

Challenges in group-level statistical inference: comparing non-parametric permutation and prevalence approaches with EEG resting state

Group-level statistical inference in neuroimaging faces significant challenges driven by between-participant variability. Additionally, the dependent measures used to estimate individual averages often follow a non-normal distribution, such as heavy-tailed power spectra. These challenges are particularly pronounced in resting-state EEG, where cortical rhythms exhibit hallmarks of nonlinearity, such as alpha-band amplitude occurrences of high-amplitude “extreme” events.

This poster implements previously established statistical pipelines written in MATLAB or Python to address within-participant variability by integrating multiple noisy within-subject replications into a single, stable global null test. Additionally, we quantify the proportion of the population exhibiting a true positive effect to provide a quantitative uncertainty estimate rather than a binary statistical inference.

We apply and compare these frameworks by focusing on one of the most robustly replicated effects in human electrophysiology: the suppression of alpha power during eyes-closed compared to eyes-open conditions (alpha blocking). This approach establishes an important first step toward future applications in intracranial recordings, where robust statistical inference must be balanced against the limited and sparse electrode coverage typical of intracranial EEG experiments.