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Exercises on EEG/MEG analysis

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Note: There are a variety of suggestions for exercises at the bottom of tutorials and examples on the MNE-Python documentation webpage.

Pre-processing and Averaging

1. Compute response-locked (rather than stimulus-locked) responses for the sample dataset. The data will look noisier – why?
2. Compute evoked responses with different high- and low-pass filters. How do they change the shape of the timecourse? How do you decide which filter is optimal?

Forward and Inverse Modelling

1. Compute forward models for EEG, MEG and EEG+MEG and compare their sensitivity maps. How can you describe and explain their differences?
2. Compute source space resolution metrics for EEG only, and compare with MEG and EEG+MEG. How do you explain the differences? Can you decide which is best?
3. Compare the results of the previous two exercises (i.e. resolution metrics and sensitivity maps). How are they related to each other?
4. Compute source space resolution metrics for different levels of regularisation (SNRs). What happens to the source estimates? How is this related to the purpose of regularisation?
5. Compute beamformers with different covariance matrices, e.g. for different latency intervals for noise and data covariances. How does this affect the results? What does this mean for the interpretation of beamforming results?

Time-Frequency and Functional Connectivity

1. Change the number of cycles in the wavelet analysis. How does this change the time and frequency resolution?
2. Compute functional connectivity in source space using different source estimation methods. How does this change the results?
3. Compute coherence for visual evoked responses (rather than auditory) for multiple labels/ROIs in source space.
4. Compute phase-slope index (PSI) for auditory evoked responses (rather than visual) in source space.

5. Compute all-to-all functional connectivity in source space labels using Coherence (Coh) and the Imaginary Part of Coherency (ImCoh), rather than phase-locking index (PLI). What happens to amplitude and topography?
6. Use symmetric (rather than pairwise) orthogonalisation for volumetric inverse envelope correlation.