# Harnessing artificial intelligence to control drug-resistant epilepsy

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Credit: Amélie Philibert

Epilepsy affects nearly one percent of the global population, making it one of the most common neurological disorders. While two-thirds of patients with epilepsy respond well to pharmacological treatment or are

eligible for resective surgery, a significant proportion of epilepsy patients unfortunately continue to suffer from chronic, debilitating and unpredictable seizures.

Epileptic seizures can have consequences that include falls, injuries, fractures, insufficient blood flow to the brain, and in some cases even death. To minimize these risks, rapid intervention is essential. However, such interventions rarely occur in hospital settings or at home because patients often suffer seizures when they are alone, making it hard for medical staff or caregivers to detect them.

## Microelectronics and AI

Thanks to major advances in computational capacities and data processing power in recent years, artificial intelligence is poised to play a vital role in every area of future medicine.

The application of these advances in the healthcare sector has made it easier to formulate accurate diagnoses and offer customized treatment to patients while at the same time improving the overall quality of healthcare.

Over the past decade, our group has drawn on advances in microelectronics and artificial intelligence to explore several avenues in an effort to solve problems related to predicting, diagnosing and treating epilepsy. We initially focused on designing microsystems that could be implanted in the skull to continuously record brain wave activity, coupled with an algorithm capable of predicting seizures.

This approach made it possible to provide seizure alarms to patients, parents, caregivers or health professionals in order to trigger early intervention or even the automatic administration of local therapy aimed at blocking progression of the seizure.

## Using algorithms to predict

More recently, we were able to show that it is possible to predict seizures using algorithms that tap into artificial intelligence techniques to monitor brain activity well in advance of their onset, much in same way that meteorologists are able to predict the next day's weather.

We also recently partnered with industry stakeholders to design smart apparel capable of early detection of seizures in a way that is non-invasive and discreet (without the need for electrodes on the head or inside the brain).

Since patients often manifest uncontrollable movements, abnormal noises, increased heart rate and rapid breathing when suffering a seizure, we believe it is possible to predict the onset of seizures using AI techniques based on physiological signs other than brain activity, such as heart rate, respiratory frequency, electrodermal activity, motor activity and sounds. These signs would be provided by miniature captors integrated into comfortably designed "smart" apparel.

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