Orchestrating cloud networks for discoverable, accessible, interoperable, and reusable neuroscience *W*592

brainlife.io

an online platform to accelerate scientific discovery by automated data management, large-scale analyses, and visualization.

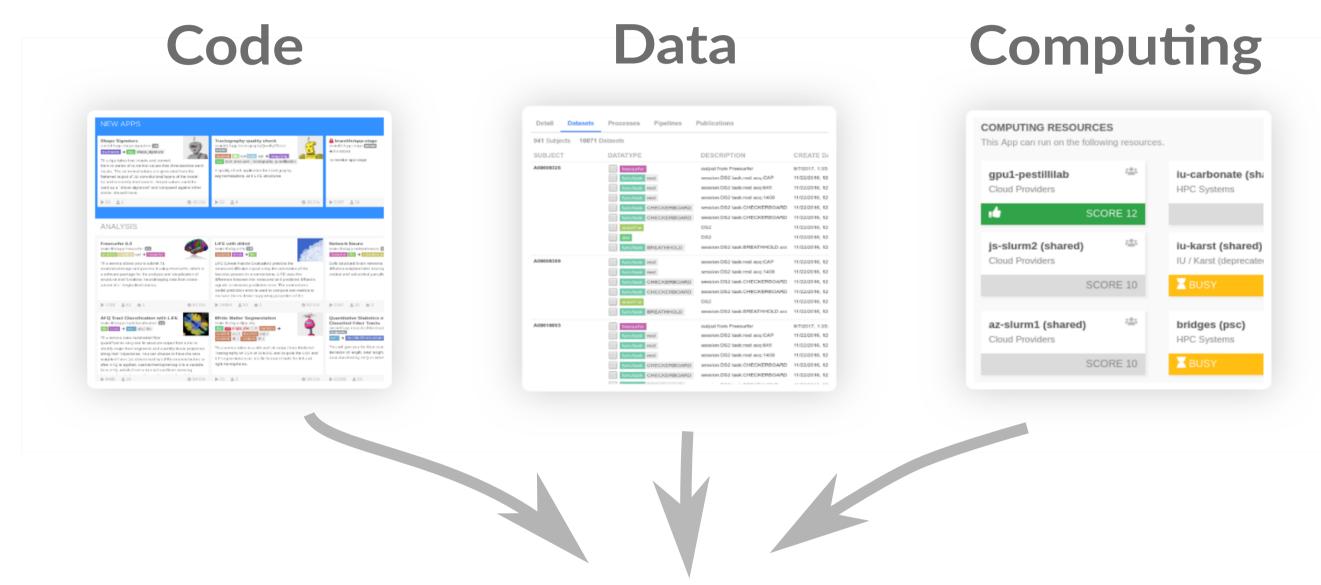


Project Goal

Neuroscience is engaging at the forefront of science by dissolving disciplinary boundaries and promoting transdisciplinary research. This process can facilitate discovery by convergent efforts from theoretical, experimental and cognitive neuroscience, as well as computer science and engineering.

To assure the success of this process, the current lack of established mechanisms to promote open sharing data, software and scientific results must be overcome. Promoting open software and data sharing has become paramount to addressing the problem of scientific reproducibility.

We address challenges to neuroscience open sharing and reproducibility by providing integrative mechanisms for publishing data, and algorithms while embedding them with computing resources to impact multiple scientific communities.



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Department of Psychological and Brian Sciences, Indiana University



UPLOAD DATA

Upload and organize large data files securely on our cloud storage and share them with your collaborators.

Convert your data to BIDS



brainlife.io

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Upload through Web UI

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	Datatype tags add context to the datatype. It can not be changed once archived.	
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ANALYZE DATA

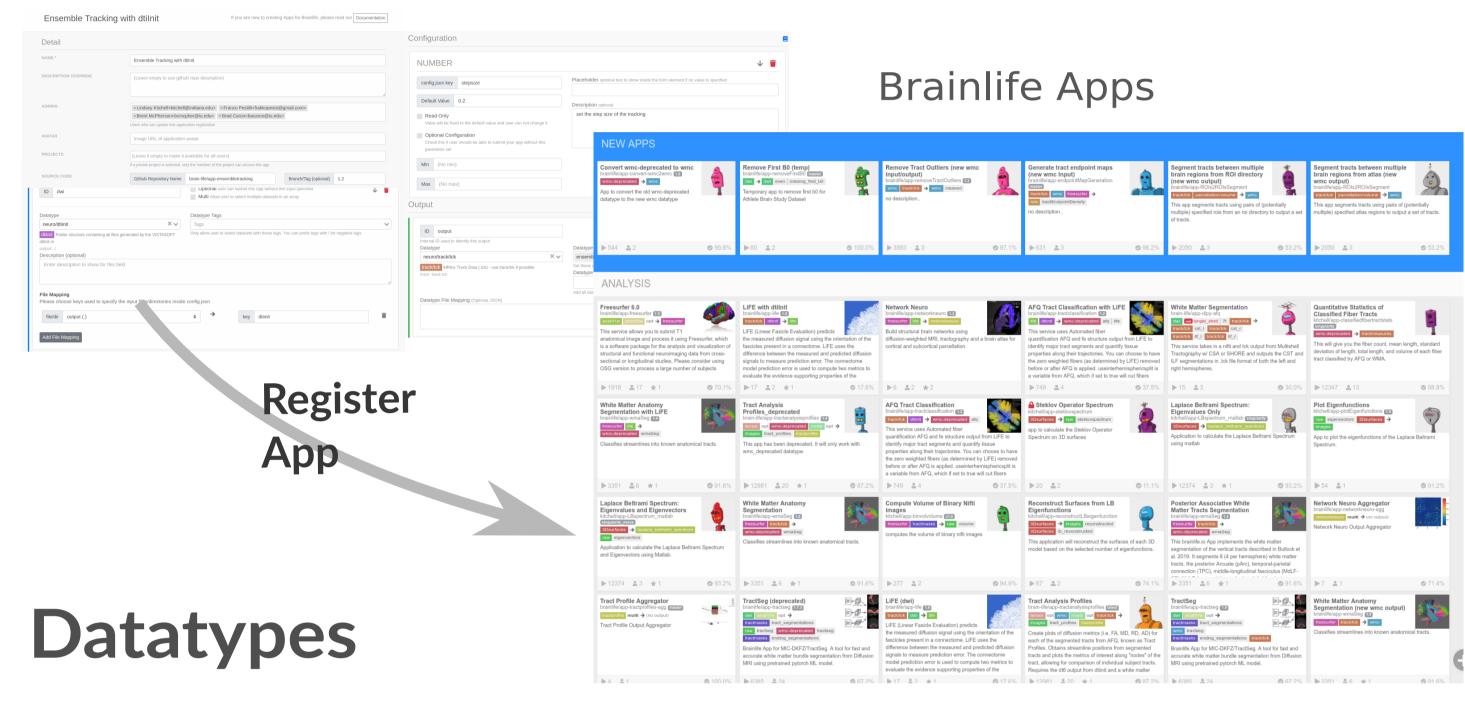
You can analyze your data and experiment with close to 200 Apps currently registered on Brainlife. Our simple web based user interface allows you to discover / learn new analysis methods

3. Monitor progress and partial output

Computational Reproducibility

Apps

brainlife.io users can register their analyses as reusable Apps. Apps are simply github.com repositories written following the brainlife.io App specification. Apps can be either an end-to-end scientific workflow or a modular step within a larger analysis pipeline. Most brainlife.io Apps are small analyses modules, they are composable. brainlife.io users can mix and match Apps to build flexible processing pipelines that best fits their data and needs.



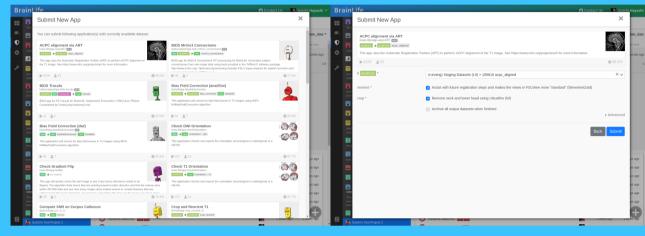
brainlife.io datatypes allow Apps to interoperate. Datatypes can be passed between Apps. The brainlife.io platform uses datatypes to recognize the type of data being processed, and to match data with analyses. brainlife.io datatypes are all related to each other by the Apps that uses them, below the network of brainlife.io datatypes.

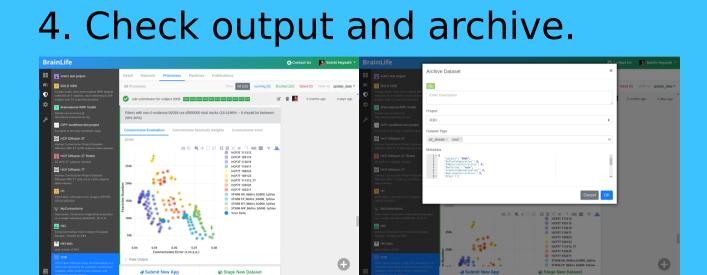
developed by various developers.

1. Select Input data / stage out of archive

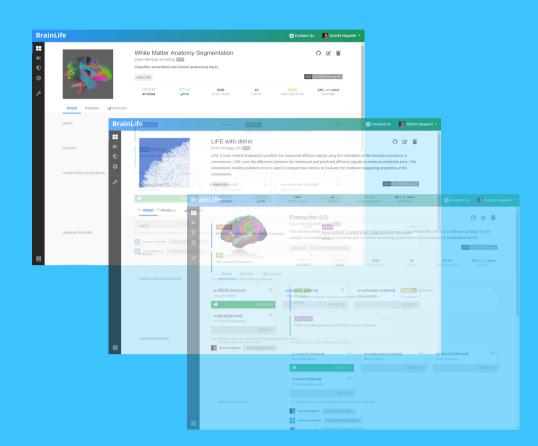
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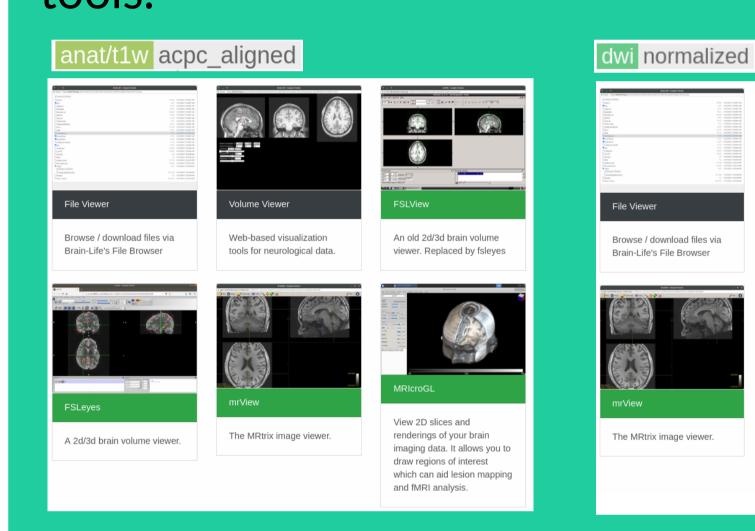


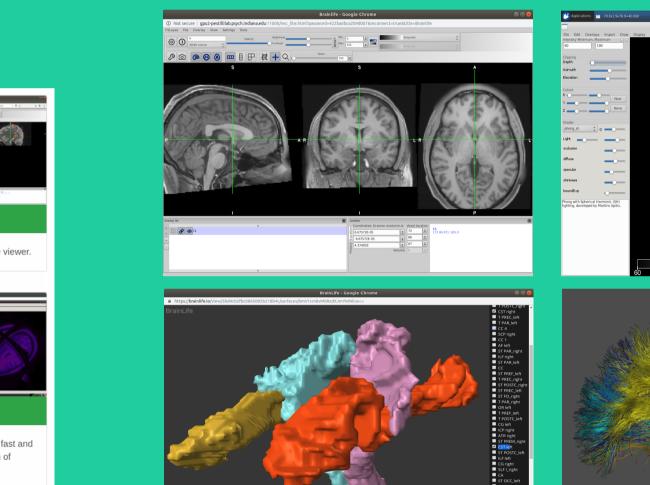
5. Discover / learn new analysis

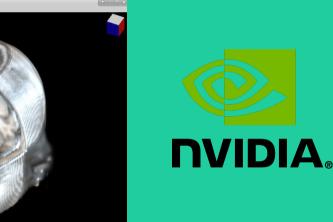


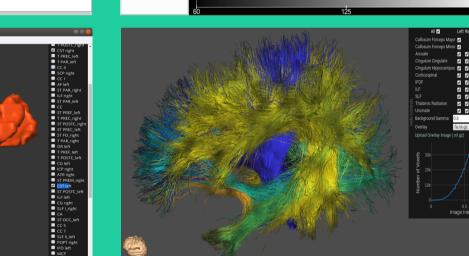
VISUALIZE RESULTS

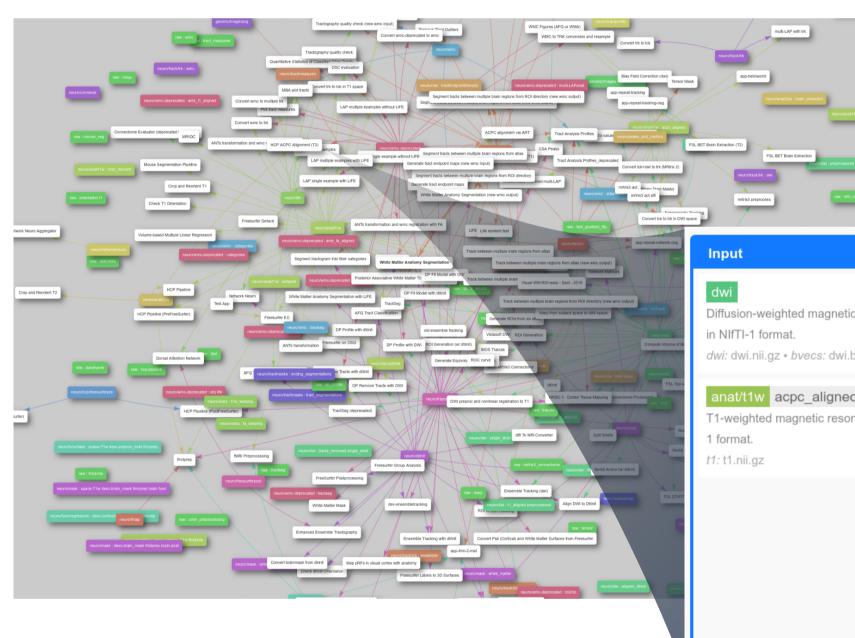
You can visualize your data using different set of visualizers registered to each datatype directly on the cloud. We provide popular UIs such as fsleyes, freeview, mricrogl, mrview, etc. via our GPU enabled virtual desktop (no need to install anything) as well as various advanced web visualization tools.







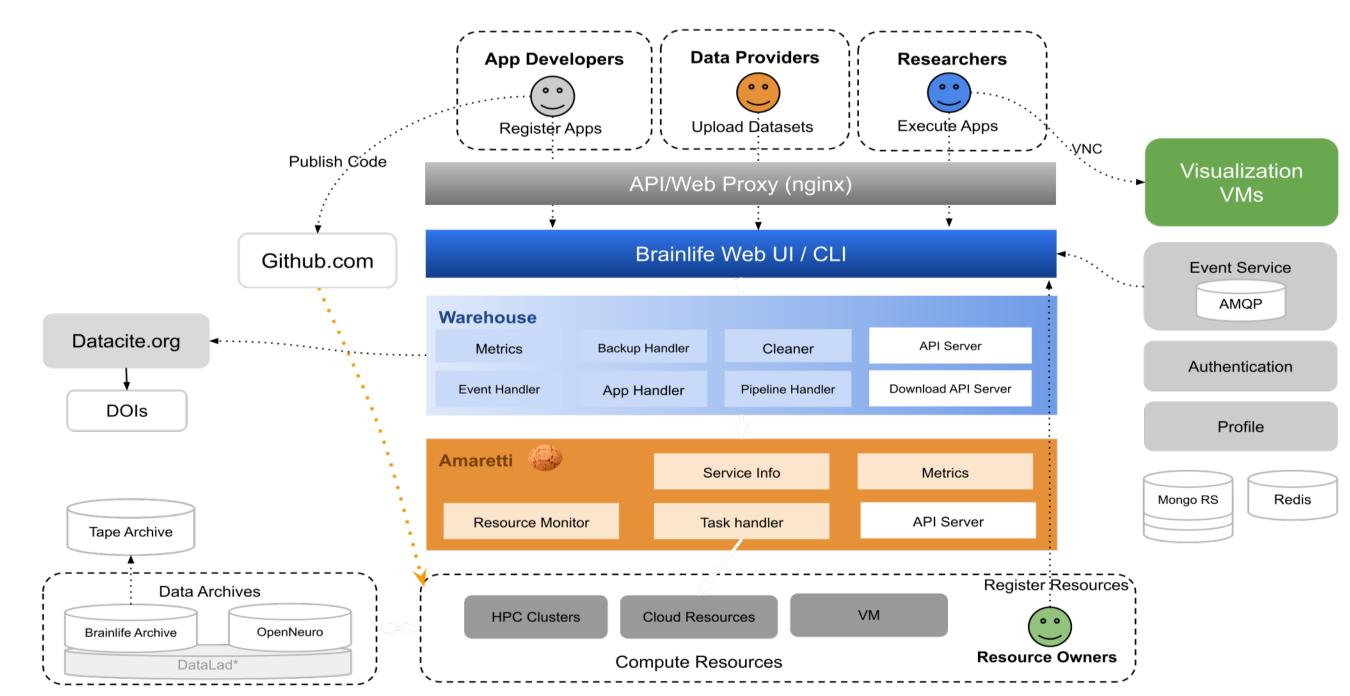




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Architecture

Brainlife platform is constructed as a collection of open-sourced* microservices that are distributed across multiple docker hosts and VMs running on jetstream-cloud. brainlife.io has a primary web user interface that communicates users inputs and requests to the data management system, the Warehouse. The Warehouse manages data, visualization and Apps and communicates with Amaretti. Amaretti is brainlife.io meta orchestration service that allows monitoring and processing across multiple high performance compute resources and clouds. * https://github.com/brainlife



BULK PROCESSING

Brainlife allows you to bulk process 1000s of subjects through our novel rule based pipeline submission mechanism just as easily as you would process an individual subject. Your jobs can be executed on our shared cloud computing resources, or on your own computing resources.

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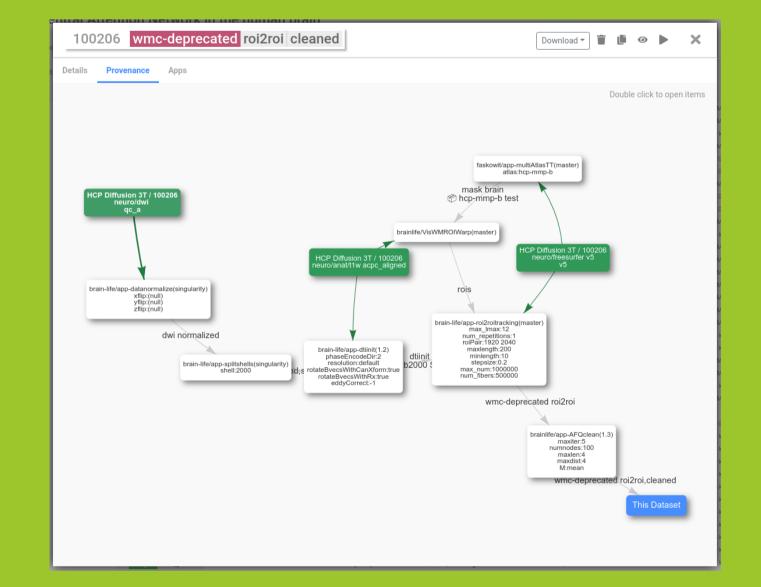
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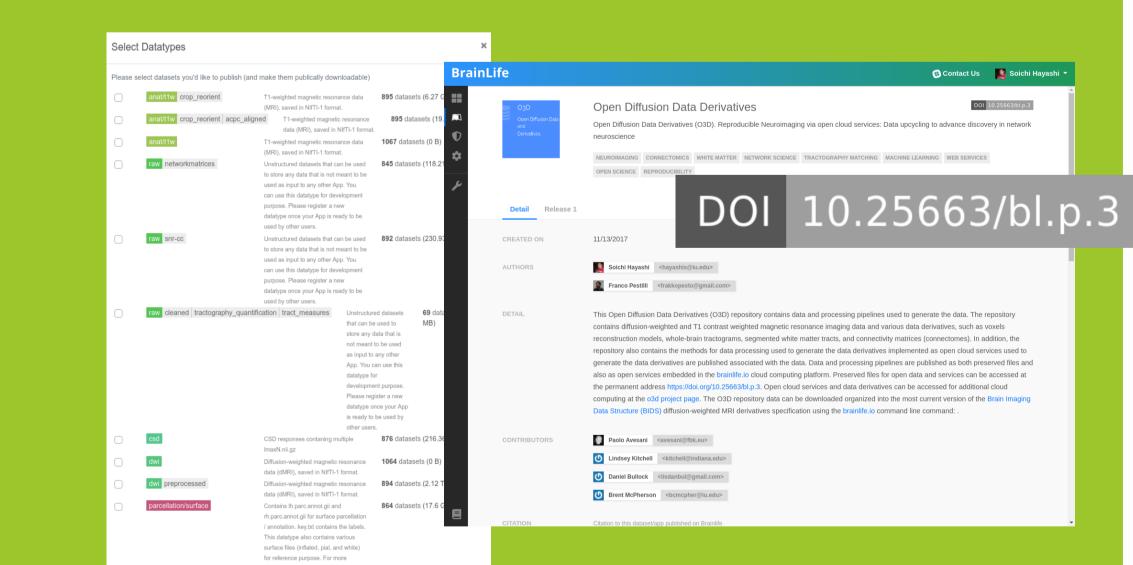
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	(a) A00056307	Comp Free	2 months ago	3 days ago
	(a) A00056022	Comp Free	2 months ago	3 days ago
	(a) A00053203	Mult Netw Comp Whit	2 months ago	2 hours ago
	(a) A00051604	Mult Netw Comp Whit	2 months ago	2 hours ago
	(d) A00044068	Comp	2 months ago	3 days ago
	(d) A00040798	Comp	2 months ago	2 days ago
	(d) A00039758	Mult Netw Comp Whit	2 months ago	32 minutes ago
	(d) A00038731	Mult Netw Comp Whit	2 months ago	1 hour ago
	Remo	Mult Netw Comp Whit	2 months ago	47 minutes ago
	idai A00035561	Mult Netw Comp Whit	2 months ado	56 minutes ado

PUBLISH RESULTS

Brainlife automatically captures full provenance of each output as you run analysis.



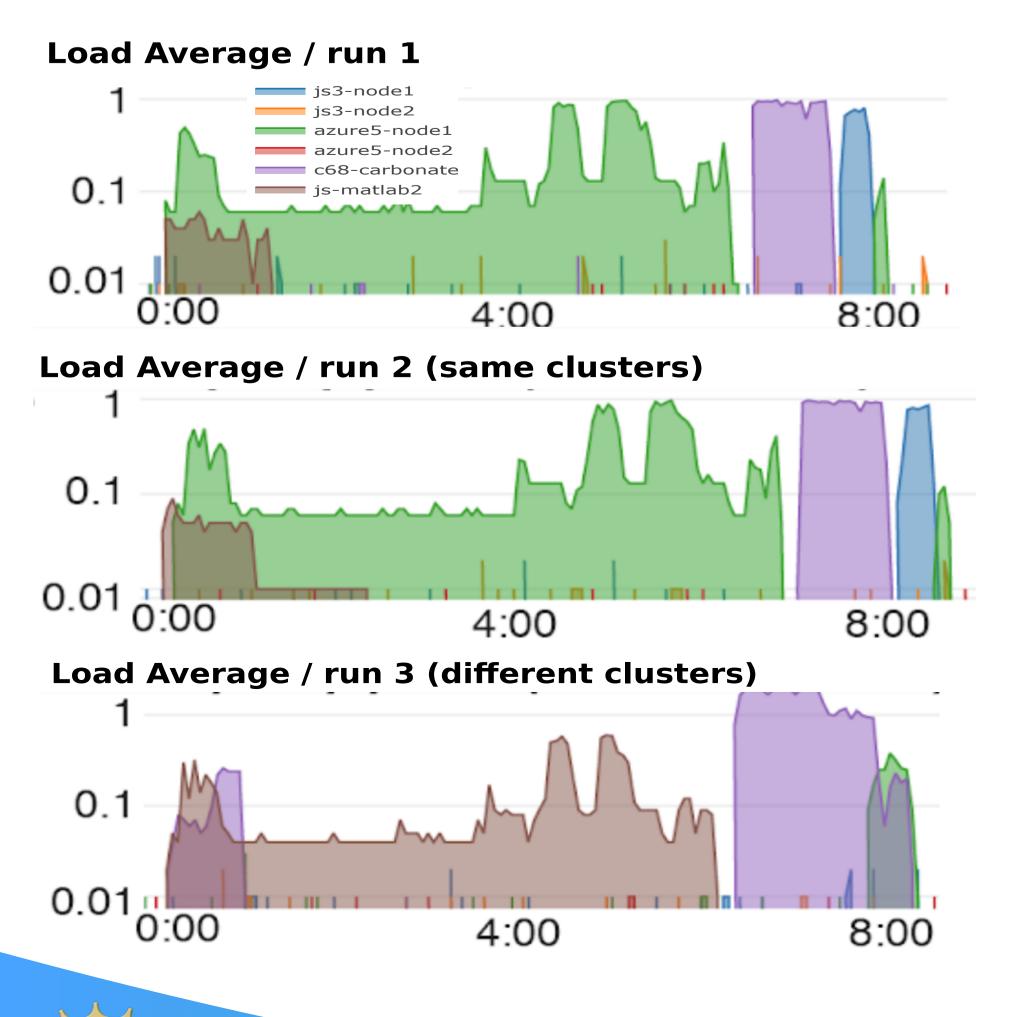
Your data derivatives and code used to generate your datasets can be published on Brainlife under a single DOI.



Avesani2019 SDATA-18-00053C

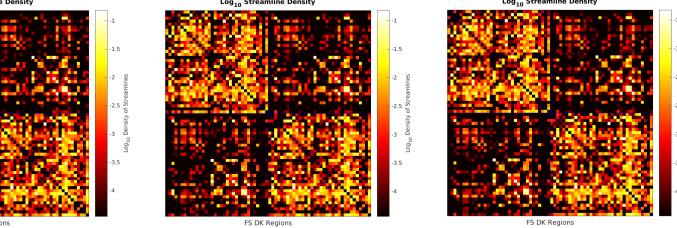
Reproducibility

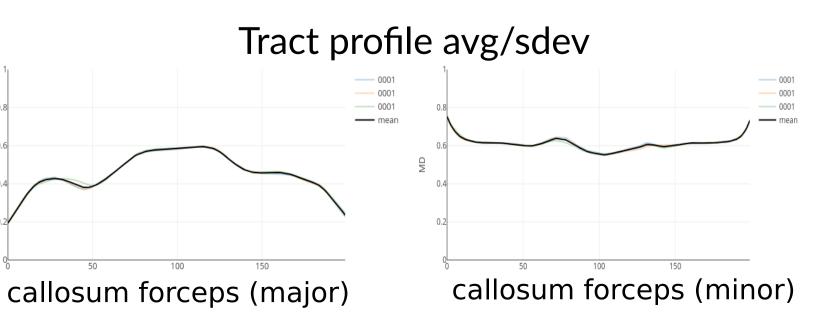
brainlife.io keeps track of all the information you need to reproduce your analyses. The data being analyzed, the Apps being used to perform the analyses (all the way down to their github.com commit ID), the parameter set for the App. Most brainlife.io Apps use singularity to containerize their execution environment to allow reproducibility. We have performed a series of experiments to demonstrate that brainlife.io can deploy Apps across diverse computing resources and obtain near-identical results (i.e., within the expected stochasticity).



Consistent results across all runs

Network Neuro / Connectivity Edge Density



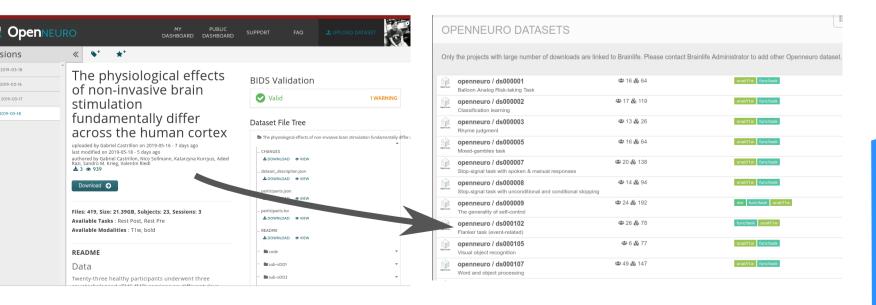


Freesurfer output (qualitative)



Interoperability

brainlife.io interoperates with a number of common data, and computing standards as well as other platforms. For example, brainlife.io can import and export most BIDS datypes (anat, dwi, fmri, fmap). brainlife.io also interoperates with a series of open science projects and data providers such as NKI, OpenNeuro, and the Human Connnectome Project. A series of DIPY workflows are available as brainlife.io Apps.



We are also actively engaging with other neuroimaging communities such as DataLad, boutique, CBRAIN and others to incooporate their technologies and to enhance our capability as well as to build stronger relationships with our community members.



Brainlife Team





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