An Approach to Seizure Onset Detection Using Fuzzy Logic Based on Seizure Evolution in Intracranial EEG

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We present a fuzzy rule-based system for epileptic seizure onset detection. Two features based on temporal evolution of seizure in electroencephalogram (EEG) were extracted from intracranial EEG (iEEG) recordings. Features extracted from multichannel EEGs were combined using fuzzy algorithms in feature domain as well as in spatial (channels) domain. Fuzzy rules were derived from experts' knowledge and reasoning. Finally, a predefined threshold was used to make the final decision. A total of 40.46 h of iEEG recordings (obtained from Freiburg Seizure Prediction EEG database) selected from 13 patients having 19 seizures was used for the system evaluation. The overall detection rate of 100% was achieved with false detection rate of 0.275/h and the average detection latency of 26.858 seconds.

Esophageal Prosthesis For Refractory Gastresophageal Reflux Disease Prevention

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5.7 million Americans are clinically diagnosed each year with refractory gastresophageal reflux disease (GERD), characterized by chronic stomach acid reflux that is insensitive to both lifestyle modifications and pharmaceutical treatments. The most widely available treatments for these patients are endoluminal antireflux procedures, including EndoCinch plication and EsophyX transoral incisionless fundoplication, and the more drastic Nissen Fundoplication. These endoluminal treatments involve stitching the gastresophageal tissue in order to restore the natural antireflux barrier of the lower esophageal sphincter (LES), a ring of muscle regulating entry to the stomach, although their efficacy in terms of decreasing long-term acid exposure has not been established. As such, patients often must rely on Nissen Fundoplication for relief. However, because Nissen Fundoplication is invasive, irreversible, and can lead to complications such as dysphagia and bloating, new methods to effectively treat refractory GERD are necessary. We propose a novel, long-term solution to treat refractory GERD by using an esophageal prosthesis to prevent retrograde acid flow while maintaining normal physiological function. Our device, a silicone band molded over a nitinol wire, strengthens the antireflux barrier by adding a compressive pressure on the LES. The prosthesis deforms to allow food to pass uninhibited during swallowing and opens to release air and vomit during belching and regurgitation, respectively. In the absence of these events, however, the band compresses the LES to prevent acid reflux from damaging esophageal tissue. As the prosthesis will be inserted laparoscopically around the distal esophagus and can be adjusted or removed at a later time if necessary, it is both minimally invasive and reversible. The device successfully established a 14 mm Hg pressure differential in an ex vivo porcine esophagus and passed a representative food bolus test. Further development of this design concept is warranted to achieve the goal of long-term acid reflux prevention in refractory GERD patients.