Summary

- Subject ID: 100788
- Structural images: 1 T1weighted
- ASL series: 1
- Standard output species: MEDICAL2020.4(Nov)
- Non-standard output species
- FreeSurfer version: 6.0.1

Anatomical

Anatomical Conformation

- Input T1w images: 1
- Mean signal intensity: 915
- Output dimensions: 320,256,160
- Output voxel size: 0.8mm x 0.8mm x 1mm
- Discarded images: 0

Brain mask and brain tissue segmentation of the T1w

The panel shows the template T1-weighted image (if several T1s images were found), with contours delineating the detected brain mask and brain tissue segmentations.

Spatial normalization of the anatomical T1w reference

Results of nonlinear alignment of the T1w reference image to the MNI152NLin2009cAsym template space. Hover on the panels with the mouse pointer to transition between both spaces.

Spatial normalization of the T1w image to the MNI152NLin2009cAsym template.

Arterial Spin Labelling

Reports for: session PNC1, acquisition se_

Summary

- Repetition time (TR): 4s
- Phase encoding (PE) direction: Anterior-Posterior
- Slice acquisition: single slab
- Slice spatial resolution: 3mm isotropic
- Continuous collected: yes, slices, framewise,displacement,tsnr,fwhm_x,fwhm_y,fwhm_z,+d_x,+d_y,+d_z
- Motion summary measures: FD: 0.0368, mRMS: 0.0016
- Quality evaluation index: CJV: 0.4, CNR: 1.0, EFC: 0.8, FWHM: 3.0882, Crow Cor: 0.8996, Coverage: 1.0
- Normalization quality: Dice Index: 0.8871, Jaccard Index: 0.7974, Cross Correlation: 0.9583, Coverage: 0.9995
- Quality evaluation index: CJV: 0.5356, CNR: 0.7771, SNR: 0.6243, Blurb: 0.6232, EFC: 0.425
- Mean CBF: 64.7, GM: 82.9, WM: 46.6, Percentiles: 5th: 16.9, 95th: 127.1
- Percentage of negative voxel: CBF: 0.16,GM: 0.03, WM: 0.34, CSF: 0.8, SCORE: 0.2, PVC: 0.1

Alignment and analysis outcomes (derivatives-driven)

FD: 0.0368 was used to generate transients from GM space to the T1w space. The white matter mask calculated with FD: 0.0368 brain tissue segmentation) was used for BBR. Note that freesurfer/fsl segmentation is used in the report in order to highlight potential tpm mistaks and other artifacts, whereas final images are resampling using ciftify resolution.

ASL Series

Summary statistics are plotted, which may reveal trends or artifacts in the ASL data. DVARS and FD show the standardized DVARS and framewise displacement measures for each time point. A carpet plot shows the time series for all brain mask voxels. Voxels are grouped into cortical (blue), and subcortical (orange) gray matter, cerebellum (purple) and white matter and CSF (red), indicated by the color map on the left-hand side.

Get figure file: sub-100788/ASL/sub-100788_task-PNC1_acq-se_desc-carpetplot_qc.png

CBF Summary

Summary statistics for time series for all voxels within the brain mask for CBF. Values are grouped into cortical (blue), and subcortical (orange) gray matter, cerebellum (green), white matter and CSF (red), indicated by the color map on the left-hand side. The scaled time series value greater than zero indicates which voxel(s) are removed by SCORE.

Get figure file: sub-100788/ASL/sub-100788_task-PNC1_acq-se_desc-carpetplot_qc.png

CBF maps

The maps until central blood flow (CBF) for basic CBF. The unit is ml/100 g/min

Get figure file: sub-100788/ASL/sub-100788_task-PNC1_acq-se_desc-meanCBF_qc.svg

SCORE CBF maps

The maps until central blood flow (CBF) for SCORE-corrected CBF. The unit is ml/100 g/min

Get figure file: sub-100788/ASL/sub-100788_task-PNC1_acq-se_desc-meanCBFscore_qc.svg

SCRUB CBF maps

The maps until central blood flow (CBF) for SCRUB-corrected CBF. The unit is ml/100 g/min

Get figure file: sub-100788/ASL/sub-100788_task-PNC1_acq-se_desc-meanCBFscrub_qc.svg

BASL CBF maps

The maps until central blood flow (CBF) for BASL-corrected CBF. The unit is ml/100 g/min

Get figure file: sub-100788/ASL/sub-100788_task-PNC1_acq-se_desc-meanCBFbasl_qc.svg

PVC CBF maps

The maps until central blood flow (CBF) for partial volume corrected CBF. The unit is ml/100 g/min

Get figure file: sub-100788/ASL/sub-100788_task-PNC1_acq-se_desc-meanCBFpvc_qc.svg

Methods

We kindly ask to report results preprocessed with this tool using the following keyboards:

HTML · Markdown · LaTeX

Arterial Spin-Labeled MRI Preprocessing and Cerebral Blood Flow Computation

Arterial spin-labeled MRI images were preprocessed using ASLPrep-0.2.Beta, which is based on Nipype 1.6.1 (Gorgolewski et al. 2011).

Anatomical Data Preprocessing

ASLPrep-0.2.x can not to process the anatomical data. A total of 1T1-weighted (T1w) images were found within the input BIDS dataset. The T1w weighted (T1w) image was corrected for intensity non-uniformity (INU) using N4BiasFieldCorrection (Tustison et al. 2010), which is distributed with ANTs 2.3.1 (Avants et al. 2008), yielding a mean INU-bias-corrected T1w reference throughout the workflow. The T1w reference was then skull-stripped with a Nipype implementation of the antsBrainExtraction.sh workflow using OpenBrainAffine for initial target alignment and ANTs 2.3.1 Atropos for refinement. Brain extraction was performed on the T1w reference, using NiMAP-MRBrainS13 pretrained models. The resulting brain mask was manually corrected if needed. Brain tissue segmentation of cerebrospinal fluid (CSF), cortical white matter (CWM), and cortical gray matter was performed on the brain-extracted T1w reference image by the FreeSurfer 6.0.1 recon-all command. The following templates were selected for spatial normalization: *IC300 (50 Hartemink' unsupervised template version (from 2 to 2 years)*,

ASL data preprocessing

For the 1 ASL runs found per subject (across all tasks and sessions), the following preprocessing was performed. First, the reliable volumes of the ASL timeseries was selected as described in aCompCor (Muschelli et al. 2014). Head motion parameters were estimated using the ASL-to-T1w transform (FSL 6.0.3 mcflirt). Susceptibility distortion correction (SDC) was omitted. Slice-timing correction was omitted. Single-shot spatial smoothing (FWHM: 6.0 mm) was applied. Cerebral blood flow (CBF) was computed using the ASL-to-T1w transform (FSL 6.0.3 oxford_asl), which generated the ASL native-space CBF series. Partial volume correction was performed using the ASL native-space CBF series and the T1w-space tissue segmentations (FSL 6.0.3 oxford_asl). Finally, the ASL native-space CBF series was resampled into the ASL reference space, which is defined as the mean ASL volume. The ASL reference was then co-registered to the T1w reference using mri_coreg (FreeSurfer) followed by mri_apply_reg (FreeSurfer), which uses the boundary-based registration cost-function (Greve and Fischl 2009). Co-registration used 6 degrees of freedom. The quality of co-registration and normalization is template-specific and depends on the number of available T1w images and the quality of their segmentations. Quality control images are provided in the derivatives/aslprep/sub-*/asl/ directory. Confounding timeseries were calculated, including both framewise displacement (FD) and DVARS. FD and DVARS are calculated using the implementations in Nipype (following the definitions by Power et al. 2014). For each ASL run, ASLPrep generates confounds in tsnrmet mrdisp or the mean framewise displacement and relative root mean square displacement.

Cerebral blood flow computation

ASLPrep was configured to calculate cerebral blood flow (CBF) using the following methods.

Cerebral blood flow (CBF) was computed using the single compartment CBF model (Buxton et al. 1998).

Structural Correlation based Outlier Rejection (SCORE) algorithm was applied to the CBF timeseries to discard CBF volumes with outlying values (Dolui et al. 2017) before computing the mean CBF. Subsequently, the SCRUB (Structural Correlation with Robust Bayesian (SCRUB) algorithm was applied to the CBF maps using structural tissue probability maps to strength the mean CBF (Dolui et al. 2017; Dolui, Wolk, et al. 2019).

CBF was also computed with Bayesian Inference for Arterial Spin Labeling (BASILS) (Chappell et al. 2009), as implemented in FSL 6.0.3. BASIL computes CBF using a special regularization of the estimated posterior image and additionally calculates a partial-volume-corrected CBF image (Chappell et al. 2011). For each CBF map, the BASL for the following options were used: the Fourier-Wavelet set-of-kernels cost and post-processing spatial regularization.

The Quality evaluation index (QEI) was computed for each CBF map (Dolui, Wolk, et al. 2019). QEI is based on the similarity between the CBF and the structural images, the spatial smoothness of the CBF, and the percentage of voxels with outlying CBF values after partial volume correction.

All accompanying ASL-MRI qc reports a single metric/quality per slice/volume/pair of transformations. *Ciftify's volumetric resampling was performed using wb_command -volume-resampling*, combined with Lanczos interpolation to minimize the smoothing effects of other kernels (Lanczos ratio). Mean internal operations of ASLPrep use Nilearn 0.6.2 (Abraham et al. 2014), *TemplateFlow (0.8.1, dev0)*, and Ciftify (Version as of 2020). For more details of the pipeline, see https://fmriprep.readthedocs.io/~aslprep/.

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Errors

Errors to report

- none