We aim to integrate simulation models of e.g. the basal ganglia-thalamo-cortical loop on the input side for dry testing of full setups. This will include software models and potentially more complex models implemented on neuromorphic hardware, enabling the development of richer control strategies.
The platform is currently in development and will be validated in experiments with patients receiving deep brain stimulation for treatment of Parkinson's disease, using paradigms to investigate motor and/or cognitive function.
Request for comments

Research Category and Technology and Methods
Basic Research: 1. Deep Brain Stimulation (DBS)
Keywords: DBS, closed-loop, EEG, platform

http://dx.doi.org/10.1016/j.brs.2023.01.591

Abstract key: PL- Plenary talks; S- Regular symposia oral; FS- Fast-Track symposia oral; OS- On-demand symposia oral; P- Posters

P2.115

ULTRA-LONG EEG RECORDINGS IN PHARMACORESISTANT EPILEPSY PATIENTS TREATED WITH VAGUS NERVE STIMULATION

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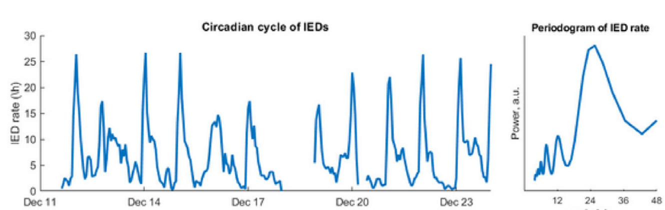
Abstract
In pharmacoresistant epilepsy patients who are not eligible for surgical treatment, vagus nerve stimulation (VNS) remains an option. However, good response (> 50% seizure reduction) is achieved in only approximately 50% of patients. At present, we cannot predict who will benefit from VNS at an individual level. Recently, ultra-long-term EEG recordings have become feasible by using minimally invasive subcutaneous electrodes (UNEEG SubQ, UNEEG Medical). We hypothesize that such recordings may provide biomarkers for evaluation and ultimately prediction of the effect of VNS.
We started a prospective observational cohort study (PREDYct) in pharmacoresistant epilepsy patients with frontotemporal or generalized seizures undergoing VNS therapy. Patients will be implanted with a subcutaneous EEG electrode two months prior to VNS surgery. Feasibility and patient's experience of the ultra-long-term EEG recordings will be evaluated. Our goal is to develop a prediction model for the success of VNS using various features from the pre-operative long-term EEG, combined with network characteristics derived from resting state fMRI and 64-channel EEG. Features that will be explored include interictal epileptiform discharge (IED) rate, duration, waveform and waveform similarity.
At present, nine patients have been included. EEG electrode implantation and recordings were successful in all nine. The first two weeks of the first four patients were annotated by an experienced electroencephalographer. A circadian rhythm in IED rate was present in three of them, most clear in the first patient with 15-30 discharges per hour during the night and five or less per hour during daytime.
In conclusion, ultra-long-term recordings are able to capture the rich dynamics of the epileptic brain and show the circadian rhythm in IED rate. At the time of the conference we will show the first results of the effect of VNS on the recordings.



IED rate over time of patient 1, indicating a prominent circadian rhythm

Research Category and Technology and Methods
Clinical Research: 15. Electroencephalography (EEG)

http://dx.doi.org/10.1016/j.brs.2023.01.592

Abstract key: PL- Plenary talks; S- Regular symposia oral; FS- Fast-Track symposia oral; OS- On-demand symposia oral; P- Posters

P2.116

CLOSED-LOOP ROBOTIC TMS MOTOR MAPPING USING AN ONLINE-OPTIMIZED SAMPLING SCHEME

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Abstract
Transcranial magnetic stimulation (TMS) is a non-invasive brain stimulation tool for modulating and mapping cortical function. TMS-based functional mapping methods typically exploit causal relationships between brain structure and function. In earlier work, we demonstrated that cortical sites of the motor area can be precisely localized by relating FEM simulation derived electric field estimates to TMS induced motor evoked potentials (MEPs) in an input-output curve fitting approach using nonlinear regression. A random sequence of on average 180 TMS coil configurations (= coil position and orientation) have proven to provide sufficient variability in their electric field pattern and evoked motor responses to discriminate neuronal populations at the primary motor cortex at single digit level based on their goodness of fit.
Here, we propose an optimized robotic TMS mapping method to significantly reduce the number of stimulation samples, improve the mapping result and reduce the time required for the mapping experiment. Starting from a set of random TMS coil configurations, new configurations are determined during the experiment based on two Pareto-weighted criteria: a) the correlation of the induced electric fields is minimized to increase the distinguishability between cortical locations, and b) the information gain of the candidate position is maximized by determining the optimal sample location on the I/O curve using Fisher information matrix optimization informed by real-time MEP feedback.
The presented method was implemented in a robotic TMS system to enable accurate and reliable coil positioning, exactly timed triggering of the TMS pulse, and the online acquisition and analysis of the MEPs.

Research Category and Technology and Methods
Basic Research: 10. Transcranial Magnetic Stimulation (TMS)
Keywords: Transcranial Magnetic Stimulation, Motor Mapping, Robotic TMS, Optimization Problem

http://dx.doi.org/10.1016/j.brs.2023.01.593

Abstract key: PL- Plenary talks; S- Regular symposia oral; FS- Fast-Track symposia oral; OS- On-demand symposia oral; P- Posters

P2.117

ELECTROCONVULSIVE THERAPY CHANGES FUNCTIONAL BRAIN CONNECTIVITY IN DEPRESSED PATIENTS

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Abstract
Treatment-resistant depression accounts for 30% of cases of major depressive disorder, representing a substantial humanistic and economic burden. Electroconvulsive therapy (ECT), an electrical stimulation of the brain which triggers a generalized seizure, provides a chance of relief for such cases. Although beneficial, the precise antidepressant mechanisms of ECT remain to be determined. We expect that ECT induces changes in brain