Epilepsy and seizures affect almost 3 million Americans of all ages, with approximately 200,000 new cases occurring each year. Recently, new cases have developed as a result of traumatic brain injury to soldiers in the aftermath of IED attacks in Iraq and Afghanistan. For 25 percent of these people, neither medication nor surgery can control their seizures.

Working with neuroscientists at Columbia University Medical Center, SEAS senior research scientist David Waltz, director of the Center for Computational Learning Systems, is developing a wearable “early warning” device to give epilepsy patients enough time to prepare for a seizure.

This warning device will use detector software based on advanced machine learning technology to detect an impending seizure. Co-PI Columbia neurophysiologist Catherine Schevon is collecting data via microelectrodes implanted in patients’ heads that supply the sample data at a rate of 30,000 times per second. This faster sample means higher-frequency brain waves can be detected, and these may play a pivotal role in seizures.

Once the software is developed, a patient would carry a small computer that monitors brain activity. The system would then reliably warn the patient in advance of seizures. Such a system would allow patients who cannot be treated successfully today to live a fuller and more active life.

The researchers’ long-term goal is to design machine-learning interfaces that could learn what brain-wave features predict seizures in individual patients. Hypothetically, this system could eventually take the form of an implanted “brain pacemaker,” stimulating the brain to prevent the seizure from happening in the first place.

Waltz received his PhD from the Massachusetts Institute of Technology, where his thesis on computer vision originated the field of constraint propagation. Along with Craig Stanfill, he also is well known as the originator of the memory-based reasoning branch of Case-Based Reasoning.