Sylvain Baillet

Neurology & Neurosurgery, and Computer Science
Montreal Neurological Institute, McGill University

on behalf of the Brainstorm project

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@sylvain_baillet,
@brainstorm2day

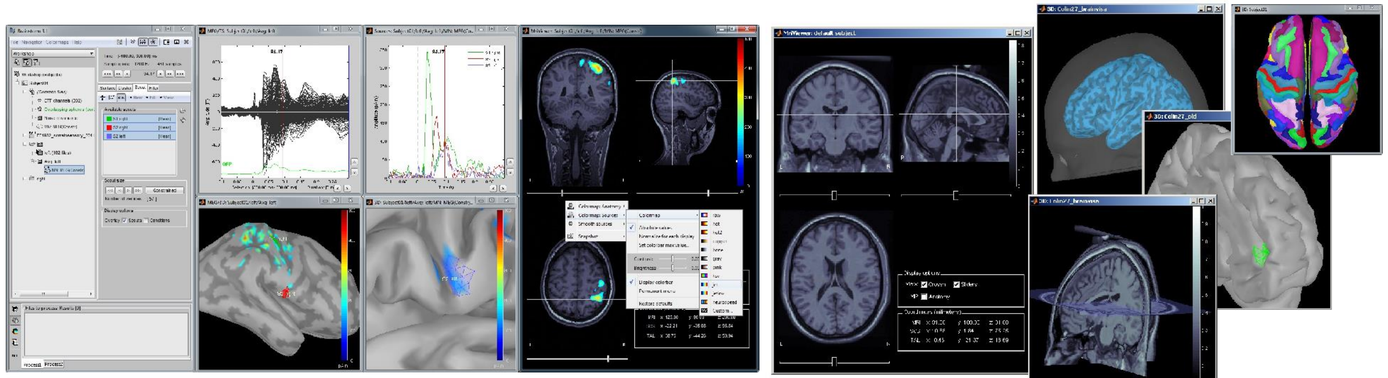
Baillet Lab

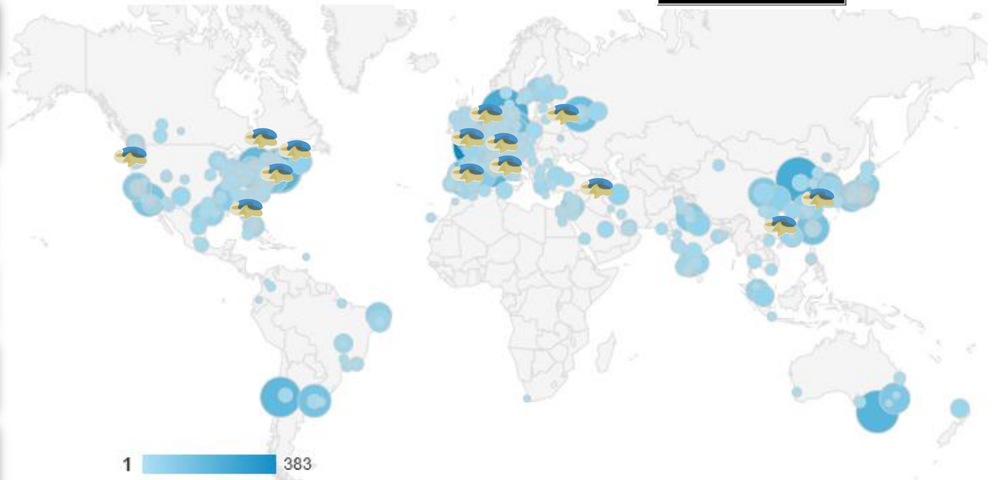
good software enables good scientific practices

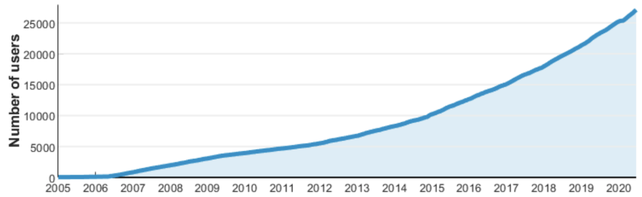
- **Define good software**

- features relevant tools
- easy to learn
- easy to use
- welcoming, supportive community
- foolproof
- evolutive
- interoperable
- enables shareable processes
- free to users would be nice.

Brainstorm is a free, open app for multimodal e-phys, MRI & NIRS







>43,000 registered accounts
45 training sessions, >2500 attendees
>3,300 user journal articles (since 2011)

The Brainstorm team

Principal investigators

Sylvain Baillet, PhD

Professor, Director MEG Research
Acting Director, *McConnell Brain Imaging Centre, Montreal Neurological Institute*
McGill University, Montreal, QC Canada

Richard M. Leahy, PhD

Signal & Image Processing Institute, Director
University of Southern California, Los Angeles, CA USA

John C. Mosher, PhD

Professor and Scientific Director, Magnetoencephalography
University of Texas Health Science Center at Houston, USA

Software engineers

François Tadel, MSc

Grenoble Institut des Neurosciences / Inserm
Université Grenoble Alpes, France

Martin Cousineau, MSc

McConnell Brain Imaging Centre, Montreal Neurological Institute
McGill University, Montreal, QC Canada

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Tadel et al., *Comp, Intel Neurosci* (2011)
Tadel et al., *Front Neurosci* (2019)
Nasiotis et al., *Scientific Data* (2019)
Niso et al., *NeuroImage* (2016)
Niso et al., *Front Neurosci* (2019)
Niso et al., *Scientific Data* (2019)

Baillet Lab neuro speed Baillet Lab neuro speed McGill

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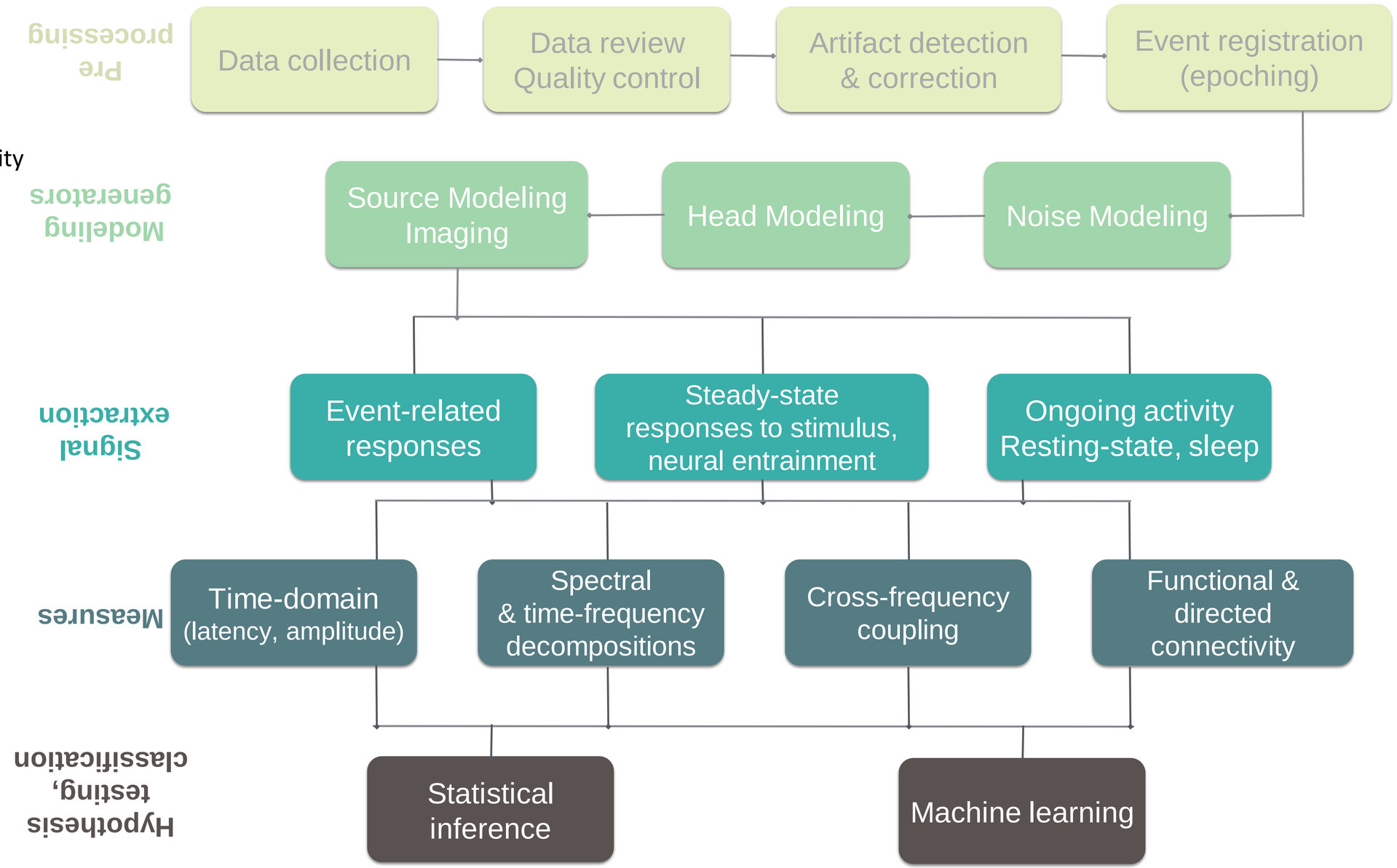
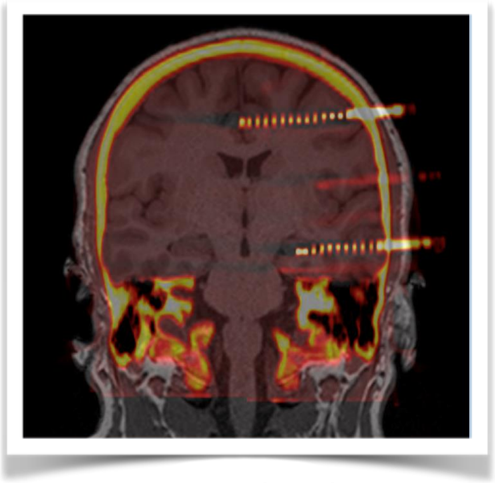


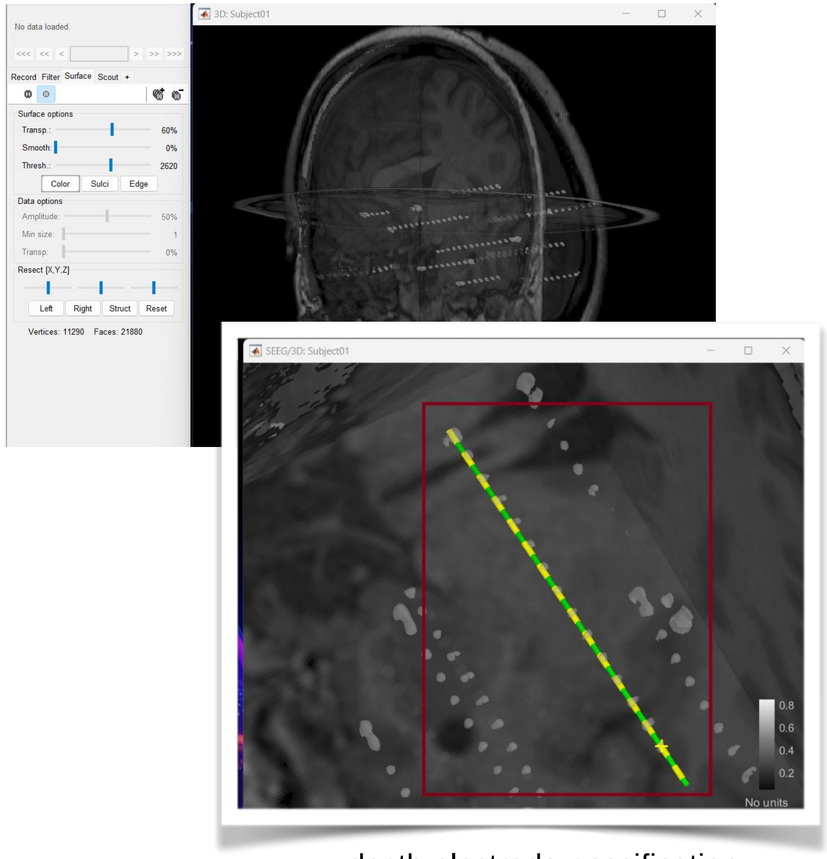
Baillet, *Nature Neurosc*ience (2017)

just added !

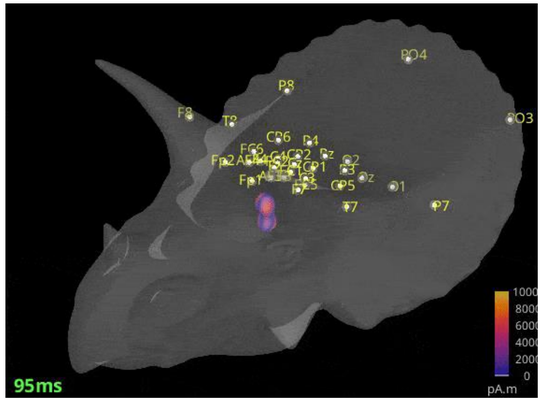
pre/post op resection volume detection



CT-MRI registration



depth-electrode specification



neurosaurology

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Brainstorm
http://neuroimage.usc.edu/brainstorm

USC McGill neuro UTHealth

News

- **Problems with automatic updates**: Read this page
- **New courses**: Kentucky (Fall) - Register
- **Software updates**: What's new | Follow us on Facebook and GitHub
- **Find users by location**:

Star
Like 2.2K

Introduction

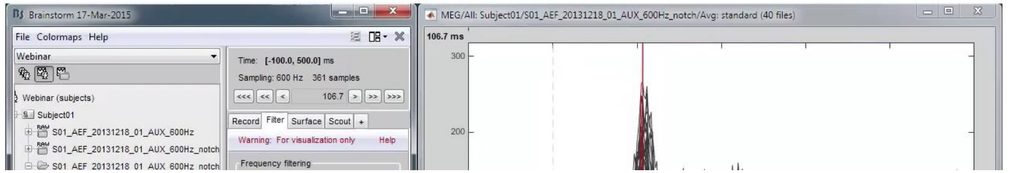
Brainstorm is a collaborative, open-source application dedicated to the analysis of brain recordings: MEG, EEG, fNIRS, ECoG, depth electrodes and multiunit electrophysiology.

Our objective is to share a comprehensive set of user-friendly tools with the scientific community using MEG/EEG as an experimental technique. For physicians and researchers, the main advantage of Brainstorm is its rich and intuitive graphic interface, which does not require any programming knowledge. We are also putting the emphasis on practical aspects of data analysis (e.g., with scripting for batch analysis and intuitive design of analysis pipelines) to promote reproducibility and productivity in MEG/EEG research. Finally, although Brainstorm is developed with Matlab (and Java), it does not require users to own a Matlab license: an executable, platform-independent (Windows, MacOS, Linux) version is made available in the downloadable package. To get an overview of the interface, you can watch this introduction video.

Since the project started by the end of the 1990's, our server has registered more than 27,000 accounts. See our reference page for a list of published studies featuring Brainstorm at work.

The best way to learn how to use Brainstorm, like any other academic software, is to benefit from local experts. However, you may be the first one in your institution to consider using Brainstorm for your research. We are happy to provide comprehensive online tutorials and support through our forum but there is nothing better than a course to make your learning curve steeper. Consult our training pages for upcoming opportunities to learn better and faster.

Finally, have a look regularly at our What's new page for staying on top of Brainstorm news and updates and Like us on Facebook to stay in touch. We hope you enjoy using Brainstorm as much as we enjoy developing and sharing these tools with the community!



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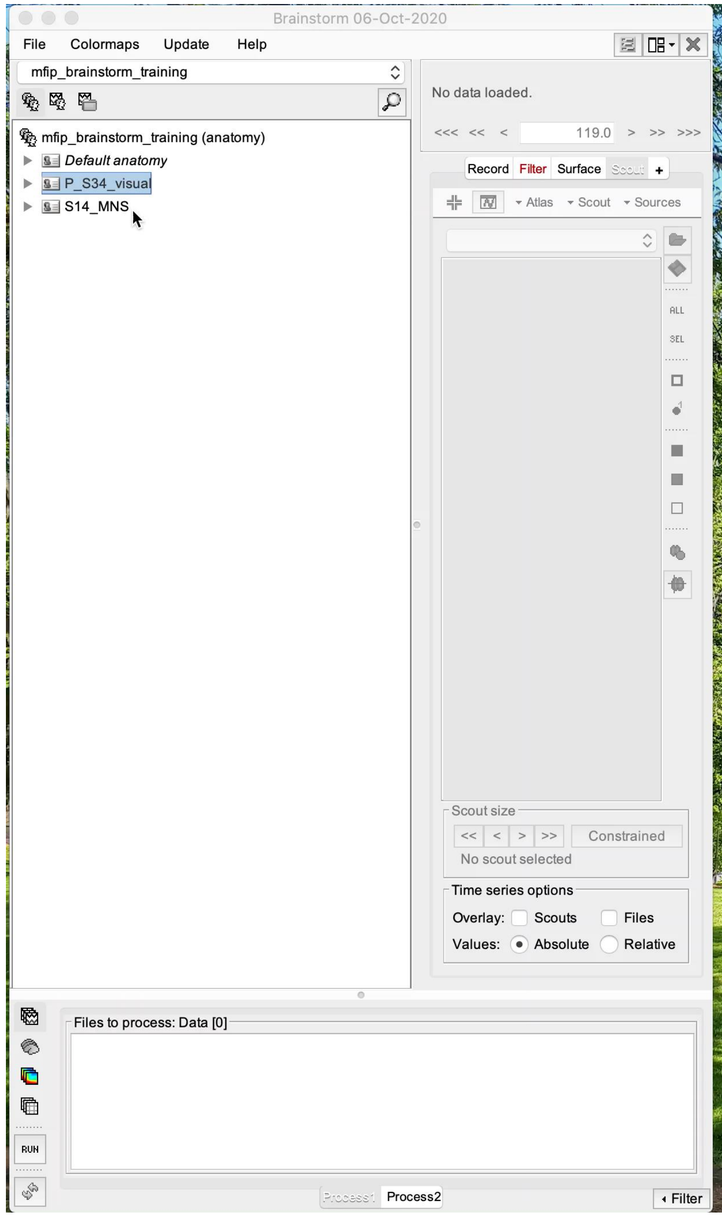

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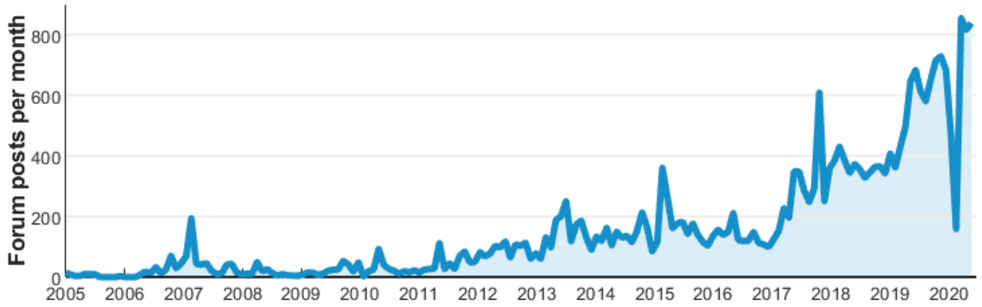

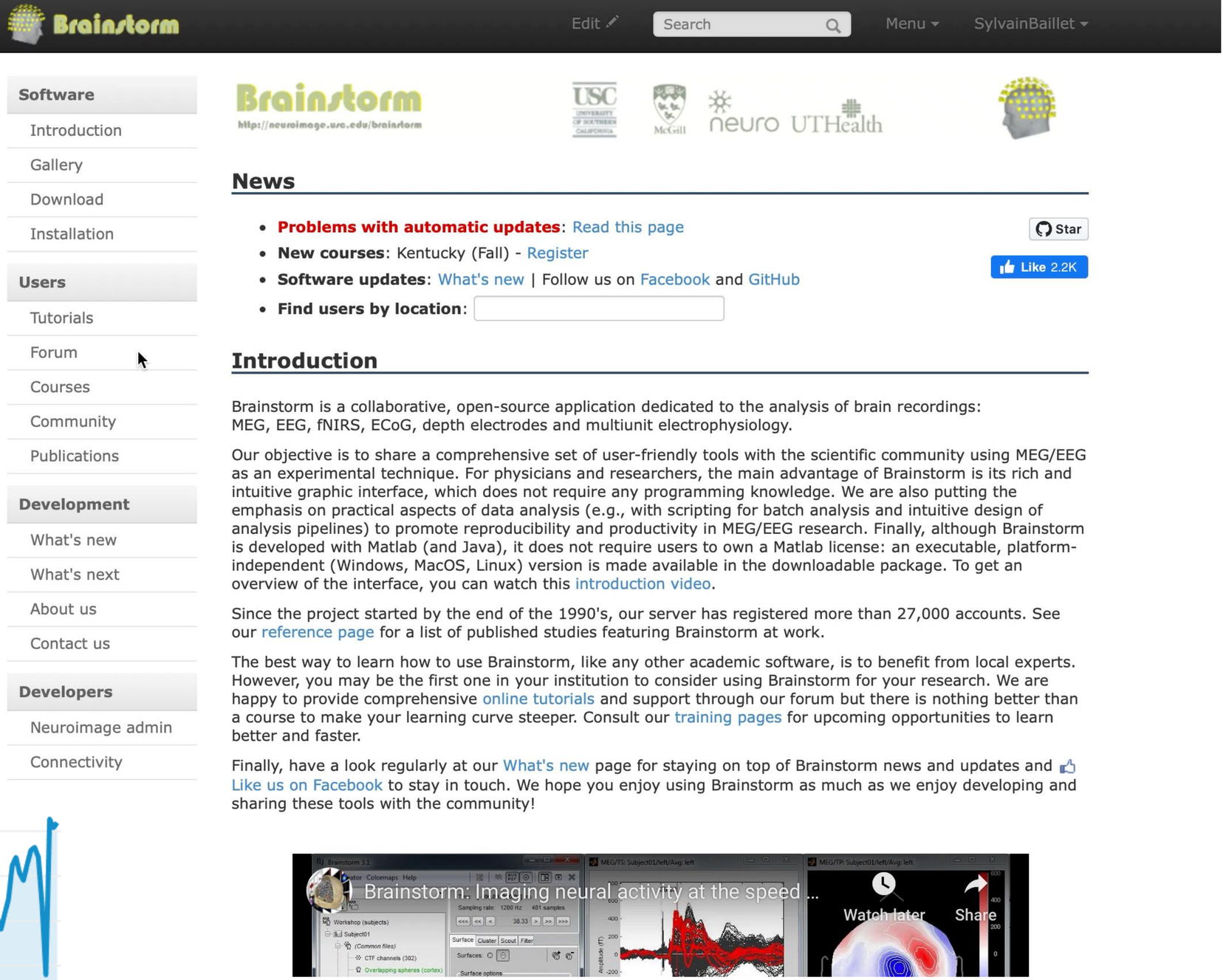

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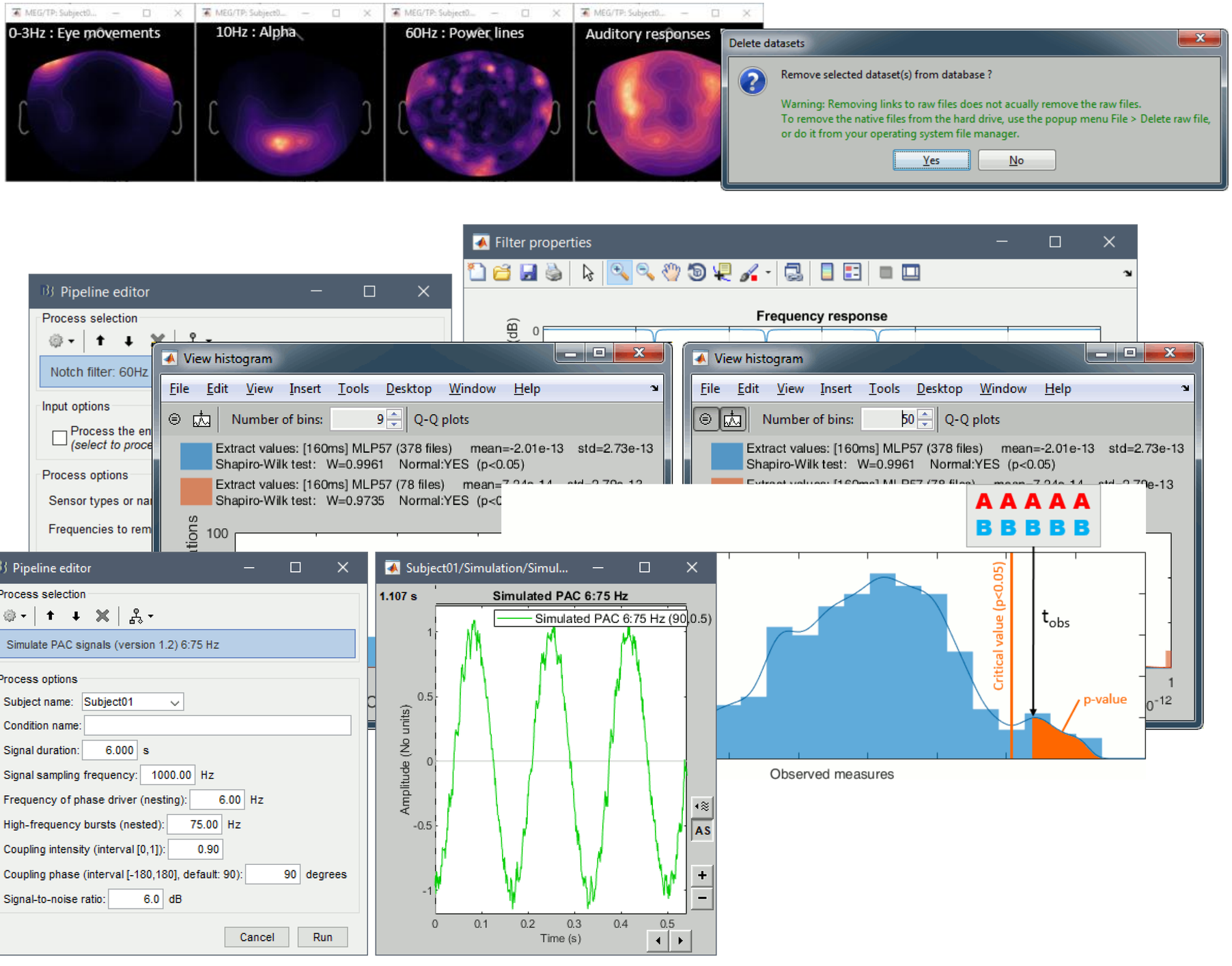

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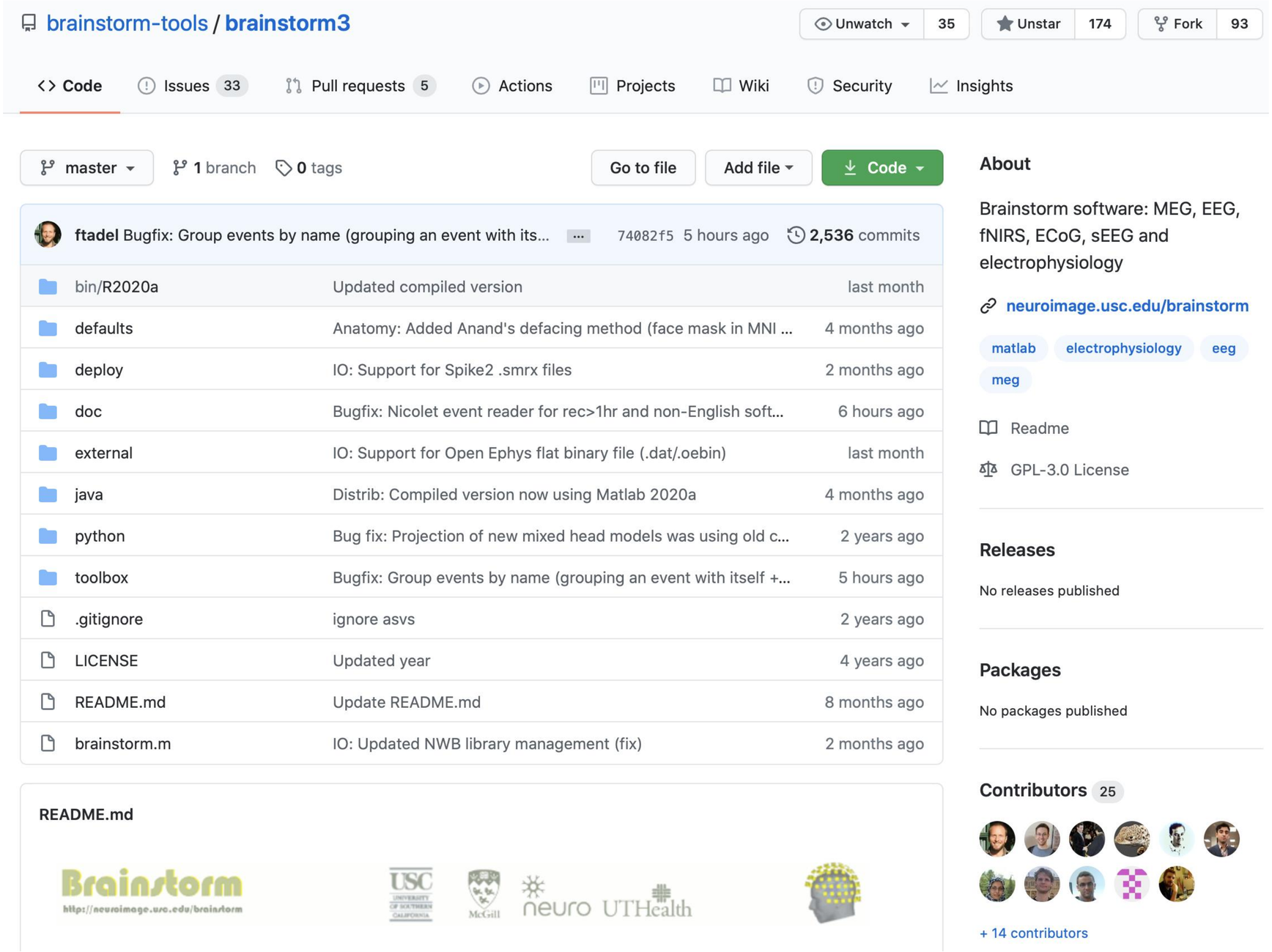

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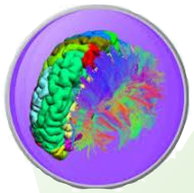
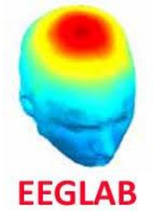
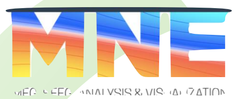
FreeSurfer







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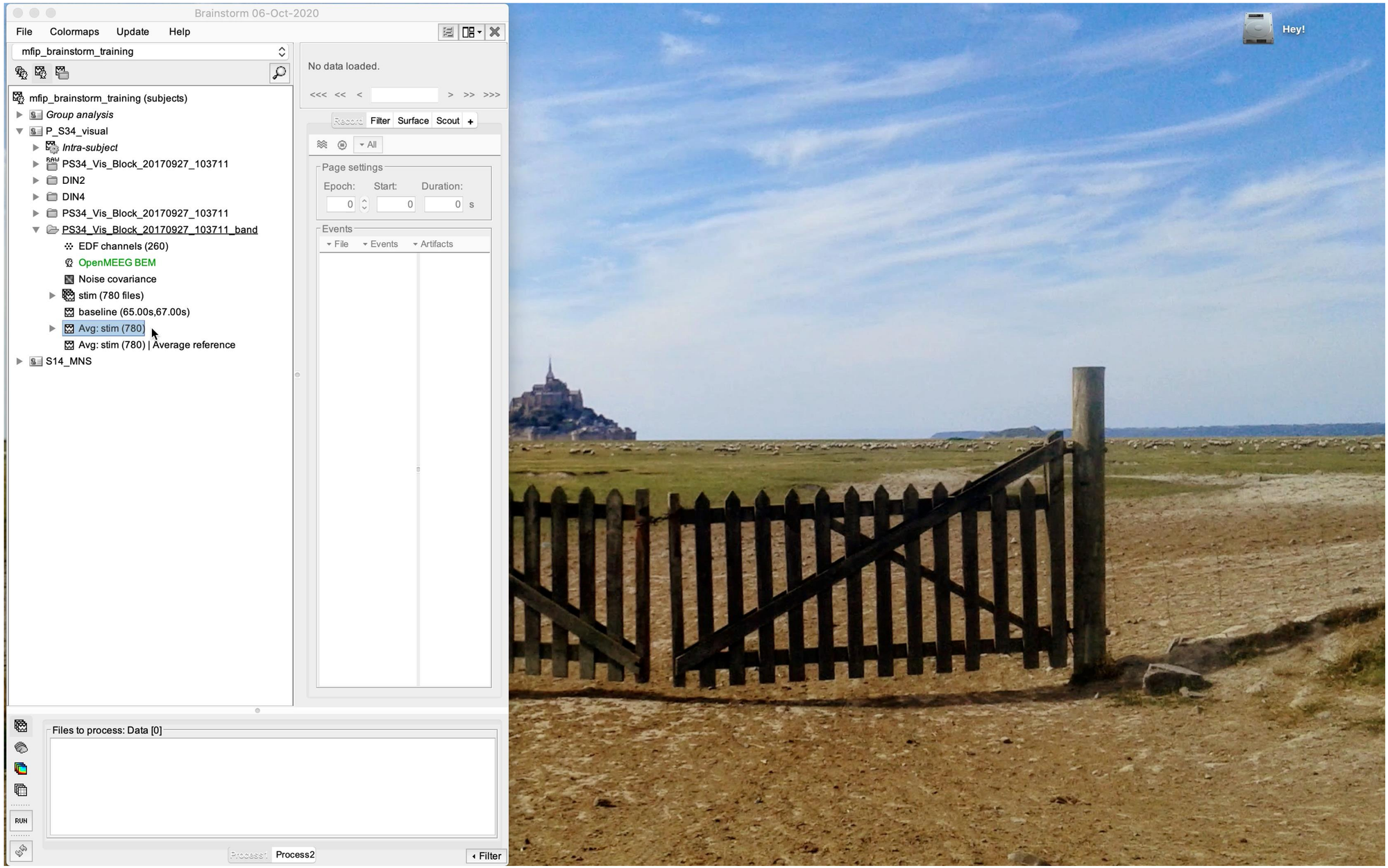

frontiers in Neuroscience

METHODS
published: 05 April 2019
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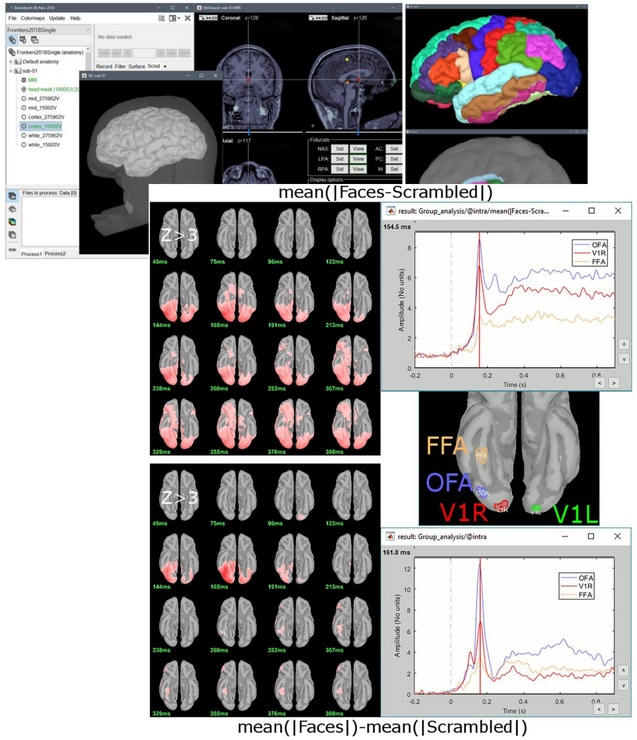
MEG/EEG Group Analysis With Brainstorm

François Tadel[1,2,3], Elizabeth Bock[1], Guiomar Niso[1,4,5], John C. Mosher[6], Martin Cousineau[1], Dimitrios Pantazis[7], Richard M. Leahy[8] and Sylvain Baillet[1]*

[1] McConnell Brain Imaging Centre, Montreal Neurological Institute, McGill University, Montreal, QC, Canada, [2] INSERM U1216 Grenoble Institut des Neurosciences (GIN), Grenoble, France, [3] Grenoble Institut des Neurosciences, Université Grenoble Alpes, Grenoble, France, [4] Center for Biomedical Technology, Universidad Politécnica de Madrid, Madrid, Spain, [5] Biomedical Image Technologies, Universidad Politécnica de Madrid and CIBER-BBN, Madrid, Spain, [6] Epilepsy Center, Neurological Institute, Cleveland Clinic, Cleveland, OH, United States, [7] McGovern Institute for Brain Research, Massachusetts Institute of Technology, Cambridge, MA, United States, [8] Signal and Image Processing Institute, University of Southern California, Los Angeles, CA, United States

Brainstorm is a free, open-source Matlab and Java application for multimodal electrophysiology data analytics and source imaging [primarily MEG, EEG and depth recordings, and integration with MRI and functional near infrared spectroscopy (fNIRS)]. We also provide a free, platform-independent executable version to users without a commercial Matlab license. Brainstorm has a rich and intuitive graphical user interface, which facilitates learning and augments productivity for a wider range of neuroscience users with little or no knowledge of scientific coding and scripting. Yet, it can also be used as a powerful scripting tool for reproducible and shareable batch processing of (large) data volumes. This article describes these Brainstorm interactive and scripted features via illustration through the complete analysis of group data from 16 participants in a MEG vision study.

Keywords: magnetoencephalography (MEG), electroencephalography (EEG), brain imaging data structure (BIDS), open data, group analysis, good practice, reproducibility, open source



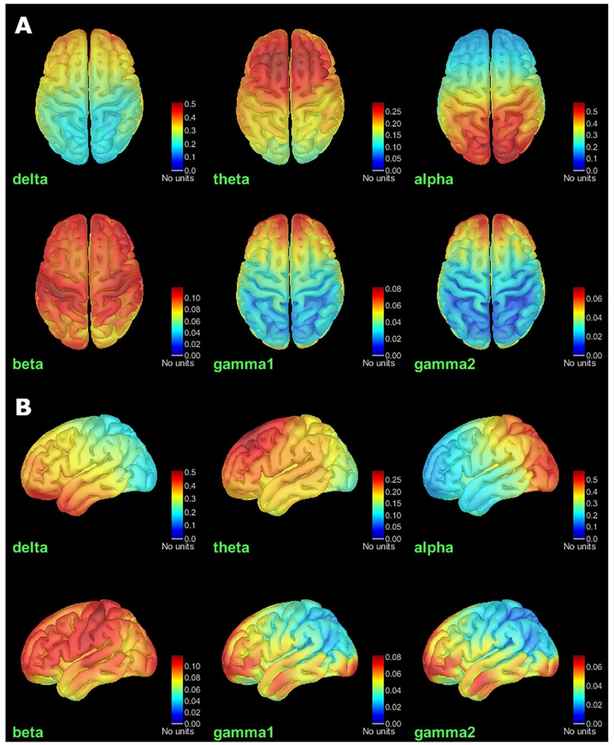
Brainstorm Pipeline Analysis of Resting-State Data From the Open MEG Archive

Guiomar Niso[1,2,3,4], Francois Tadel[1,5,6], Elizabeth Bock[1], Martin Cousineau[1], Andrés Santos[3,4] and Sylvain Baillet[1]*

[1] McConnell Brain Imaging Centre, Montreal Neurological Institute, McGill University, Montreal, QC, Canada, [2] Center for Biomedical Technology, Universidad Politécnica de Madrid, Madrid, Spain, [3] Biomedical Image Technologies, ETSI Telecomunicación, Universidad Politécnica de Madrid, Madrid, Spain, [4] Biomedical Research Networking Centre on Bioengineering, Biomaterials and Nanomedicine (CIBER-BBN), Madrid, Spain, [5] Inserm U1216, Grenoble, France, [6] Grenoble Institut des Neurosciences, Université Grenoble Alpes, Grenoble, France

We present a simple, reproducible analysis pipeline applied to resting-state magnetoencephalography (MEG) data from the Open MEG Archive (OMEGA). The data workflow was implemented with Brainstorm, which like OMEGA is free and openly accessible. The proposed pipeline produces group maps of ongoing brain activity decomposed in the typical frequency bands of electrophysiology. The procedure is presented as a technical proof of concept for streamlining a broader range and more sophisticated studies of resting-state electrophysiological data. It also features the recently introduced extension of the brain imaging data structure (BIDS) to MEG data, highlighting the scalability and generalizability of Brainstorm analytical pipelines to other, and potentially larger data volumes.

Keywords: magnetoencephalography, resting-state, MEG-BIDS, power spectral density, reproducibility, analytical pipelines, open data, open science



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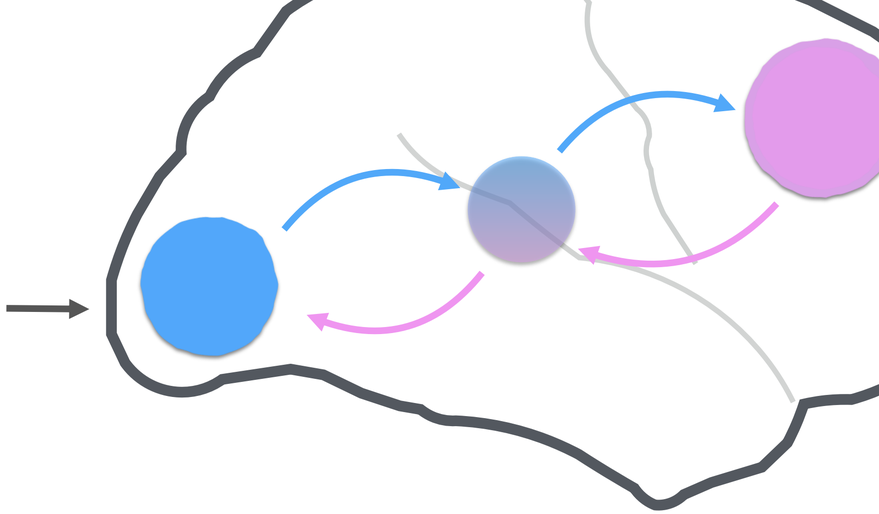
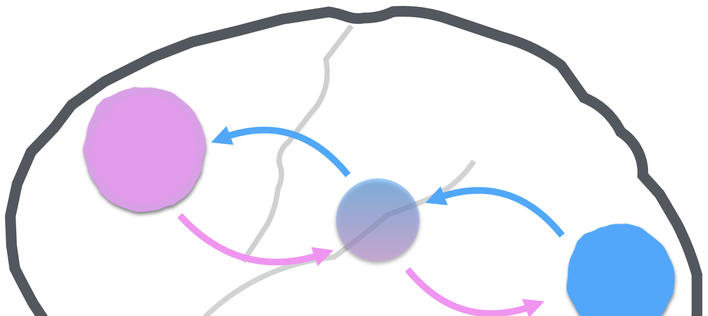
- that’s right, Matlab isn’t free
- but available to thousands of higher-education institutions, industry
- compiled version of Brainstorm can run on all operating systems
- for free.

takeaways



- good software can enable good scientific practices.

- Google it: “Brainstorm MEG EEG”
- **Tweet it !** @brainstorm2day, @sylvain_baillet
- **Facebook it!** BrainstormSoftware



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NIH National Institutes of Health

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