PSYCH 5621 Intro to the ERP

Week 15: EEG Data Analysis based on Python

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PSYCH 5621

11/28/2023 TUESDAY

Python Pipeline of EEG Data Analysis

(preprocess -> ERP analysis -> time-frequency analysis;
single-subject analysis -> multiple-subject analysis)

11/30/2023 THURSDAY

Advanced EEG Data Analyses

(MVPA: classification-based decoding, representational similarity analysis;
Link between EEG and Deep Learning in cognitive neuroscience)

Python Pipeline of EEG Data Analysis

Why Python? (from ChatGPT)

- Open Source and Cost-Effective
- Rich Library Ecosystem
- Community Support and Development
- Integration with Machine Learning and AI
- Flexibility and Versatility
- Reproducibility and Collaboration
- Customization and Extensibility

Python Pipeline of EEG Data Analysis

Why Python? (Personal View)

- Newer packages

[HTML] **EEGLAB**: an open source toolbox for analysis of single-trial EEG dynamics including independent component analysis

A Delorme, S Makeig - Journal of neuroscience methods, 2004 - Elsevier

We have developed a toolbox and graphic user interface, **EEGLAB**, running under the crossplatform MATLAB environment (The Mathworks, Inc.) for processing collections of single-trial …

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FieldTrip: open source software for advanced analysis of MEG, EEG, and invasive electrophysiological data

R Oostenveld, P Fries, E Maris… - Computational …, 2011 - dl.acm.org

… **FieldTrip** from other (publicly available) toolboxes as described elsewhere in this issue. We will first describe **FieldTrip** … This paper ends with some concluding remarks on the **FieldTrip** …

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[HTML] **PyMVPA**: A python toolbox for multivariate pattern analysis of fMRI data

M Hanke, YO Halchenko, PB Sederberg, SJ Hanson… - Neuroinformatics, 2009 - Springer

… , and open-source software toolbox, called **PyMVPA**, for the application of classifier-based analysis techniques to fMRI datasets. **PyMVPA** makes use of Python's ability to access …

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Old MATLAB EEG Packages

[HTML] MEG and **EEG** data analysis with MNE-**Python**

A Gramfort, M Luessi, E Larson… - Frontiers in …, 2013 - frontiersin.org

… **EEG** data analysis pipelines by writing **Python** scripts. Moreover, MNE-**Python** is tightly integrated with the core **Python** … as the greater neuroimaging ecosystem in **Python** via the Nibabel …

☆ Save 99 Cite Cited by 2246 Related articles All 27 versions Web of Science: 1161 »

[HTML] NeuroRA: a **Python toolbox** of representational analysis from multi-modal neural data

Z Lu, Y Ku - Frontiers in neuroinformatics, 2020 - frontiersin.org

… , **EEG**, MEG, fMRI, et al. and even different species. Our **toolbox** NeuroRA is developed based on **Python** … threshold and output to a data format that could be opened in other **toolboxes**. …

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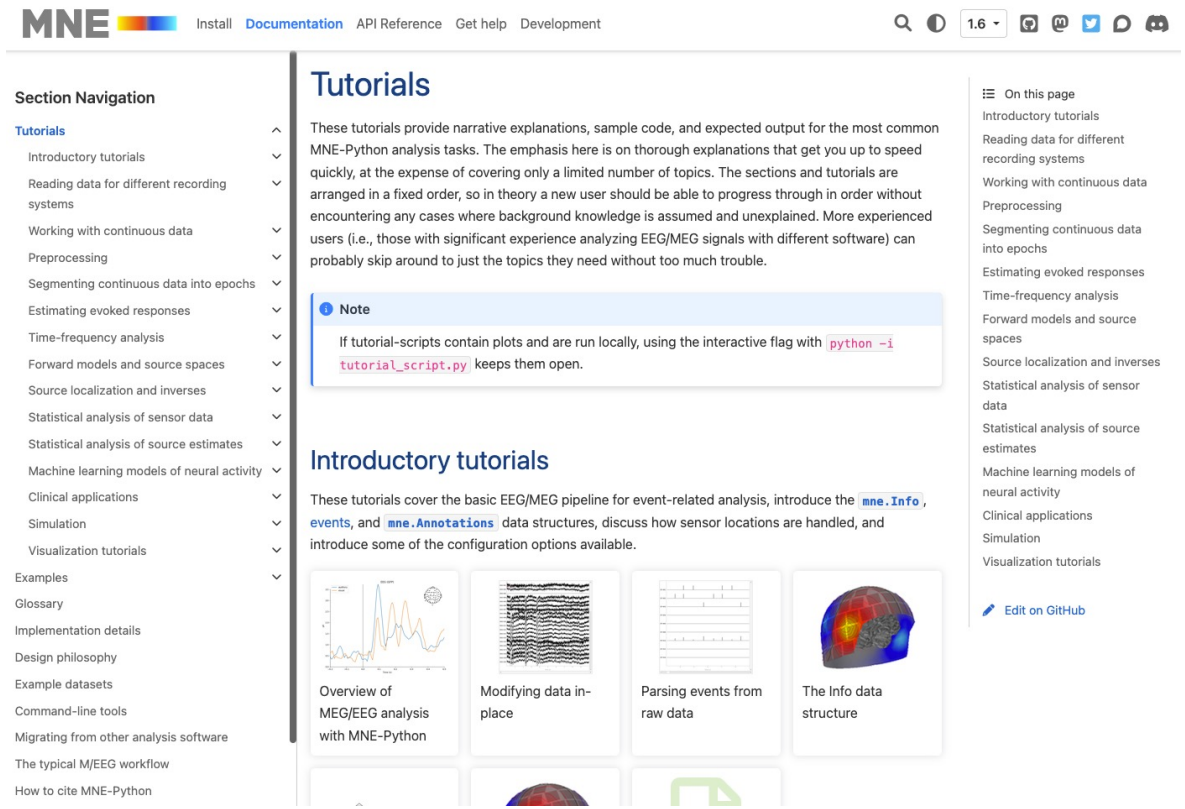
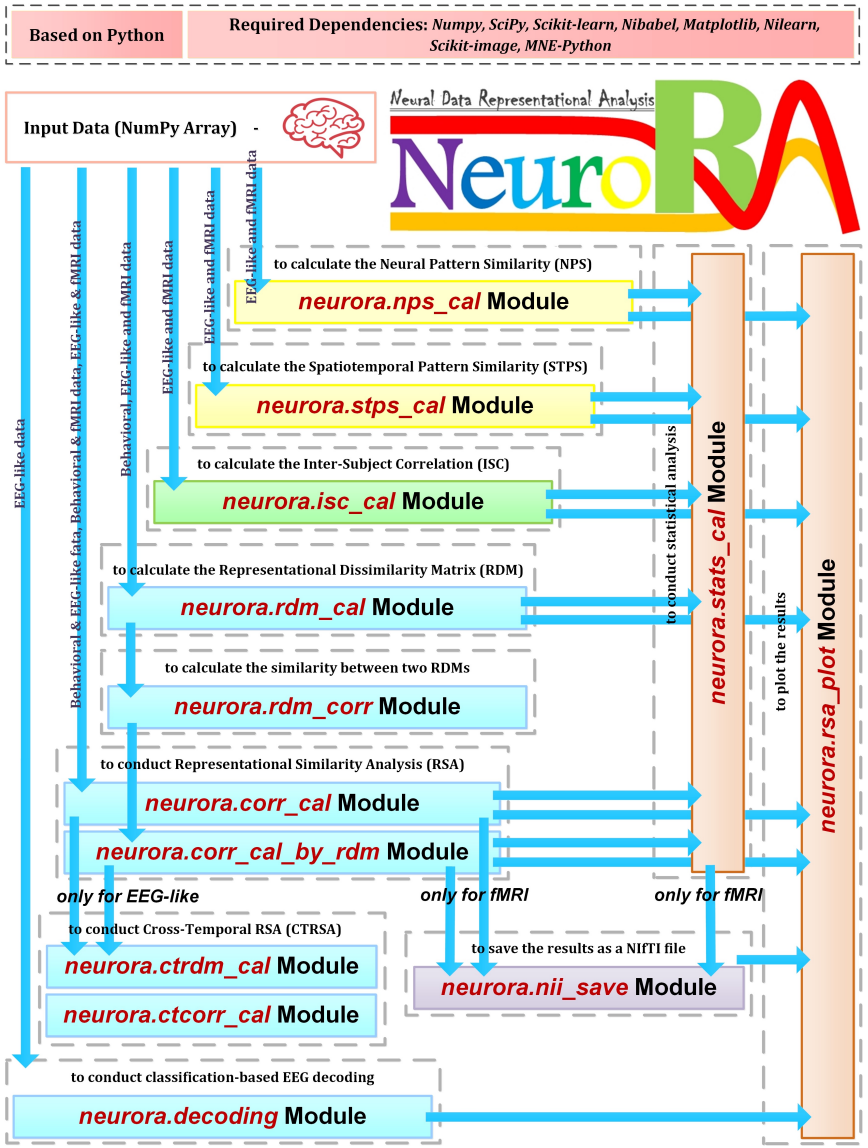
New Python EEG Packages

Python Pipeline of EEG Data Analysis

Why Python? (Personal View)

- Easier to use and easier to learn

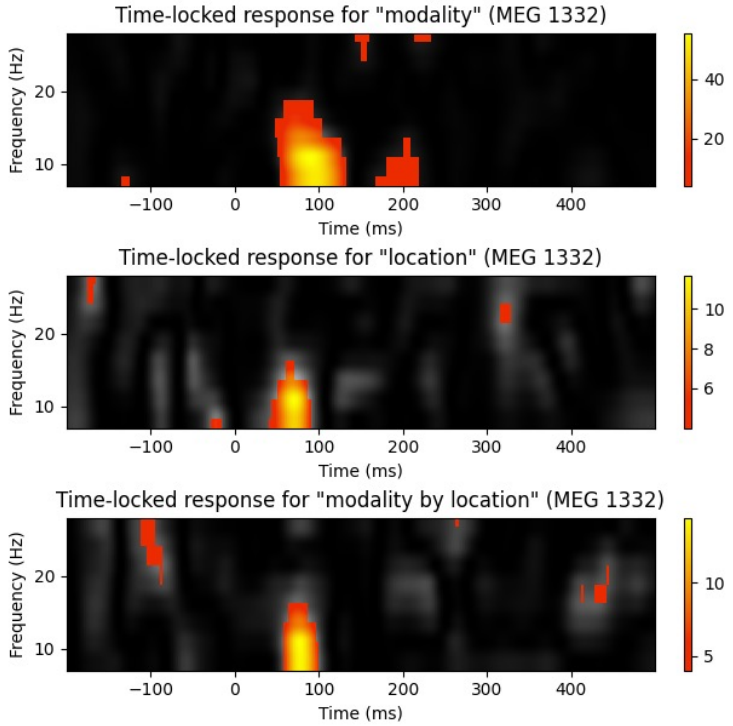


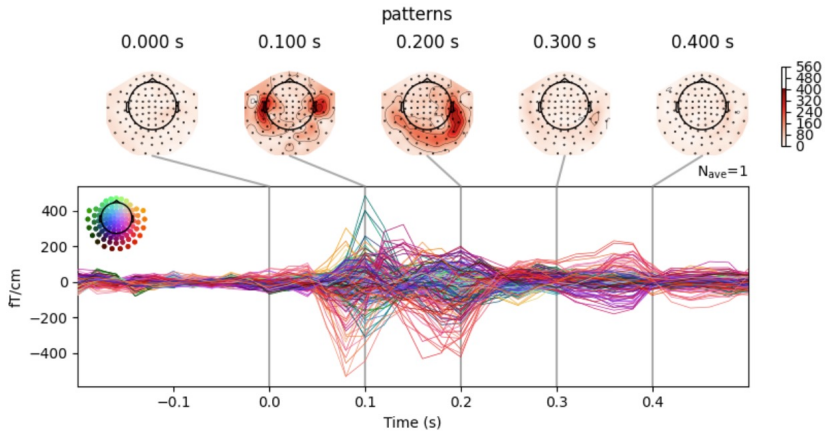


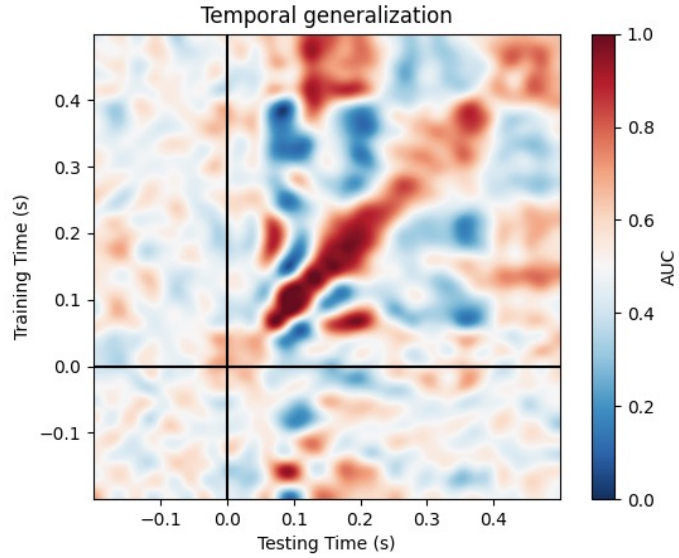
Python Pipeline of EEG Data Analysis

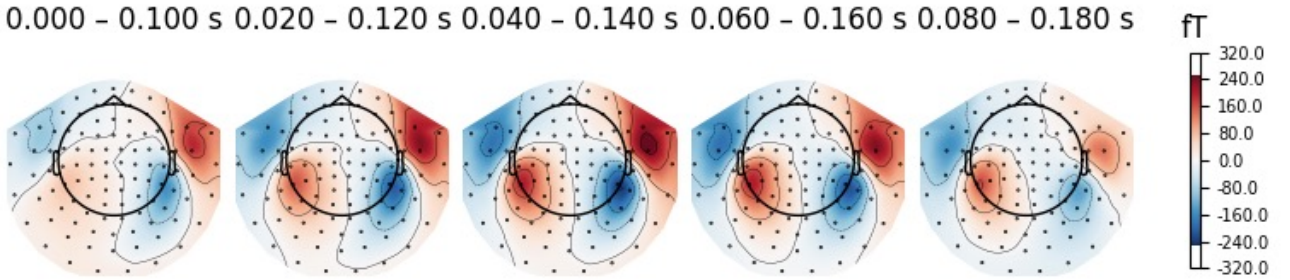
Why Python? (Personal View)

- Easier to plot nice figures









GOAL of today's class

Everyone can learn to use Python to do EEG data analysis, from loading the data to plotting the results.

Tutorial:
https://github.com/ZitongLu1996/Python-EEG-Handbook

Resources

EEGlab tutorial:
https://eeglab.org/tutorials/

MNE tutorial:
https://mne.tools/stable/auto_tutorials/index.html

Recognize ICAs:
https://labeling.ucsd.edu/tutorial/labels

Q&A

Any question about the final project?