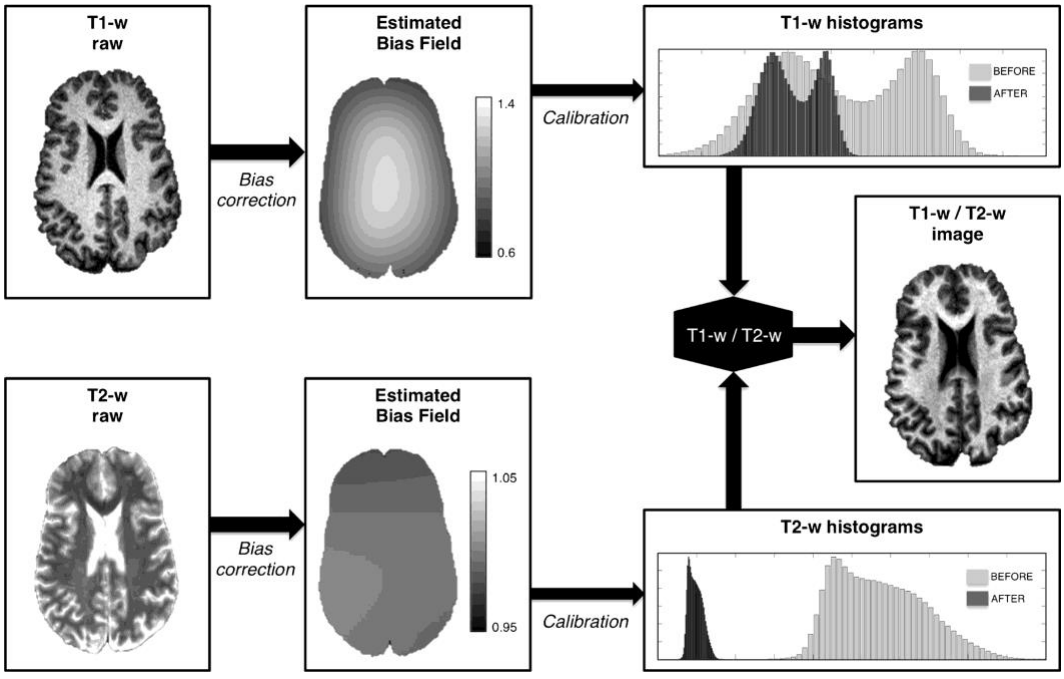
MRTool-T1T2

The T1-w/T2-w image module of MRTool implements a processing workflow for the generation of the T1-w/T2-w image. The T1-w and T2-w images are subjected to bias correction to remove the slow intensity variations related not only to the MR hardware but also its interaction with the subject's cranial tissue. Subsequently, the intensity of the bias-corrected images is equalized. Finally, the multi-modal T1-w/T2-w image is calculated as the ratio of the standardized T1-w and T2-w images.

Image calibration options:

1) **Nonlinear histogram matching: external calibration**
   This nonlinear intensity calibration is based on the intensity extracted from non-brain tissues (e.g. cerebrospinal fluid, bone, soft tissues).
2) **Nonlinear histogram matching: internal calibration**
   This nonlinear intensity calibration is based on the intensity extracted from brain tissues (e.g. white matter, gray matter, cerebrospinal fluid).
3) **Linear histogram matching: external calibration**
   This linear intensity rescaling is based on non-brain landmarks (e.g. eye balls and temporal muscle). NOTE: only use this rescaling option when the intensity range inside the brain falls within the intensity values of eye ball and temporal muscle. See *Ganzetti et al. 2014 - Frontiers in Human Neuroscience* for more information.

'T1-w/T2-w image' image processing framework



User guide

The files required in input are:

Output Directory	Directory where the output files should be saved
Anatomical T1w image	Structural T1-weigthed image to be processed
Anatomical T2w image	Structural T2-weigthed image to be processed
T1w template image	T1-weigthed template image. Select the file mni_icbm152_t1_tal_nlin_sym_09a.nii stored in the directory 'MRTool/template'
T2w template image	T2-weigthed template image. Select the file mni_icbm152_t2_tal_nlin_sym_09a.nii stored in the directory 'MRTool/template'
Tissue probability maps	Tissue probability maps required for the implementation of the module. Choose the default TPM.nii file available in the directory 'MRTool/template'.
T1w bias regularization	Regularization parameter for intensity non-uniformity (INU) correction (default: 10^{-4}) of the T1-w image
T1w bias FWHM	Smoothing (FWHM) parameter for intensity non-uniformity (INU) correction (default: 60) of the T1-w image
T2w bias regularization	Regularization parameter for intensity non-uniformity (INU) correction (default: 10^{-4}) of the T2-w image
T2w bias FWHM	Smoothing (FWHM) parameter for intensity non-uniformity (INU) correction (default: 60) of the T2-w image
Calibration flag	Type of intensity calibration: 1. Nonlinear histogram matching: external calibration 2. Nonlinear histogram matching: internal calibration 3. Linear histogram matching: external calibration

The files generated in output by the module are:

y_t1w.nii	Deformation field: MNI space to subject space (for both T1-w and T2-w)
iy_t1w.nii	Deformation field: subject space to MNI space (for T1-w image)
t1w.nii	Raw T1-w image given as input (in native space)
t2w.nii	Raw T2-w image given as input (in native space)
mt1w.nii	INU-corrected T1-w image (in native space)

mrt2w.nii	INU-corrected T2-w image (aligned with mt1w.nii)
emt1w.nii	INU-corrected and calibrated T1-w image (in native space)
emrt2w.nii	INU-corrected and calibrated T2-w image (aligned with the T1-w image)
emt1w_on_t2w.nii	T1-w/T2-w image computed from INU-corrected and calibrated T1-w and T2-w images (in native space)
wmt1w.nii	INU-corrected T1-w image in MNI space
wmt2w.nii	INU-corrected T2-w image in MNI space
wemt1w.nii	INU-corrected and calibrated T1-w image in MNI space
wemt2w.nii	INU-corrected and calibrated T2-w image in MNI space
wemt1w_masked.nii	INU-corrected, calibrated and skull-stripped T1-w image in MNI space
wemt2w_masked.nii	INU-corrected, calibrated and skull-stripped T2-w image in MNI space
wemt1w_on_t2w.nii	T1-w/T2-w image computed from INU-corrected and calibrated T1-w and T2-w images (in MNI space)
wemt1w_on_t2w_masked.nii	Skull-stripped T1-w/T2-w image computed from INU-corrected and calibrated T1-w and T2-w images
w_mask.nii	Binary mask in MNI space

Referencing

If you employ 'T1-w/T2-w image' in your research please reference the articles below:

- Ganzetti, M., Wenderoth, N., Mantini, D., 2014. Whole brain myelin mapping using T1- and T2-weighted MR imaging data. Front Hum Neurosci 8, 671.

- Ganzetti, M., Wenderoth, N., Mantini, D., 2015. Mapping pathological changes in brain structure by combining T1- and T2-weighted MR imaging data. Neuroradiology 57, 917-928.

Contacts

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