

Data visualization with MNE-Python

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Hi!



Arriving at the Donders in corona times.

Postdoc in **The Predictive Brain Lab**

My **research interests**

- visual predictive processing
- oscillatory activity (MEG)
- source reconstruction techniques
- MEG decoding
- core dev of **MNE-Python**



Overview



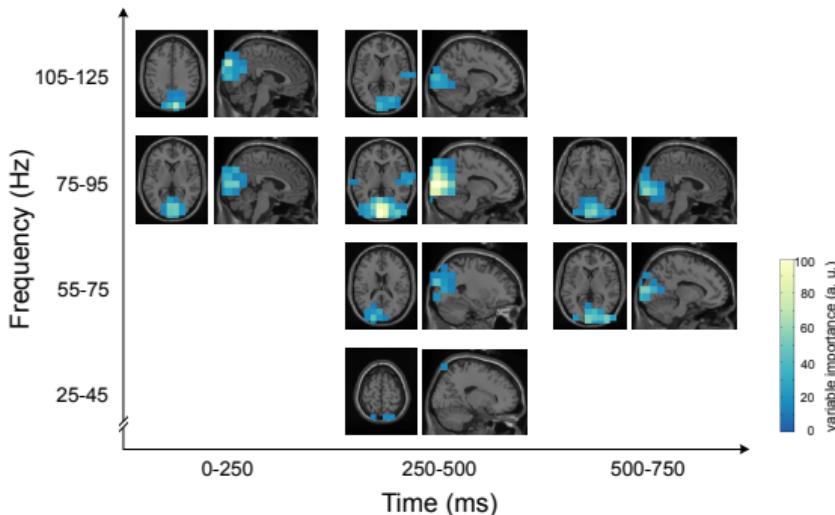
1. Visualizing **MEEG** data
2. **MNE-Python**: what, who, and visualization?
3. **Live Demo** of visualization in MNE-Python
4. How do I **get started** with MNE-Python?
5. **Contributing** to MNE-Python

MEEG data: a visualization challenge



MEG and EEG measure **neuronal activity** (magnetic fields/electric potentials).

MEEG data is high-dimensional



- high temporal resolution (1 kHz)
- 20-400 sensors
- source space: thousands of points
- multiple frequencies

Westner & Dalal [preprint]

DOI: 10.1101/153551

MNE-Python



Open source software package to **process** and **visualize** MEEG data.



- using the Python ecosystem
- 30-10 years of development
(MNE-C/MNE-Python)

frontiers in
NEUROSCIENCE

METHODS ARTICLE
published: 26 December 2013
doi: 10.3389/fnins.2013.00267



MEG and EEG data analysis with MNE-Python

Alexandre Gramfort^{1,2,3}, Martin Luessi², Eric Larson⁴, Denis A. Engemann^{5,6}, Daniel Strohmeier⁷, Christian Brodbeck⁸, Roman Goj⁹, Mainak Jas^{10,11}, Teon Brooks⁸, Lauri Parkkonen^{10,11} and Matti Hämäläinen^{2,11}*

Who is MNE-Python?



Coding Sprint 2019 @ Facebook AI Research, Paris



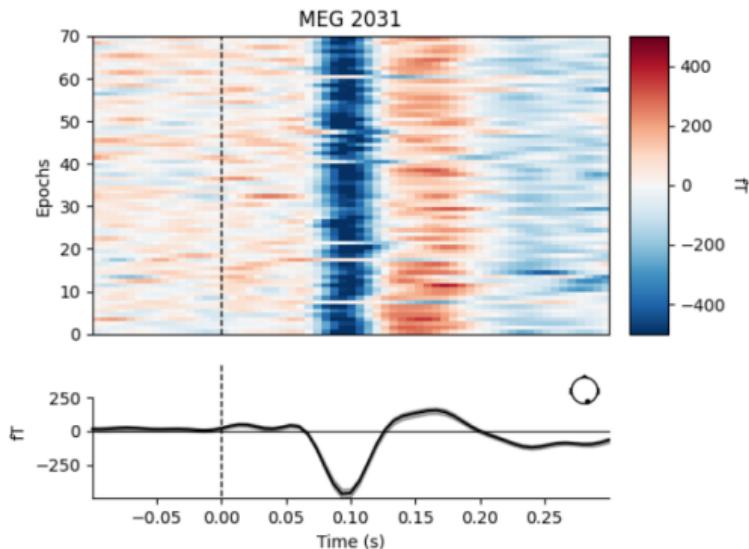
What can I do with MNE-Python?



A slide show of MNE-Python (viz) possibilities.

Pre-processing

Example: Denoising with X-DAWN



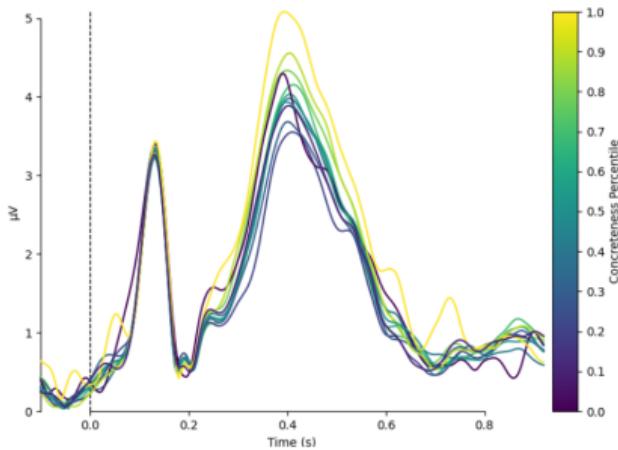
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Evoked data analyses

Example: Compare evoked fields



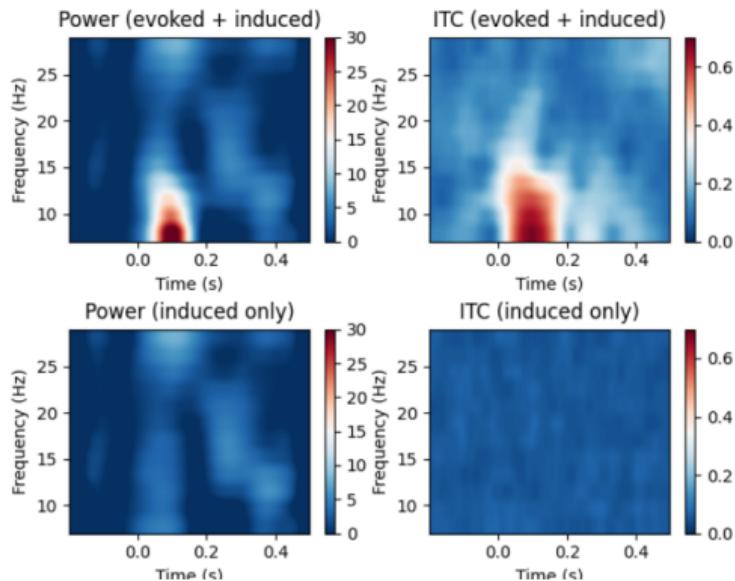
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Time-frequency analysis

Example: Compute different time-frequency characteristics



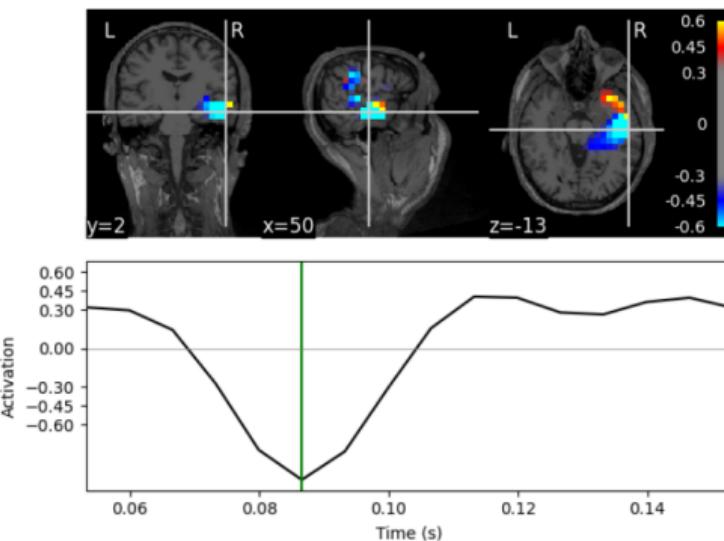
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Source reconstruction

Example: LCMV beamformer source estimation



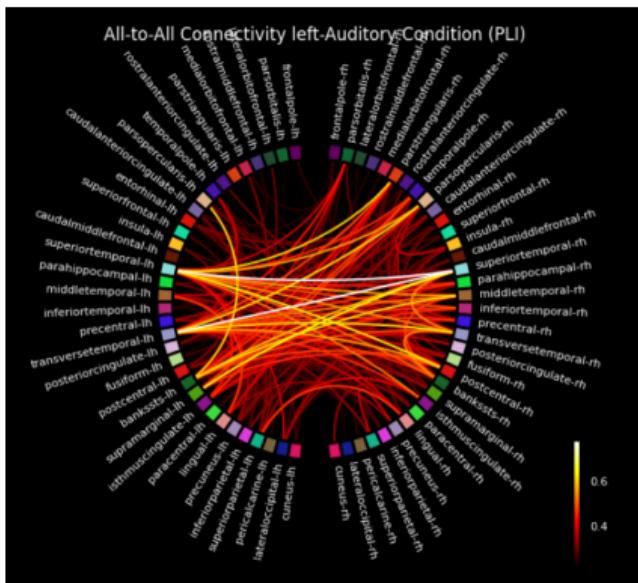
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Connectivity

Example: All-to-all source space connectivity



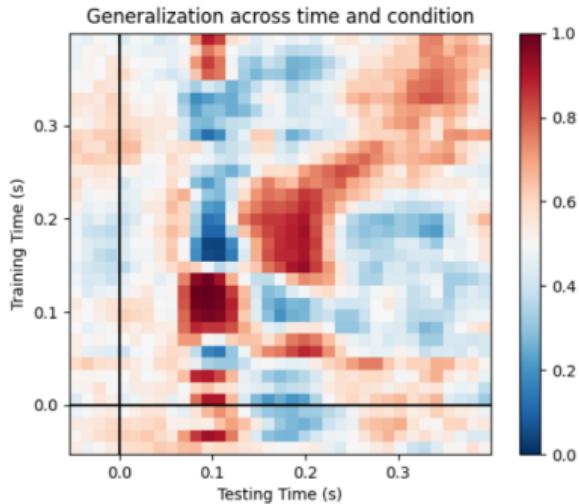
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Statistics and Decoding

Example: Time generalization of decoding performance



Data visualization in MNE-Python



Most visualizations rely on `matplotlib` and `pyvista`.

MNE-Python supports:

- 3D rendering
- interactive plots
- Jupyter notebooks

Let's try a live demo!



Code can be obtained here: https://github.com/britta-wstnr/demo_openMR

How do I get started as a user?



Many tutorials and examples on mne.tools:

The screenshot shows the MNE website homepage. At the top, there is a navigation bar with links for 'Install', 'Overview', 'Tutorials', 'Examples', 'Glossary', 'API', 'More', and a version dropdown set to 'v0.22.0'. A search bar is also present. To the right, there is a sidebar titled 'Version 0.22.0' containing links for 'What's new', 'Installation', 'Documentation', and 'Cite'. Below this, there is a section titled 'Direct financial support' listing various funding agencies and grants.

MNE MEG + EEG ANALYSIS & VISUALIZATION

Open-source Python package for exploring, visualizing, and analyzing human neurophysiological data: MEG, EEG, sEEG, ECoG, fNIRS, and more.

Source estimation
Distributed, sparse, mixed-norm, beamformers, dipole fitting, and more. [Try it →](#)

idx=45.0 clim

11.0
10.0
9.00
8.00
0.05

National Institutes of Health: R01-EB009448, EB009448, EB009448, NS056385, HD40712, NS44319, NS37462, NS104585, P41-EB015896, RR14075-06

US National Science Foundation: 0958669, 1042134

European Research Council: YSTG-263584, 676943

US Department of Energy: DE-FG02-99ER62764 (MIND)

Agence Nationale de la Recherche: 14-ANR-0002-01 IDEx Paris-Saclay, 11-IDEX-0003-02

Paris-Saclay Center for Data Science: PARIS-SACLAY

Google: Summer of code (>6)

Amazon: AWS Research Grants

Chan Zuckerberg Initiative: Essential Open Source Software for Science



Contributing: my story and message



You don't have to have a computer science background
for open source.



- 2017: Google Summer of Code
- beamformer module
- since 2019: core dev

Let's increase diversity and inclusion in open source together.

Thank you for your attention!

DONDERS
INSTITUTE

MNE-Python contributors, alphabetical order

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