**State-space models of evoked potentials to improve surgical outcomes in epilepsy patients**

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Differential Equations Seminar, UMBC

April 6, 2020

*Abstract:*

Medically-refractory epilepsy (MRE) is a devastating neurological disease that is defined by recurrent and unprovoked seizures that are insufficiently controlled by anti-epileptic medication. Surgical resection of areas in the brain identified as the *seizure onset zone* (SOZ) can be a curative option for patients with well-localized (‘focal’) MRE, but localization of the SOZ heavily relies on visual inspection of intracranial electroencephalographic (iEEG) data and has historically resulted in surgical failure rates around 50%. In this talk, I will describe a study that aims to improve seizure onset localization by employing *dynamical network models*. Specifically, we have recorded iEEG data in MRE patients that have undergone extensive evaluation with single-pulse electrical stimulation (SPES), a technique recently used to probe functional brain networks such as language and motor cortices. We hypothesize that a dynamical quantification of the connectivity networks derived from the evoked responses induced by SPES could also be used to accurately localize the SOZ. We construct linear, time-invariant state-space models from the SPES data and calculate properties of the model that we believe may be clinically-relevant, such as the largest *reachable state space* covered by finite energy stimulation inputs. This denotes the “largest” network response attainable via stimulation. I will give an overview of these dynamical network techniques and describe their potential impact in the clinical treatment of medically-refractory epilepsy.

*Bio:*

Rachel June Smith is a postdoctoral fellow in the Biomedical Engineering department at Johns Hopkins University. She received her B.S. from the University of Tennessee, Knoxville, and her M.S. and Ph.D. from University of California, Irvine, in Biomedical Engineering. Her work has focused in biomedical signal processing; first in ECG signals processing, later in arterial blood pressure waveform analysis to predict hypotension in the ICU, and her doctoral work focused on EEG signals processing to predict treatment outcome in pediatric epilepsy patients. Dr. Smith is an NIH-funded IRACDA fellow through ASPIRE at Johns Hopkins, a program that prepares biomedical scientists and engineers to pursue careers in academia through training in research, teaching, and mentorship of students. She served as a Pedagogical Fellow at UCI from 2017-2019 and was awarded the Most Promising Future Faculty award in 2018.