New way to detect epileptic seizures

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Researchers at Concordia University have pioneered a computer-based method to detect epileptic seizures as they occur – a new technique that may open a window on the brain's electrical activity. Their paper, "A Novel Morphology-Based Classifier for Automatic Detection of Epileptic Seizures," presented at the annual meeting of the Engineering in Medicine and Biology Society, documents the very successful application of this new seizure-detection method.

An epileptic seizure, which is caused by disruptions in the normal electrical activity of the brain, can produce a range of symptoms including convulsions and unconsciousness. To learn more about the timing and nature of seizures, the electrical activity of patients' brains is often recorded using electroencephalograms (EEGs). At the moment, however, epilepsy experts must review these recordings manually – a time-consuming process.

"EEG recordings may cover a period of several weeks," explains study co-author Rajeev Agarwal, a professor in Concordia's Department of Electrical and Computer Engineering. "That's a lot of data to review. Automating the process is difficult, because there's no exact definition for a seizure, so there's no template to look for. Every seizure is different with every patient."

However, seizures have certain recognizable characteristics. They occur when neurons fire in a synchronous or rhythmic manner. As seizures progress, the EEG signals have very strong transitions. Seen on an EEG recording, the waves of electrical activity tend to be spike-like.

The Concordia team, led by PhD candidate and lead author Rajeev Yadav, devised an algorithm to check the sharpness of the electrical signals on the EEG recordings as measured by their angle or slope. A series of sharp signals indicate a seizure.

This approach proved extremely successful. In the study of EEG recordings of seven patients, the new method detected every seizure while scoring an extremely low rate of false positives. Results are far better than those obtained with existing methods.

This method of detecting seizures may have applications beyond epilepsy. "Patterns of sharp electrical activity in the brain are generally not a good thing," says Agarwal, who is also co-founder, chief technical officer and vice-president of Leap Medical Inc.

"Think of comatose patients in the ICU for example," he continues. "Some of them may be having seizures or epileptic form like activity, but there's no way to know at the moment. Our method may allow health professionals to gain a much clearer picture of patients' brain function."

The research team continues to evaluate and refine this method of seizure detection. More patient data from several different centres is being reviewed, and further publications on the subject are planned. So far, according to Agarwal, results are promising.

More information: Cited research: ieeexplore.ieee.org/xpl/freeab … jsp?arnumber=5626781

Provided by Concordia University

https://phys.org/news/2011-03-epileptic-seizures.html