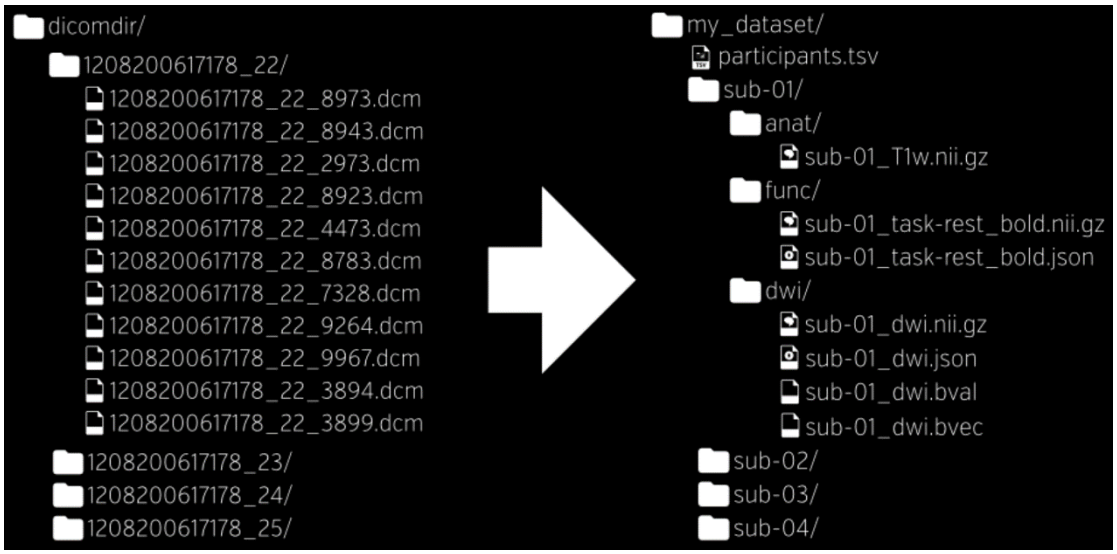
1 Data Structure

1. We added a new python script *ccs_pre_bids2ccs.py* for converting the Brain Imaging Data Structure (BIDS) [1] to CCS Data Structure. BIDS is a simple and intuitive way to organize and describe neuroimaging and behavioral data.

Figure 1 shows the organization of data.



2 Preprocessing of Structural Magnetic Resonance Imaging

2. The preprocessing of structural MRI has been organized into 3 scripts: ： ccs_anat_01_pre_freesurfer.sh, ccs_anat_02_freesurfer.sh, ccs_anat_03_postfs.sh.

ccs_anat_01_pre_freesurfer.sh includes: (1) reorient to RPI, (2) crop the image, (3) using SANLM to denoise, (4) Brain extraction and generate brain mask;

cortical reconstruction is achieved by ccs_anat_02_freesurfer.sh;

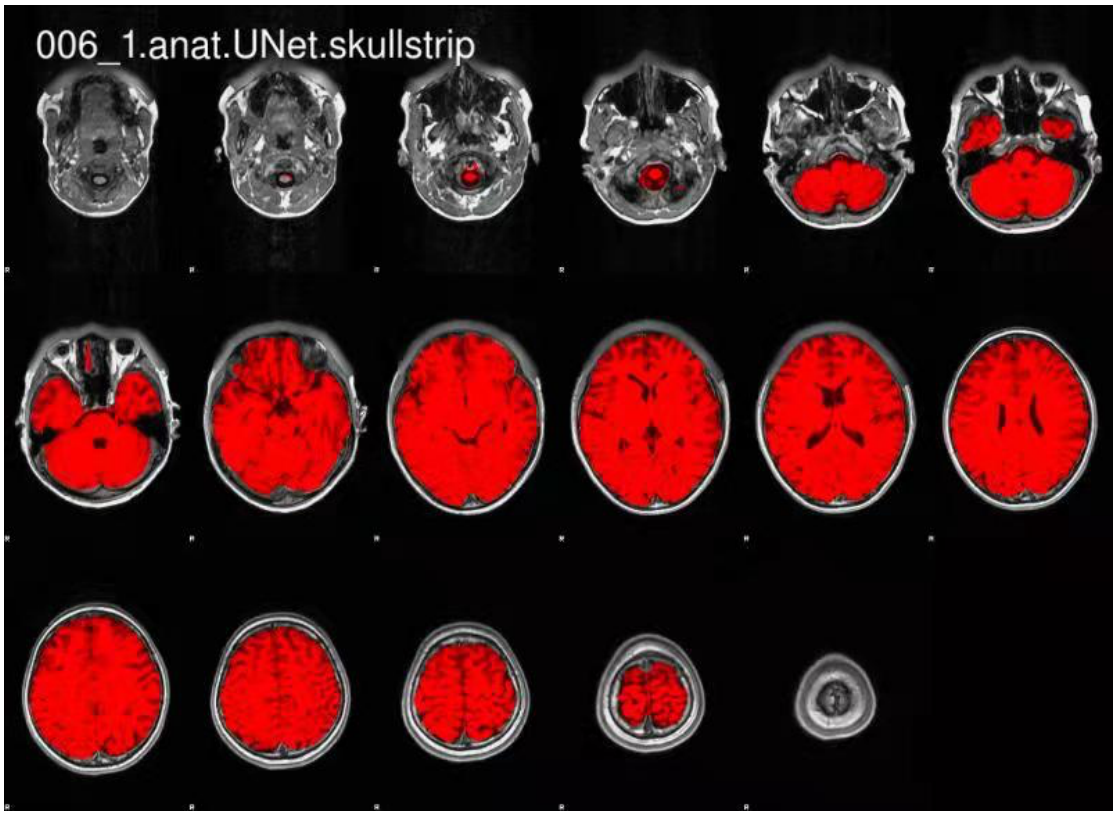
and registration is achieved by ccs_anat_03_postfs.sh.

3. Now we can do denoising, in ccs_anat_01_pre_freesurfer.sh, by directly call the SANLM of spm without matlab GUI.

4. Brain extraction (a.k.a. skull stripping) and generated brain mask, in

ccs_anat_01_pre_freesurfer.sh, is now achieved by a new model trained by convolutional neural network (i.e. U-Net Model)[2].

Figure 2 highlights the brain tissue after skull stripping in red.



5. In ccs_anat_02_freesurfer.sh, the brain mask will be replaced by the mask generated by our new model as described in 4.

3 Preprocessing of Resting-state Functional Magnetic Resonance Imaging

The preprocessing of resting-state fMRI has been organized into the script: template_preproc_funcpart.sh：

6. Now, we use an ICA-based strategy for automatic removal of motion artifacts (ICA-AROMA) [3] that can identifie motion components with high accuracy and robustness. This strategy does not require classifier re-training, retains the data's autocorrelation structure and largely preserves temporal degrees of freedom. As signal from white matter and cerebrospinal fluid timeseries might also contain variance related to motion artifacts, we applied ICA-AROMA prior to nuisance

regression.

7. Since motion artifacts has been removed using ICA-AROMA as described in 6, the 24 parameters of had motion have not been taken into consideration in the next step of nuisance regression.

8. Temporal filtering is removed, since it is not recommended after applying ICA-AROMA.

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[2] X. Wang, X.H. Li, J.W. Cho, B.E. Russ, N. Rajamani, A. Omelchenko, L. Ai, A. Korchmaros, S. Sawiak, R.A. Benn, P. Garcia-Saldivar, Z. Wang, N.H. Kalin, C.E. Schroeder, R.C. Craddock, A.S. Fox, A.C. Evans, A. Messinger, M.P. Milham, and T. Xu, U-net model for brain extraction: Trained on humans for transfer to non-human primates. Neuroimage 235 (2021) 118001.

[3] R.H.R. Pruim, M. Mennes, D. van Rooij, A. Llera, J.K. Buitelaar, and C.F. Beckmann, ICA-AROMA: A robust ICA-based strategy for removing motion artifacts from fMRI data. Neuroimage 112 (2015) 267-277.