2022 年度（第 54 回）倉田奨励金

受領№.1549

マイクロデバイスによるリアルタイム脳波信号解析による てんかん発作の予知

代表研究者　　バネルジーアミット　京都大学　講師

Forecasting epileptic seizure by real-time EEG signal analysis by a micro-device

Representative　BANERJEE Amit, Kyoto University, Junior Associate Professor

研究概要

Epilepsy is a chronic neurological disorder that can cause abrupt loss of consciousness, convulsive seizure, and a variety of other symptoms. Around 1 million people in Japan, and about 50 million people worldwide suffer from epilepsy. Unfortunately, existing anti-epilepsy drugs don't work in ～ 30% of these patients, leading to serious physical injuries, accidental death, and an overall poor quality of life.

A reliable and portable device that can distinguish between ‘normal’, ‘pre-seizure’, and ‘seizure’ patterns in the electrical signal of brain-activity, called electroencephalogram (EEG) signal, in real-time can facilitate seizure-forecasting. In this research, a non-linear micro-electromechanical (MEMS) device is proposed for implementing ‘physical reservoir computing’, a type of hardware-based artificial intelligence (AI) system, which will be trained to classify real-time EEG signals into ‘normal’, ‘pre-seizure’, ‘seizure’ classes. The objective is to acquire the ability to alert patients and caregivers of an impending seizure, so that they can take timely precaution.

Using state-of-the-art microfabrication tools, proposed MEMS device will be fabricated from silicon; then, an ‘echo-state’ reservoir-computing architecture will be implemented for training and testing EEG data. In the testing phase, classification accuracy will be empirically evaluated and enhanced by tuning the reservoir or device design. Since, the AI computation is done at the hardware (MEMS device) level, the proposed device will be self-sufficient, besides being low-cost, low-power-consuming, and portable. Thus, I envision, the proposed device can be integrated with emerging low-cost topical EEG acquisition devices in future to improve the quality of life of actual epilepsy patients.