Real-Time Seizure Forecasting for Epileptics on a Consumer Product

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Epilepsy threatens the lives and freedom of around 50 million individuals worldwide annually. Predicting epileptic episodes (seizures) would increase the quality of life of epileptics. However, existing products to predict seizures for epileptics are invasive, inefficient, or inaccurate. To help patients understand and proactively treat their disease, I have developed a consumer product to forecast seizures that avoids issues in existing devices. The product reads brainwaves in real-time from a lightweight, user-friendly scalp electroencephalogram, then sends them wirelessly to a smartphone for processing by a patient-customized forecasting model to alert patients of future seizure outcomes. The forecasting model has been tested on ten patients. Over the course of a day, the model learned each patient's brainwave patterns pre-seizure, which it used to forecast seizures over the next day. For all patients, the model significantly outperformed a chance predictor. It runs in the background as patients perform other tasks, alerting them of an upcoming seizure; on average, alerting them 42.4 minutes prior to a seizure. An important aspect of this research is the combination of the model and the first fully-functioning autonomous consumer device in seizure forecasting, including a full data ecosystem to adjust the model given changes in patient's brain patterns. The product interacts with proprietary diagnostic software for clinicians. This product is completely noninvasive, consumes little battery, takes only milliseconds to forecast, and is accurate in testing. It includes a highly-requested novel feature for patients to tune the sensitivity of their forecasts.

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