Comparing Surrogate Data Analysis Methods for EEG Signal Processing

Internship Type

Master 2 or last year of Engineering school
Topic : signal processing, statistical analysis, neuroimaging, neuroscience

Date or Duration of Internship

Flexible, typically 4–6 months in Spring 2025.

Context

Electroencephalography (EEG) is an imaging modality that allows to non-invasively follow brain activity. Our team uses EEG signals to extract various measures, such as phase-amplitude coupling (PAC) and inter-trail coherence (ITC), which help characterize pathologies such as amyotrophic lateral sclerosis (ALS). A major problem with these measures is that it is difficult to determine whether changes can be associated with a cause of interest (for instance, the task of an experimental protocol or a patient's pathology) or are rather due to random fluctuations. To overcome this issue, one resorts to statistical analysis. The internship will focus on a subgroup of methods relying on surrogate data analysis.

Objective

The objective of the internship is to perform an empirical comparison of different methods for surrogate data analysis. This requires designing and implementing a pipeline for data analysis and method comparison, starting first from simulated data, then moving to real data if time permits.

Mission

The intern will:

- understand the gist of surrogate data analysis;

- do a bibliographic search of such methods and understand their similarities and differences;

- design and implement a pipeline in python to (1) simulate data, (2) apply PAC or ITC analysis on simulated or real data, (3) apply a surrogate data analysis method, (4) compare the result of the method with the model gold standard, and (5) quantify the method's performance.

Skills

Coding with Python
Data analysis
Signal processing
Some knowledge of statistics
Interest in imaging methods and neuroimaging

Monetary compensation

Monetary compensation in agreement with current French regulation (about 600€/month).

Contact

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