Novel Mathematical Approach to Aid in the Design of an Alert System for an Ongoing Focal Seizure

Santiago-Reyes, Gustavo
Santiago-Reyes, Omar

Studying the effects of seizures in the brain is necessary to better understand and treat epilepsy. With the use of an electroencephalogram (EEG), researchers and health professionals can record the electrical activity occurring inside the brain, which is why this method is used to study seizures. Furthermore, because of the neurons' extreme sensibility to changes in the environment, any difference in it will be tied with a response to maintain homeostasis. Hence, the question arose: how will electrical frequencies that occur during a seizure theoretically correlate with temperature displacement in the brain? The researchers developed a theoretical approach to determine if the proposed hypothesis was sustainable. It stated that seizures would cause an increase in average brain temperature. Numerical values concerning the morphology of the focus, physical properties of the blood and cerebral tissue, and the amplitude and frequency recorded with EEG readings were considered to develop a function that outputs the temperature changes that would theoretically occur under different conditions. It was discovered that the temperature change that occurs during a seizure is large enough to be perceivable at the focus and adjacent regions. This means that it is possible to apply this mathematical model to create a device that can detect these changes in temperatures and alert patients of an ongoing seizure to avoid risks. Also, a cost effective method to analyze the effect of seizures in the brain could be derived from this model by establishing a correlation with data acquired from EEG tests.