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# A neural prosthetic device with closed-loop epileptic seizure detection and conditional therapeutic stimulation

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In recent years, alternative treatments and devices are proposed to investigate and treat epilepsy in addition to pharmacological and surgical treatments. Several prosthesis devices with deep brain stimulation (DBS) or vagus nerve stimulation are becoming popular treatments for epilepsy clients. These devices use open-loop continuous neural stimulations to control medical refractory epilepsies complementarily with a limited effective rate of around 45%. Besides, by using continuous stimulations and an implantable battery, lifetime of such a device is often limited and periodically operations for clients are required to replace the battery/devices.

To overcome the above limitations, this work proposed a neural prosthetic device with closed-loop epileptic seizure detection and conditional therapeutic stimulation. The low-power analog front-end and bio-signal processing circuitries are used to detect the seizure's signal before it propagates to the whole cortex and activating stimulations to stop the seizure. The integrated circuitries and planner cortical electrodes are developed and verified. A prototype portable seizure controller is assembled using chip-on-board integration with real-time seizure detection algorithms.

The experimental results with two epileptic animal models using Long-Evans rats indicate that at least 92% of seizures are detected and seizure activities are suppressed by conditional stimulations. Long term animal tests using the portable device with integrated chips and electrodes are currently undergoing. The proposed prosthetic device with closed-loop epileptic seizure detection and stimulation yields a promising treatment for absence epilepsy.

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