BrainTrack : Dynamic identification of brain networks by Bayesian tracking of electrophysiological data

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Introduction

BrainTrack is an Academy of Finland -funded project (2015–2019) with the aim to develop a novel method to estimate **functional brain networks** from magnetoencephalographic (MEG) as well as from scalp and intracranial electroencephalographic (EEG) recordings using **Bayesian tracking** [1].

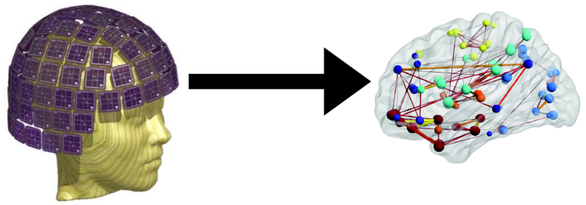


Figure 1 : Joint estimation of sources and network structure from non-invasive MEG/EEG recordings.

The computational core of BrainTrack is a **spatio–temporal marginalized particle filter** algorithm [1] that will estimate the network structure along with source parameters. The Bayesian model for the measurements is based on our previous work [2, 3].

Significance

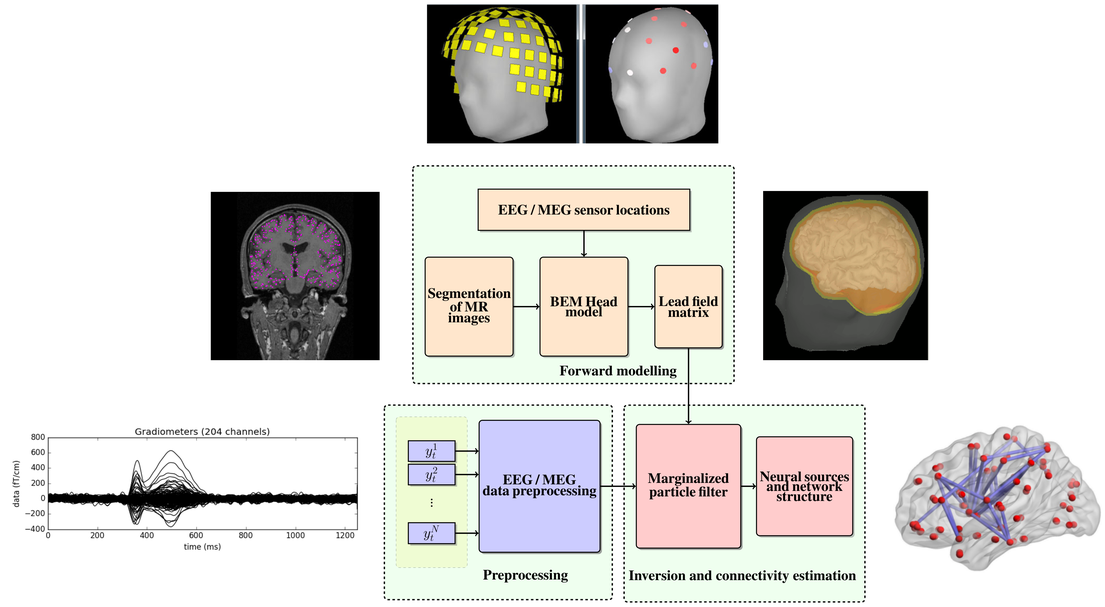
1. Tools for better characterization of epileptic activity as a **dynamic functional network** to aid the accurate **localization** of **epileptic foci**.
2. Real-time connectivity estimation for **neurofeedback** experiments.

International collaboration

The project will be done in collaboration with

- *Asahikawa Medical University*, Japan (Combined intracranial EEG and MEG recordings)
- *University of Cambridge*, UK (Bayesian particle filtering methodology)
- *McGill University*, Canada (Interpretation of connectivity measures and neurofeedback experiments)
- *Université de Montréal*, Canada (Interpretation of connectivity in pathological conditions, intracranial EEG + MEG recordings)

Research Framework



Expected Results and Impact

1. A platform for **accurate, real-time** estimation of functional brain connectivity from electrophysiological data.
2. Clinical applications: **Characterization** of spreading pathological brain activity in **network disorders** such as epilepsy.
3. Neuroscience applications: Identification of functional brain networks supporting various **cognitive functions**.

References

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