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The Brain Imaging Data Structure

Overview of the project and what BIDS does and allows to do



Camille Maumet

Univ Rennes, Inria, CNRS, Inserm



Glioma MR Imaging 2.0

- Build a pan-European and multidisciplinary network of **international experts in glioma research, patient organisations, data scientists, and MR imaging scientists**
- Use **advanced MR imaging for improved decision making** in diagnosis, patient monitoring, and assessment of treatment response in clinical trials and clinical practice.



Esther Warnert



Radim Jancalek



Jan Petr



Vera Keil



Lydiane Hirschler



WG1 - Advanced MRI biomarkers for glioma characterisation

Working Group 1 focusses on coordinating the identification and quantification of advanced MRI biomarkers for the application in the field of glioma.



Kyrre Emblem



Marion Smits



Fran Borovecki



WG4 – Stakeholder relations

Working Group 4 ensures representation of all relevant stakeholders within GliMR and acts as liaison from GliMR to all relevant stakeholders.



WG2 - Multi-site data integration

Working Group 2 coordinates multi-site data integration and enables the creation of large datasets in glioma diagnostics via the creation of common GDPR- and BIDS-compliant forms and data structures.



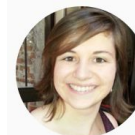
WG5 – Dissemination

Working Group 5 disseminates the Action's goals and results in tailored manners to all relevant stakeholders.



WG3 - Clinical translation

Working Group 3 focusses on fostering cross-border information exchange about past and current clinical trials and studies of glioma.



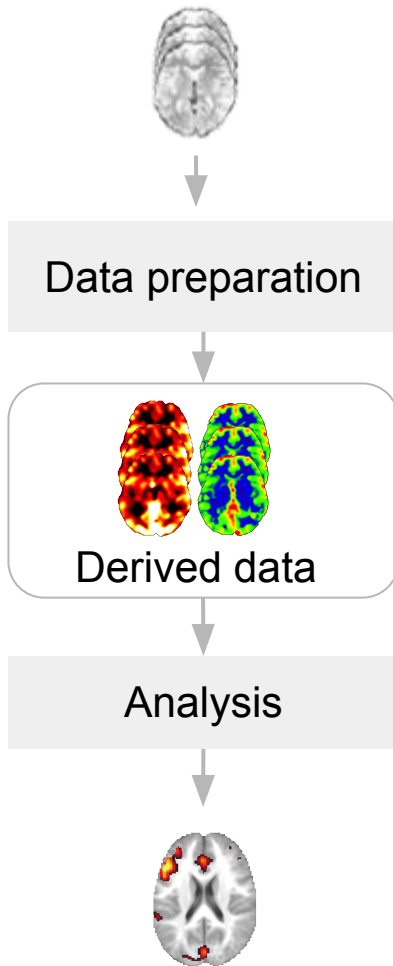
Patricia Clement



Joana Pinto



Gliomas research in Europe

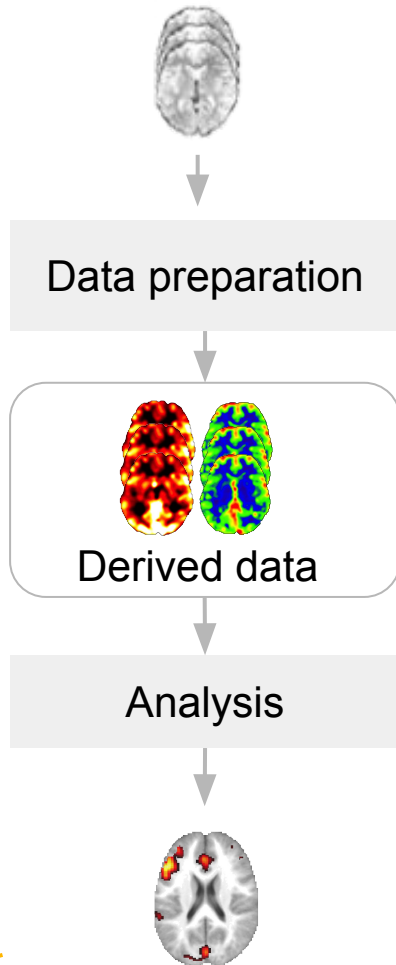


- **50,000 new cases** of gliomas per year in Europe

- **Low incidence** rate

>> Limited samples sizes

Why do we need large samples?



Reproducibility crisis

SCIENCE

A Waste of 1,000 Research Papers

Decades of early research on the genetics of depression were built on nonexistent foundations. How did that happen?

ED YONG MAY 17, 2019



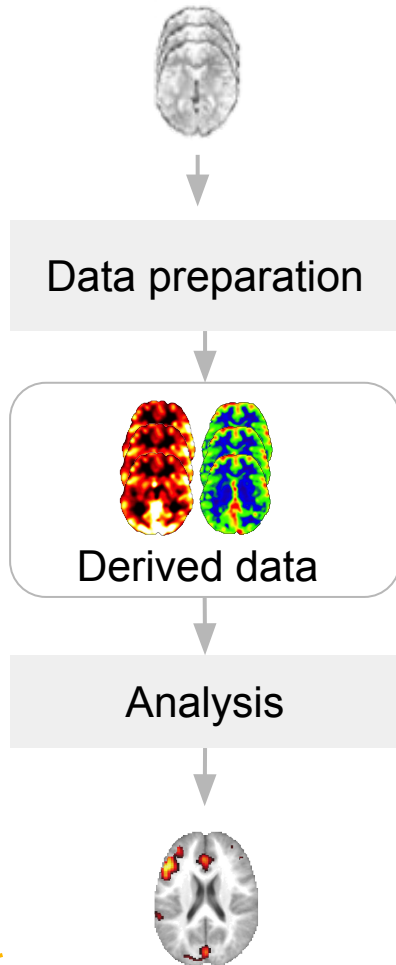
SEAN NEL / SHUTTERSTOCK

In 1996, a group of European researchers found that a certain gene, called *SLC6A4*, might influence a person's risk of depression.

It was a blockbuster discovery at the time. The team found that a less active version of the gene was more common among 454 people who had mood disorders than in 570 who did not. In theory, anyone who had this particular gene variant could be at higher risk for depression, and that finding, they said, might help in diagnosing such disorders, assessing suicidal behavior, or even

By Ed Yong, The Atlantic Science, May 2019, [link](#).

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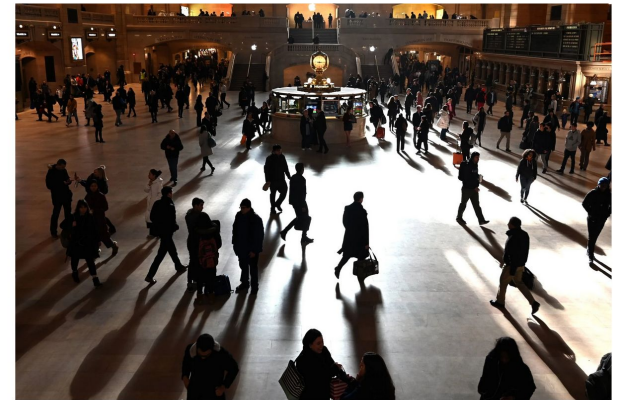
By Ed Yong, The Atlantic Science, May 2019, [link](#).

Algorithmic injustice

The New York Times

Many Facial-Recognition Systems Are Biased, Says U.S. Study

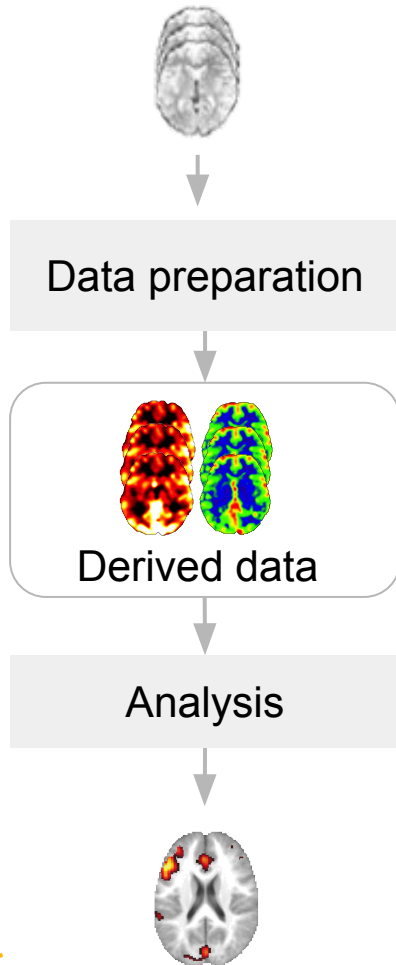
Algorithms falsely identified African-American and Asian faces 10 to 100 times more than Caucasian faces, researchers for the National Institute of Standards and Technology found.



Morning at Grand Central Terminal. Technology for facial recognition is frequently biased, a new study confirmed. Timothy A. Clary/Agence France-Presse — Getty Images

By Natasha Singer and Cade Metz, The New York Times, Dec. 2019, [link](#).

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As a **community**, we need to create and work on **bigger & more representative and diverse datasets**

GliMR WG2 **Multi-site data integration**

WG2 - Multi-site data integration

Working Group 2 coordinates multi-site data integration and enables the creation of large datasets in glioma diagnostics via the creation of common GDPR- and BIDS-compliant forms and data structures.



Camille
Maumet

Cyril
Pernet



Data Privacy

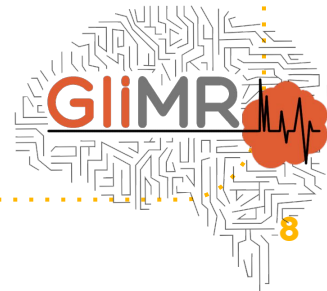


Data infrastructure



Data portability

Image credits: "Privacy lock", "Transport map", "Mini bus"



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Data infrastructure



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Data portability

How differences in acquisition parameters can be conveyed with enough details to support future post-processing?

- **Extend the international BIDS standard** in setting up the structures for sharing advanced MR imaging data.



Brain Imaging Data Structure (BIDS):

A global community of 200+ members!



Guiomar
Niso



Melanie
Ganz



Robert
Oostenveld



Russ
Poldrack



Kirstie
Whitaker

Why BIDS?

- Data sharing and exchange
 - With other labs
 - Within your lab
 - With yourself in 6 months :)
- Automatic pipeline processing

What is BIDS?



- It's a data **structure** ; nothing to do with **format** per se
- It's about:
 - how you organize data in a folder
 - how you name files
 - how you document metadata
 - using community standards and dictionaries to do all the above
- It cares about imaging data but also behaviour/cognition

bids.neuroimaging.io

What is BIDS?

CREDITS

SCIENTIFIC DATA

OPEN

SUBJECT CATEGORIES

- » Data publication and archiving
- » Research data

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

Krzysztof J. Gorgolewski¹, Tibor Auer², Vince D. Calhoun^{3,4}, R. Cameron Craddock^{5,6}, Samir Das⁷, Eugene P. Duff⁸, Guillaume Flandin⁹, Satrajit S. Ghosh^{10,11}, Tristan Glatard^{7,12}, Yaroslav O. Halchenko¹³, Daniel A. Handwerker¹⁴, Michael Hanke^{15,16}, David Keator¹⁷, Xiangrui Li¹⁸, Zachary Michael¹⁹, Camille Maumet²⁰, B. Nolan Nichols^{21,22}, Thomas E. Nichols^{20,23}, John Pellman⁶, Jean-Baptiste Poline²⁴, Ariel Rokem²⁵, Gunnar Schaefer^{1,26}, Vanessa Sochat²⁷, William Triplett¹, Jessica A. Turner^{3,28}, Gaël Varoquaux²⁹ & Russell A. Poldrack¹

Received: 18 December 2015

Accepted: 19 May 2016

Published: 21 June 2016



Data Sharing Task Force



The Poldrack Lab @ Stanford

What is BIDS?

Evolution of BIDS

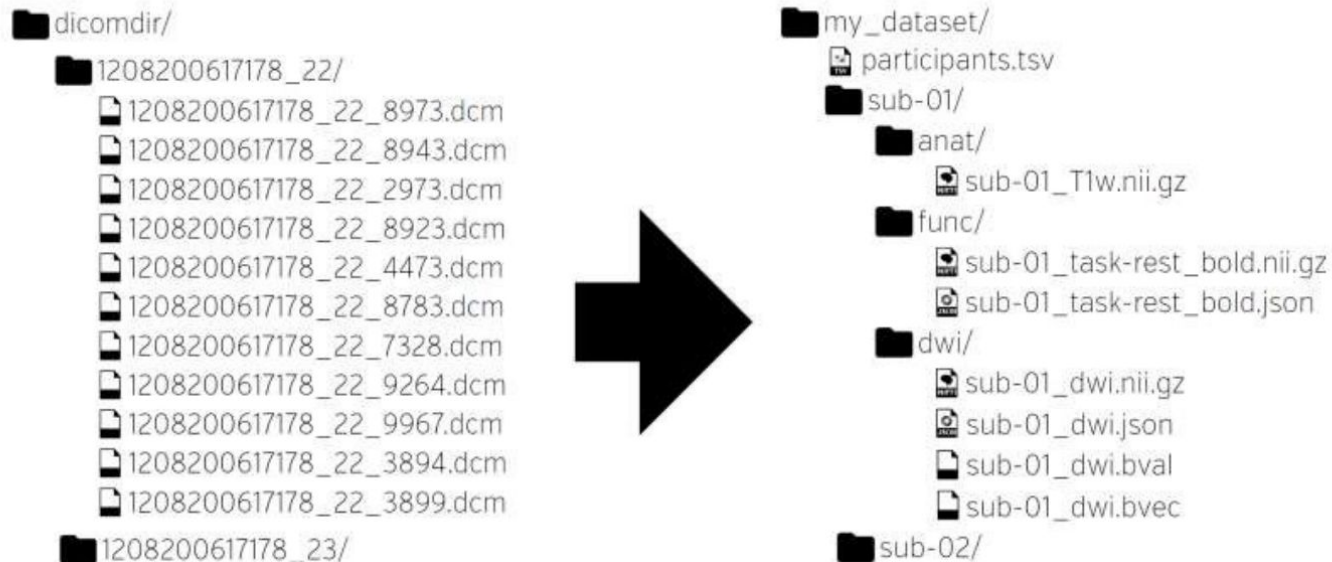
1. Kickoff meeting at Stanford in Spring 2015
2. Meeting at OHBM 2015 (June)
3. Introduced to neuroinformatics community at INCF Congress 2015 (August)
4. First release candidate and public call for comments (September)
5. Version 1.0.0 published along the introductory paper

→ Initially covered structural MRI and fMRI, now all sort of MRI, PET, EEG, MEG, iEEG, extensions for animal, connectivity, imaging genomics ..

What is BIDS?

Essence of BIDS

- Directory hierarchy and file naming system
 - Conveys essential meta-data in filenames alone
- Remaining meta-data in “sidecar” files



What is BIDS?

Metadata as text files (tsv, json) with standard dictionary

Name	Date modified	Type
stimuli	21/03/2018 21:58	File folder
sub-002	24/03/2018 08:56	File folder
sub-003	24/03/2018 08:56	File folder
sub-004	24/03/2018 08:56	File folder
sub-005	24/03/2018 08:56	File folder
sub-006	24/03/2018 08:56	File folder
sub-007	24/03/2018 08:56	File folder
sub-008	24/03/2018 08:56	File folder
sub-009	24/03/2018 08:56	File folder
sub-010	24/03/2018 08:56	File folder
sub-011	24/03/2018 08:56	File folder
sub-012	24/03/2018 08:56	File folder
sub-013	24/03/2018 08:56	File folder
sub-014	24/03/2018 08:56	File folder
sub-015	24/03/2018 08:56	File folder
sub-016	24/03/2018 08:56	File folder
sub-017	24/03/2018 08:56	File folder
sub-018	24/03/2018 08:56	File folder
sub-019	24/03/2018 08:56	File folder
dataset_description.json	15/03/2018 11:30	JSON File
participants.tsv	19/03/2018 20:21	TSV File
README.txt	15/03/2018 11:33	TXT File

```
participant_id age sex
sub-002        34  M
sub-003        12  F
sub-004        33  F
```

Subjects info are shared at the root - easy to figure populations, age, and other basic demographics

What is BIDS? A community!



Technical challenges: Standards, Databases, Good practices (version control, etc.)

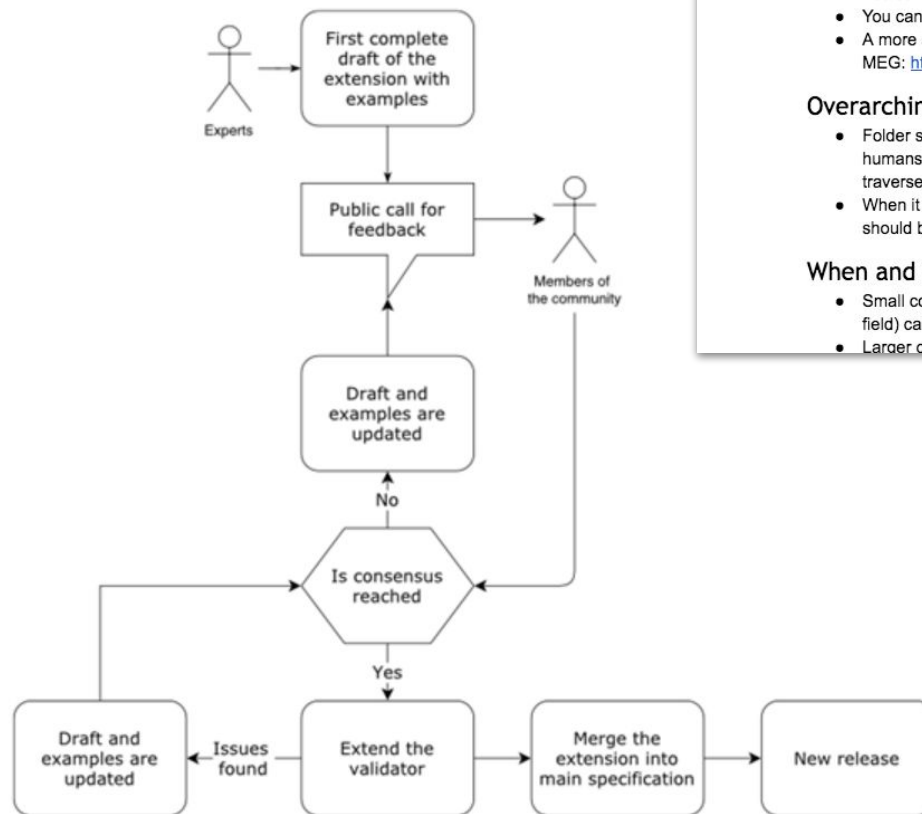
A culture change: towards community-driven research

- Making resources **available to the scientific community**
- **Reusing** existing resources (datasets, tools) that were created by others
- **Developing tools collaboratively** with a community of contributors

<https://github.com/bids-standard>

Extending BIDS: the BEPs

BIDS Extension Proposals



BIDS Extension Proposals: A Guide

Why contribute to BIDS?

- You can make something that is good even better without building it from scratch.
- You can interact with and get to know other experts in the field.
- A more substantial extension can lead to standalone publications (see for instance BIDS MEG: <https://www.nature.com/articles/sdata2018110>)

Overarching principles in the design of BIDS

- Folder structure must be not only machine-readable but also easy to interpret by humans. In other words, readability is as important as the ability to programmatically traverse the folder structure.
- When it comes to file names within folders, redundancy trumps concision – the files should be identifiable by their names even if removed from the folder structure.

When and how to start a BIDS Extension Proposal?

- Small contributions (typos, rephrasing of a description, adding a single new metadata field) can be just added as a [Pull Request on GitHub](#)
- Larger contributions that are expected to involve longer and more involved discussions



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Thank you!