

dmri_process_T1_brain_extract.m

- NIfTI → NIfTI-gz (.nii.gz)
- Brain extraction

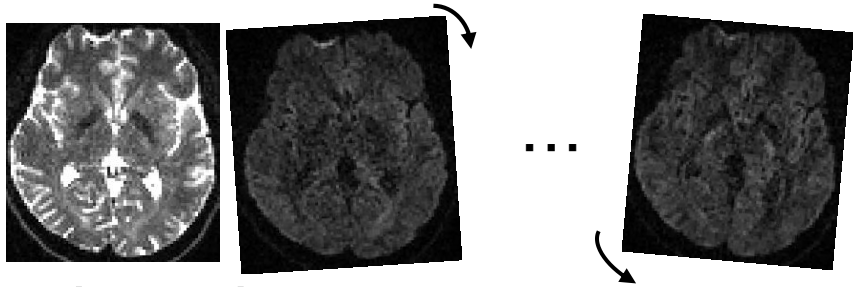
For FSL

dMRI data preprocessing

dmri_process_DWI_import.m

DICOM → NIfTI (.nii.gz)

dmri_process_DWI_motion_correct.m



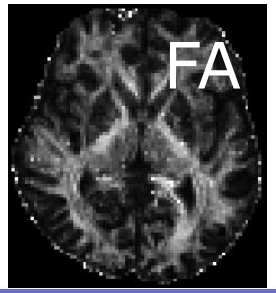
b0 b=1000

dmri_process_DWI_brain_mask_extract.m

Brain extraction

dmri_process_FA_image_coreg_create.m

Make an FA image.



MRI – dMRI coregistration

dmri_process_DWI_import.m
dmri_process_DWI_motion_correct.m
dmri_process_DWI_brain_mask_extract.m
dmri_process_FA_image_coreg_create.m

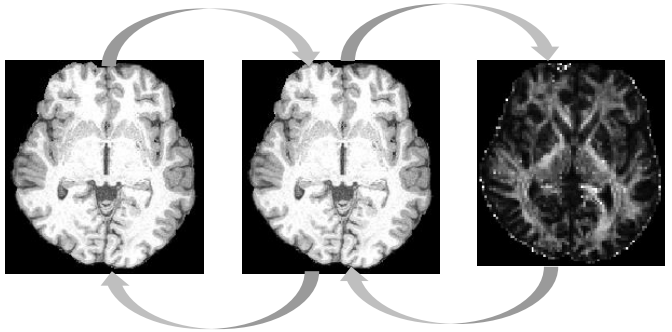
Coregistration

dmri_process_T1_freesurfer.m

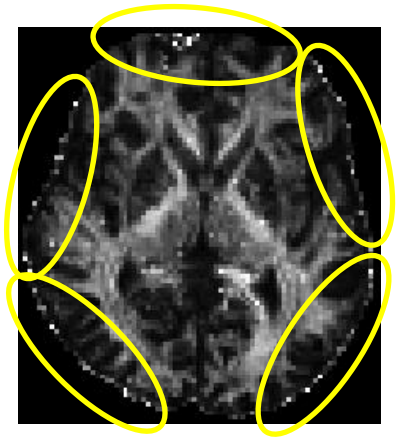
Freesurfer recon-all

dmri_process_images_coregister.m

dmri_process_T1_freesurfer.m
dmri_process_images_coregister.m
dmri_process_FA_image_clean.m



Freesurfer – MRI - dMRI Coregistration



dmri_process_FA_image_clean.m

Remove noisy white dots in FA.

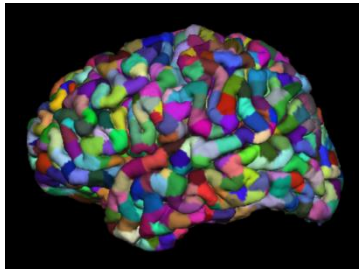
Parcellation & ROI generation

dmri_process_cortex_import.m

Make BRAIN-MAT of VBMEG.

dmri_process_cortex_parcel.m

Cortical parcellation (.mat)



dmri_process_FA_parcel_volume_files_create.m

- Cortical parcellation (.label)

dmri_process_cortex_import.m
dmri_process_cortex_parcel.m
dmri_process_FA_parcel_volume_files_create.m
dmri_process_fiber_tracking_mask_create.m

- Surface ROI (.label) → Volume ROI (.nii.gz)

dmri_process_fiber_tracking_mask_create.m

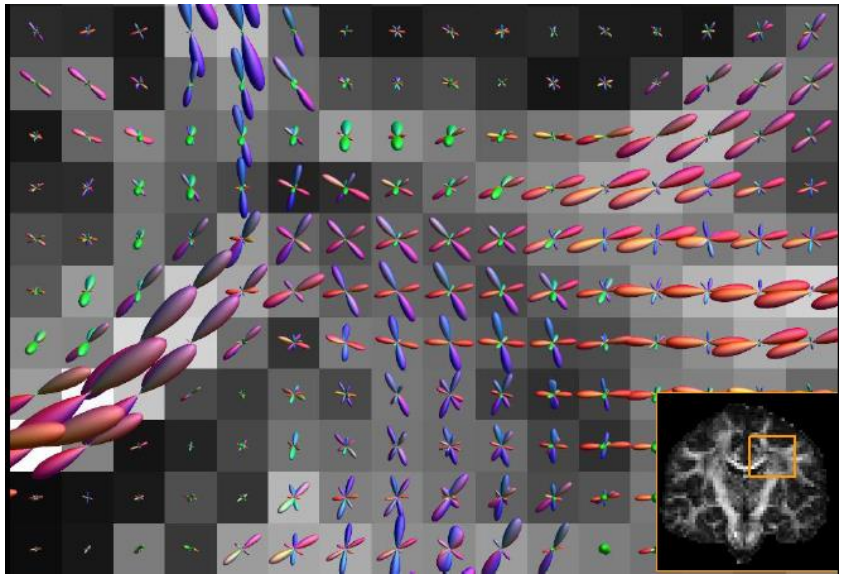
Fiber tracking mask

Make a white-matter ROI volume.

Estimate fiber orientation distribution

dmri_process_fodf_calc.m

Fiber orientation distribution function (fODF)



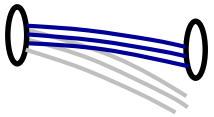
Tournier, OHBM2012 educational course slides

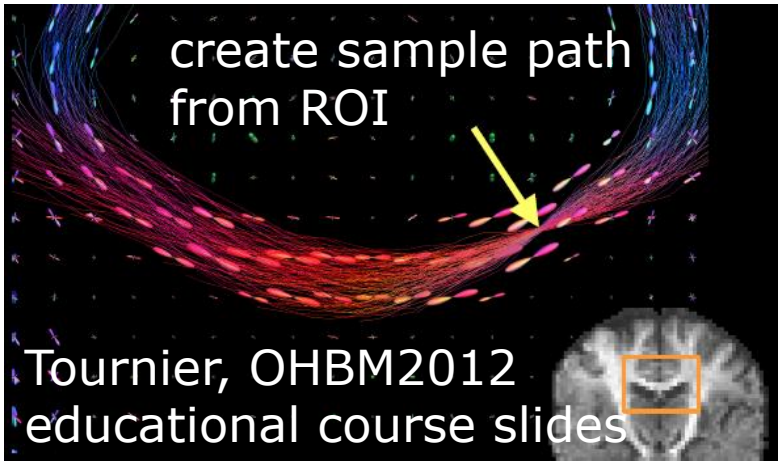
dmri_process_fodf_calc.m

Tracking fibers & Computing SC matrices

dmri_process_fiber_tracking_execute.m

- Conduct probabilistic tractography.
- Extract fibers reaching the ROIs.





- Compute connectivity strength c between the ROIs.

$$c = \frac{f_t}{f_s} \times \frac{v_s}{v_t}$$

f_s : # of fibers from seed ROI
v_s : # of voxels of seed ROI
f_t : # of fibers to target ROI
v_t : # of voxels of target ROI

- Calculate fiber length between the ROIs.

dmri_process_connection_calc.m

- Set a threshold of connectivity strength c.

Transmission delay
+ local time constant

dmri_process_fiber_tracking_execute.m
dmri_process_connection_calc.m

- Compute the time delays from the fiber lengths.