**Real Time Seizure Recognition via EEG, AI, and Nonlinear Dynamics**

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For decades, my wife's deep frontal lobe seizures were misdiagnosed by "specialists" who at one point admitted her to a mental hospital even though her mother was a diagnosed epileptic and at other points accidentally overdosed her and stuck us with the bills from their mistakes. Last year, my wife had brain surgery to correct her Epilepsy. We know now that the main cause of these misdiagnoses was the inability for an EEG to detect "deep brain" seizures.

They say the apple doesn't fall far from the tree and in the case of our daughter, this was certainly the case. Diagnosed with brain cancer at the 20-week anatomy scan after finding a mass in her brain, Nicolette was misdiagnosed by the first pediatric neurologist whose only solution was to add more dangerous meds to stop the seizures from killing her. One of these meds even caused blindness in one of Nicolette's eyes. This "specialist" would ignore our attempts to help find solutions and quickly put us in our place, never hesitating to let us know she was the "specialist" and we were nobodies. Finally, Nicolette was correctly diagnosed by a humble doctor after the first doctor was away for a conference with "specialists" and in short order Nicolette received the needed brain surgery for Ohtahara patients.

This cautionary tale about blindly believing "specialists" is enough to scar any family member, but that is only one part to Nicolette's story. The scars are many and the cuts are deep as we continued to find hospital errors that put Nicolette at risk and battled with insurance companies to approve medications. One particular battle to get a medication dealt with Nicolette being denied the life-saving medication because her EEG reading didn't match the "required pattern." This cut was so deep, I became driven to find a way to prevent other families, doctors, and insurance companies from having to go through this. There had to be a way to get more information from EEG readings! Thus began a 6 year journey to learn the mathematics of Nonlinear Dynamics, python, and Data Science so I could find ways to read the brain's electrical output better than an EEG monitor.

The original goal was to predict seizures via Bayesian Inference. This failed due the mathematics of Chaos Theory. Failure was not an option and my data analysis continued, eventually discovering a common "volcano" pattern, complete even with a volcano cauldron, that all EEG patients displayed going into a seizure. This allowed me to put a program into the EEG that, as long as there was an EEG on file for the patient, would allow the EEG to sound an alarm for the family in the room if the brain displayed the "volcano" pattern. This effectively eliminated the fear of sleeping through a deadly, silent seizure.

But what about patients admitted to an ER and hooked up to an EEG, or for those with no baseline on file? I generalized the previous solution to include any patient, even if it was their first EEG. Taking in real-time EEG readings, running them through my proprietary python program, and finally through a TensorFlow Deep Learning model, any particular moment in an EEG reading can be identified as a seizure or not.

A complete paper found at: Github