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Epileptic Seizure Onset Detection via Energy and Neural Synchronization Decision Fusion

Authors : Marwa Qaraqe, Muhammad Ismail, Erchin Serpedin

Abstract : This paper presents a novel architecture for a patient-specific epileptic seizure onset detector using scalp electroencephalography (EEG). The proposed architecture is based on the decision fusion calculated from energy and neural synchronization related features. Specifically, one level of the detector calculates the condition number (CN) of an EEG matrix to evaluate the amount of neural synchronization present within the EEG channels. On a parallel level, the detector evaluates the energy contained in four EEG frequency subbands. The information is then fed into two independent (parallel) classification units based on support vector machines to determine the onset of a seizure event. The decisions from the two classifiers are then combined together according to two fusion techniques to determine a global decision. Experimental results demonstrate that the detector based on the AND fusion technique outperforms existing detectors with a sensitivity of 100%, detection latency of 3 seconds, while it achieves a 2:76 false alarm rate per hour. The OR fusion technique achieves a sensitivity of 100%, and significantly improves delay latency (0:17 seconds), yet it achieves 12 false alarms per hour.

Keywords : epilepsy, EEG, seizure onset, electroencephalography, neuron, detection
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