P2.150

COMBINATORIAL MAPPING OF MODULATORY TARGETS: COMPUTATIONAL DESIGN & SIMULATION

Thomas Richner, Brian Lundstrom. *Mayo Clinic Rochester, Rochester, MN, USA*

Abstract

Current implantable bioelectronic devices target either the lesion directly or a canonical circuit, because finding a patient-specific network of indirect targets which modulate the lesion has been infeasible. We propose that when stereo EEG (sEEG) leads are implanted to record seizures, there is an opportunity to use stimulation and evoked activity to map out modulatory connections. Further, we hypothesize that combination of multiple stimulation sites will be more modulatory than single sites. However, this is a combinatorial (very large) problem, so exhaustively testing all combinations of sites is infeasible. We introduce a computational solution to this problem and test it in simulation.

Our proposed solution is to stimulate random combinations of sites in parallel and then analyze the evoked potentials using a generalized linear model (GLM). We tested this method by simulating a large, randomly connected, nonlinear, system of differential equations. We stimulated random combinations of sites in parallel to generate a dataset. We fit a GLM to the evoked potentials using maximum likelihood estimation, and L1 regularization was used to find an effective, sparse, combination of modulatory connections. This combination, which was not previously tested, was found to robustly evoke responses at the target. We propose using this approach to find patient-specific, modulatory, targets in patients with epilepsy undergoing SEEG prior to device implantation.

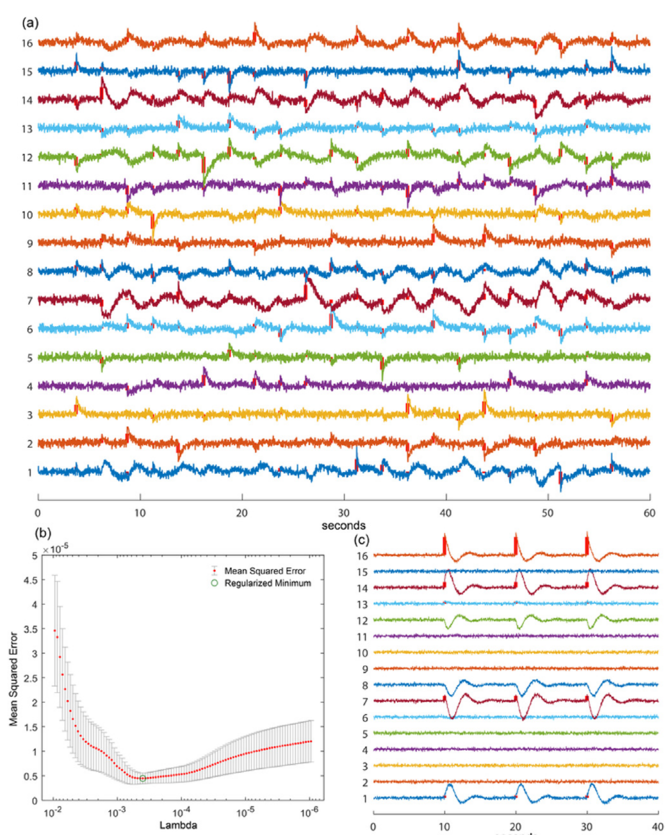

Figure 1. A simulation of combinatorial mapping of modulatory targets. (a) Random combinations of sites were stimulate, and (b) a GLM was fit to (c) chose an effective combination of stimulation sites to modulate the target channel (ch 1 in this example).

Research Category and Technology and Methods
Basic Research: 19. Modeling and computational methods
Keywords; stimulation, modeling, epilepsy, machine learning

http://dx.doi.org/10.1016/j.brs.2023.01.627

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

P2.151

OPTIMIZING TDCS PROTOCOLS BY LOOKING FOR THE BEST TIMING OF STIMULATION WITH RESPECT TO TASK EXECUTION

Sarah Feroldi, Alessandra Vergallito, Nicholas Diani, Eleonora Arrigoni, Alberto Pisoni, Leonor J. Romero Lauro. *University of Milano-Bicocca, Italy*

Abstract

Previous studies from our group showed how the neurophysiological effects of tDCS depend on the background activity of the stimulated area: at rest, anodal tDCS increased cortical excitability in a widespread network (Romero Lauro et al., 2014; 2016), while participants' involvement in a task during tDCS restricted such increment along the functionally activated network (Pisoni et al., 2018).

This study aims at investigating how different coupling of the stimulation induced by tDCS with the endogenous stimulation induced by a concurrent task execution might result in stronger behavioral effects.

We applied anodal tDCS for 20 minutes to the right posterior parietal cortex before, after, or during a visuospatial attention task (Posner task, PT) to find the most effective coupling between stimulation and task execution to induce greater changes in participants' performance on a second visuospatial task (Attention Network Task, ANT).

This resulted in a within-subject study in which 11 healthy adults participated in four experimental sessions, one sham and three anodal, counterbalanced between participants.

Statistical analyses were carried out using mixed-model regression inserting accuracy and reaction times (RTs) as dependent variables and subjects' intercept as random factor.

We found a main effect of stimulation ($\chi^2(3)$= 10.85; p<.05): in particular, stimulation applied after PT improved accuracy in the ANT compared to sham condition (p<.05).

Stimulation had also a main effect on RTs ($\chi^2(3)$= 87.25; p<.001), and, interestingly, the stimulation during PT resulted in prolonged RTs in the ANT compared to all conditions (p<.05). In line with previous literature, participants were more accurate and faster for congruent target or the valid cue.

Our preliminary results further confirm the dependence of anodal tDCS behavioral effect on the background activity of the targeted brain area, showing an advantage of pre-activating the targeted brain area with a similar task before the stimulation.

Research Category and Technology and Methods
Clinical Research: 9. Transcranial Direct Current Stimulation (tDCS)
Keywords: stimulation timing, tDCS, visuospatial task, attention

http://dx.doi.org/10.1016/j.brs.2023.01.628

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

P2.152

CONSISTENCY OF MEPS ELICITED AT TWO TMS INTENSITIES

Daniel Manning [1,2], Recep Ozdemir [1,2], Stephanie Buss [1,2], Mouhsin Shafi [1,2], Peter Fried [1,2]. [1] *Berenson-Allen Center for Noninvasive Brain Stimulation - Beth Israel Deaconess Medical Center, Boston, MA, USA;* [2] *Department of Neurology - Harvard Medical School, Boston, MA, USA*

Abstract

Background: The mechanisms of cortico-motor plasticity can be evaluated in human motor cortex by comparing the amplitude of motor evoked potentials (MEPs) elicited by single-pulse transcranial magnetic stimulation (spTMS) after a repetitive transcranial magnetic stimulation (rTMS) regimen. Post-rTMS increases/decreases in MEPs are interpreted as long-term potentiation-/depression-like changes, respectively.