
BIDS for MRI: Structure and Conversion

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Basic filename structure

sub-01

└ anat

└ sub-01_run-01_T1w.nii.gz

Basic filename structure

sub-01

└ anat ← datatype

└ sub-01_run-01_T1w.nii.gz

Basic filename structure

sub-01

└ anat ← datatype

└ sub-01_run-01_T1w.nii.gz



extension

Basic filename structure

sub-01

└ anat ← datatype

└ sub-01_run-01_T1w.nii.gz

↑
suffix

↑
extension

Basic filename structure

sub-01

└ anat ← datatype

└ sub-01_run-01_T1w.nii.gz



entities



suffix



extension

BIDS for MRI- The Folder Structure

Anatomical → anat

Diffusion-weighted → dwi

Field mapping → fmap

Functional → func

```
dset/
├── dataset_description.json
├── participants.tsv
├── sub-01
│   ├── anat
│   │   ├── sub-01_T1w.json
│   │   └── sub-01_T1w.nii.gz
│   ├── dwi
│   │   ├── sub-01_dwi.bval
│   │   ├── sub-01_dwi.bvec
│   │   ├── sub-01_dwi.json
│   │   └── sub-01_dwi.nii.gz
│   ├── fmap
│   │   ├── sub-01_acq-dwi_dir-AP_epi.json
│   │   ├── sub-01_acq-dwi_dir-AP_epi.nii.gz
│   │   ├── sub-01_acq-dwi_dir-PA_epi.json
│   │   ├── sub-01_acq-dwi_dir-PA_epi.nii.gz
│   │   ├── sub-01_acq-func_dir-AP_epi.json
│   │   ├── sub-01_acq-func_dir-AP_epi.nii.gz
│   │   ├── sub-01_acq-func_dir-PA_epi.json
│   │   └── sub-01_acq-func_dir-PA_epi.nii.gz
│   └── func
│       ├── sub-01_task-nback_run-01_bold.json
│       ├── sub-01_task-nback_run-01_bold.nii.gz
│       ├── sub-01_task-nback_run-01_events.tsv
│       ├── sub-01_task-nback_run-01_sbref.json
│       └── sub-01_task-nback_run-01_sbref.nii.gz
```

Anatomical MRI

sub-01

└ anat

└─ sub-01_T1w.nii.gz

└─ sub-01_T1w.json

└─ sub-01_mod-T1w_defacemask.nii.gz

└─ sub-01_T2w.nii.gz

└─ sub-01_T2w.json

└─ sub-01_mod-T2w_defacemask.nii.gz

Anatomical MRI

sub-01

└ anat

└ sub-01_T1w.nii.gz

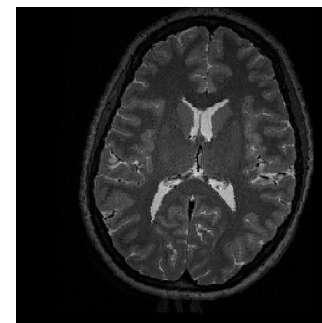
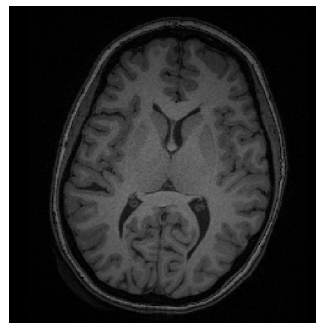
└ sub-01_T1w.json

└ sub-01_mod-T1w_defacemask.nii.gz

└ sub-01_T2w.nii.gz

└ sub-01_T2w.json

└ sub-01_mod-T2w_defacemask.nii.gz



Anatomical MRI

sub-01

└ anat

├ sub-01_T1w.nii.gz

├ sub-01_T1w.json

├ sub-01_mod-T1w_defacemask.nii.gz

├ sub-01_T2w.nii.gz

├ sub-01_T2w.json

└ sub-01_mod-T2w_defacemask.nii.gz

Anatomical MRI

sub-01

└ anat

├ sub-01_T1w.nii.gz

├ sub-01_T1w.json

├ sub-01_mod-T1w_defacemask.nii.gz

├ sub-01_T2w.nii.gz

├ sub-01_T2w.json

└ sub-01_mod-T2w_defacemask.nii.gz

Diffusion-weighted MRI

sub-01

└─ dwi

└─ sub-01_dwi.nii.gz

└─ sub-01_dwi.json

└─ sub-01_dwi.bvec

└─ sub-01_dwi.bval

└─ sub-01_sbref.nii.gz

└─ sub-01_sbref.json

Diffusion-weighted MRI

sub-01

└─ dwi

└─ sub-01_dwi.nii.gz

└─ sub-01_dwi.json

└─ sub-01_dwi.bvec

└─ sub-01_dwi.bval

└─ sub-01_sbref.nii.gz

└─ sub-01_sbref.json



Diffusion-weighted MRI

sub-01

└─ dwi

└─ sub-01_dwi.nii.gz

└─ sub-01_dwi.json

└─ sub-01_dwi.bvec

└─ sub-01_dwi.bval

└─ sub-01_sbref.nii.gz

└─ sub-01_sbref.json

```
0 0.98807364702224 0.01873399689793 0.10248889029026 -0.60841137170791 0.11875726282596
0 -0.01852251589298 0.99980324506759 0.65190172195434 0.77669501304626 0.51643615961074
0 -0.15286396443843 -0.00651476159691 0.75134563446044 -0.16303530335426 -0.848050892353
```

```
p 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000
```

Diffusion-weighted MRI

sub-01

└─ dwi

└─ sub-01_dwi.nii.gz

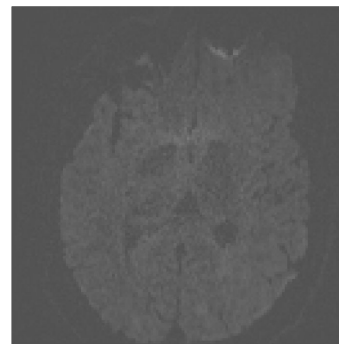
└─ sub-01_dwi.json

└─ sub-01_dwi.bvec

└─ sub-01_dwi.bval

└─ sub-01_sbref.nii.gz

└─ sub-01_sbref.json



Field mapping

sub-01

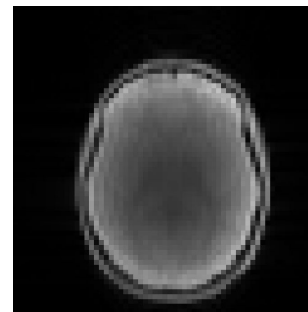
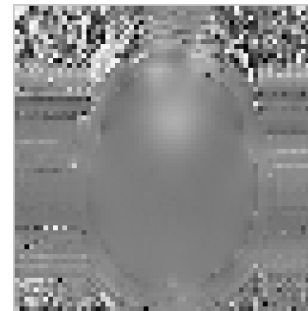
└─ fmap

└─ sub-01_phasediff.nii.gz

└─ sub-01_phasediff.json

└─ sub-01_magnitude1.nii.gz

└─ sub-01_magnitude1.json



Field mapping

sub-01

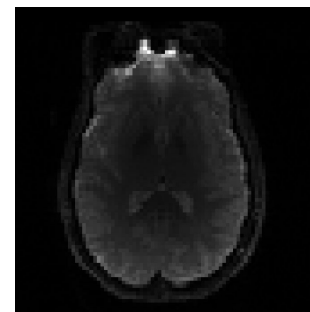
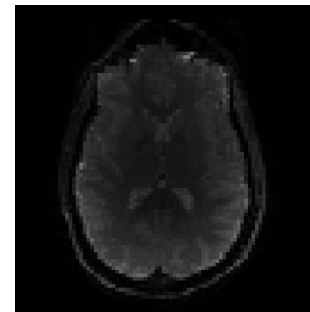
└─ fmap

└─ sub-01_dir-AP_epi.nii.gz

└─ sub-01_dir-AP_epi.json

└─ sub-01_dir-PA_epi.nii.gz

└─ sub-01_dir-PA_epi.json



Functional MRI

sub-01

└─ func

├─ sub-01_task-nback_bold.nii.gz

├─ sub-01_task-nback_bold.json

├─ sub-01_task-nback_events.tsv

├─ sub-01_task-nback_sbref.nii.gz

├─ sub-01_task-nback_sbref.json

├─ sub-01_task-rest_cbv.nii.gz

└─ sub-01_task-rest_cbv.json

Functional MRI

sub-01

└─ func

├─ sub-01_task-nback_bold.nii.gz

├─ sub-01_task-nback_bold.json

├─ sub-01_task-nback_events.tsv

├─ sub-01_task-nback_sbref.nii.gz

├─ sub-01_task-nback_sbref.json

├─ sub-01_task-rest_cbv.nii.gz

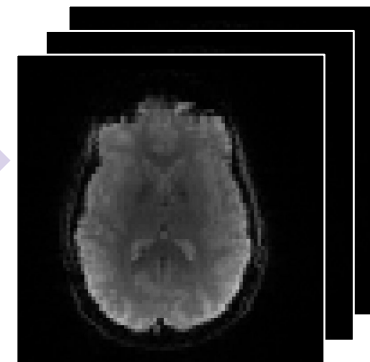
└─ sub-01_task-rest_cbv.json

Functional MRI

sub-01

└─ func

- └─ sub-01_task-nback_bold.nii.gz
- └─ sub-01_task-nback_bold.json
- └─ sub-01_task-nback_events.tsv
- └─ sub-01_task-nback_sbref.nii.gz
- └─ sub-01_task-nback_sbref.json
- └─ sub-01_task-rest_cbv.nii.gz
- └─ sub-01_task-rest_cbv.json



Functional MRI

sub-01

└─ func

├─ sub-01_task-nback_bold.nii.gz

├─ sub-01_task-nback_bold.json

├─ sub-01_task-nback_events.tsv

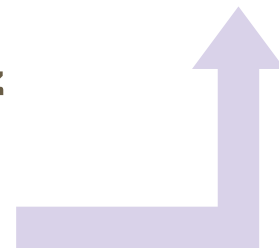
├─ sub-01_task-nback_sbref.nii.gz

├─ sub-01_task-nback_sbref.json

├─ sub-01_task-rest_cbv.nii.gz

└─ sub-01_task-rest_cbv.json

onset	duration	trial_type
1.5	2	1back
10.5	1.5	1back
15	3	1back
25.5	2.5	2back



Functional MRI

sub-01

└─ func

├─ sub-01_task-nback_bold.nii.gz

├─ sub-01_task-nback_bold.json

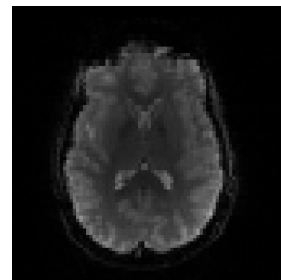
├─ sub-01_task-nback_events.tsv

├─ sub-01_task-nback_sbref.nii.gz

├─ sub-01_task-nback_sbref.json

├─ sub-01_task-rest_cbv.nii.gz

└─ sub-01_task-rest_cbv.json



Metadata

sub-01

└─ func

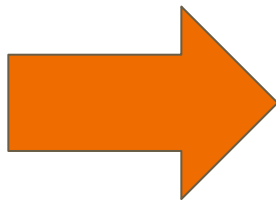
├─ sub-01_task-nback_bold.nii.gz
├─ sub-01_task-nback_bold.json
├─ sub-01_task-nback_events.tsv
├─ sub-01_task-nback_sbref.nii.gz
├─ sub-01_task-nback_sbref.json
├─ sub-01_task-rest_cbv.nii.gz
└─ sub-01_task-rest_cbv.json



```
{  
  "EchoTime": 0.06052,  
  "EffectiveEchoSpacing": 0.000245314,  
  "FlipAngle": 77,  
  "MagneticFieldStrength": 3,  
  "Manufacturer": "Siemens",  
  "ManufacturersModelName": "Prisma",  
  "MultibandAccelerationFactor": 3,  
  "ParallelReductionFactorInPlane": 2,  
  "PhaseEncodingDirection": "j-",  
  "RepetitionTime": 1.5,  
  "SliceThickness": 2.5,  
  "SpacingBetweenSlices": 2.5,  
  "TaskName": "strangerthings",  
  "TotalReadoutTime": 0.0208517  
}
```

Converting MRI data to BIDS

```
rawdata/  
└─ sub-01  
   └─ 1-localizer  
      └─ 00001.dcm  
      └─ 00002.dcm  
      └─ 00003.dcm  
   └─ 2-mprage  
      └─ 00001.dcm  
      └─ 00002.dcm  
      └─ 00003.dcm  
      └─ 00004.dcm  
      └─ 00005.dcm  
   └─ 3-nback-task  
      └─ 00001.dcm  
      └─ 00002.dcm  
      └─ 00003.dcm  
      └─ 00004.dcm
```



```
dset/  
└─ dataset_description.json  
└─ participants.tsv  
└─ sub-01  
   └─ anat  
      └─ sub-01_T1w.json  
      └─ sub-01_T1w.nii.gz  
   └─ dwi  
      └─ sub-01_dwi.bval  
      └─ sub-01_dwi.bvec  
      └─ sub-01_dwi.json  
      └─ sub-01_dwi.nii.gz  
   └─ fmap  
      └─ sub-01_acq-dwi_dir-AP_epi.json  
      └─ sub-01_acq-dwi_dir-AP_epi.nii.gz  
      └─ sub-01_acq-dwi_dir-PA_epi.json  
      └─ sub-01_acq-dwi_dir-PA_epi.nii.gz  
      └─ sub-01_acq-func_dir-AP_epi.json  
      └─ sub-01_acq-func_dir-AP_epi.nii.gz  
      └─ sub-01_acq-func_dir-PA_epi.json  
      └─ sub-01_acq-func_dir-PA_epi.nii.gz  
   └─ func  
      └─ sub-01_task-nback_run-01_bold.json  
      └─ sub-01_task-nback_run-01_bold.nii.gz  
      └─ sub-01_task-nback_run-01_events.tsv  
      └─ sub-01_task-nback_run-01_sbref.json  
      └─ sub-01_task-nback_run-01_sbref.nii.gz
```

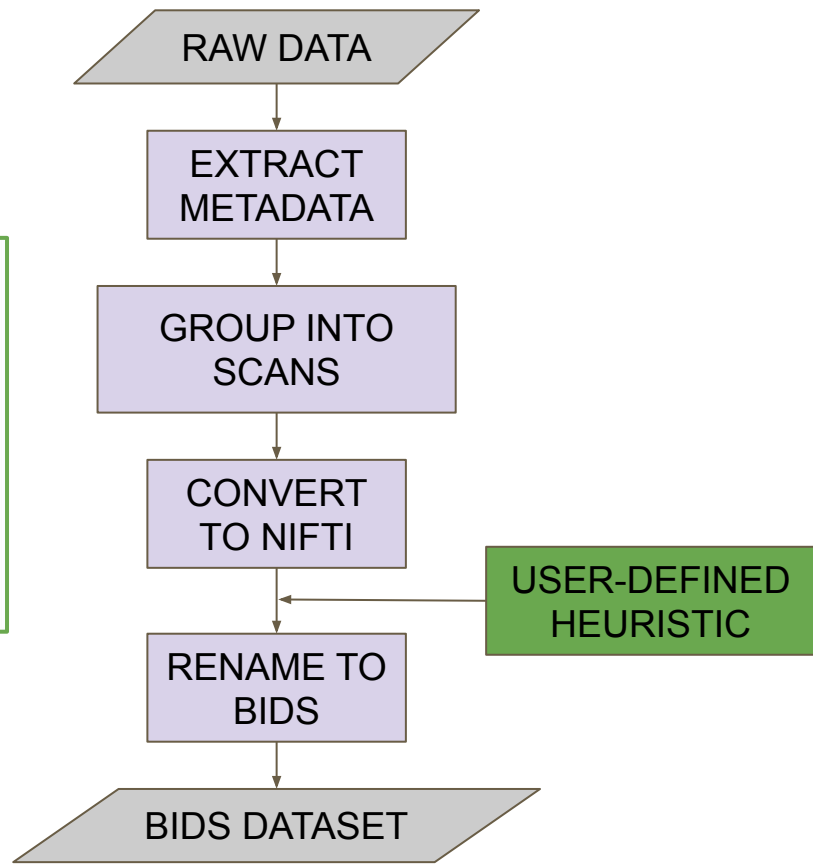

Converting MRI data to BIDS

- HeuDiConv
- ReprIn
- BIDScoin
- bidsify
- bidskit
- Data2Bids
- Dcm2Bids
- XNAT2BIDS
- Horos (Osirix) Bids Output Extension

HeuDiConv

```
import os
def create_key(template, outtype='nii.gz', annotation_classes=None):
    if template is None or not template:
        raise ValueError('Template must be a valid format string')
    return template, outtype, annotation_classes
def infotodict(seqinfo):
    """Heuristic evaluator for determining which runs belong where
    allowed template fields - follow python string module:
    item: index within category
    subject: participant id
    seqitem: run number during scanning
    subindex: sub index within group
    """
    t1w = create_key('sub-{subject}/{session}/anat/sub-{subject}_{session}_run-00{item:01d}_T1w')
    info = {t1w: []}
    for idx, s in enumerate(seqinfo):
        if (s.dim1 == 320) and (s.dim2 == 320) and ('t1_fl2d_tra' in s.protocol_name):
            info[t1w].append(s.series_id)
    return info
```

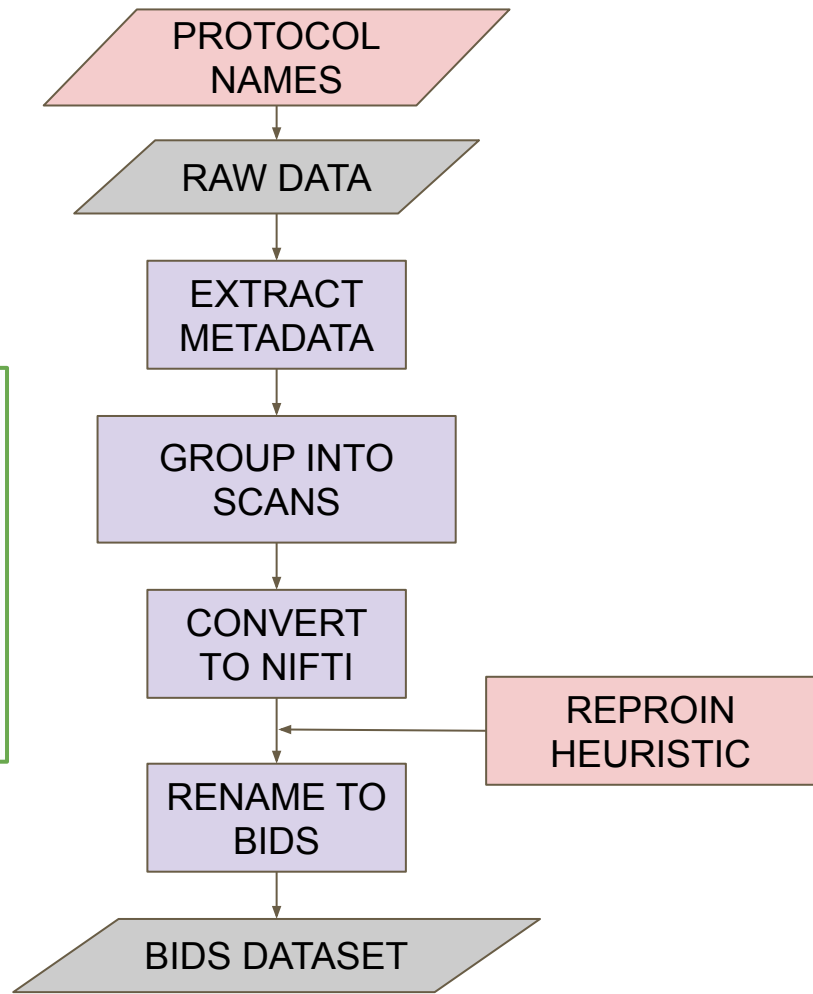
<https://reproducibility.stanford.edu/bids-tutorial-series-part-2a/>



HeuDiConv + ReprIn

```
import os
def create_key(template, outtype='nii.gz', annotation_classes=None):
    if template is None or not template:
        raise ValueError('Template must be a valid format string')
    return template, outtype, annotation_classes
def infotodict(seqinfo):
    """Heuristic evaluator for determining which runs belong where
    allowed template fields - follow python string module:
    item: index within category
    subject: participant id
    seqitem: run number during scanning
    subindex: sub index within group
    """
    t1w = create_key('sub-{subject}/{session}/anat/sub-{subject}_{session}_run-00{item:01d}_T1w')
    info = {t1w: []}
    for idx, s in enumerate(seqinfo):
        if (s.dim1 == 320) and (s.dim2 == 320) and ('t1_fl2d_tra' in s.protocol_name):
            info[t1w].append(s.series_id)
    return info
```

<https://reproducibility.stanford.edu/bids-tutorial-series-part-2a/>



Caveats to converters

1. Possible identifiable metadata in the sidecar json files!
2. Anatomical scans not generally defaced.
3. Some metadata must be filled out by hand.
4. MRI converters do not generally include physiological or task files.