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The Brain Imaging Data Structure

ZI Mannheim, Nov 3, 2020

Workshop agenda

Part 1: Introduction to the Brain Imaging Data Structure (BIDS)

Part 2: Automated BIDS conversion

Part 1: Introduction to the Brain Imaging Data Structure

- Why BIDS?
- How does BIDS work?

Brain Imaging Data Structure

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The brain imaging data structure, a format for organizing and describing outputs of neuroimaging experiments

Krzysztof J. Gorgolewski ✉, Tibor Auer, Vince D. Calhoun, R. Cameron Craddock, Samir Das, Eugene P. Duff, Guillaume Flandin, Satrajit S. Ghosh, Tristan Glatard, Yaroslav O. Halchenko, Daniel A. Handwerker, Michael Hanke, David Keator, Xiangrui Li, Zachary Michael, Camille Maumet, B. Nolan Nichols, Thomas E. Nichols, John Pellman, Jean-Baptiste Poline, Ariel Rokem, Gunnar Schaefer, Vanessa Sochat, William Triplett, Jessica A. Turner, Gaël Varoquaux & Russell A. Poldrack -Show fewer authors

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19k Accesses | **214** Citations | **105** Altmetric | Metrics

Benefits from adopting a common neuroimaging data standard:

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- **Minimized curation**: easy to understand and work with data. Maintain accessibility and usability
  - within lab overtime
  - Between labs
  - Between public databases

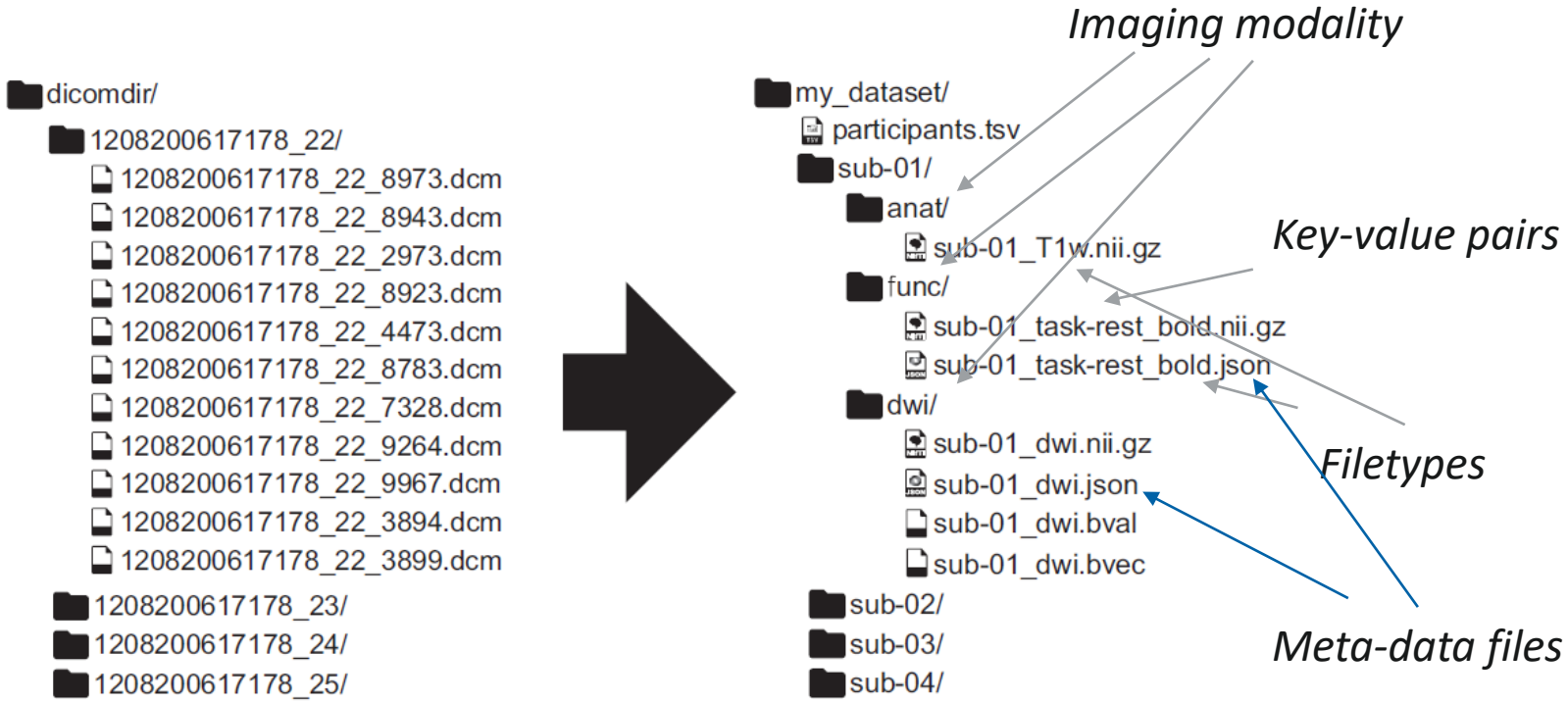
- **Error reduction**: avoid misunderstandings

- **Optimized usage of data analysis software**: enabling completely automated analysis workflows

- **Development of automated tools** for verifying consistency and completeness

Gorgolewski et al., 2016

Key characteristics of BIDS



Gorgolewski et al., 2016

Key characteristics of BIDS

- **Raw versus derived data**

- **File formats:**
  - Imaging data: Nifti
  - Meta-data information: json
  - Meta-data (array-) information: tsv

  - **Required, recommended and optional meta-data**

Gorgolewski et al., 2016

Adoption & Resources for BIDS

- **Official website**: https://bids.neuroimaging.io/

- **Online resources (tutorials, dictionary, etc.):** https://bids-specification.readthedocs.io/en/stable/

- **Extentions for other modalities** such as EEG and MEG available

- **Tools** such as validator, converters, databases, automated analysis pipelines are available to work on BIDS datasets

Recommended reading for the start:

- Article introducing BIDS: Gorgolewski et al., 2016 + Supplement
- Introductory presentations on OSF: https://osf.io/yn93h/, in particular Nastase, 2020

Part 2: Automated BIDS conversion

*As a clinical psychologist busy with a bunch of neuroscience projects, used to work with Windows, with limited programming experience, little knowledge of programming languages such as Python, quite a bit practical experience with Matlab and SPM and several datasets on stock waiting for (re-) analysis: HOW THE *** CAN I GET STARTED WITH BIDS???*

An anonymous researcher at the Central Institute

Automated BIDS conversion

- **Tools to convert data to BIDS are available:** HeuDiConv, dcm2niix, PyBIDS, bidsify, bidskit, pyBIDSconv, dcm2BIDS, etc.

- „This is the most unpleaseant part… a single-use script manually tailored to the idiosyncrasies of each data set“ (Samuel A. Nastase on https://osf.io/ycrjq/)

- *Aim: Develop an automated BIDS conversion tool that is flexible enough to be applied to all my datasets.*

Rapid and automated BIDS conversion (RaBIDS)

Key characteristics of RaBIDS:

- User feeds a datasheet with descriptive information about the experiment (subjects, tasks, dicom descriptors, path to data, etc.)
- For each functional task, a conditions-sheet needs to be provided, listing task information (conditions, relevant logfile events, etc.)

First step: dicom conversion

- The datasheet is loaded by a Matlab program called RaBIDS_1_Import.m, which is essentially a wrapper for dicm2nii (https://github.com/xiangruili/dicm2nii) to streamline dicom conversion to nifti. SPM is used for some routines.
- Images are renamed and organized according to BIDS

Second step: create stimulus onset times (SOTs)

- A Matlab program called RaBIDS_2_Create_SOTS.m reads task information from the experiment logfiles and creates BIDS compatible stimulus protocol files

Rapid and automated BIDS conversion (RaBIDS)

RaBIDS can be downloaded from the repository on GitHub (latest release: v0.2.1)

https://github.com/christianparet/RaBIDS

Also available on GitHub:

- A walkthrough how to use RaBIDS with example data
- User manual
- Reference for error messages

Work in progress! Open for everyone to use & contribute

Rapid and automated BIDS conversion (RaBIDS)

What RaBIDS v0.2.1 can do:

- Import EPIs from BOLD-imaging, anatomical scans and fieldmap scans (but see below)
- Manage dicom import directly from hobbes
- Deal with relatively unstructured primary/raw datasets

Current limitations:

- Modalities/sequences other than BOLD, anatomical and fieldmap not possible
- Fieldmap import works exclusively for sequences with output of a phase difference map and 1-2 magnitude images
- Automated SOTs creation only possible from Presentation logfiles

Summary

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- A data standard improves accessibility and usability of data
- BIDS offers a low-threshold standard that is being widely adopted in the neuroimaging field
- Adopting BIDS facilitates data sharing
- Adopting BIDS opens up an increasing number of resources for data analysis and data management
- RaBIDS could be helpful to adopt BIDS right away, without any technical hurdles. Contributors are welcome!

DGPs Kommission Open Science:

„Die Brain Imaging Data Structure als standardisierte Dateiablagestruktur für MRT-Daten kann […] als „best practice-Beispiel“ dienen.“ (Gollwitzer et al., 2020, p. 5)

Outlook, visions and discussion

Converting data to BIDS

The hard way...

There are many tools that can facilitate BIDS conversion: **HeuDiConv**, **dcm2niix**, **PyBIDS**, **bidsify**, **bidskit**, **pyBIDSconv**, **dcm2BIDS**, etc.

The easy way!
Using a prespecified naming convention when creating program cards on the scanner console can allow for automated BIDS conversion—e.g. **ReproIn** (for Siemens).

Visconti di Oleggio Castello et al, *Zenodo*, 2020

Credit: Slide from S.A. Nastase, Princeton Neuroscience Institute, retrieved from https://osf.io/ycrjq/

Vielen Dank
für Ihre Aufmerksamkeit

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