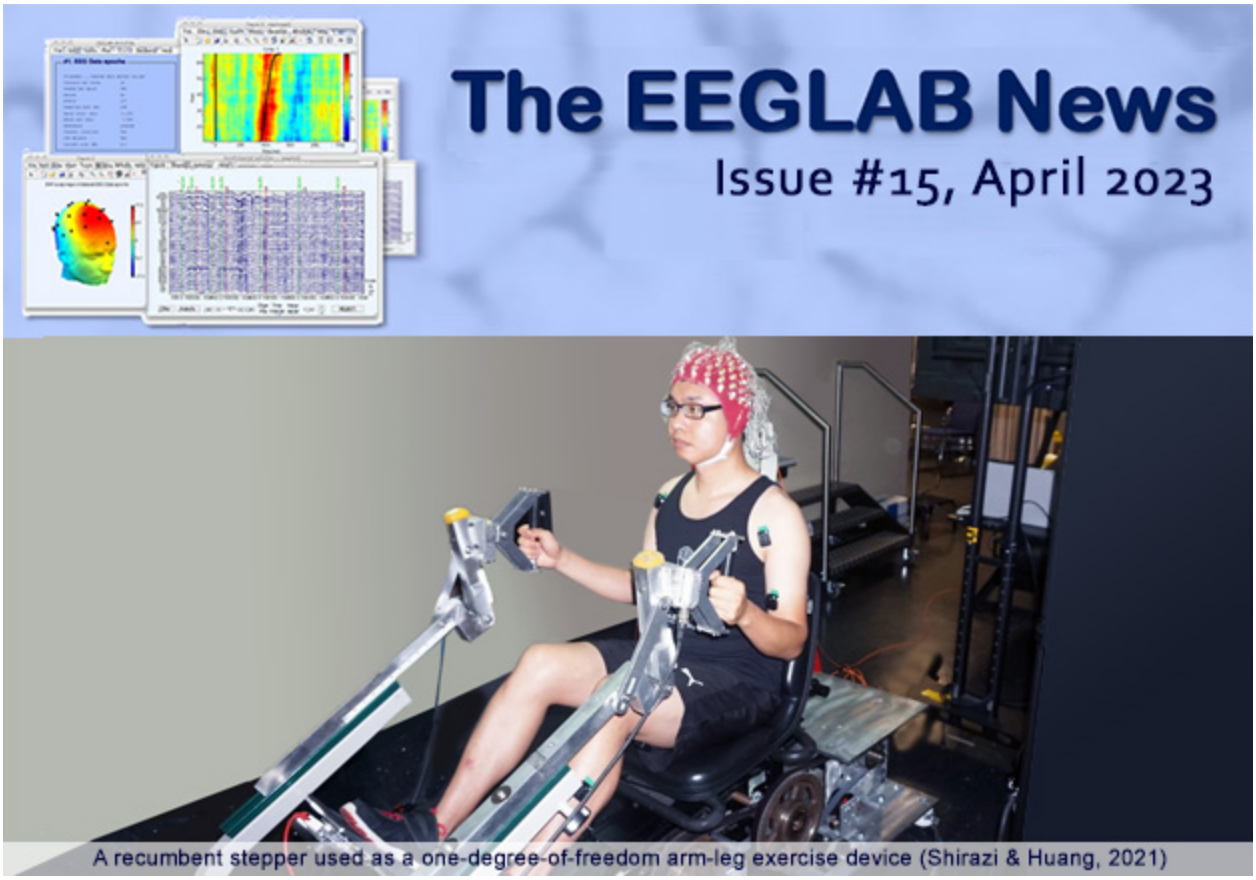

View this email in your browser

What's New

New Version of EEGLAB. A new version of EEGLAB has been released in February (version 2023.0). This version now fully supports MEG including MEG source localization. Other improvements include portability and compatibly with other tools (Fieldtrip, Brainstorm), better handling of boundary events and better BIDS support (including support for behavioral information and motion capture data). A series of new tutorials were published including a new MEG pipeline, new documentation of how to specify MEG sensor coordinates, and a new section on how to use individual subject MR head images for EEG or MEG source localization. Also, a new pipeline (as recently presented at the PracticalMEEG workshop) for (pre)processing EEG and MEG data is available here.

Plug-Ins

Here we highlight new EEGLAB plug-ins of possible wide interest to EEGLAB users. Please send descriptions of new plug-ins for consideration. These should have a brief lead introduction, and further text and images to be published on a continuation page.

BIDS-matlab-tools. The BIDS-matlab-io plug-in is now in Version 7.5. It is now possible to import and export behavioral information, and to import (concurrently captured) motion capture data. MEG and iEEG BIDS-formatted repositories can also be imported (and support for MEG coordinates was implemented). Using the Brain Imaging Data Structure (BIDS) in EEGLAB has several advantages:

- **Standardization**: BIDS provides a standardized format for organizing EEG data, which makes it easier to share and compare data across different studies and research groups. By adopting a

common data format, researchers can reduce the time and effort required to integrate data from multiple sources.

- **Metadata**: BIDS includes a metadata specification that allows researchers to include important information about their EEG data, such as the experimental conditions, recording parameters, and data preprocessing steps. HED annotation specifying the nature of events during the recording can be included. This metadata is stored in a consistent format, which makes it easier to interpret and use in downstream analyses.
- **Accessibility**: BIDS is an open format that is supported by a growing number of software tools and platforms, including EEGLAB. By using BIDS, researchers can take advantage of these tools and platforms to streamline their EEG analyses and share their data with others.
- **Reproducibility**: By using a standardized format and including detailed metadata, BIDS can improve the reproducibility of EEG studies. Researchers can more easily replicate analyses and validate findings when they have access to well-organized and documented data.
- **HED Compatibility**: Without detailed descriptions of events that occured during EEG recording sessions, their EEG data are not ready for further analysis or re-analysis, and require some 'electroarcheological' research to understand the nature of the data and its events, discouraging its further use and usability. EEGLAB tools for creating and using event descriptions for BIDS data using the Hierarchical Event Descriptors (HED) system are now also available. Visit hedtags.org to learn more about HED and BIDS.

Overall, using BIDS formatting for EEGLAB data can help researchers improve the quality and impact of their EEG studies by providing a common framework for organizing, sharing, and analyzing data.

Open Science

Here we highlight news of open EEG and related data, tools, and other resources.

In the video section below, we link a short tutorial on using The Neuroscience Gateway (NSG) to analyze 200+ publicly available BIDS-formated datasets (with over 10k participants, 11.8TB in all) on NEMAR. NSG is a web-based platform that provides researchers with free access to high-performance computing resources and a suite of scientific software tools for analyzing neuroimaging data. By using the NSG to process BIDS datasets stored in the NEMAR.org website, researchers can take advantage of the platform's scalability to significantly speed up the processing of large neuroimaging datasets. Using NSG can also reduce the burden on researchers' local computing resources, which may not be able to handle large-scale processing tasks. Additionally, NSG provides a user-friendly interface for accessing and running popular neuroimaging analysis tools, such as EEGLAB. By leveraging the NSG's resources and tools, researchers can more efficiently and effectively analyze BIDS (or any other) datasets without fear of exceeding their available compute power.

Profiles

This section contains personal profiles of EEGLAB developers and/or users, with a description of how they use EEGLAB in their research.

Drs. Seyed Yahya Shirazi, Maryam Mahmoudi, Deepa Gupta, Yu-Shuang Liu, and Talía Román López

For this "research profile," we take a look at several EEGLAB 2022 workshop participants in order to see the myriad ways EEGLAB is benefiting current research. Close to 150 attendees from across the United States descended on the San Diego Supercomputer Center to share their research and learn from one another. One participant, Seyed Yahya Shirazi, Ph.D., is performing a study to determine the best tailored rehabilitation exercises for stroke patients. Maryam Mahmoudi, Ph.D., is investigating whether Brain Computer Interfaces (BCI) can help nonverbal people communicate their needs. Deepa Gupta, Ph.D., analyzes children's electroencephalography (EEG) data in response to watching a movie. Yu-Shuang Liu, Ph.D., hopes to track students' eye movements during tutoring sessions to identify best tutoring strategies. And Talía Román López, Ph.D., studies the cognitive processes of visual working memory and visual attention. Read more! »

Upcoming Events

This section contains announcements of future events of possible interest to EEGLAB users. Please submit brief descriptions.

- EEGLAB was represented by Ramon Martinez and Johana Wagner at the PracticalMEEG workshop in France last December.

- **33rd EEGLAB workshop**. From July 3rd to July 7th, the 33rd EEGLAB workshop will be held in Aspet, France. The event will feature lectures on how to process data using EEGLAB, including scripting and automated pipelines, multiple EEGLAB plug-ins, connectivity analysis, and deep learning. The workshop operates on a first-come, first-served basis and has reached capacity within one or two week in some years. More information »

From the EEGLABLIST

(… the EEGLABLIST email list) *This section contains questions and answers from the eeglablist archives or elsewhere.*

Q: We've recently begun adding the use of ICLABEL to our pre-processing pipeline. What we've found is that it labels only a minority of components as brain activity, with the majority being labeled as "other." If we reject the components labeled as non-brain activity, we end up rejecting the majority of the components, and this seems wrong. Can anyone who has been using ICLABEL comment on how to select components for removal? Thanks in advance, Michael

A: ICLABEL compares component properties in your data (e.g., component scalp projection maps, power spectra) with datasets in its large training data (mainly datasets from our 20-yr history of applying ICA decomposition to EEG data at SCCN). ICA decomposition can be negatively affected by several factors: too little data, abundant non-brain noise in the data, etc. - and by the conditions under which it was recorded (e.g., Were participants moving? Were the electrodes securely placed? etc.).

So the first thing I would suggest you look at is whether your data preprocessing and data rejection process was adequate for the data. Next, I would suggest you see how much of the data is accounted for by the labeled Brain components plus the non-brain components of known origin (e.g., Eye Movement components). Many times components rated as 'Other' by ICLabel account for quite little of the data (e.g., single-channel ICs) - forming an (as it were) ICA 'noise subspace'.

If you perform PCA decomposition on your dataset and look at the values of the resulting eigenvalue spectrum, you will typically find that a large proportion of EEG data 'lives' in relatively few dimensions - ICA decompositions typically find a *relatively* small set of ICs that account for most of this subspace such that each basis element (Independent Component) is as temporally distinct from the others as

possible -- and is thereby typically *functionally* distinct from others. - **Scott Makeig**

[Read more of this thread here.]

In Print

Here we list recent papers highlighting EEGLAB function and plug-in capabilities. Please submit suggested papers, with a brief summary description.

Delorme A. EEG is better left alone. Sci Rep. 2023 Feb 9;13(1):2372. doi: 10.1038/s41598-023-27528-0. PMID: 36759667; PMCID: PMC9911389.

De Sanctis P, Wagner J, Molholm S, Foxe JJ, Blumen HM, Horsthuis DJ. Neural signature of mobility-related everyday function in older adults at-risk of cognitive impairment. Neurobiol Aging. 2023 Feb;122:1-11. doi: 10.1016/j.neurobiolaging.2022.11.005. Epub 2022 Nov 9. PMID: 36463848.

Rockhill AP, Mantovani A, Stedelin B, Nerison CS, Raslan AM, Swann NC. Stereo-EEG recordings extend known distributions of canonical movement-related oscillations. *J Neural Eng*. 2022 Dec 22. doi: 10.1088/1741-2552/acae0a. Epub ahead of print. PMID: 36548996.

Shirazi SY, Huang HJ. Differential Theta-Band Signatures of the Anterior Cingulate and Motor Cortices During Seated Locomotor Perturbations. IEEE Trans Neural Syst Rehabil Eng. 2021;29:468-477. doi: 10.1109/TNSRE.2021.3057054. Epub 2021 Mar 2. PMID: 33539300; PMCID: PMC7989773.

Shirazi SY, Huang HJ. More Reliable EEG Electrode Digitizing Methods Can Reduce Source Estimation Uncertainty, but Current Methods Already Accurately Identify Brodmann Areas. *Front Neurosci*. 2019 Nov 6;13:1159. doi: 10.3389/fnins.2019.01159. PMID: 31787866; PMCID: PMC6856631.

A set of new papers *(see below) is showing that narrow-band rhythms in EEG near 90 Hz (!) are a basic, though just now being explored feature of EEG records! We have seen the phenomenon ourselves in an (unpublished) juggling experiment...* -Scott

Dickey, C.W., Verzhbinsky, I.A., Jiang, X., Rosen, B.Q., Kajfez, S., Stedelin, B., Shih, J.J., Ben-Haim, S., Raslan, A.M., Eskandar, E.N. and Gonzalez-Martinez, J., 2022. Widespread ripples synchronize human cortical activity during sleep, waking, and memory recall. *Proceedings of the National Academy of Sciences*, *119*(28), p.e2107797119.

Dickey, C.W., Verzhbinsky, I.A., Jiang, X., Rosen, B.Q., Kajfez, S., Eskandar, E.N., Gonzalez-Martinez, J., Cash, S.S. and Halgren, E., 2022. Cortical ripples during NREM sleep and waking in humans. *Journal of Neuroscience*, *42*(42), pp.7931-7946.

Dickey, C.W., Sargsyan, A., Madsen, J.R., Eskandar, E.N., Cash, S.S. and Halgren, E., 2021. Travelling spindles create necessary conditions for spike-timing-dependent plasticity in humans. *Nature communications*, *12*(1), p.1027.

Dickey, C.W., Verzhbinsky, I.A., Kajfez, S., Rosen, B.Q., Pati, S. and Halgren, E., 2022. Cortico-cortical and hippocampo-cortical co-rippling are facilitated by thalamo-cortical spindles and upstates, but not by thalamic ripples. *bioRxiv*, pp.2022-09.

Fabo, D., Bokodi, V., Tóth, E., Szabó, J.P., Salami, P., Keller, C.J., Hajnal, B., Thesen, T., Devinsky, O., Doyle, W. and Mehta, A., 2022. The role of superficial and deep layers in the generation of high frequency oscillations in the human epileptic cortex.

Online

Processing EEG data for free on the Expanse Supercomputer

Data shared on the NEMAR.org electrophysiology data repository can be analyzed using EEGLAB scripts through the Neuroscience Gateway (NSG), for which EEGLAB has a plug-in.

Dr. Arnaud Delorme, February 24, 2023