Building a more collaborative neuroimaging science
Camille Maumet

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Building a more collaborative neuroimaging science

Camille Maumet
Univ Rennes, Inria, CNRS, Inserm

Think Open Rovereto Workshop 2020 - July 10, 2020
Sample sizes in neuroimaging

2015 : 30 participants per study

[Poldrack et. al, Nature Neuroscience 2017]

Image credits: Sculpture by Malin Bjornsdotter “Cerebia”, OHBM Brain Art SIG
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

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
Why are middle-aged marathon runners faster than twentysomethings?

According to new data from the running app Strava, runners in their 40s are streets ahead of younger rivals.

Selection bias

The Guardian, “Why are middle-aged marathon runners faster than twenty somethings?” Oliver Balch
Speech Recognition Tech Is Yet Another Example of Bias

Siri, Alexa and other programs sometimes have trouble with the accents and speech patterns of people from many underrepresented groups.

By Claudia Lopez Lloreda on July 5, 2020


Having to adapt our way of speaking to interact with speech recognition technologies is a familiar experience for people whose first language is not English or who do not have conventionally American-sounding names. I have even stopped using Siri because of it.

Lack of diversity
Sample sizes in neuroimaging

2015: 30 participants per study

We need **bigger, more representative and more diverse** samples

[Poldrack et. al, Nature Neuroscience 2017]

Image credits: Sculpture by Malin Bjornsdotter “Cerebia”, OHBM Brain Art SIG
Beyond papers...
Publishing research artefacts

- Preprocessing
- Derived data
- Statistical analysis

Image credits: Parcels 1, 2 & 4 (CC0), Parcel 3 (CC0), Parcel 5 (CC0).
Publishing research artefacts

Preprocessing

Derived data

Statistical analysis

Image credits: Parcels 1 2 & 4 (CC0), Parcel 3 (CC0), Parcel 5 (CC0).
Publishing research artefacts

Preprocessing -> Derived data -> Statistical analysis

HAL, BiorXiv, Pubmed

Image credits: Parcels 1 2 & 4 (CC0), Parcel 3 (CC0), Parcel 5 (CC0).
Publishing research artefacts

Preprocessing → Derived data → Statistical analysis → HAL, BiorXiv, Pubmed

Image credits: Parcels 1, 2, & 4 (CC0), Parcel 3 (CC0), Parcel 5 (CC0).
BIDS

- Used in over 60 labs around the world
- Adopted by: FCP-INDI, Developing Human Connectome, SchizConnect and Donders Data repository.
- Extensions: MEG, iEEG, EEG
Publishing research artefacts

Preprocessing

Derived data

Statistical analysis

HAL, BiorXiv, Pubmed

Image credits: Parcels 1 2 & 4 (CC0), Parcel 3 (CC0), Parcel 5 (CC0).
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HAL, BiorXiv, Pubmed, neurosynth.org, brainspell.org

Image credits: Parcels 1 2 & 4 (CC0), Parcel 3 (CC0), Parcel 5 (CC0).
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HAL, BiorXiv, Pubmed, Neurosynth.org, Brainspell

Image credits: Parcels 1, 2 & 4 (CC0), Parcel 3 (CC0), Parcel 5 (CC0).
fMRI Results

Publication

Figure
(selected slices)

Thresholded
statistics

Peak locations

❌ Incomplete statistical results
❌ Ambiguous/incomplete methods
❌ Metadata is not searchable
NIDM-Results pack

[Maumet et al., Sci. Data 2016]
NIDM-Results pack

[NIDM-Results .nidm.zip]

- ClusterLabels.nii.gz
- Contrast.nii.gz
- ContrastStandardError.nii.gz
- DesignMatrix.csv
- DesignMatrix.png
- ExcursionSet.nii.gz
- ExcursionSet.png
- GrandMean.nii.gz
- Mask.nii.gz
- nidm.json
- nidm.ttl
- ParameterEstimate_001.nii.gz
- ParameterEstimate_002.nii.gz
- ResidualMeanSquares.nii.gz
- SearchSpaceMask.nii.gz
- TStatistic.nii.gz
- ZStatistic.nii.gz

[Maumet et al., Sci. Data 2016]
NIDM in SPM, FSL & NeuroVault

1. Export

$ niddm fsl_ds107_group 49 -g Control

2. Publication on NeuroVault

https://github.com/incf-nidash/nidmresults-spm
https://github.com/incf-nidash/nidmresults-fsl
Meta-analysis with NIDM-Results

Coordinate-based meta-analysis

Image-based meta-analysis

Publishing research artefacts

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Image credits: Parcels 1 2 & 4 (CC0), Parcel 3 (CC0), Parcel 5 (CC0).
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Image credits: Parcels 1, 2 & 4 (CC0), Parcel 3 (CC0), Parcel 5 (CC0).
A new challenge: dealing with analytic variability...
Open data

Unique study
30 participants

+ Images
+ Homogenous
- Datasets

Crédits: Brains, Neil Conway, Flickr (CC BY 2.0)
Open data

Unique study
30 participants

Consortium
1000 participants

OpenNEURO
NEUROVAULT
studyforrest.org
ABIDE
1000 Functional
Connectomes Project
NITRC
OSF
ADHD 200
CORR
NKI

+ Images
+ Homogenous
- Datasets

Crédits : Brains, Neil Conway, Flickr (CC BY 2.0)
Open data

Unique study
30 participants

Consortium
1000 participants

Cohort
100 000 participants

+ Images
+ Homogenous
- Datasets

Crédits : Brains, Neil Conway, Flickr (CC BY 2.0)
Working with open data

1. Raw data
2. Feature extraction
3. Derived data
4. Statistical analysis
5. Results
Working with open data

1. Raw data
2. Feature extraction
3. Derived data
4. Statistical analysis
5. Results
6. Meta-analyses
Working with open data

1. Raw data
2. Feature extraction
3. Derived data
4. Statistical analysis
5. Results
6. Meta-analyses
Working with open data

- Raw data
  - Feature extraction
  - Derived data
    - Statistical analysis
      - Results
  - Statistical analysis
    - Results
  - Meta-analyses

Statistical analysis

Results

Raw data
Working with open data

1. Raw data
2. Feature extraction
3. Derived data
4. Statistical analysis
5. Results
6. Meta-analyses
Working with open data

Feature extraction
- Derived data

Statistical analysis
- Results

Raw data
- Feature extraction
- Derived data

Statistical analysis
- Results

Meta-analyses
Analytic variability

“Different acceptable analysis methods”

Carp et al. (2012)
How does analytic variability impact neuroimaging results?
BIDS Provenance

Preprocessing

Derived data

Statistical analysis

<table>
<thead>
<tr>
<th>BEP028</th>
<th>Provenance</th>
<th>Satra Ghosh and Camille Maumet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>new BEP, actively looking for contributors and community input.</td>
</tr>
</tbody>
</table>

Looking for contributors and community input

Join us!

Image credits: Parcels 1 2 & 4 (CC0), Parcel 3 (CC0), Parcel 5 (CC0).
Working together as a community!
## Brain standards by and for the community

### INCF

**Working Groups/Special Interest Groups**

Special Interest Groups are composed of users and developers from across the INCF network working collaboratively to develop, refine, and/or implement community standards. Working Groups are composed of SIG members working on short-term funded projects that aim to achieve a concrete deliverable.

<table>
<thead>
<tr>
<th>Working Group/Special Interest Group</th>
<th>Description</th>
<th>Read more</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FAIR Metadata Working Group</strong></td>
<td>The aim of this working group is the harmonization of Common Data Elements (CDEs) for data discovery and metadata annotation.</td>
<td></td>
</tr>
<tr>
<td><strong>Neuroinformatics for Aging</strong></td>
<td>This SIG will be a community dedicated to the creation and application of neuroinformatics technologies to address clinical and wellness challenges in aging.</td>
<td></td>
</tr>
<tr>
<td><strong>Neuroinformatics for cell types</strong></td>
<td>This SIG will coordinate common efforts for defining and describing cell types across neuroscience, to reduce duplicate efforts and to improve interoperability and reuse of cell type-specific data collected across groups.</td>
<td></td>
</tr>
<tr>
<td><strong>Neuroshapes: Open SHACL schemas for FAIR neuroscience data</strong></td>
<td>This SIG aims to coordinate community efforts for the development of open, use case driven and shared validatable data models (schemas, vocabularies) to enable the FAIR principles (Findable, Accessible, Interoperable and Reusable) for basic, computational and clinical neuroscience (metadata).</td>
<td></td>
</tr>
<tr>
<td><strong>Reproducibility and Best Practices in Human Brain Imaging</strong></td>
<td>The SIG aim is to collect, compile, synthesize and distribute information from task forces working on separate projects but with reproducibility in neuroimaging as an overarching theme.</td>
<td></td>
</tr>
<tr>
<td><strong>Standardised Representations of Network Structures</strong></td>
<td>This SIG deals with the various tools and formats for creating and sharing representations of biological neuronal networks, and will work towards ensuring these are as interoperable and usable as possible for computational neuroscientists.</td>
<td></td>
</tr>
<tr>
<td><strong>Neuroimaging Quality Control (nQC)</strong></td>
<td>This SIG aims to develop standards and best practices for quality control of neuroimaging data, including standardized protocols, easy to use tools and comprehensive manuals.</td>
<td></td>
</tr>
</tbody>
</table>

You can join a group or create your own!

[https://www.incf.org/resources/working-groups](https://www.incf.org/resources/working-groups)
Researching collaboratively

Hackathons

http://www.brainhack.org/?
Working open training
Mozilla Open leaders

Open Sesame (Cohort C)
Notes and full recording.

Mozilla Open Leaders
@MozOpenLeaders

Open Leaders are fueling the #internethealth movement.
Work Open, Lead Open #WOLO.

🔗 mztl.a/openleaders 🔗 Joined October 2016

Source:
https://medium.com/read-write-participate/open-leaders-7-demos-recap-8cee3423dbb5

https://foundation.mozilla.org/en/initiatives/mozilla-open-leaders/
Developing open science in our community

OHBM Open Science SIG

The OHBM Open Science Special Interest Group

Dedicated to promoting and supporting open science within our community

Learn more
Developing open science in our community
OHBM Open Science SIG 2020

Welcome to the OSR!
The OHBM Open Science Room (OSR) is a conference within a conference. It is part of the Organisation for Human Brain Mapping (OHBM) annual meeting.

The OSR aims to be a welcoming and inclusive space for discussion around open practices within neuroimaging and science more generally. Joining in with the activities of the OSR is a key opportunity to connect with others in the community, learn from each other, and start collaborations to build a more inclusive, transparent and future-ready scientific field.

A virtual meeting with global access!
This year the OHBM meeting and OSR will be open for virtual attendance only! The OHBM meeting runs from Tuesday 23rd June 2020 to Friday 3rd July 2020, for two weeks instead of the usual five days, to give all virtual attendees full opportunity to soak up the experience.

Rémi Gau
Liza Levitis
Cass Gould van Praag
Stephan Heunis
Developing open science in our community

OHBM Open Science SIG 2020

Hub 1
Asia, Pacific

Hub 2
Europe, Middle East, Africa

Hub 3
Americas

Rémi Gau
Liza Levitis
Cass Gould van Praag
Stephan Heunis
Nominations are now open! Details of the roles can be found [here](https://ossig.netlify.app/) and you can self-nominate [here](https://ossig.netlify.app/) before July 20th 2020 at 11:59 pm anywhere on earth.

- General Chair Elect
- Secretary Elect
- Treasurer Elect
- Inclusivity Officer
- Hackathon Co-Chairs (two officers)
- Open Science Room Co-Chairs (two officers)
Thank you

https://team.inria.fr/empenn/

https://ohbm.github.io/osr2020/volunteers/

https://ohbm.github.io/hackathon2020/team/

Credit: Presentation template by SlidesCarnival, adapted
Building a more collaborative neuroimaging science

@cmaumet
camille.maumet@inria.fr

Thank you!

Join the community:

Mozilla Open Leaders

Credit: Presentation template by SlidesCarnival, adapted