SmartEEG Report

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Abstract

As we grow and progress the medical sciences, the tools we have access to become better and stronger. We will be able to monitor almost every aspect of the human function, from the slightest twitch in the muscles to the electrical signals in our very brains. However, with this new influx of information, a technology is grossly overlooked: the method in which we view this data. Imagine that you need to correct your taxes and need some information from a large purchase like a car or a home; you would not sift through every single purchase that year, from the smallest grocery purchase to the quarters that you spend in vending machines. You would want to focus on those documents that are relevant to that purchase. Yet, doctors working in epilepsy research must deal with exactly that: rather than being able to focus on important data, they must sift through continuous irrelevant monitoring records to find the few spots that may indicate a seizure event.

SmartEEG aims to remedy this issue. SmartEEG can show doctors the exact data that they need in order to more efficiently recognize EEG patterns around seizure events, allowing doctors to focus their time on more important issues. SmartEEG can take an .edf file, a standard file output format for EEG monitoring machines, and prunes the data down to digestible increments. SmartEEG accomplishes this by recognizing alarm tags, annotations that indicate a possible seizure risk or seizure event and categorizing the level of risk present (being low, medium, or high). In the case of a medium or high-risk event, SmartEEG will save fifteen minutes before and after the event and prunes the rest of the irrelevant data. SmartEEG then presents the EEG graph in a scrollable, tabulated format. This will assist doctors by expediting the EEG reviewing process and provide an easily manageable location where doctors can quickly jump between important data periods and safely ignore areas of little or no interest.

Design

The current method that's used to manage monitoring data is to select data that is around a patient reported seizure event and prune the rest. The issue with this method is that seizures can occur without the patient knowing it, resulting in a loss of valuable data. SmartEEG improves upon this method by utilising seizure detection devices to access the risk of the data. SmartEEG uses the alarms of these seizure detection devices to assess the risk probability of the data and is able to categorize segments of the data to be low, medium or high risk. SmartEEG will output these selected segments as output files that will be displayed as EEG graphs.

Challenges

While developing the SmartEEG Desktop Application, it was found that the Nihon Kohden's EDF standard did not match with the EDF library's standard for EDF files. To fix this issue in regards to the EDF files that were provided for the SmartEEG, a converter function was created. Within this function, it takes the EDF file provided by the user and manually changes

the physical minimum and maximums of the signals, so that it reaches the standard used in the library that was used.

The visual aspect of the SmartEEG had challenges in how the samples of the EEG were being plotted in an accurate and efficient manner. Using Qt Designer in Visual Studios, QCustomPlot was used to create a graphical visual of the pruned EDF file from the original EDF file. QCustomPlot provides a flexible and efficient Qt library that helps create an EEG visual for the user to look through and analyze.

Future Implementations

As of now, the SmartEEG only works with .edf files that were created before the pruning process of the file. In the future implementation and design of the SmartEEG, the application program would prune out irrelevant monitoring data from a live feed. This live feed would come from a wearable device from a patient, and would be read in as the data is being read in from the patient. The SmartEEG would have the ability to detect the beginning of a seizure event and would stop pruning at the end of a seizure event.

Right now, the SmartEEG has a simple UI in which it only asks to read in an .edf file, in the future implementation, the SmartEEG would have a more robust user interface in which the user can save the output files, make annotations, and have the ability to distinguish of the monitoring data is of high, medium, or low risk.

With these future implementations, users all around the world would save time and spend it helping more patients other than looking at EEG data for an indefinite amount of time.