

fMRIPrep

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What is fMRIPrep

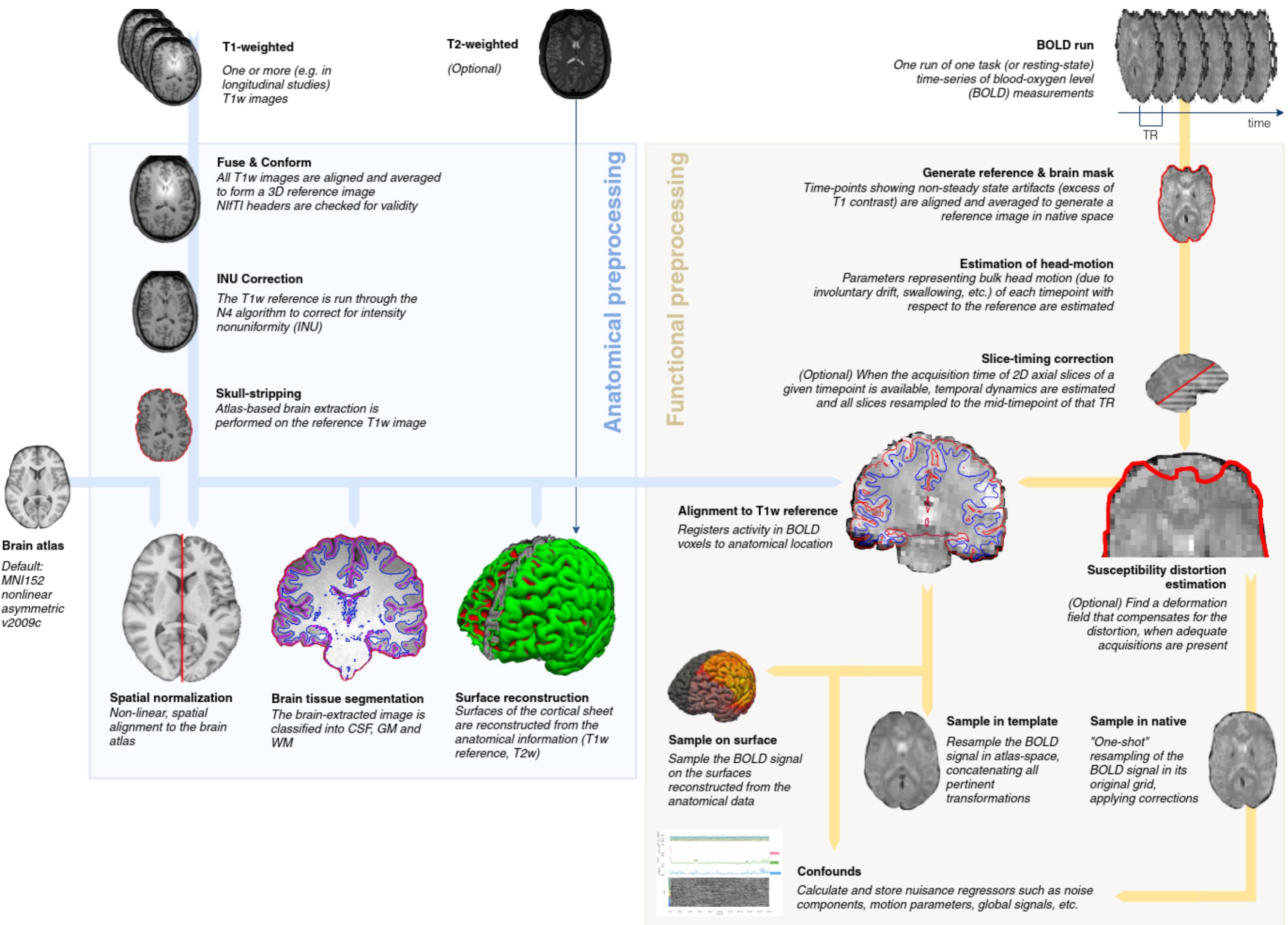
- Preprocessing pipeline created by the Standard Center for Reproducible Neuroscience
- Designed to be robust, easy to use, and transparent
- Performs minimal processing: motion correction, fieldmap correction, normalization, bias field correction, and brain extraction
- Makes use of the best bits of popular software packages (e.g., ANTs, FSL, FreeSurfer, AFNI), as well as custom code

Reasons to use fMRIPrep

- Field-tested
- Reproducible
- Each step has been optimized
- Easy to use output
- Automatically generated reports for QC of each step

Reasons to not use fMRIPrep

- Data do not meet assumptions (e.g., narrow FOV)
- Need unlimited flexibility
- Have study population that does not conform to standard adult MNI templates (e.g., infants, NHP, rodent)



Options of interest

- ICA-AROMA
- FreeSurfer (including longitudinal)
- Anatomy only
- Fieldmap-less distortion correction
- Multi-echo EPI
- Multiple output spaces

Things fMRIPrep does not do

- Smoothing
- ICA-FIXX
- Denoising with user-specified confounds (e.g., in preparation for resting-state analyses)

What do I need to run fMRIPrep?

Minimum requirements

1. Data must be in BIDS format
2. Must have at least one T1w image

Quick review of BIDS (Brain Image Data Structure)

What is BIDS?

- BIDS is a system for naming and organizing ‘raw’ neuroimaging files
- BIDS is not a new file format

Stuff



What is BIDS?

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Animals



Household
Items

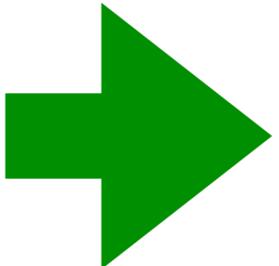


Fruits
and
Vegetables



In practice for MRI data

Name
└ pilot
0002_MPRAGE_SAG_iPAT2_20190507101206_2.json
0002_MPRAGE_SAG_iPAT2_20190507101206_2.nii
0003_ep_bold_mb3_p2_feedback_20190507101206_3.json
0003_ep_bold_mb3_p2_feedback_20190507101206_3.nii
0004_ep_bold_mb3_p2_feedback_20190507101206_4.json
0004_ep_bold_mb3_p2_feedback_20190507101206_4.nii
0006_ep_bold_mb3_p2_resting_20190507101206_6.json
0006_ep_bold_mb3_p2_resting_20190507101206_6.nii
0007_ep_bold_mb3_p2_resting_20190507101206_7.json
0007_ep_bold_mb3_p2_resting_20190507101206_7.nii
0009_ep2d_diff_mb2_p2_64dirs_20190507101206_9.bval
0009_ep2d_diff_mb2_p2_64dirs_20190507101206_9.bvec
0009_ep2d_diff_mb2_p2_64dirs_20190507101206_9.json
0009_ep2d_diff_mb2_p2_64dirs_20190507101206_9.nii



Name
└ CHANGES
└ code
dataset_description.json
participants.tsv
README
└ sourcedata
└ sub-pilot
└ anat
sub-pilot_acq-MPRAGE_run-01_T1w.json
sub-pilot_acq-MPRAGE_run-01_T1w.nii.gz
└ dwi
sub-pilot_run-01_dwi.bval
sub-pilot_run-01_dwi.bvec
sub-pilot_run-01_dwi.json
sub-pilot_run-01_dwi.nii.gz
└ func
sub-pilot_task-feedback_run-01_bold.json
sub-pilot_task-feedback_run-01_bold.nii.gz
sub-pilot_task-feedback_run-01_events.tsv
sub-pilot_task-feedback_run-01_sbref.json
sub-pilot_task-feedback_run-01_sbref.nii.gz
sub-pilot_task-rest_run-01_bold.json
sub-pilot_task-rest_run-01_bold.nii.gz
sub-pilot_task-rest_run-01_events.tsv
sub-pilot_task-rest_run-01_sbref.json
sub-pilot_task-rest_run-01_sbref.nii.gz
sub-pilot_scans.tsv
task-feedback_bold.json
task-rest_bold.json

How to run fMRIPrep?

Option 1: Docker

- fMRIPrep is a Docker container
- Can be run directly from Docker

```
docker run -ti --rm \
    -v filepath/to/data/dir:/data:ro \
    -v filepath/to/output/dir:/out \
    nipreps/fmriprep:latest \
    /data /out/out \
    participant
```

- Can be run using the fmriprep-docker wrapper script

```
pip install --user --upgrade fmriprep-docker
```

```
fmriprep-docker /path/to/data/dir /path/to/output/dir participant
RUNNING: docker run --rm -it -v /path/to/data/dir:/data:ro \
    -v /path/to_output/dir:/out nipreps/fmriprep:20.2.0 \
    /data /out participant
```

Option 2: Compute Canada

- Khan Lab has a set of wrapper scripts: neuroglia-helpers

```
git clone http://github.com/khanlab/neuroglia-helpers ~/neuroglia-helpers
```

- BIDS apps can be run using bidsBatch

```
bidsBatch fmriprep_20.2.0 ~/my-bids-dataset ~/my-bids-dataset/derivatives/fmriprep-v20.2.0 participant
```

Tips on running fMRIPrep

- Running time scales with number of functional runs
- If using Docker, it is recommended to only process one subject at a time
- If using Compute Canada, try and keep the job under 24 hours
- If time/memory is an issue, consider omitting FreeSurfer or looking into the threads and memory options for fMRIPrep

Where to get help?

1. fMRIPrep read the docs: <https://fmriprep.org/en/stable/>
2. Neurostars: <https://neurostars.org/>
3. fMRIPrep git page: <https://github.com/nipreps/fmriprep>

Output