

BIDS: Tools and Services

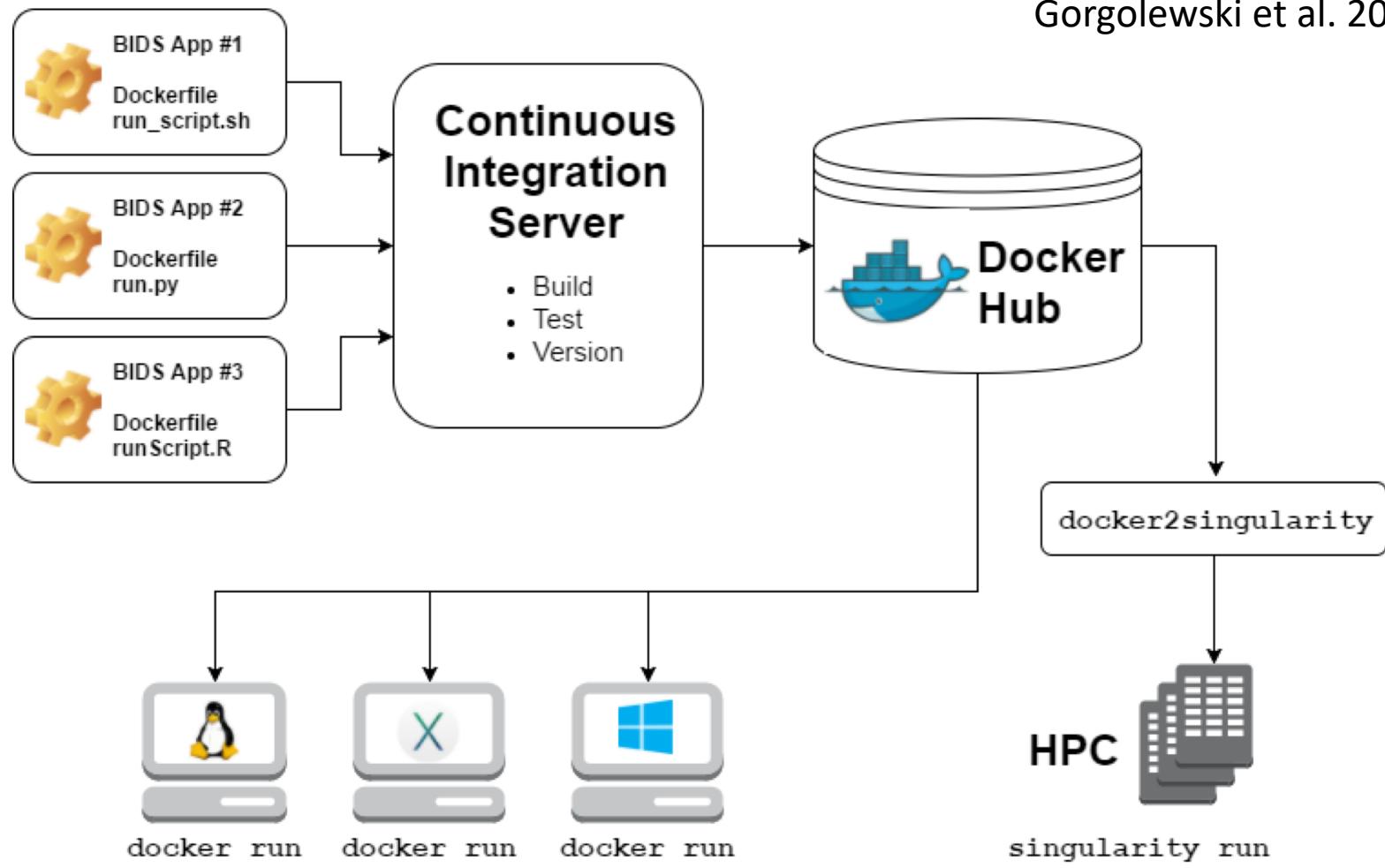
CHRIS GORGOLEWSKI
@CHRISFILOG



tool_cmd /bids_dataset /output

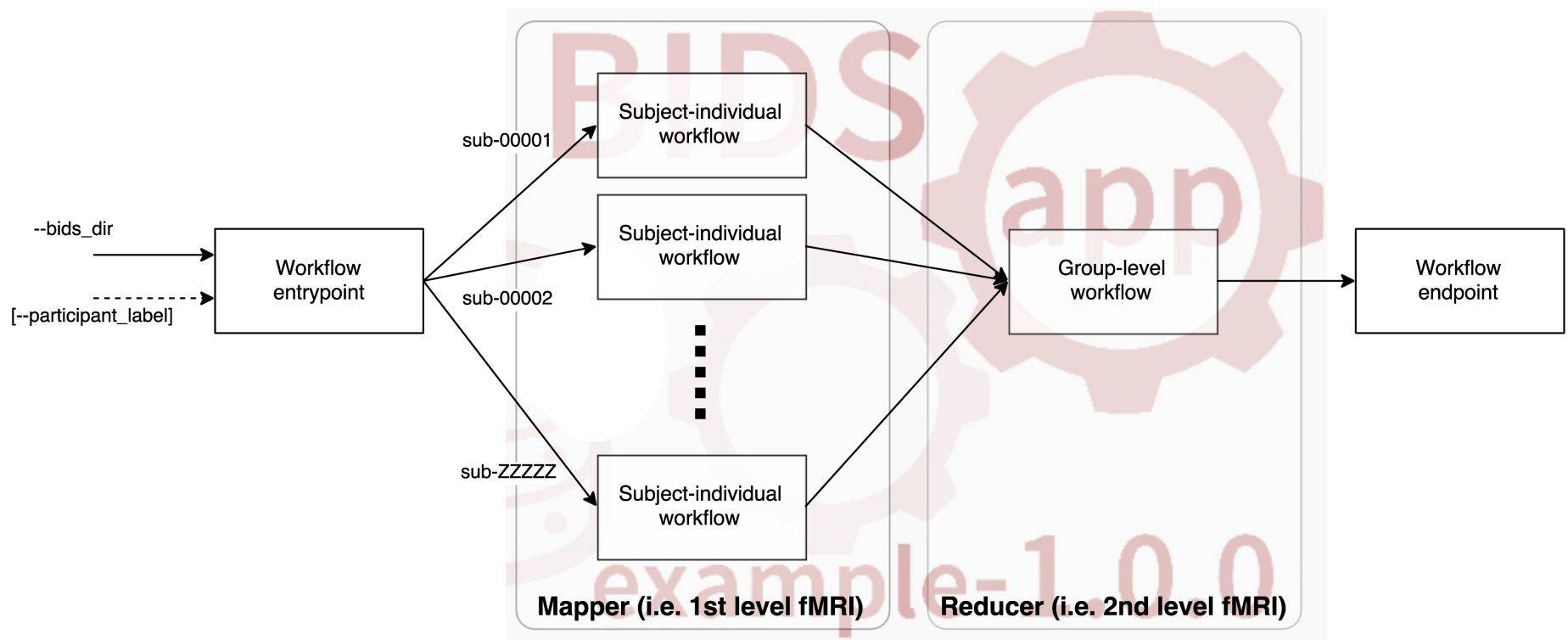
BIDS Apps

Gorgolewski et al. 2017



Self-contained!





Simple parallelization scheme – map/reduce

Available BIDS Apps

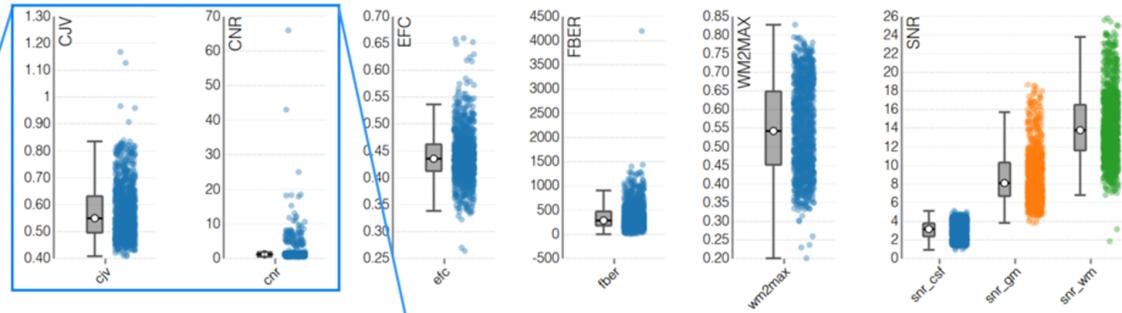
bids/example	version 0.0.6	issues 0	build passing	pull requests 0	docker pulls 363	424.5MB 23 layers
bids/freesurfer	version v6.0.0-3	issues 0	build passing	pull requests 0	docker pulls 440	2.6GB 55 layers
bids/ndmg	version v0.0.48-1	issues 0	build passing	pull requests 0	docker pulls 6k	757MB 31 layers
bids/BROCCOLI	version v1.0.1	issues 1	build passing	pull requests 0	docker pulls 157	3GB 21 layers
bids/FibreDensityAndCrosssection	version v0.0.1	issues 0	build passing	pull requests 0	docker pulls 41	576.8MB 31 layers
bids/SPM	version v0.0.7	issues 0	build passing	pull requests 0	docker pulls 202	1.5GB 24 layers
bids/MRIQC	version 0.9.3	issues 0	build Project not found	pull requests 1	docker pulls 868	1.5GB 35 layers
bids/QAP	Image not found	issues 0	build passing	pull requests 3	docker pulls 6	Image not found
bids/CPAC	version v1.0.1a_19	issues 0	build passing	pull requests 0	docker pulls 383	1.4GB 38 layers
bids/hyperalignment	Image not found	issues 0	build passing	pull requests 0	docker pulls 1	Image not found
bids/mindboggle	version 0.0.1	issues 2	build failed	pull requests 1	docker pulls 223	1.7GB 43 layers
bids/MRtrix3_connectome	version latest	issues 0	build passing	pull requests 1	docker pulls 81	3.4GB 51 layers
bids/rs_signal_extract	version 0.1	issues 0	build passing	pull requests 0	docker pulls 38	240MB 17 layers
bids/aa	version enh_vario...	issues 0	build passing	pull requests 0	docker pulls 39	3.8GB 57 layers
bids/niak	version latest	issues 3	build passing	pull requests 1	docker pulls 43	2.2GB 48 layers
bids/oppni	version latest	issues 0	build passing	pull requests 0	docker pulls 52	3GB 36 layers
bids/fmriprep	version 0.3.2	issues 0	build failed	pull requests 0	docker pulls 78	3.8GB 46 layers
bids/brainiak-srm	version latest	issues 0	build passing	pull requests 0	docker pulls 41	559.3MB 13 layers
bids/nipypipelines	version 0.3.0	issues 0	build passing	pull requests 0	docker pulls 26	478.1MB 20 layers
bids/HCPPipelines	version v3.17.0-13	issues 0	build passing	pull requests 1	docker pulls 185	2.5GB 65 layers
bids/MAGeTbrain	Image not found	issues 0	build failed	pull requests 0	docker pulls 0	Image not found
bids/tracula	version v6.0.0-2	issues 0	build passing	pull requests 1	docker pulls 137	3.4GB 56 layers

MRIQC: group anatomical report

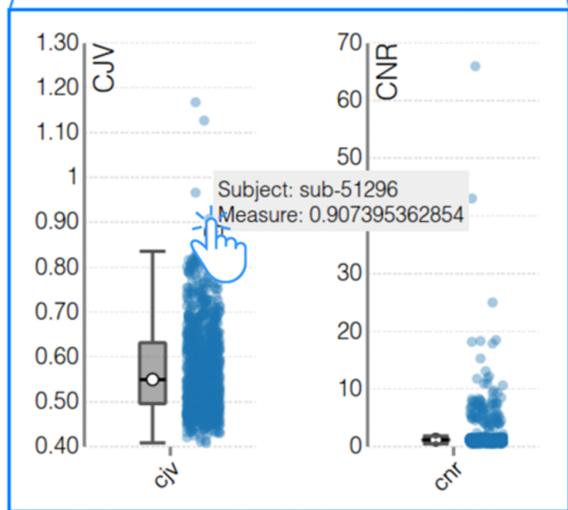
1

Summary

- Date and time: 2017-02-05, 12:27.
- MRIQC version: 0.9.0-rc2.



2



Data points in the scatter plots of the group report can be clicked to open the corresponding individual report. This feature is particularly useful to identify low-quality datasets visually.

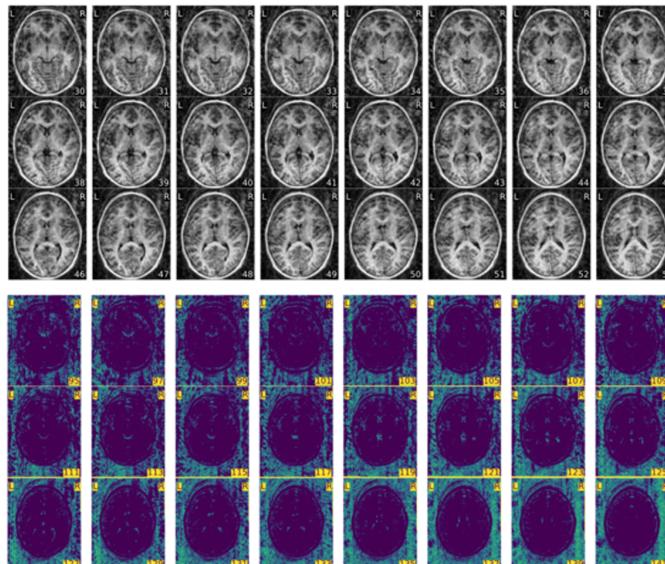
3

The individual reports show the calculated IQMs and metadata in the summary, and a series of image mosaics and plots designed for the visual assessment of images.

MRIQC: individual anatomical report

Summary

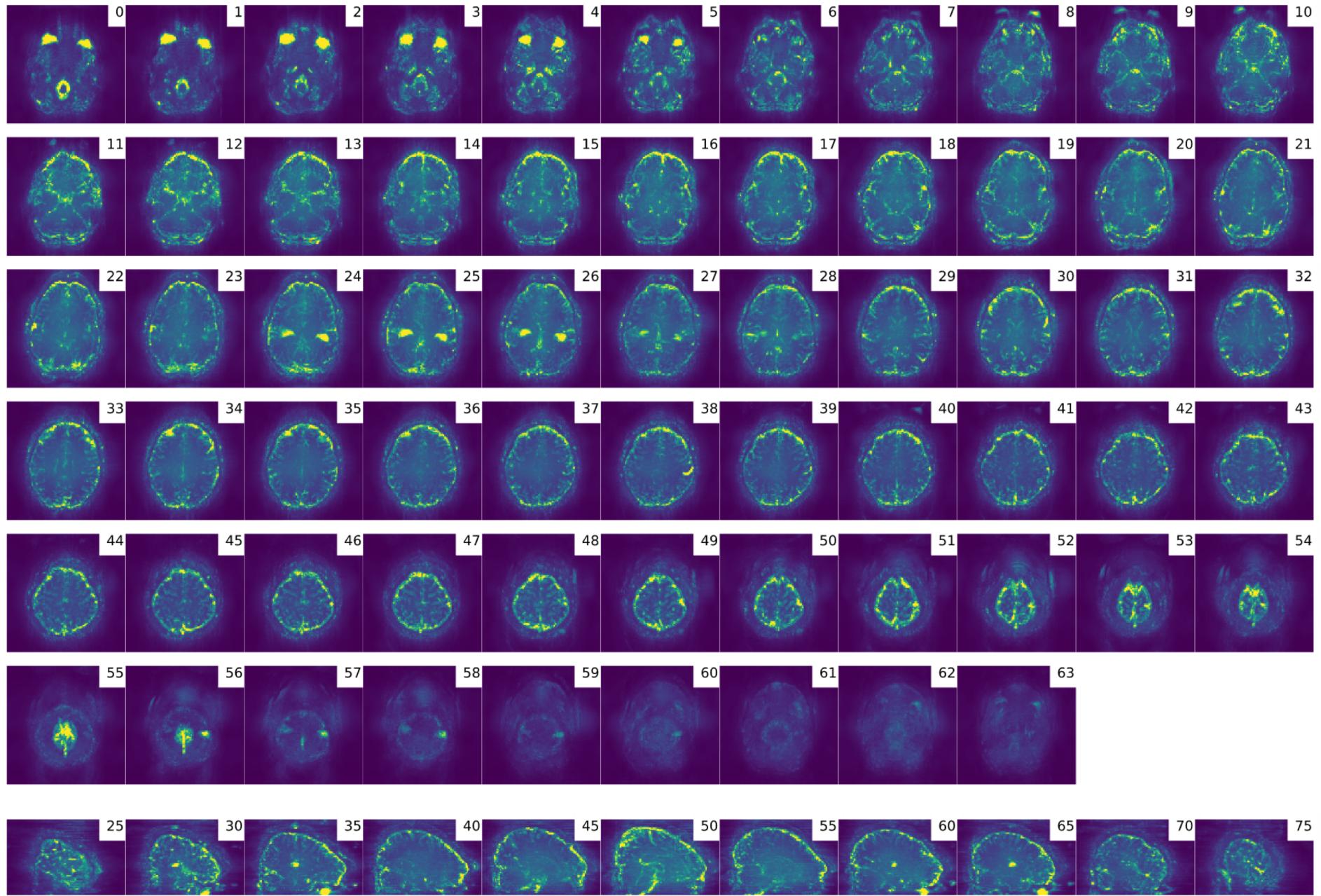
- Subject ID: 51296.
- Date and time: 2017-02-05, 03:44.
- MRIQC version: 0.9.0-rc2.

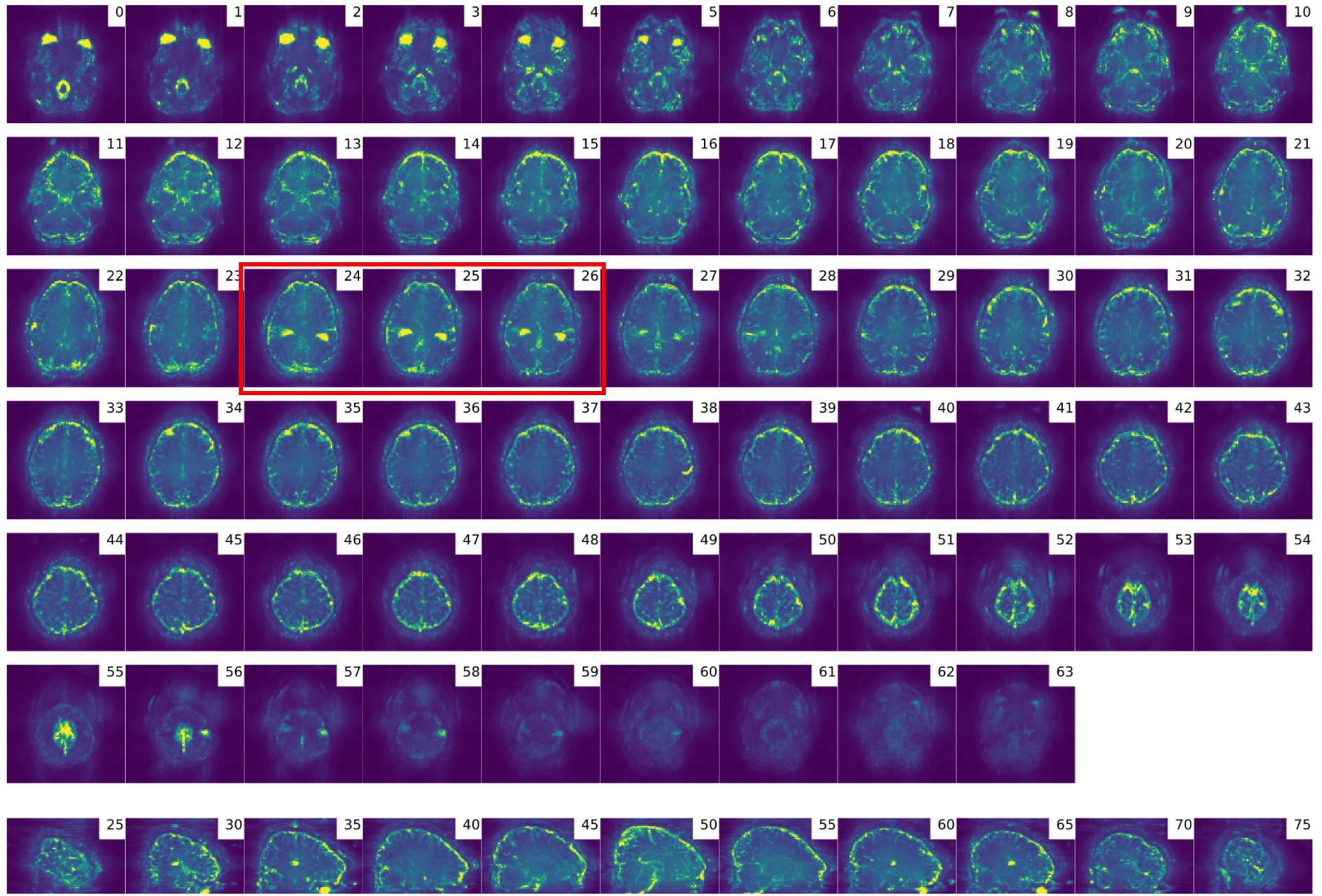


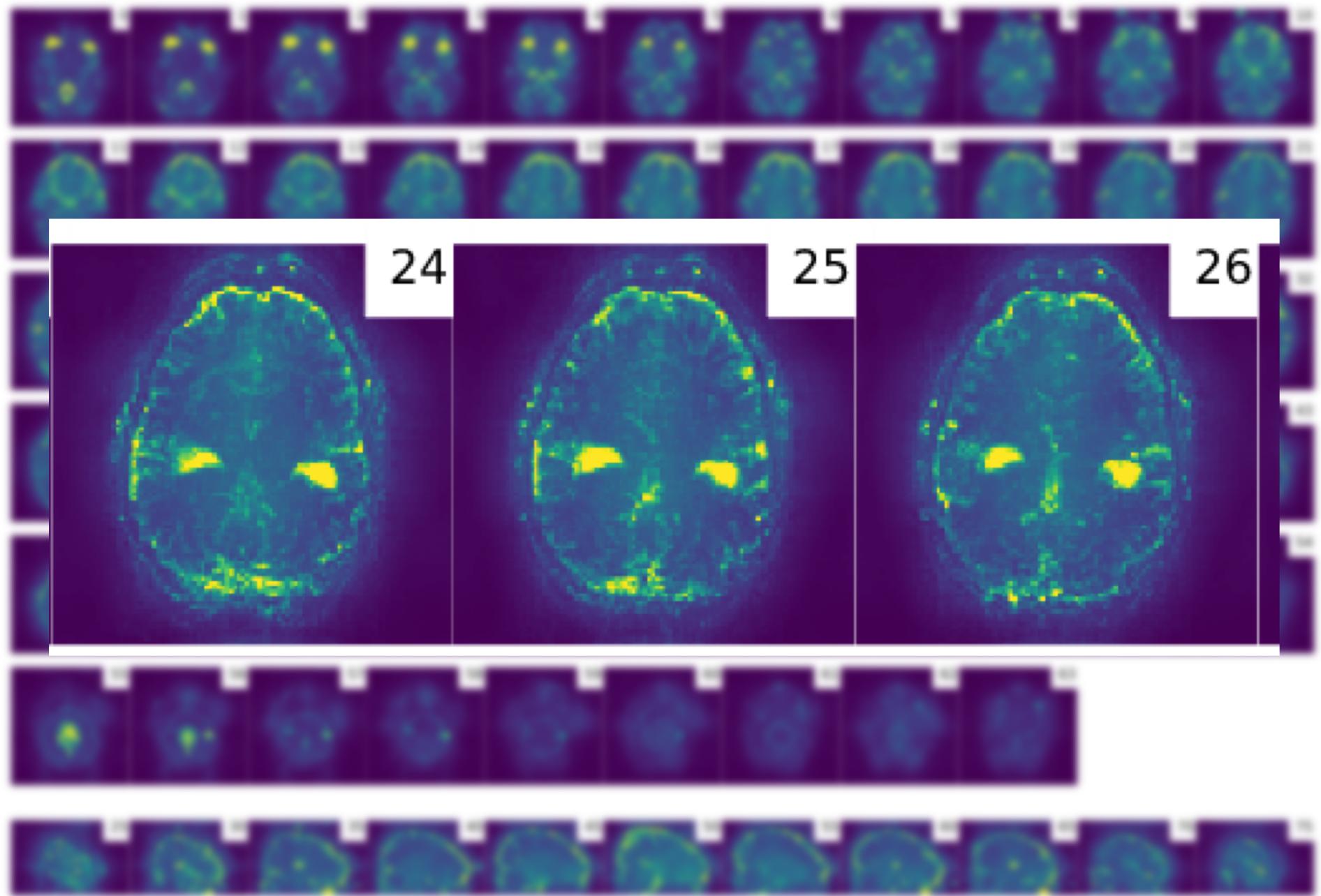
MRIQC

Quality control

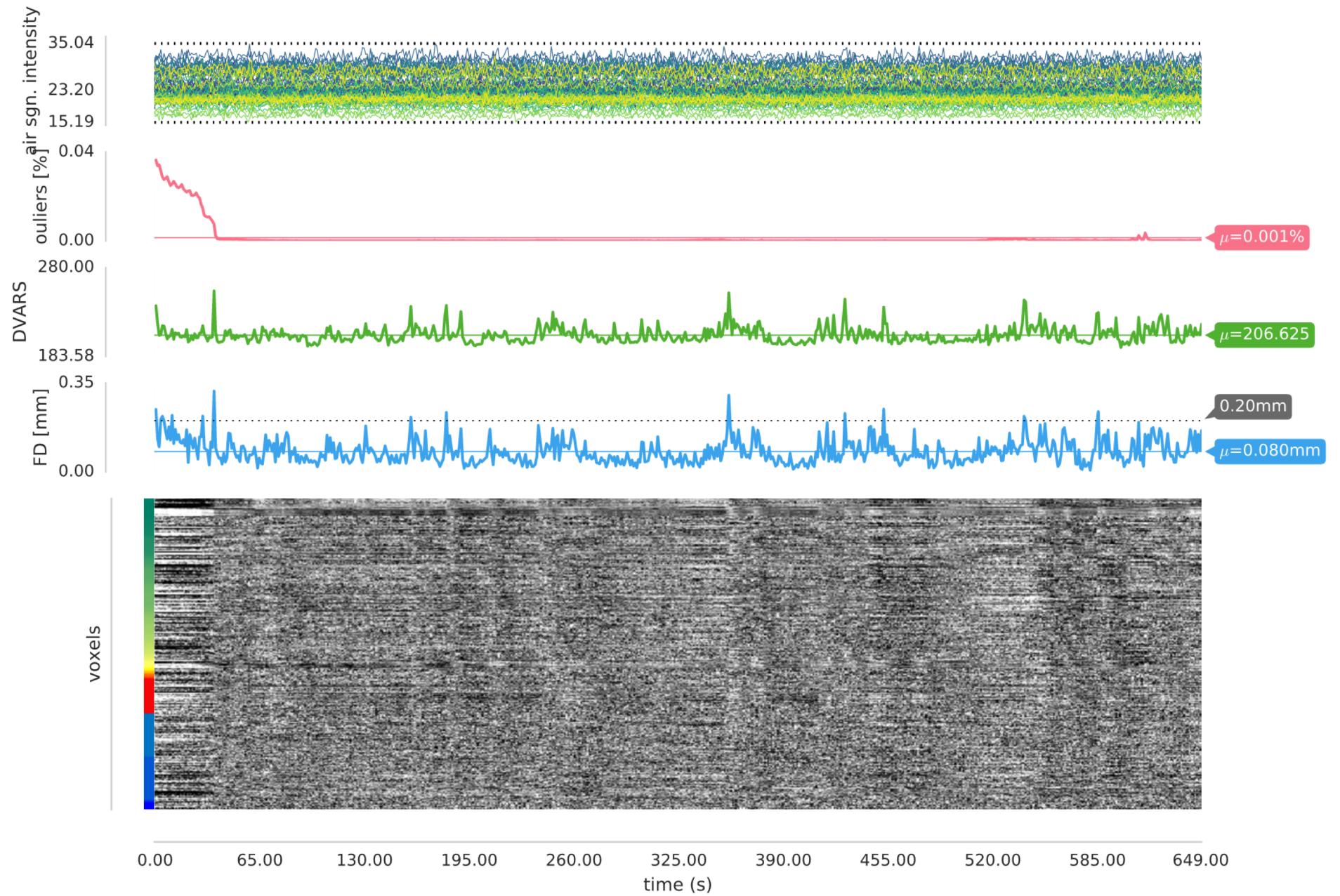
for structural and functional images







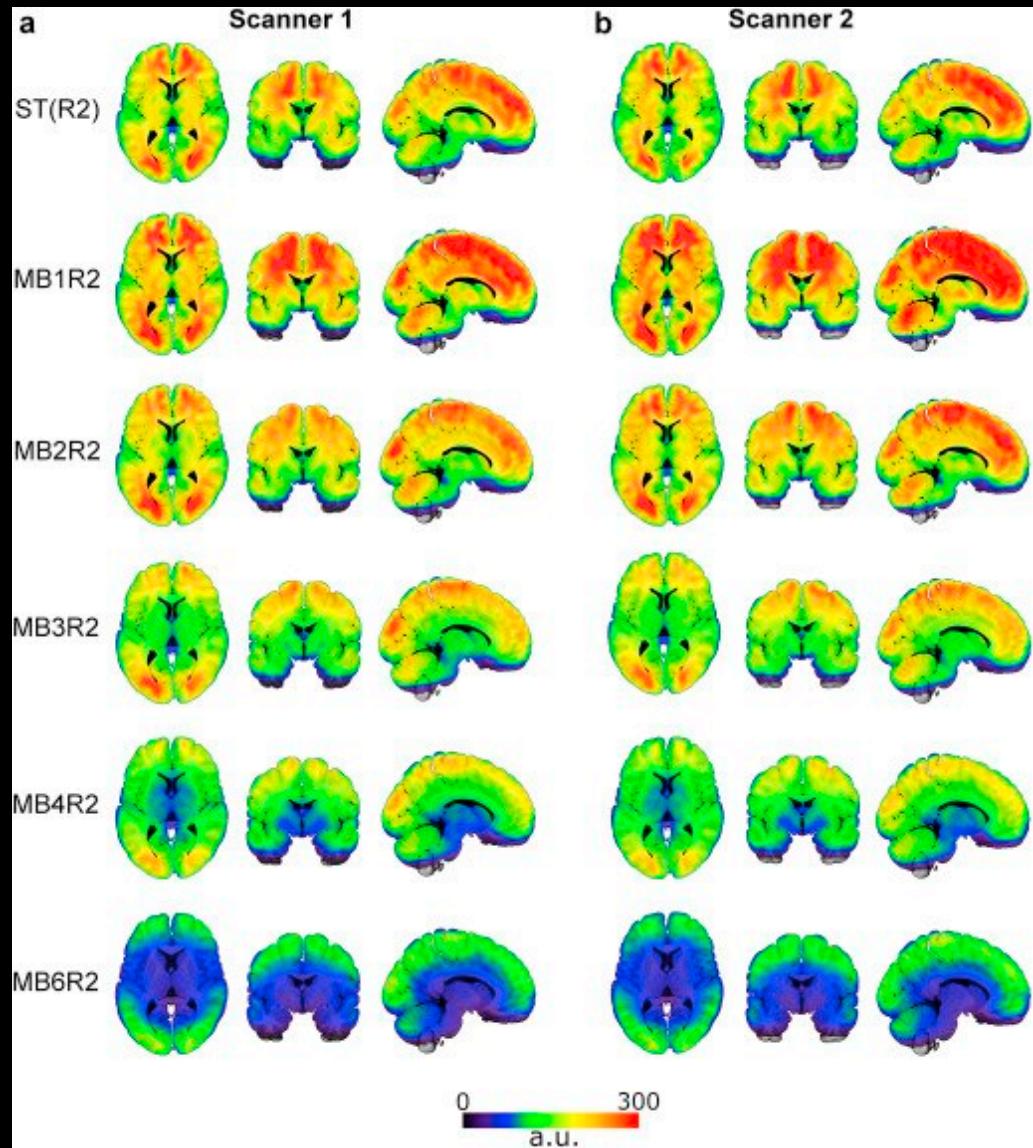
https://github.com/chrisfilo/slice_leakage



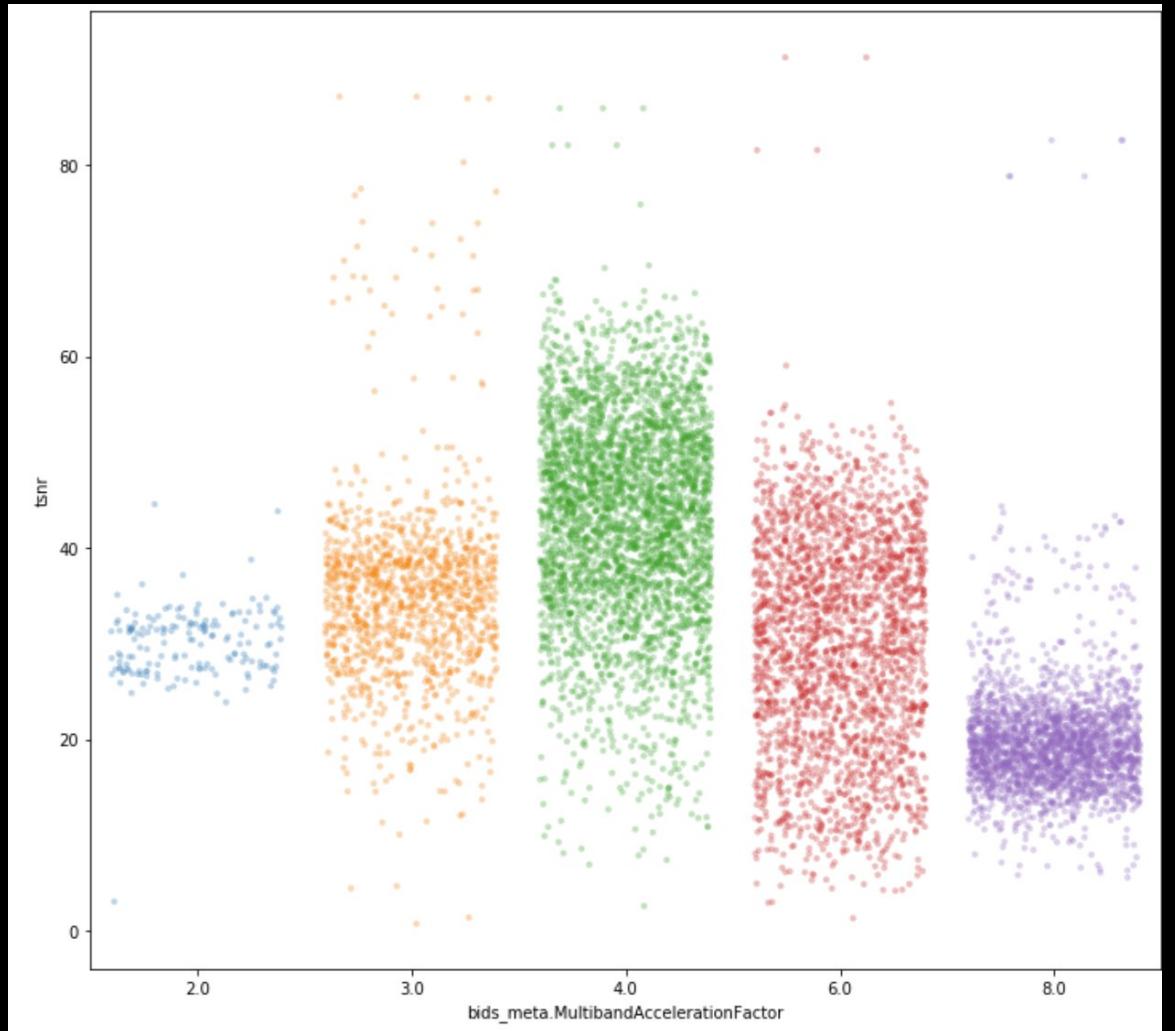
mriqc.nimh.nih.gov

- Crowdsourced database of MR QC metrics
- Over QC metrics from over 40,000 unique BOLD scans
- Publicly available

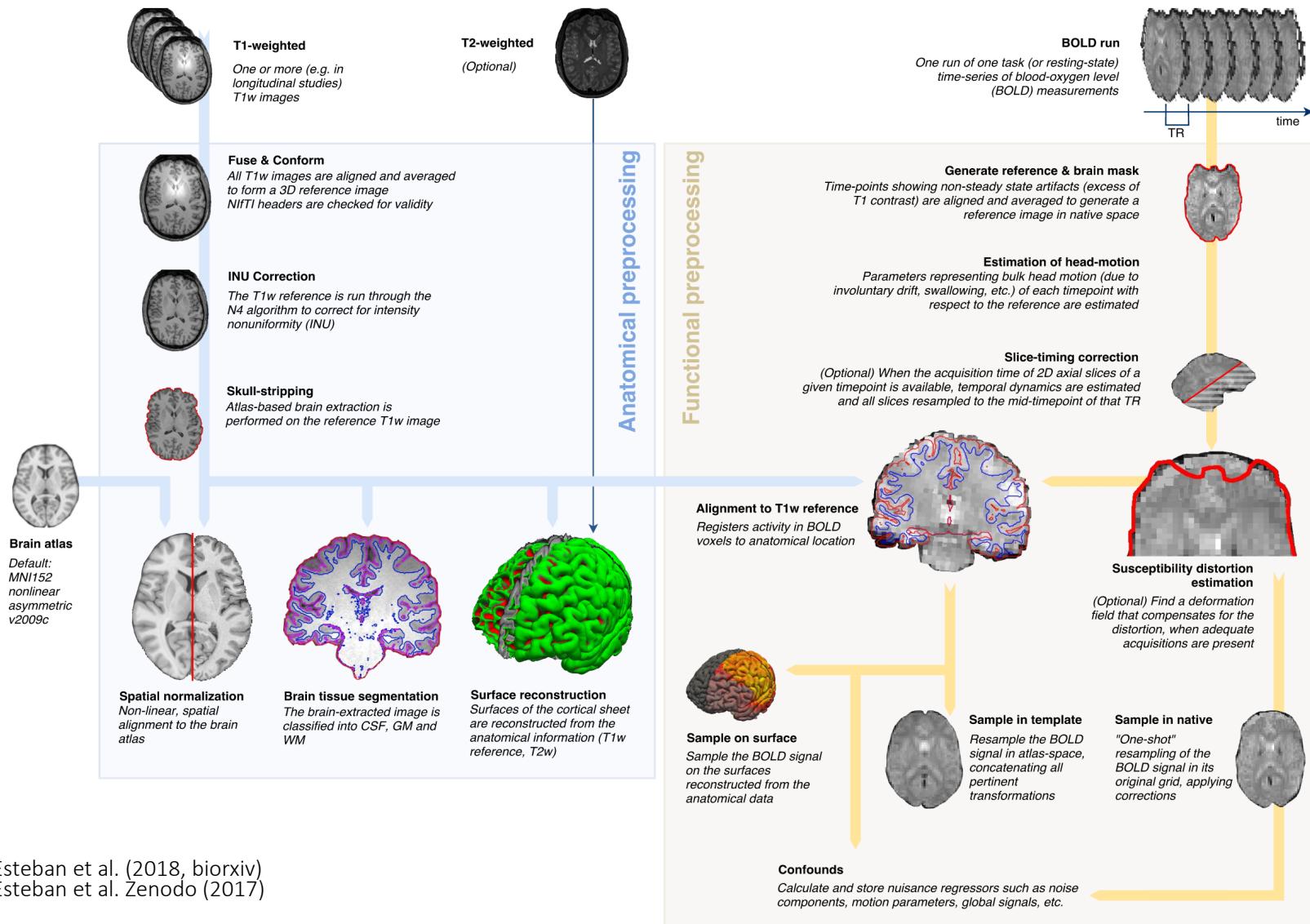
Is tSNR
lower for
higher multi
band
factors?



Is tSNR
lower for
higher multi
band
factors?



FMRIprep: Robust preprocessing

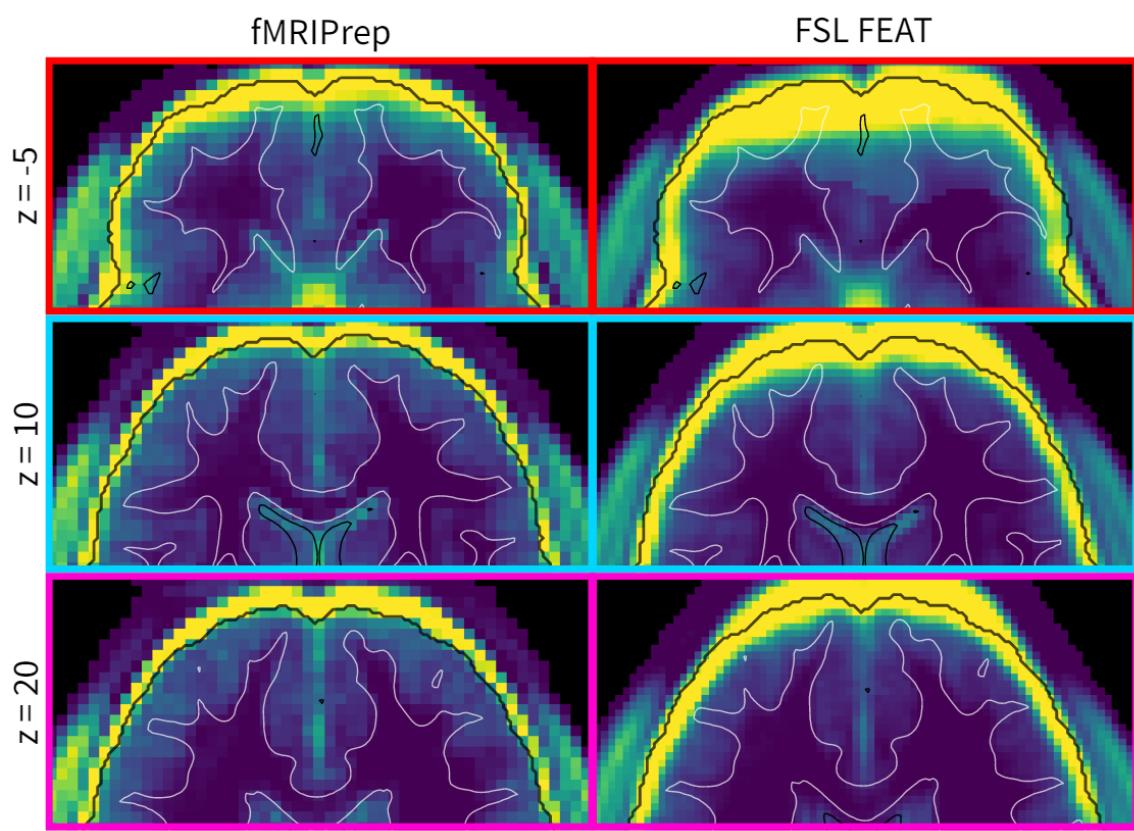
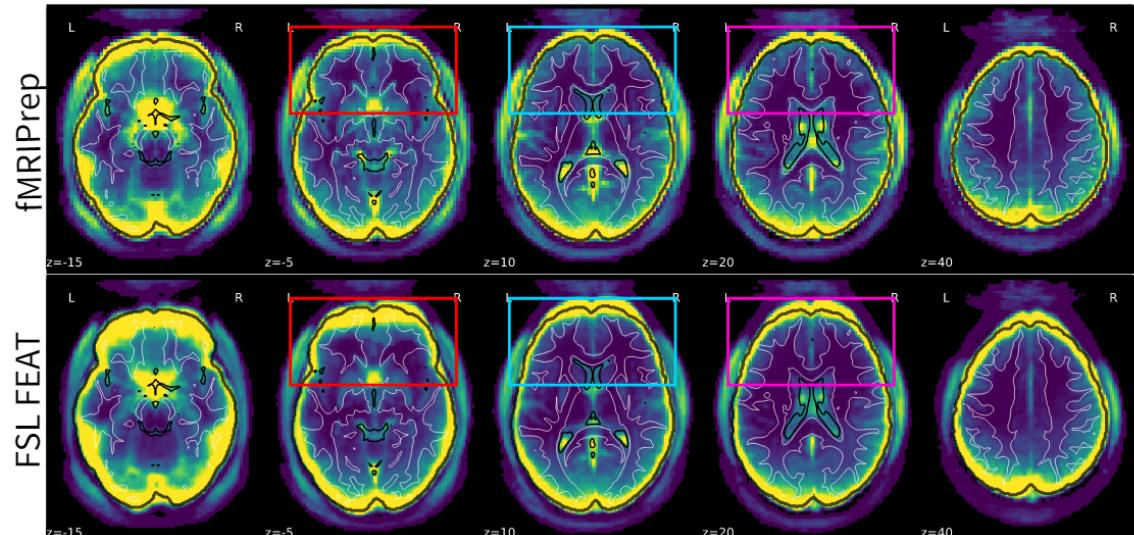


Esteban et al. (2018, biorxiv)
 Esteban et al. Zenodo (2017)

Accession	Scanner	S	T	R	Modalities	Part. IDs (Phase I)	Part. IDs (Phase II)	N	TR	#TR	Resolution
DS000001	N/A	1	1	21	1 T1w, 3 BOLD	02, 03, 09, 15	01, 02, 07, 08	7	2.0	6300	3.12x3.12x4.00
DS000002	N/A	1	3	48	1 T1w, 6 BOLD	01, 11, 14, 15	02, 03, 04, 10	8	2.0	9510	3.12x3.12x5.00
DS000003	N/A	1	1	6	1 T1w, 1 BOLD	03, 07, 09, 11	02, 09, 10, 11	6	2.0	956	3.12x3.12x4.00
DS000005	N/A	1	1	21	1 T1w, 3 BOLD	01, 03, 06, 14	01, 04, 05, 15	7	2.0	5040	3.12x3.12x4.00
DS000007	SIEMENS	1	3	46	1 T1w, 5 BOLD	09, 11, 18, 20	03, 04, 08, 12	8	2.0	8205	3.12x3.12x4.00
DS000008	N/A	1	2	38	1 T1w, 5 BOLD	04, 09, 12, 14	10, 12, 13, 15	7	2.0	6808	3.12x3.12x4.39
DS000009	SIEMENS	1	4	48	1 T1w, 6 BOLD	01, 03, 09, 10	17, 18, 21, 23	8	2.0	10528	3.00x3.00x4.00
DS000011	N/A	1	4	41	1 T1w, 5 BOLD	01, 03, 06, 08	03, 09, 11, 14	7	2.0	8041	3.12x3.12x5.00
DS000017	N/A	2	2	48	4 T1w, 9 BOLD	2, 4, 7, 8	2, 5, 7, 8	5	2.0	8736	3.12x3.12x4.00
DS000030	SIEMENS	1	8	30	1 T1w, 7 BOLD	10[440,638,668,855]		4	2.2	6254	3.00x3.00x4.00
DS000031	SIEMENS	107	9	191	29 T1w, 18 T2w, 46 FM, 191 BOLD	01		1	1.2	79017	2.55x2.55x2.54
DS000051	N/A	1	1	54	2 T1w, 7 BOLD	03, 04, 05, 13	02, 04, 06, 09	7	2.0	10800	3.12x3.12x6.00
DS000052	N/A	1	2	28	2 T1w, 4 BOLD	06, 08, 12, 14	05, 10, 12, 13	7	2.0	6300	3.12x3.12x6.00
DS000053	SIEMENS	1	3	32	1 T1w, 8 BOLD	002, 003, 005, 006		4	1.2	10712	2.40x2.40x2.40
DS000101	SIEMENS	1	1	16	1 T1w, 2 BOLD	06, 08, 16, 19	05, 11, 17, 20	8	2.0	2416	3.00x3.00x4.00
DS000102	SIEMENS	1	1	16	1 T1w, 2 BOLD	05, 19, 22, 23	08, 10, 16, 20	8	2.0	2336	3.00x3.00x4.00
DS000105	N/A	1	1	71	1 T1w, 11 BOLD	1, 2, 3, 6	1, 4, 5, 6	6	2.5	8591	3.50x3.75x3.75
DS000107	N/A	1	1	14	1 T1w, 2 BOLD	02, 05, 20, 29	05, 36, 39, 47	7	3.0	2315	3.00x3.00x3.00
DS000108	GE	1	1	41	1 T1w, 5 BOLD	01, 03, 07, 17	03, 10, 24, 26	7	2.0	7860	3.44x3.44x4.50
DS000109	SIEMENS	1	1	12	1 T1w, 2 BOLD	02, 10, 39, 47	02, 11, 15, 39	6	2.0	2148	3.00x3.00x3.54
DS000110	N/A	1	1	80	1 T1w, 10 BOLD	07, 09, 17, 18	01, 02, 03, 06	8	2.0	14880	3.44x3.44x4.01
DS000114	N/A	2	5	70	2 T1w, 10 BOLD	01, 05, 07, 08	02, 03, 04, 07	7	5.0	10626	4.00x4.00x4.00
DS000115	N/A	1	3	24	1 T1w, 3 BOLD	31, 68, 77, 78	04, 33, 67, 79	8	2.5	3288	4.00x4.00x4.00
DS000116	PHILIPS	1	2	36	1 T1w, 6 BOLD	02, 08, 10, 15	08, 12, 15, 17	6	2.0	6120	3.00x3.00x4.00
DS000119	SIEMENS	1	1	31	1 T1w, 3 BOLD	10, 51, 59, 74	11, 26, 56, 58	8	1.5	7564	3.12x3.12x4.00
DS000120	SIEMENS	1	1	11	1 T1w, 2 BOLD	04, 05, 08, 24		4	1.5	2376	3.12x3.12x4.00
DS000121	N/A	1	1	28	1 T1w, 4 BOLD	01, 04, 05, 20	01, 18, 22, 26	7	1.5	5656	3.12x3.12x4.00
DS000133	PHILIPS	2	1	24	2 T1w, 6 BOLD	06, 21, 22, 23		4	N/A	3480	4.00x4.00x4.00
DS000140	PHILIPS	1	1	36	1 T1w, 9 BOLD	05, 27, 32, 33		4	2.0	7380	2.80x2.80x3.00
DS000148	GE	1	1	12	1 T1w, 1 T2w, 3 BOLD	09, 26, 28, 33		4	1.8	3162	3.00x3.00x3.00
DS000157	PHILIPS	1	1	4	1 T1w, 1 BOLD	04, 21, 23, 28		4	1.6	1485	4.00x4.00x3.99
DS000158	SIEMENS	1	1	4	1 T1w, 1 BOLD	064, 081, 122, 149		4	2.0	1240	3.00x3.00x3.30
DS000164	SIEMENS	1	1	4	1 T1w, 1 BOLD	006, 012, 019, 027		4	1.5	1480	3.50x3.50x3.50
DS000168	SIEMENS	1	1	4	1 T1w, 1 BOLD	08, 27, 30, 49		4	2.5	2112	3.00x3.00x3.00
DS000170	GE	1	4	48	1 T1w, 12 BOLD	1700, 1708, 1710, 1713		4	3.0	2160	3.44x3.44x3.40
DS000171	SIEMENS	1	2	20	1 T1w, 5 BOLD	control0[4,8,14], mdd03		4	3.0	2066	2.90x2.90x3.00
DS000172	SIEMENS	1	1	16	1 T1w, 1 FM, 4 BOLD	control0[1,5,6,8]		4	3.0	2400	2.82x2.82x3.00
DS000177	SIEMENS	1	1	4	1 T1w, 1 BOLD	04, 07, 10, 11		4	3.0	920	3.00x3.00x3.00
DS000200	SIEMENS	1	1	4	1 T1w, 1 BOLD	2004, 2011, 2012, 2014		4	2.5	480	3.28x3.28x4.29
DS000205	SIEMENS	1	2	12	1 T1w, 3 BOLD	01, 05, 06, 07		4	2.2	4103	3.00x3.00x3.00
DS000208	SIEMENS	1	1	4	1 T1w, 1 BOLD	27, 45, 56, 69		4	2.5	1200	3.44x3.44x3.00
DS000212	N/A	1	2	40	1 T1w, 10 BOLD	07, 13, 20, 29		4	3.0	5808	3.12x3.12x4.00
DS000213	SIEMENS	1	1	4	1 T1w, 1 BOLD	06, 10, 12, 13		4	2.0	1120	3.00x3.00x3.99
DS000214	SIEMENS	1	1	4	1 T1w, 1 BOLD	EES0[06,31,33,34]		4	1.6	1364	3.44x3.44x5.00
DS000216	GE	1	1	16	1 T1w, 4 BOLD	01, 02, 03, 04		4	3.5	2688	3.00x3.00x3.00
DS000217	SIEMENS	1	2	60	1 T1w, 15 BOLD	Exp1s[02,11,15], Exp2s12		4	1.5	11472	2.00x2.00x2.00
DS000218	PHILIPS	1	1	12	1 T1w, 3 BOLD	02, 07, 12, 17		4	1.5	6709	2.88x3.00x2.88
DS000219	PHILIPS	1	1	14	1 T1w, 3 BOLD	04, 09, 10, 12		4	1.5	7807	2.88x3.00x2.88
DS000220	N/A	3	1	12	3 T1w, 3 BOLD	tbi[03,05,06,10]		4	N/A	1728	3.00x3.00x4.00
DS000221	N/A	2	1	15	1 T1w, 9 FM, 3 BOLD	010[016,064,125,251]		4	2.5	9855	2.30x2.30x2.30
DS000223	N/A	1	1	28	1 T1w, 4 BOLD	01, 04, 15, 19	01, 11, 13, 14	7	2.0	5371	2.64x2.64x3.82
DS000224	SIEMENS	12	6	399	4 T1w, 4 T2w, 10 FM, 79 BOLD	MSC[05,06,08,09]	MSC[05,08,09,10]	5	2.2	88528	4.00x4.00x4.00
DS000228	SIEMENS	1	1	4	1 T1w, 1 BOLD	pixar[001,017,103,132]		4	2.0	672	3.06x3.06x3.29
DS000229	SIEMENS	1	1	12	1 T1w, 3 BOLD	02, 05, 07, 10		4	2.0	4680	3.44x3.44x3.00
DS000231	SIEMENS	1	1	12	1 T1w, 3 BOLD	01, 02, 03, 09		4	2.0	4548	2.02x2.02x2.00
DS000232	N/A	4	2	112	4 T1w, 16 BOLD	02, 05, 06, 09	02, 03, 07, 10	7	2.2	73960	2.01x2.01x2.00
DS000233	PHILIPS	1	2	80	2 T1w, 10 BOLD	rid0000[12,24,36,41]	rid0000[01,17,31,32]	8	2.0	15680	3.00x3.00x3.00
DS000237	N/A	1	1	41	1 T1w, 5 BOLD	03, 08, 11, 12	01, 03, 04, 06	7	1.0	19844	3.00x3.00x3.00
DS000243	SIEMENS	1	1	13	1 T1w, 1 BOLD	012, 032, 042, 071	023, 066, 089, 094	8	2.5	2884	4.00x4.00x4.00

Total 2176 120 202 322 551769

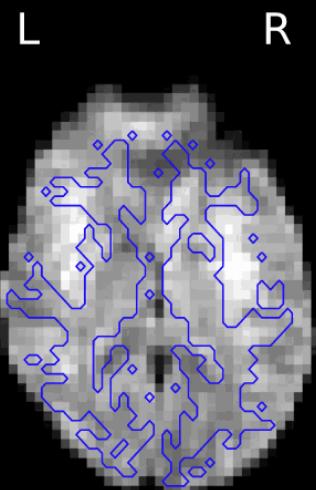
Robustness tested on 60 OpenfMRI datasets



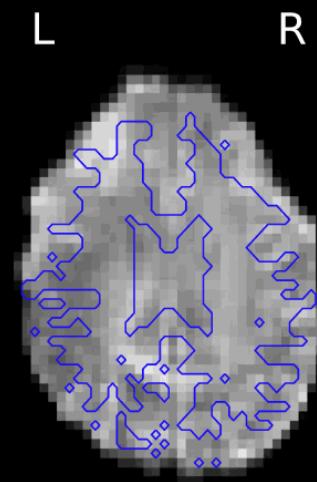
Robustness

high
quality
results

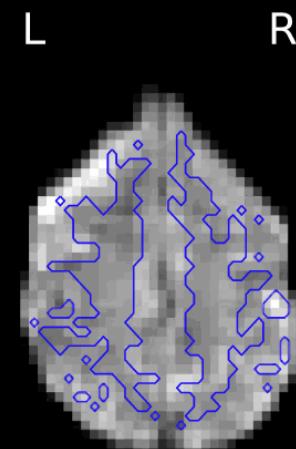
Distortion correction without fieldmaps



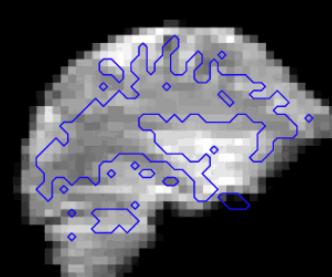
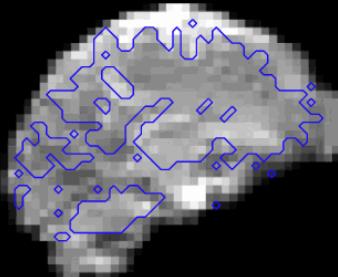
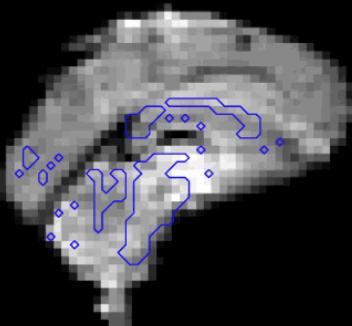
$z=26$



$z=40$



$z=55$

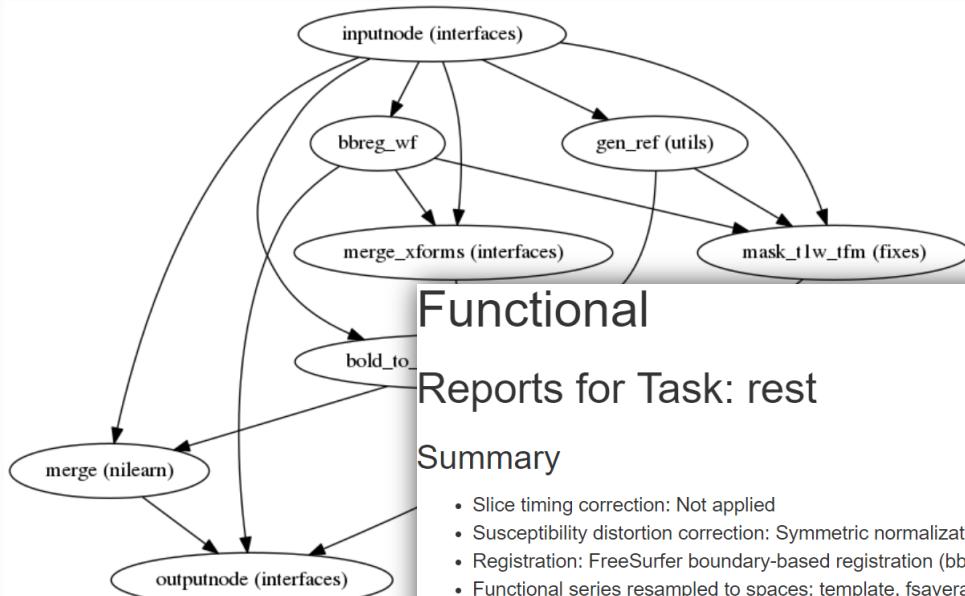


The glass box software design principles

1. Write educational documentation
2. Verify/visualize assumptions
3. Guide dissemination of the results

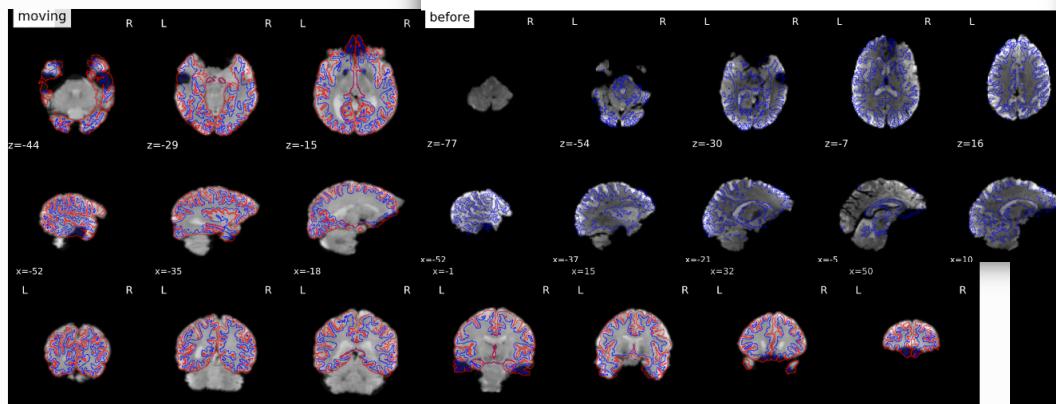
EPI to T1w registration

`fmriprep.workflows.bold.registration.init_bold_reg_wf`



([Source code](#), [png](#), [svg](#), [pdf](#))

The reference EPI image of each run is aligned to the subject using the gray/white matter boundary



Animation showing EPI to T1w registration (FreeSurfer `bbregister`)

Transparency: documentation and reports

Citing FMRIprep

Select which options you have run FMRIprep with to generate custom language we recommend to include in your paper.

With Freesurfer:

Susceptibility Distortion Correction: `none` ▾

With AROMA:

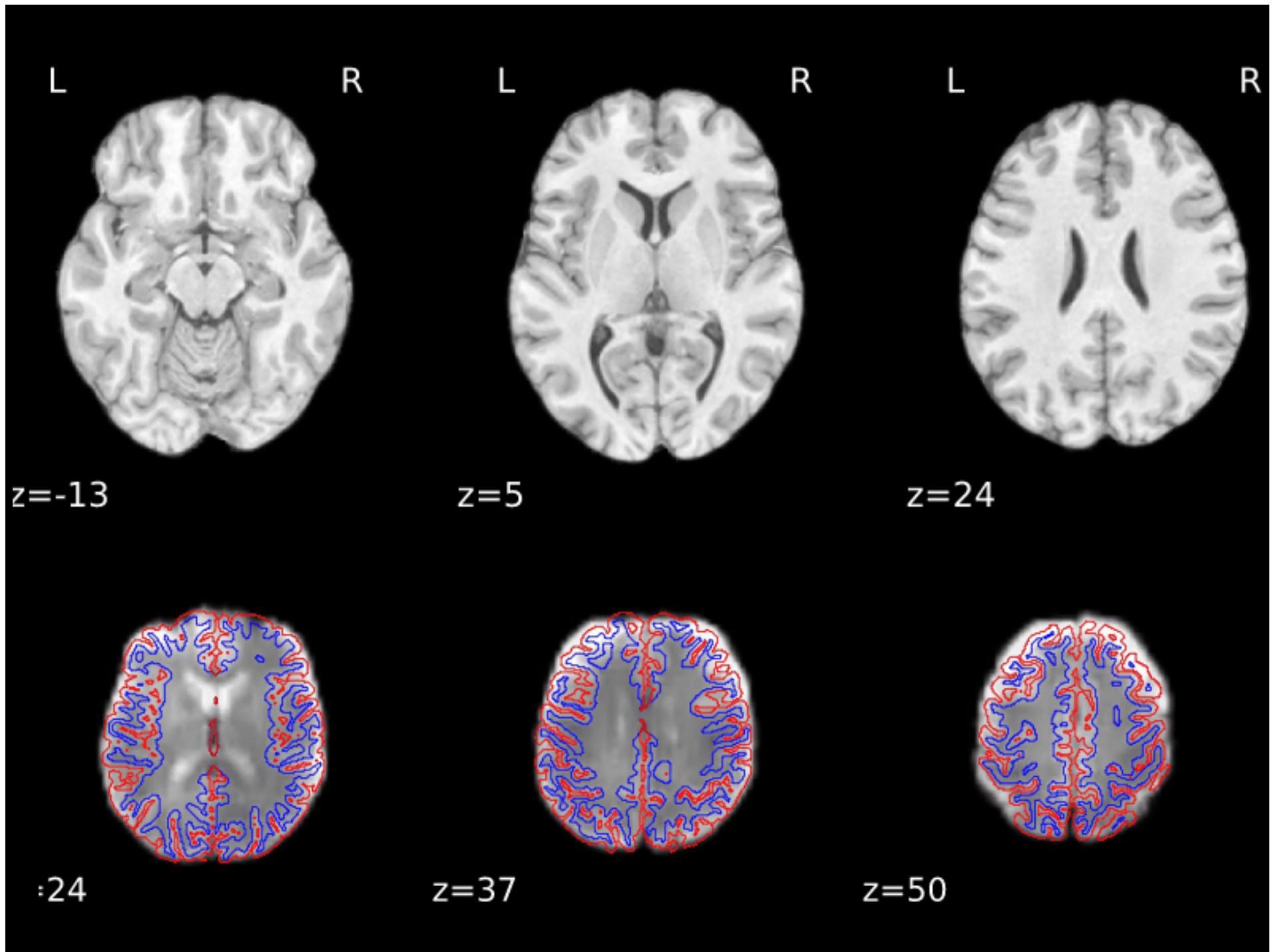
Skullstrip template: `OASIS` ▾

With slicetime correction:

Results included in this manuscript come from preprocessing performed using FMRIprep version latest [1], a Nipype [2,3] based tool. Each T1w (T1-weighted) volume was corrected for INU (intensity non-uniformity) using `N4BiasFieldCorrection` v2.1.0 [4] and skull-stripped using

`antsBrainExtraction.sh` v2.1.0 (using the OASIS template). Brain surfaces were reconstructed using `recon-all` from FreeSurfer v6.0.0 [5], and the brain mask estimated previously was refined with a custom variation of the method to reconcile ANTs-derived and FreeSurfer-derived segmentations of the cortical gray-matter of Mindboggle [20]. Spatial normalization to the ICBM 152 Nonlinear Asymmetrical template version 2009c [6] was performed through nonlinear registration with the `antsRegistration` tool of ANTs v2.1.0 [7], using brain-extracted versions of both T1w volume and template. Brain tissue segmentation of cerebrospinal fluid (CSF), white-matter (WM) and gray-matter (GM) was performed on the brain-extracted T1w using `fast` [16] (FSL v5.0.9).

Functional data was slice time corrected using `3dtshift` from AFNI v16.2.07 [10] and motion corrected using `mcflirt` (FSL v5.0.9 [8]). This was followed by co-registration to the corresponding T1w using boundary-based registration [15] with 9 degrees of freedom, using `bbregister` (FreeSurfer v6.0.0). Motion correcting transformations, BOLD-to-T1w transformation and T1w-to-template (MNI) warp were concatenated and applied in a single step using `antsApplyTransforms` (ANTs v2.1.0) using Lanczos interpolation.



[Code](#)[Issues 121](#)[Pull requests 17](#)[Projects 1](#)[Wiki](#)[Insights](#)[Settings](#)

WIP: Adding ICA_AROMA functionality #539

[Merged](#)effigies merged 59 commits into [poldracklab:master](#) from [jdkent:master](#) on Jun 28, 2017[Conversation 106](#)[Commits 59](#)[Checks 0](#)[Files changed 11](#)

+336 -34



jdkent commented on May 26, 2017

[Contributor](#)

This is my attempt at adding ICA_AROMA functionality to fmriprep. Almost 100% certain it doesn't work as is.

I have ICA_AROMA completing its own transforms since it appears the template space could be something something different than ICA AROMA is expecting, in addition, ICA_AROMA requires a affine fsl matrix and fnirt fsl warp to pass in so ANTs is off the table (afaik).

I may continue editing/working on this, but first I wanted feedback if this is a worthwhile endeavour or if it's better to hi-jack the original code from ICA-AROMA to make it flexibly fit in the fmriprep workflows (as was done with compcor).

Thanks!
James

Reviewers

chrisfilo



effigies

**Assignees**

No one—assign yourself



James Kent

FMRIprep: a robust preprocessing pipeline for functional MRI

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‡Contributed equally to this work

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<https://doi.org/10.1101/306951>

send us your feedback

FitLins - Fitting Linear Models to BIDS Datasets

FitLins is a tool for estimating linear models, defined by the [BIDS Model](#) specification proposal, to BIDS-formatted datasets.

This software is in alpha stage, and should be considered unstable. Users are welcome to test the software, and open issues.

The CLI follows the [BIDS-Apps](#) convention:

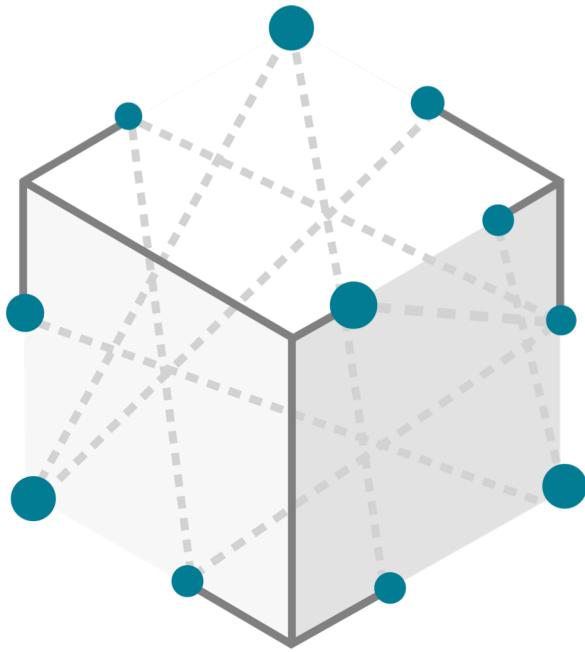
Usage:

```
fitlins <bids_root> <out_dir> <analysis_level> [--model <model_name>]
```

See the output of `fitlins --help` for all valid options:

```
usage: fitlins [-h] [-v]
                [--participant-label PARTICIPANT_LABEL [PARTICIPANT_LABEL ...]]
                [-m MODEL] [-p PREPROC_DIR] [--space {MNI152NLin2009cAsym}]
                [--debug]
                bids_dir output_dir {run,session,participant,dataset}
```

<https://github.com/poldracklab/fitlins>



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Access to data!



Upload Dataset

1: Select

2: Rename

3: Issues

x

Your dataset is not a valid BIDS dataset. Fix the 1 Error
and select your folder again.

Error: 1

The compulsory file /da

By aleph4@gmail.com - 2 days ago

- Hide Replies



Are the T1 anat images available for this dataset? That is needed for preprocessing with fmriprep.

DELETE

REPLY

EDIT

By neggink@princeton.edu - Dataset Uploader - 22 minutes ago



I am in contact with the researcher and will get T1s as soon as possible.

DELETE

REPLY

EDIT

ds000009_R2.0.1

34/856 files complete

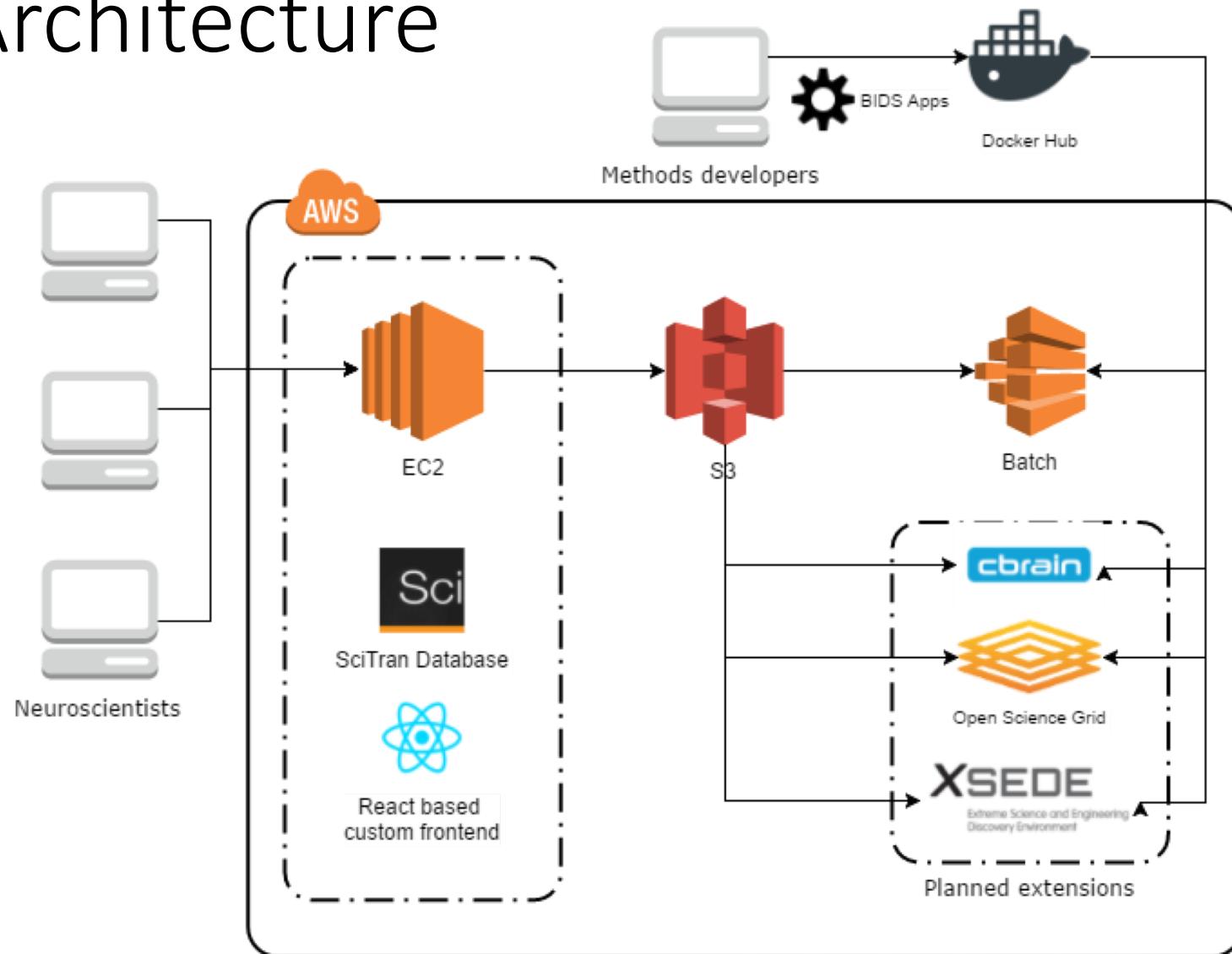
uploading

sub-29_task-stopsignal_run-01_bold.nii.gz...

sub-29_dwi.nii.gz...

sub-29_T1w.json

Architecture



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Reproducibility

data snapshots +
software containers

==

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