

Sharing more than research papers for transparent & reusable research

Camille Maumet

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Submitted on 3 Nov 2020

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Carl von Ossietzky Universität Oldenburg

Workshop "Open and reproducible neuroimaging"
University of Oldenburg - Nov 3, 2020

Sharing more than research papers **for transparent & reusable research**

Camille Maumet
Univ Rennes, Inria, CNRS, Inserm

@cmaumet

Sharing research artefacts

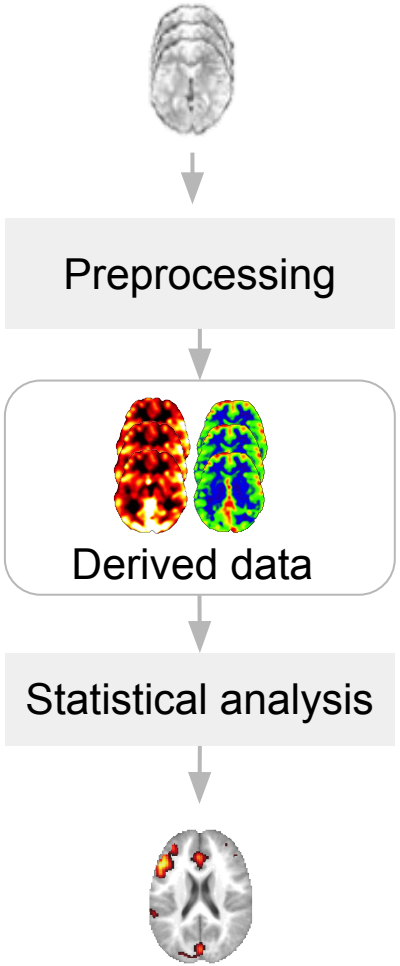
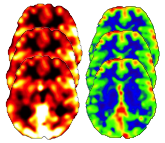


Image credits: Parcels 1 2 & 4 (CC0), Parcel 3 (CC0), Parcel 5 (CC0).

Sharing research artefacts



Preprocessing



Derived data

Statistical analysis





HAL, BiorXiv
Pubmed

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

But...



Incomplete reporting

Image credits: Blank page; Sculpture by Malin Bjornsdotter "Cerebia", OHBM Brain Art SIG; Brains, Neil Conway, Flickr (CC BY 2.0)

But...



Incomplete reporting

Difficult to build on existing work

Hard to summarize the literature

Image credits: Blank page; Sculpture by Malin Bjornsdotter "Cerebia", OHBM Brain Art SIG; Brains, Neil Conway, Flickr (CC BY 2.0)

But...



Incomplete reporting

Difficult to build on existing work

Hard to summarize the literature



Low sample sizes

Image credits: Blank page; Sculpture by Malin Bjornsdotter "Cerebia", OHBM Brain Art SIG; Brains, Neil Conway, Flickr (CC BY 2.0)

But...



Incomplete reporting

- Difficult to build on existing work
- Hard to summarize the literature



Low sample sizes

- Unreliability
- Lack of diversity

Image credits: Blank page; Sculpture by Malin Bjornsdotter "Cerebia", OHBM Brain Art SIG; Brains, Neil Conway, Flickr (CC BY 2.0)

But...



Incomplete reporting

- Difficult to build on prior work
- Hard to summarize the literature



Low sample sizes

- Unreliability
- Lack of diversity

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

with **enough details to enable reuse**.



Image credits: Blank page; Sculpture by Malin Bjornsdotter "Cerebia", OHBM Brain Art SIG; Brains, Neil Conway, Flickr (CC BY 2.0)

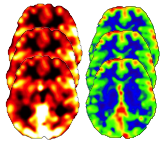
Beyond papers...

Sharing neuroimaging results

Sharing research artefacts

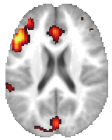


Preprocessing



Derived data

Statistical analysis





HAL, BiorXiv
Pubmed

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

fMRI Results

Paper



When the Single Matters more than the Group (II): Addressing the Problem of High False Positive Rates in Single Case Voxel Based Morphometry Using Non-parametric Statistics

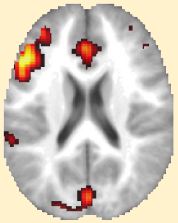
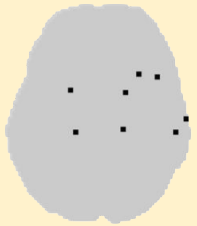


Figure
(selected slices)



Thresholded
statistics



Peak locations

fMRI Results

Paper



When the Single Matters more than the Group (II): Addressing the Problem of High False Positive Rates in Single Case Voxel Based Morphometry Using Non-parametric Statistics

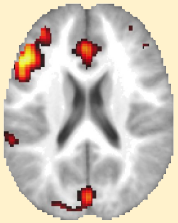
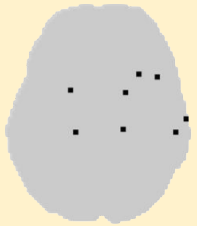


Figure
(selected slices)



Thresholded
statistics

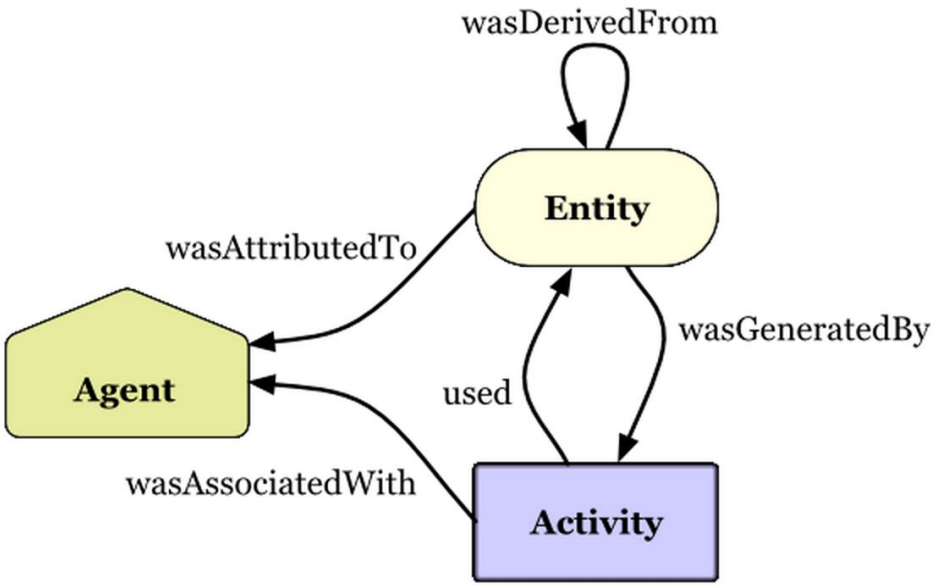


Peak locations

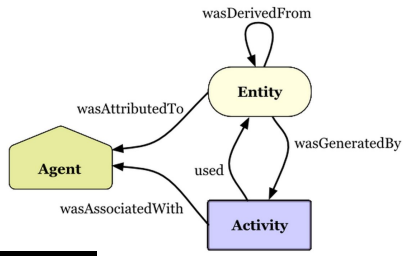
- Incomplete statistical results
- Ambiguous/incomplete methods
- Metadata is not searchable

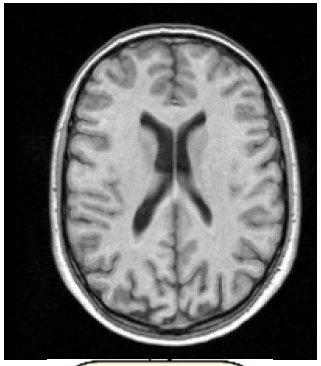
NIDM - NeuroImaging Data Model

- Based on W3C PROV
- Extensible graph-based representation (RDF)
- With a query language (SPARQL)



W3C PROV Example

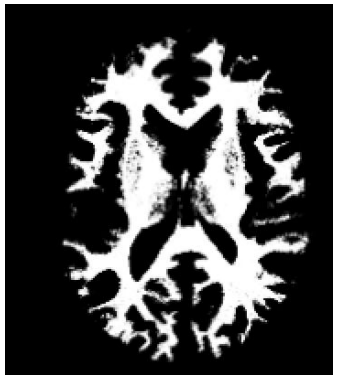




Entity

Segmentation

Activity



Entity

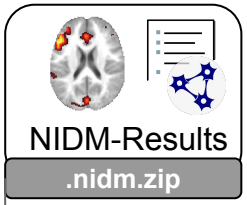


Entity

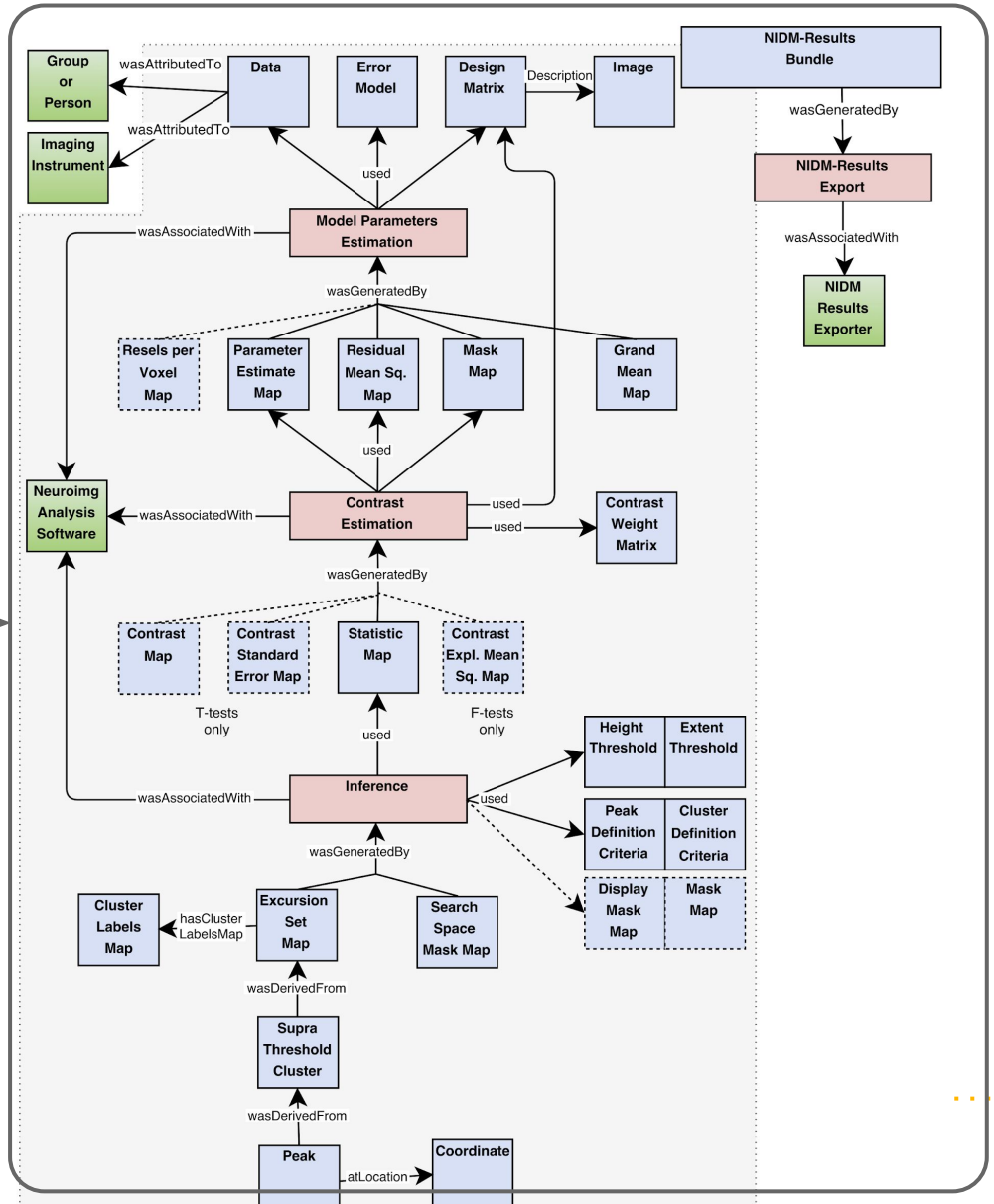
SPM

Agent

NIDM-Results



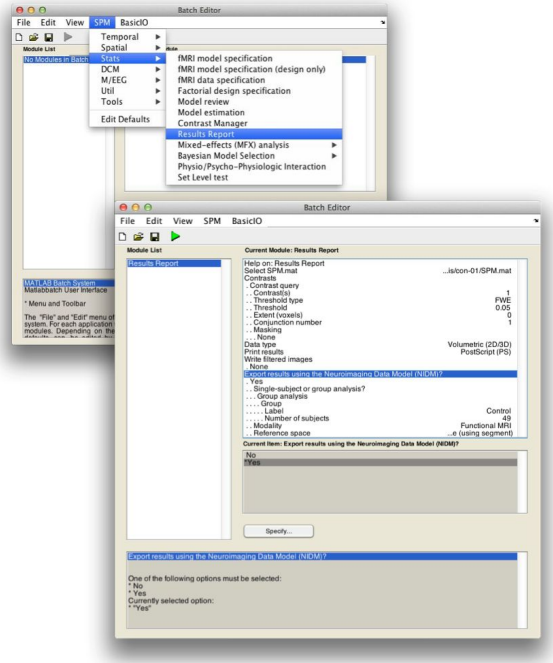
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- Contrast.nii.gz
- ContrastStandardError.nii.gz
- DesignMatrix.csv
- DesignMatrix.png
- ExcursionSet.nii.gz
- ExcursionSet.png
- GrandMean.nii.gz
- Mask.nii.gz
- nidm.json
- nidm.ttl
- ParameterEstimate_001.nii.gz
- ParameterEstimate_002.nii.gz
-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



[Maumet et al., Sci. Data 2016]

NIDM in SPM, FSL & NeuroVault

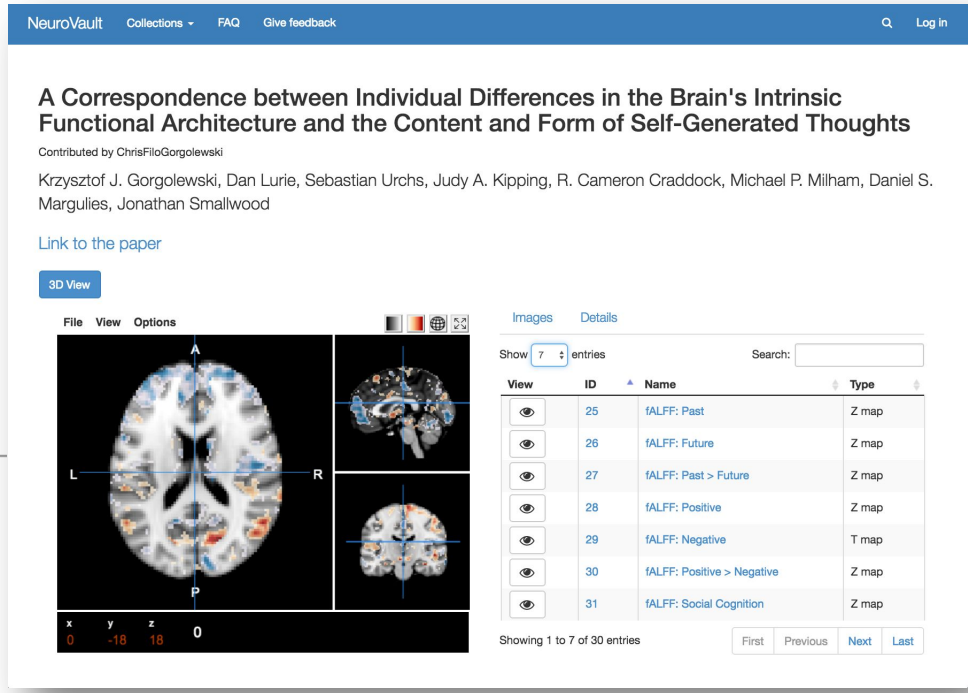
SPM



1. Export

2. Publication on NeuroVault

NIDM-Results



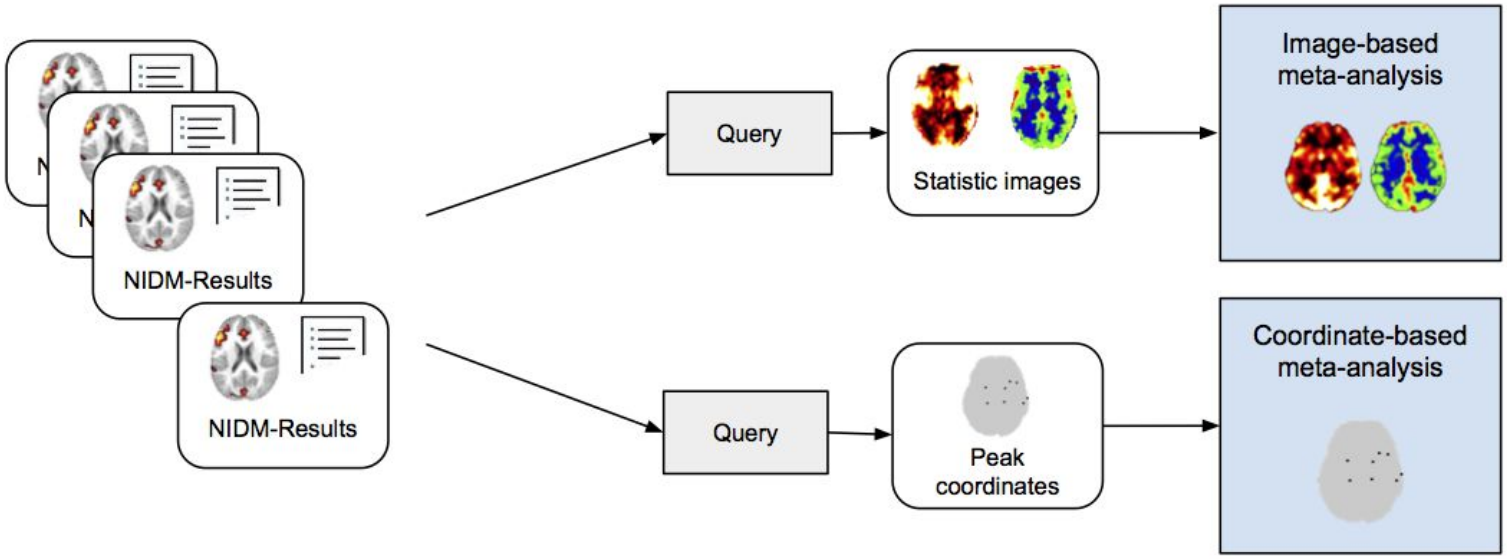
FSL

```
$ nidmfsl fsl_ds107_group 49 -g Control
```

https://github.com/incf-nidash/nidmresults-spm, https://github.com/incf-nidash/nidmresults-fsl

Data reuse

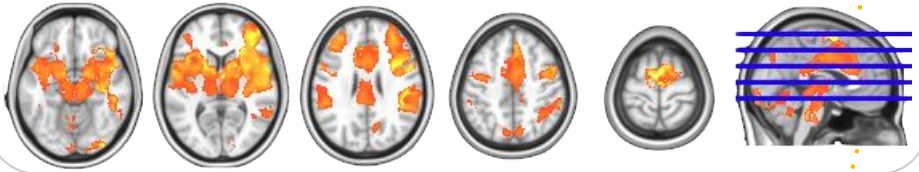
Meta-analysis with NIDM-Results



Coordinate-based meta-analysis



Image-based meta-analysis

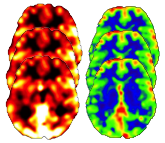


Scripts available at http://github.com/incf-nidash/nidmresults-paper

Sharing research artefacts

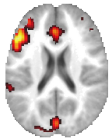


Preprocessing



Derived data

Statistical analysis





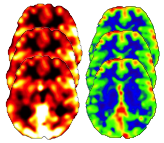
HAL, BiorXiv
Pubmed

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

Sharing research artefacts

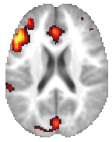


Preprocessing



Derived data

Statistical analysis





HAL, BiorXiv
Pubmed



NEUROVAULT

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

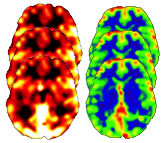
Beyond papers...

Sharing neuroimaging data

Sharing research artefacts

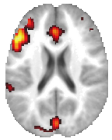


Preprocessing



Derived data

Statistical analysis





HAL, BiorXiv
Pubmed



NEUROVAULT

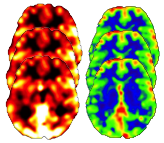
Image credits: Parcels 1 2 & 4 (CC0), Parcel 3 (CC0), Parcel 5 (CC0).

Sharing research artefacts



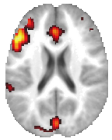


Preprocessing



Derived data

Statistical analysis





HAL, BiorXiv
Pubmed



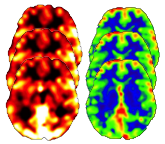
NEUROVAULT

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

Sharing research artefacts

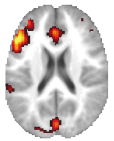


Preprocessing



Derived data

Statistical analysis







+ NIDM-Terms

HAL, BiorXiv
Pubmed





NIDM-Terms: A Community-Driven Controlled Vocabulary of Brain Initiative Imaging Experiments

Nazek Queder

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

Sharing research artefacts



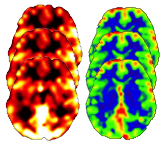


+ NIDM-Terms

NIDM-Terms: A Community-Driven Controlled Vocabulary of Brain Initiative Imaging Experiments

Nazek Queder

Preprocessing

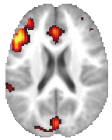


Derived data



???

Statistical analysis





HAL, BiorXiv
Pubmed

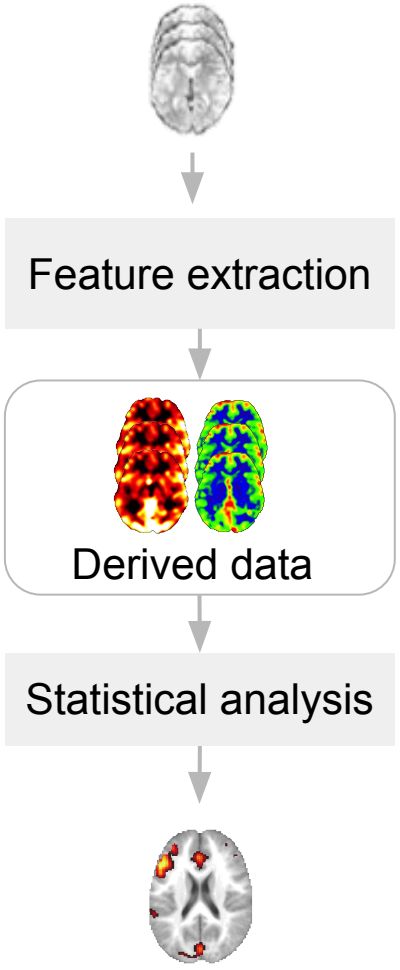


NIDM

NEUROVAULT

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

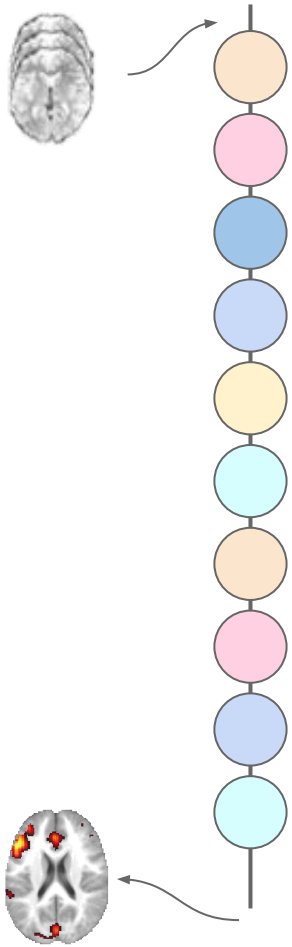
Analytic variability



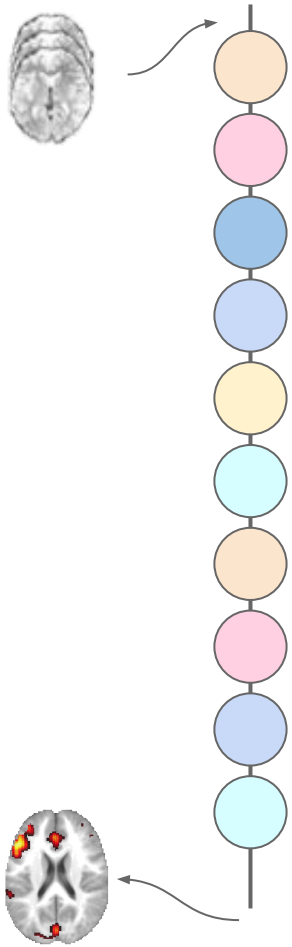
"Different **acceptable** analysis methods"

Carp et al. (2012)

Analytic variability



Analytic variability



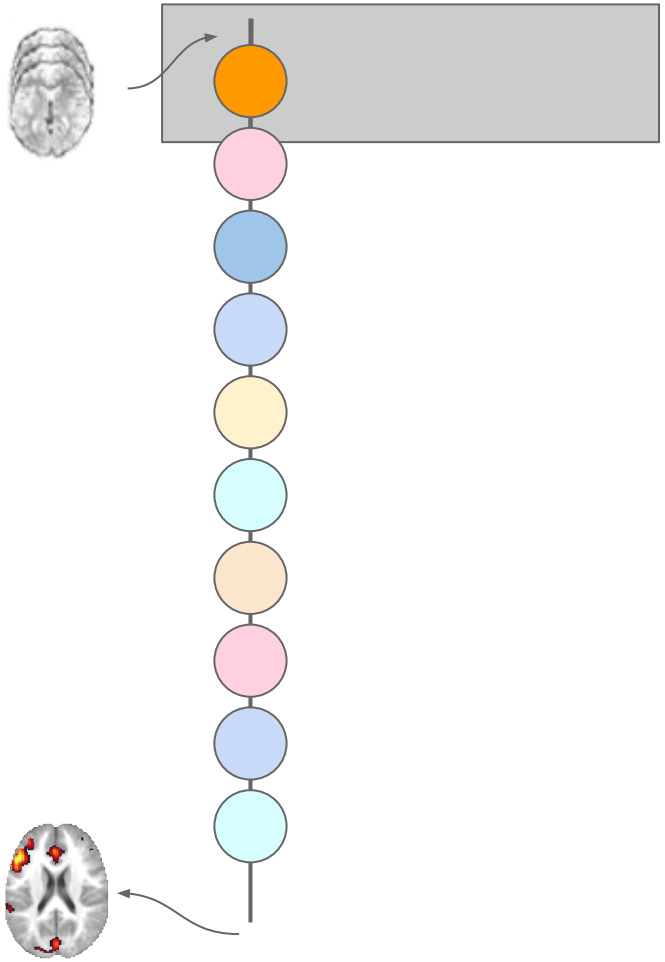
Spatial registration

Segmentation

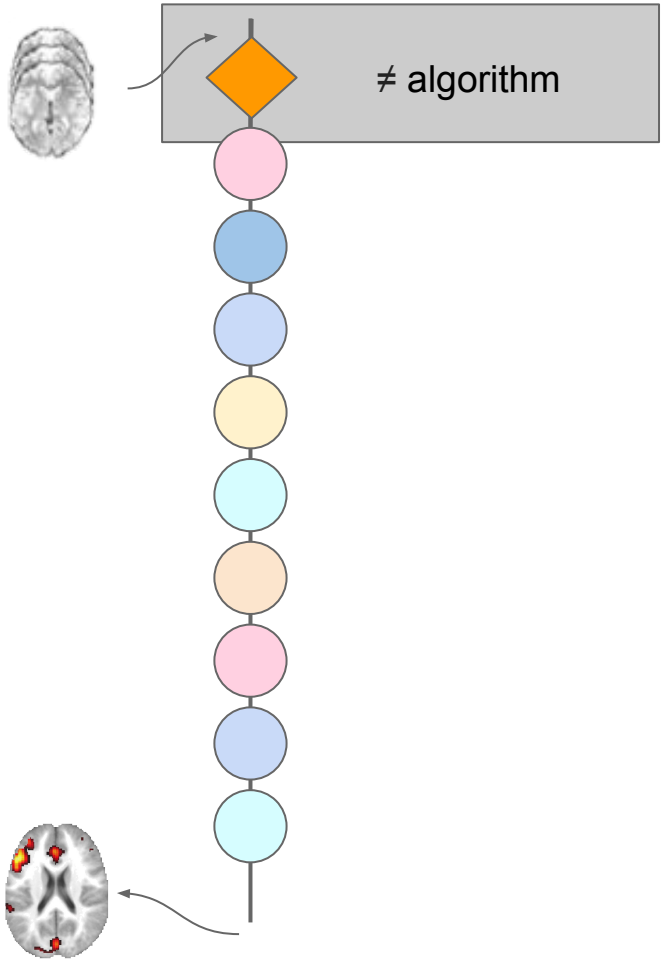
Cross-modality registration

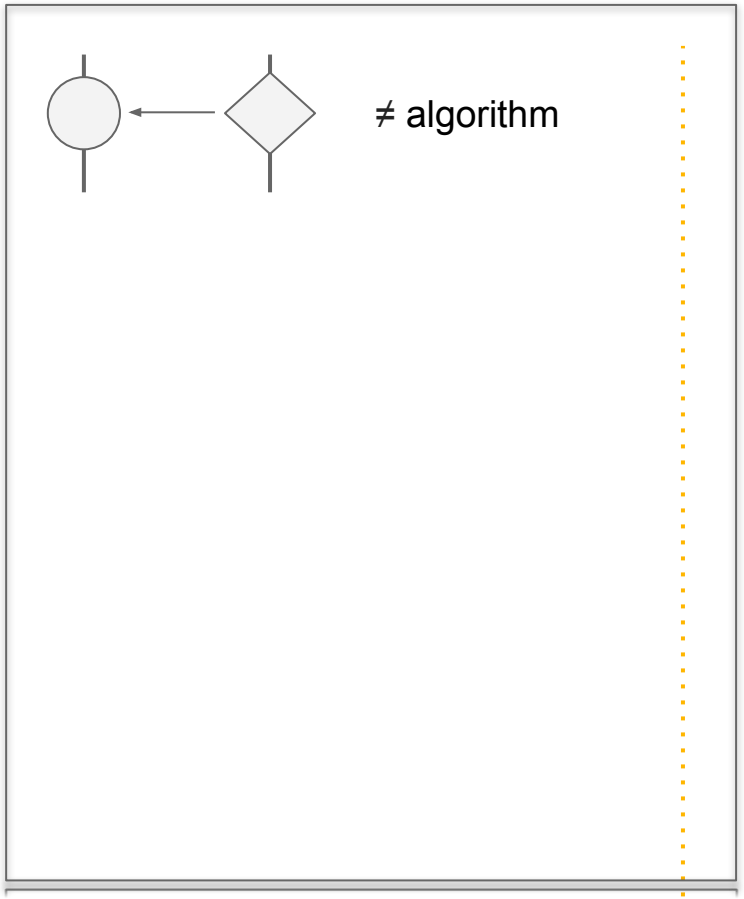
etc.

Analytic variability

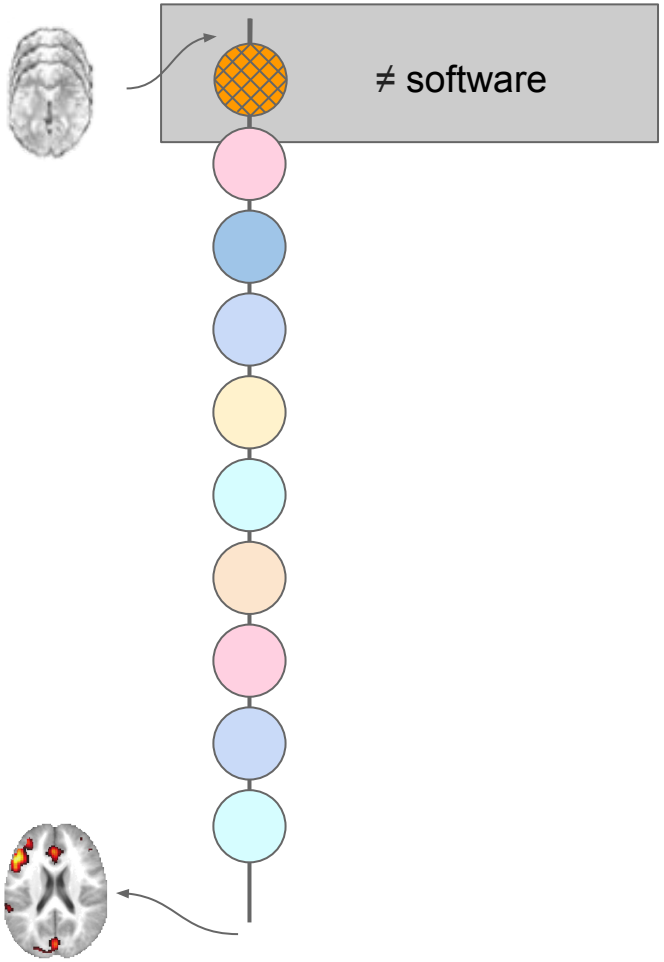


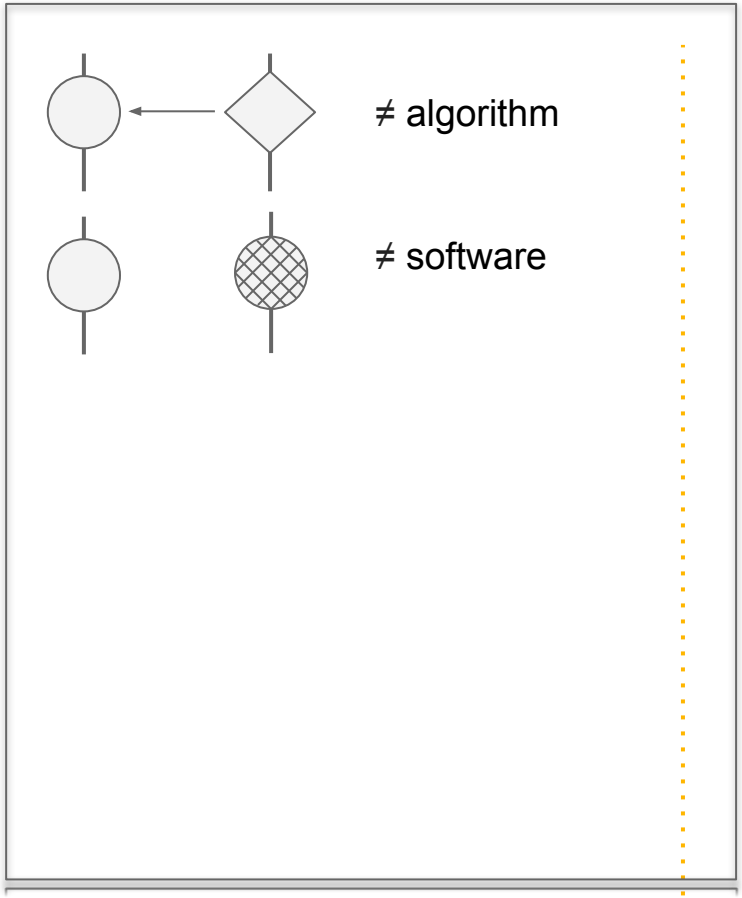
Analytic variability



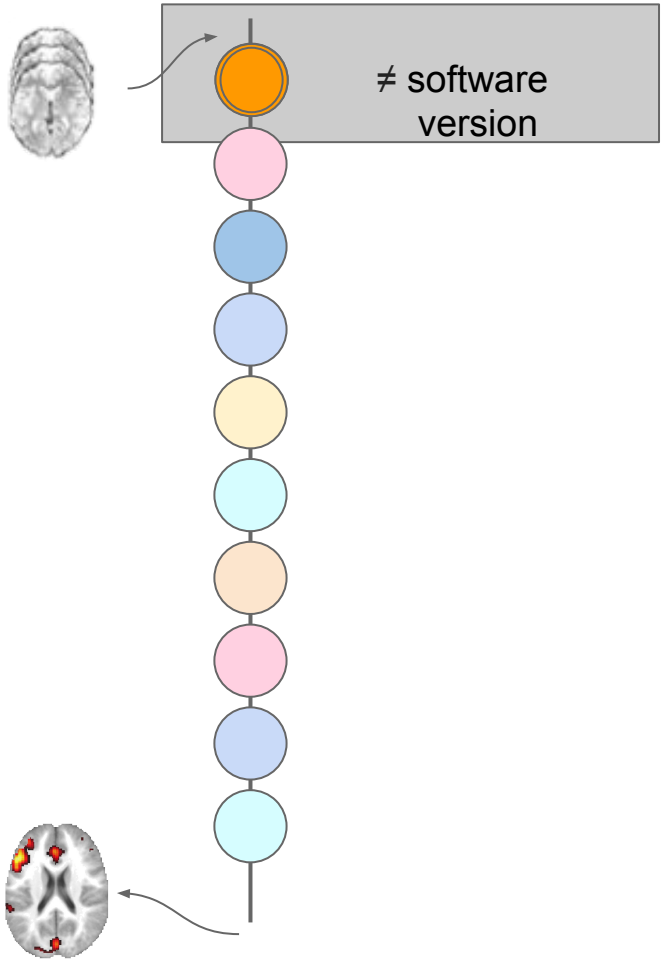


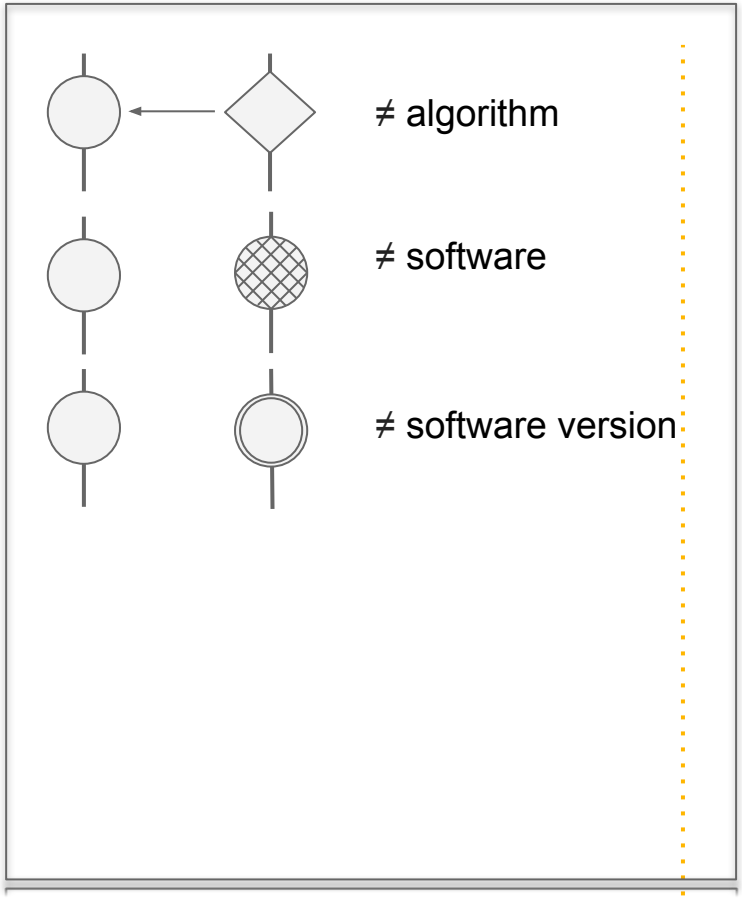
Analytic variability



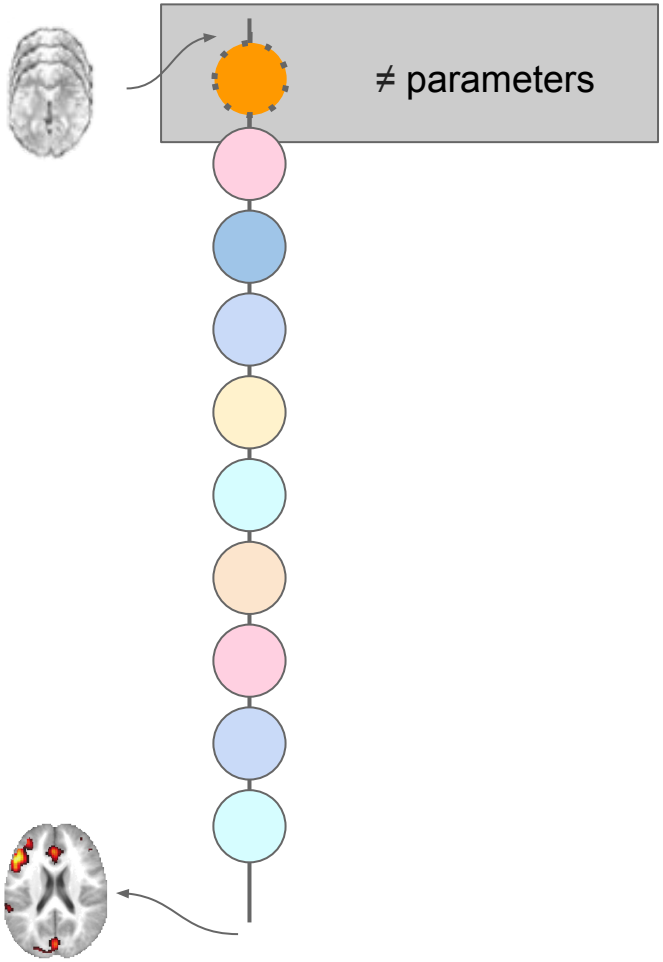


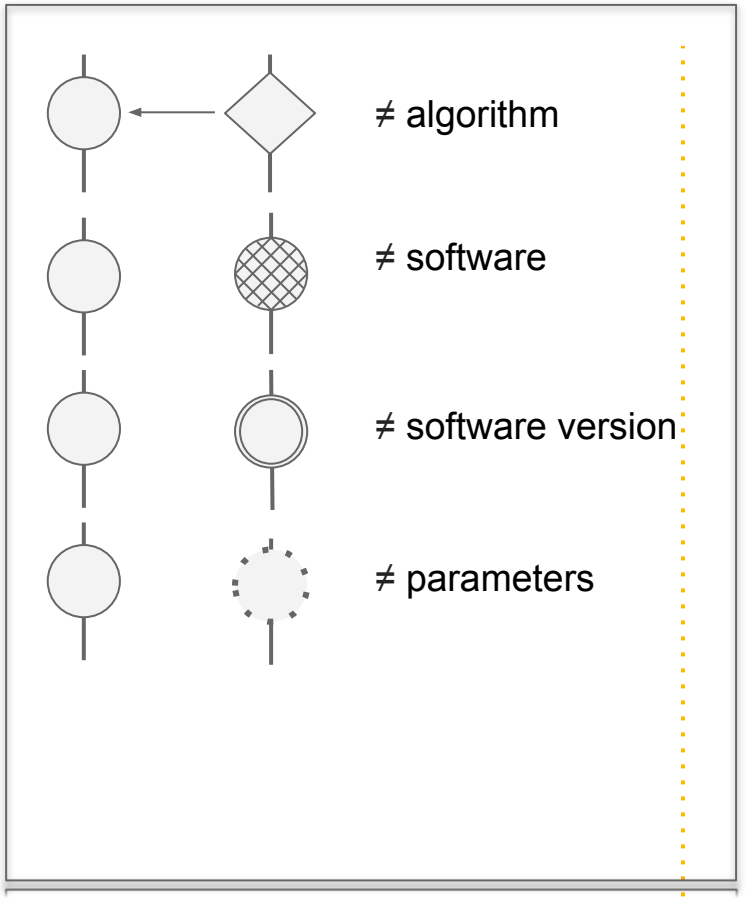
Analytic variability



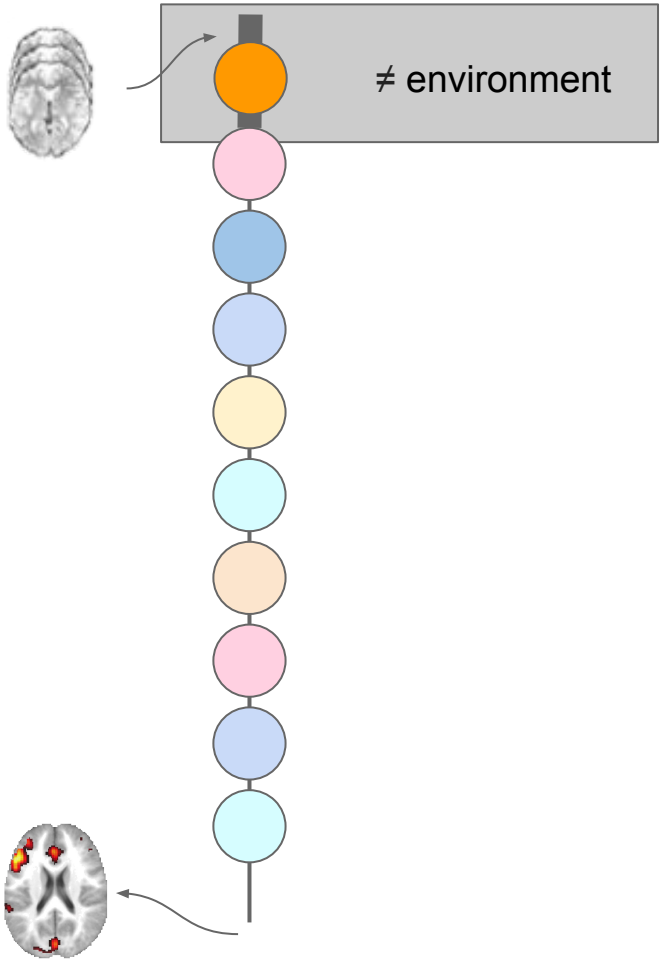


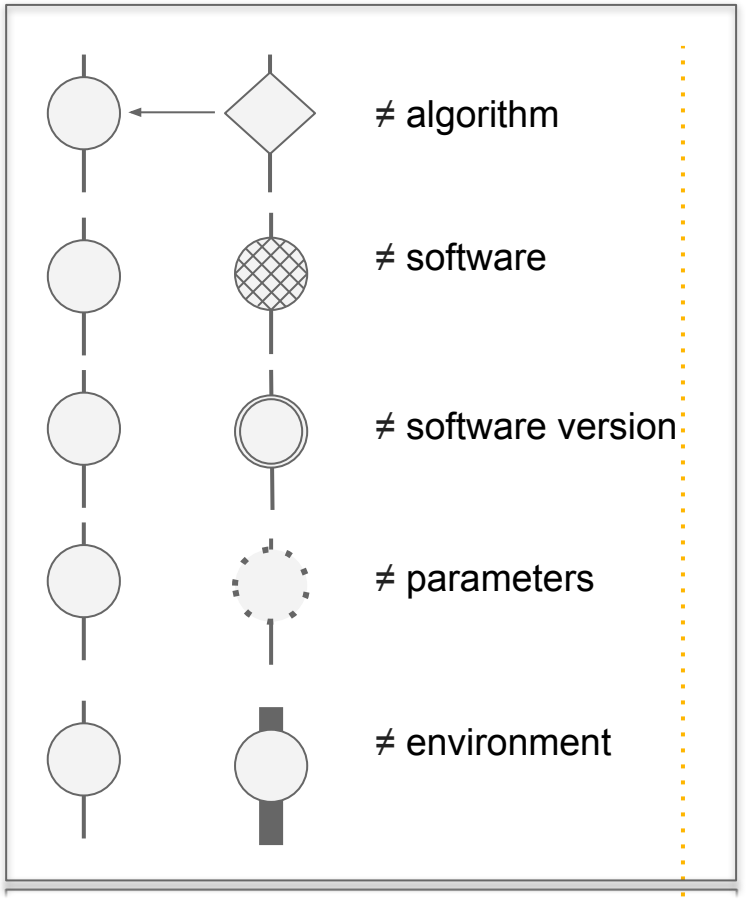
Analytic variability



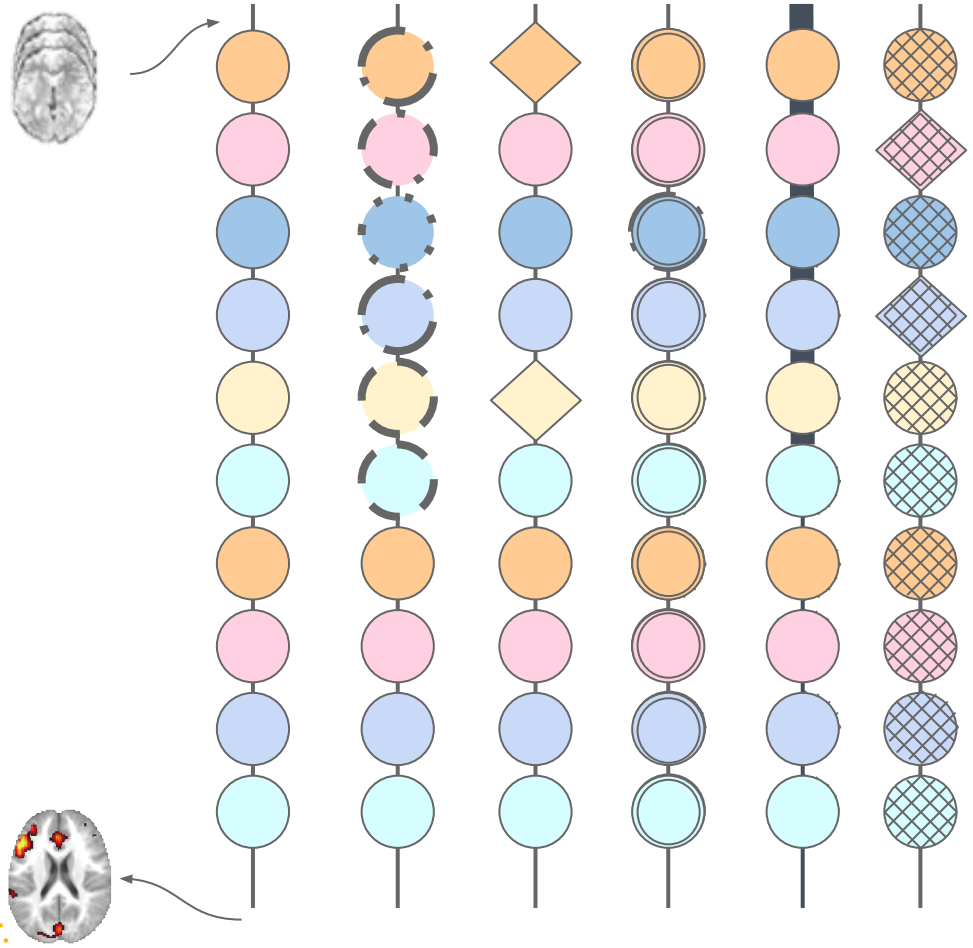


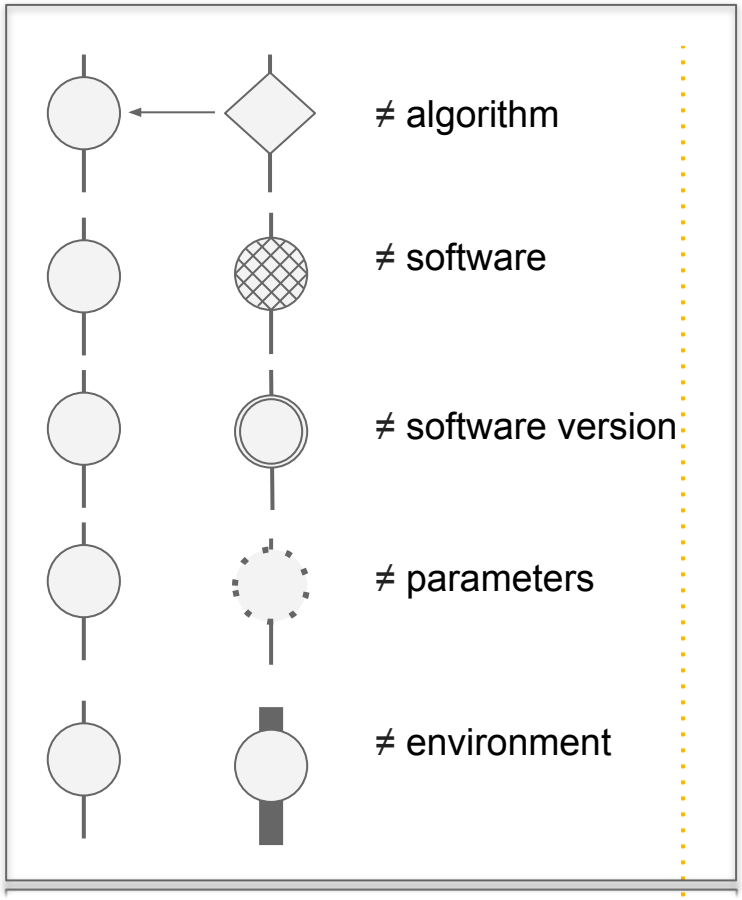
Analytic variability



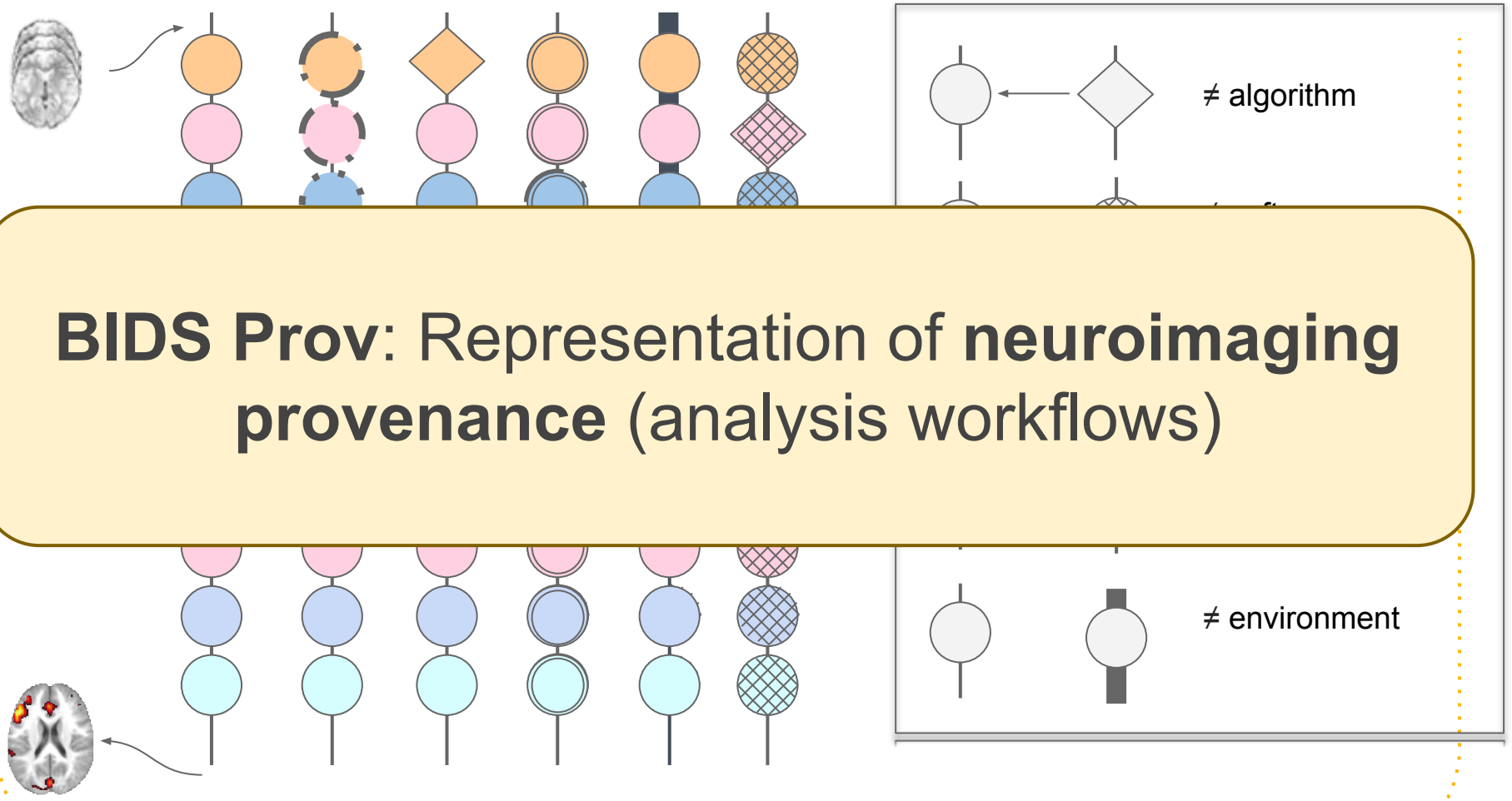


Analytic variability





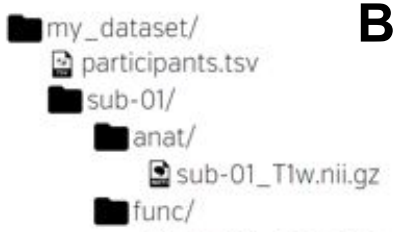
Analytic variability



BIDS Prov: Representation of **neuroimaging provenance** (analysis workflows)

BIDS Prov **Bridging BIDS & NIDM**

BIDS

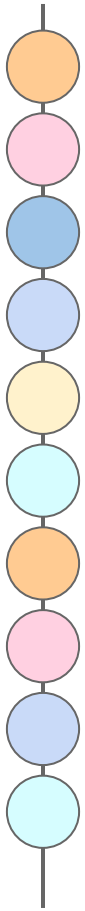


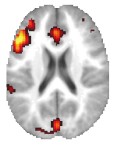


File naming convention + JSON files

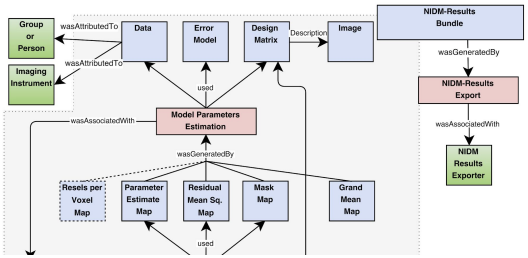
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60 labs worldwide





NIDM



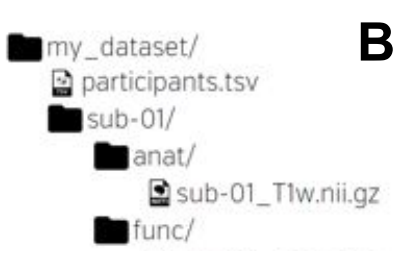
Semantic web (RDF)

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10 labs US / Europe / Canada

BIDS Prov **Bridging BIDS & NIDM**

BIDS





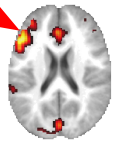
File naming convention + JSON files

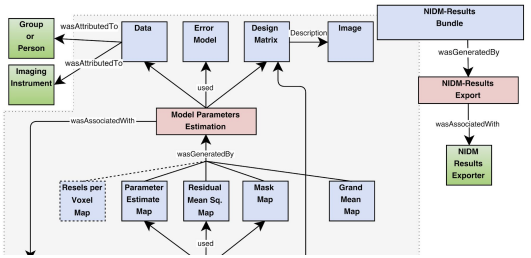
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Enabler JSON-LD

NIDM





Semantic web (RDF)

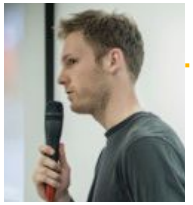
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10 labs US / Europe / Canada

BIDS Provenance



Satra Ghosh



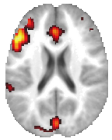
Rémi Adon



Preprocessing

Derived data

Statistical analysis



BEP028	Provenance	Satra Ghosh and Camille Maumet	new BEP, actively looking for contributors and community input.

BIDS
BRAIN IMAGING DATA STRUCTURE



Looking for contributors and community input

Join us!

https://github.com/bids-standard/BEP028_BIDSprov

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

Sharing more than research papers **for transparent & reusable research**

Camille Maumet

Thank you!

Join BIDS Prov - BEP028

- https://github.com/bids-standard/BEP028_BIDSprov

Credit: Presentation template by SlidesCarnival, adapted

@cmaumet