Title:

A novel visualization method of Stereo-EEG (SEEG) data using time-frequency analysis.

Authors:

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Rationale:

In Stereo EEG (SEEG), the isolation of the epileptogenic zone (EZ) relies largely on the skill and experience of the epileptlogist. Time frequency analysis can provide an objective method to analyze SEEG data, but can be difficult to interpret. A time frequency analyzer was developed to assist clinicians in visualization of data across multiple SEEG contacts.

Methods:

A program was developed from first principles using Matlab. Raw SEEG data was Notch filtered to remove power line harmonic contamination. A Continuous Wavelet Transform (CWT) was performed for frequencies from 0.5Hz-200Hz, arranged into 8 frequency bands under guidance from clinicians. The time varying power of each frequency band was then computed by summing the magnitude squared coefficients of scales in each frequency band. The visualization program then normalized the coefficients of signals involved in the epileptogenic network to compare key events.

Results:

The program analyzed pre-ictal, ictal and inter-ictal discharges over the clinically hypothesized epileptogenic network. Time-Frequency data of one spike from each scenario was analyzed and classified to determine whether each frequency band was involved. Correlating frequency activity common to all events gave a result identifying the EZ conclusive with visual analysis.

Discussion:

The visualizer developed using time-frequency data, has the potential to identify the EZ in SEEG, in conjunction with traditional techniques of analysis. As epileptiform spikes were studied, a correct representation of frequencies could not be obtained, however the involvement pattern gave a 'signature' for each type of event. This data processing engine requires further testing but can be refined to make time-frequency data accessible to clinicians.

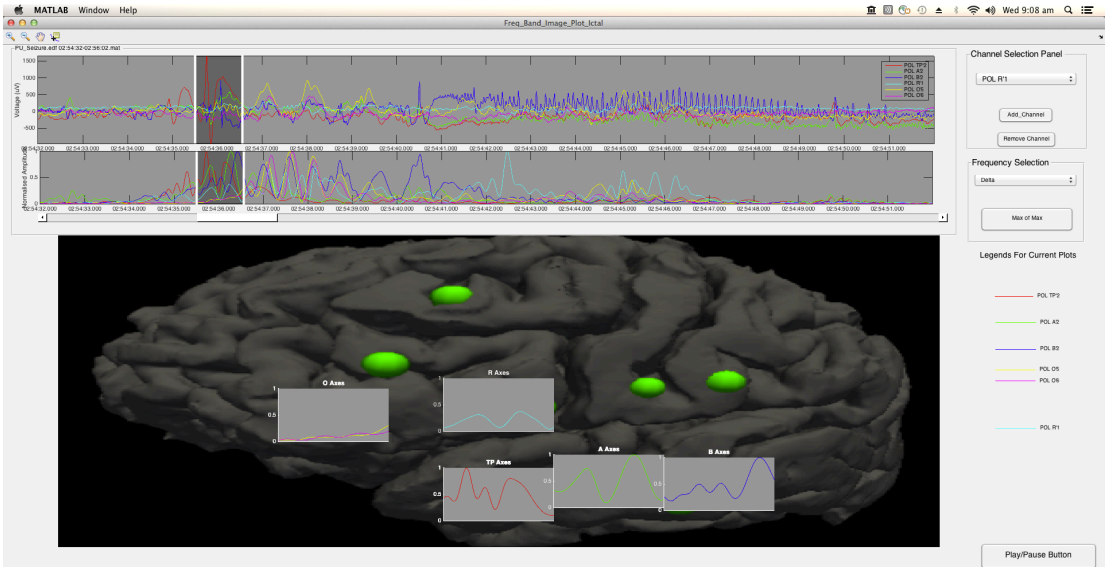

Figure 1: Final Design of the program shows the time frequency data for each electrode contact overlaid upon a reconstruction of the patient's brain correlated with the electrode exit points.