Seizure Prediction Using Spectral Density Analysis on Pediatric EEGs

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This study had two goals: to identify frequencies within the gamma band, 30 to 100 Hz, that contribute the most electrical power during seizure periods, and to explore pre-seizure patterns at these frequencies. This was accomplished using mathematical analysis on eighteen-channel, bipolar montage, pediatric scalp EEGs. . Five seizure periods and five control non-seizure periods were chosen per patient. In Part 1, Welch's method was used to calculate the power spectral densities of each channel in these ten periods. The squared magnitudes of the average differences between the power spectral densities of each seizure and the five non-seizure periods were graphed. Points within the top 10% and 20% of the five graphs were analyzed to find common peaks that represented gamma frequencies contributing the most electrical power during that patient's seizures. In Part 2, five thirty-second pre-seizure periods and five thirty second control non-seizure periods were extracted for each patient. A visualization technique called ERP Imaging was used to compare each patient's thirty second pre-seizure voltages at the significant frequencies from Part 1 to the patient's control periods. This comparison was used to identify thirty second pre-seizure patterns. Across seven of the eight patients, frequencies between 70 and 100 Hz contributed the most power during seizures. For six of those seven patients, there was a clear pre-seizure pattern of dense 5 to 10 microvolt activity at those high gamma frequencies thirty seconds before seizure onset.