Graphing & Filtering EEG Data with MNE Python

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Learning Objectives

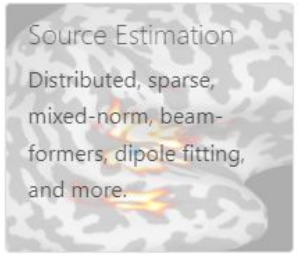
- Basic MNE Python
- Anatomy of EEG files
- Plot Raw EEG
- Basic preprocessing steps
- More EEG Plots
- Other resources for EEG data

MNE Python

MNE

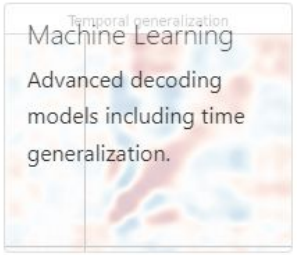
MEG + EEG ANALYSIS & VISUALIZATION

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



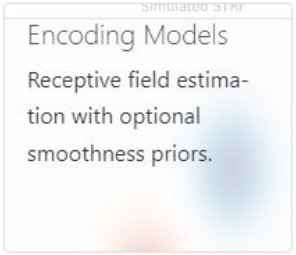
Source Estimation

Distributed, sparse, mixed-norm, beam-formers, dipole fitting, and more.



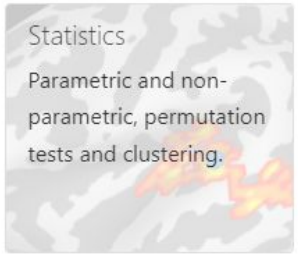
Machine Learning

Advanced decoding models including time generalization.



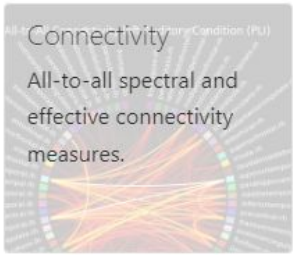
Encoding Models

Receptive field estimation with optional smoothness priors.



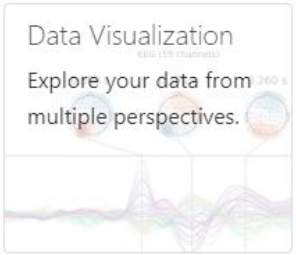
Statistics

Parametric and non-parametric, permutation tests and clustering.



Connectivity

All-to-all spectral and effective connectivity measures.



Data Visualization

Explore your data from multiple perspectives.

Why MNE Python?

- Documentation
- Tutorials
- Functions for EEG data processing and analysis
- Support for reading most file formats
  - fif
  - Xdf
  - Csv
  - …..
- It’s Python… great for leveraging other ML capacities; suitable for realtime applications

Anatomy of EEG Files

EEG & File Information

- Absolutely essential:
  - EEG channel labels
  - sampling frequency
- Other potentially useful information:
  - Subject name
  - Session number
  - Task name
  - Markers
  - …

THE EEG Data

Channel

Timestamp	Channel 1	…	Channel n	Markers
1655.2337	4138.055	…	4208.205	Baseline start
…				…
1655.233879	4135.093	…	4246.354	Eye open end

Signal Amplitude

Plot EEG

Channel

Timestamp	Channel 1	…	Channel n	Markers
1655.2337	4138.055	…	4208.205	Baseline start
…				…
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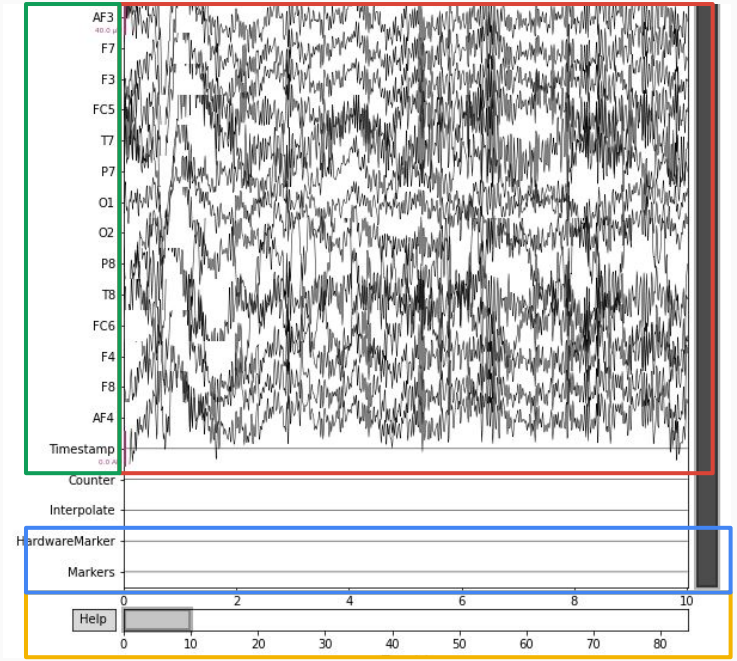
Signal Amplitude

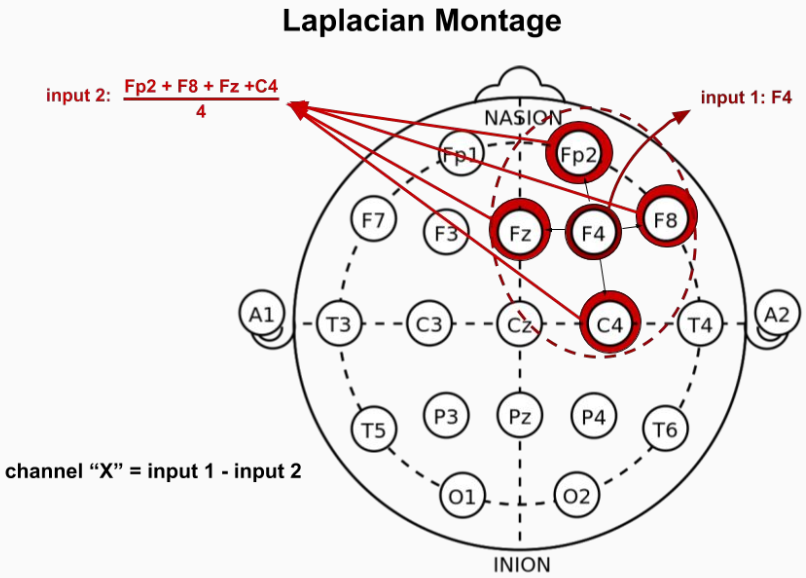


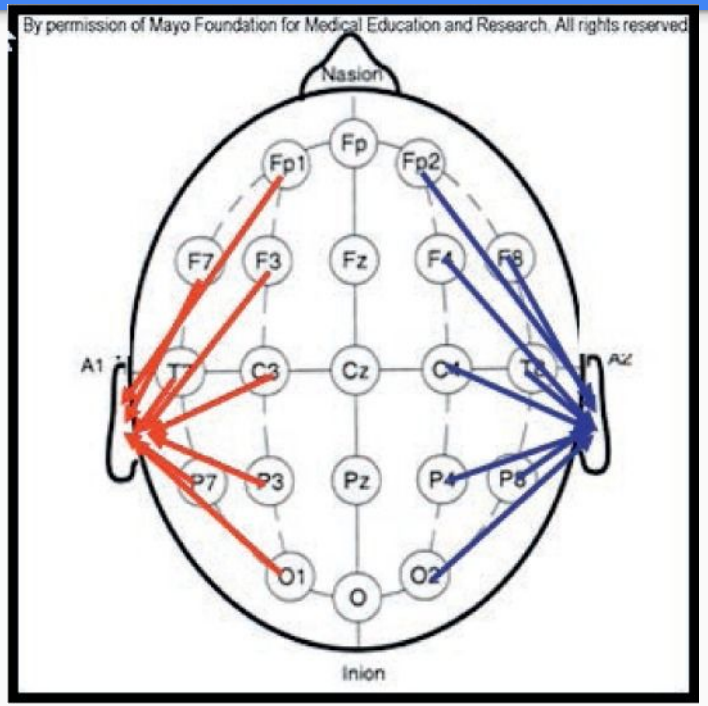
Basic Preprocessing Steps

Filtering

- Bandpass Filter ~1-30Hz
- Notch Filter 60Hz
- More next week!

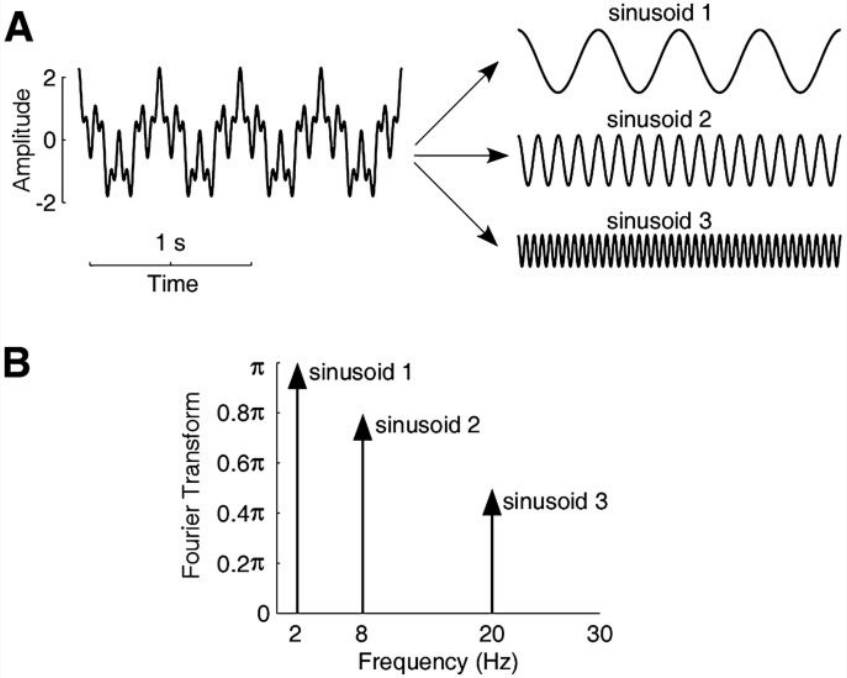
Montage

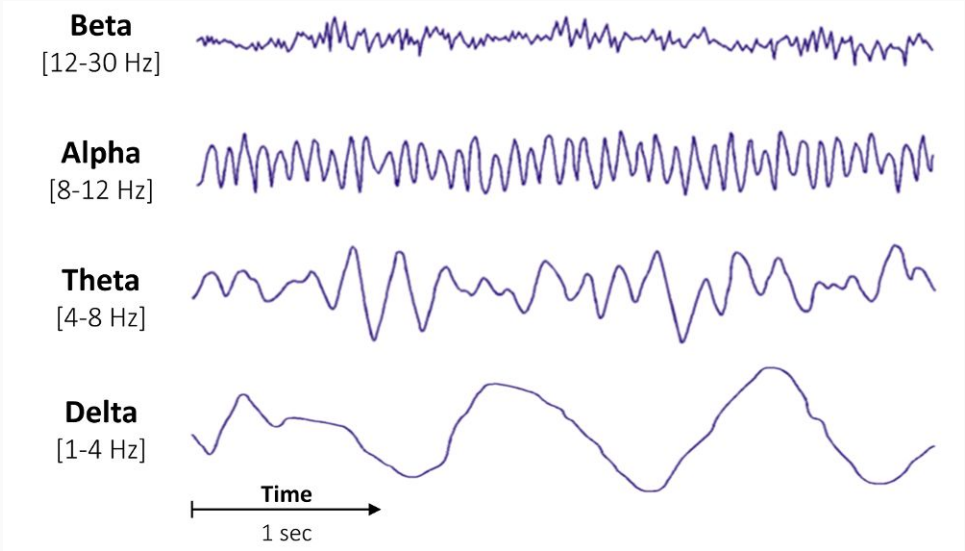




Acharya, Jayant N.; Acharya, Vinita J. Overview of EEG Montages and Principles of Localization, Journal of Clinical Neurophysiology: September 2019 - Volume 36 - Issue 5 - p 325-329
doi: 10.1097/WNP.0000000000000538

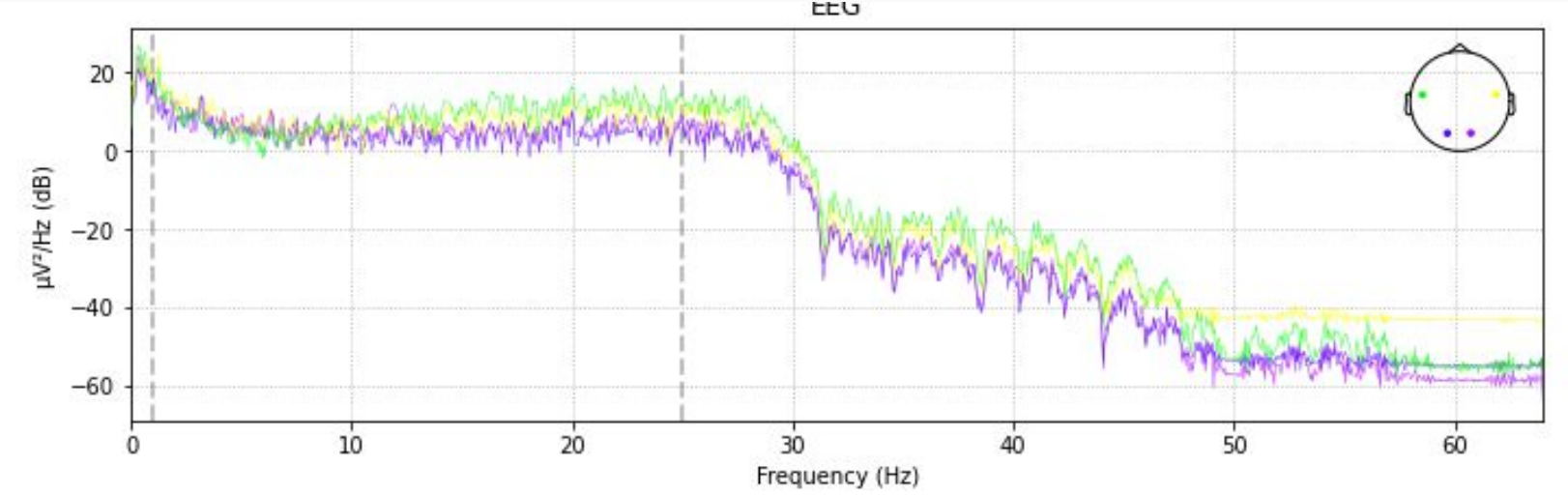
Time Domain vs Frequency Domain





More EEG Plots

Spectrum (Frequency)



More…

https://mne.tools/stable/auto_tutorials/time-freq/20_sensors_time_frequency.html

Other Resources for EEG Data

- Matlab Processing
  - EEGLab (with GUI)
  - FieldTrip (no GUI)
- Data Recording
  - Lab streaming layer (near-real-time access, time-synchronization, networking, recording)

Thanks!

Questions?

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