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Auto-eeg demo: a user-friendly application for EEG analysis

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Abstract

- The EEG is the responsible to measure the brain activity. Complicated statistical and mathematical analysis is the primary tool in neuroscience. Combined with big data and deep learning the ability to automatically learn how to interpret EEGs increase even more. On the application side the complexity increase simultaneously with the decrease of the usability.
- The importance of EEG analysis is clearly correlate with important areas of our daily life functioning. His optimization helps neuroscientists diagnoses and reliability of data.
- We are developing a system, Demo, that generates time aligned markers indicating points of interest in the signal, and then produces a summarization if its findings based on a statistical analysis of this markers in a friendly interface.
- The application is more than functional, it's friendly-user to support the decision making.

Introduction

- Although EEG instrumentation is becoming more common in research centers, the software availability and standardization remain limited or with a very low usability compared to the other functional brain imaging modalities.
- The acceptance seems to be very hard, once that the technological challenges repel the adoption of the tools by the users.
- The user’s needs for analysis and visualization of EEG data vary depending on their application. For instance, the raw recordings can be used to identify abnormal brain activity or seizure events.
- The software solution would be beneficial to the imaging community and provide automation, standardization and reproducibility of the EEG analysis, with the possibility of importing large amounts of data to mathematical and visual analisys.

Software Overview

The training uses machine learning algorithms based on hidden Markov models and deep learning to learn mappings of EEG events to diagnoses.
The software is written almost entirely in python. Its interface is design in QT Design, which generated python files for the the GUI. Demo also use Shell scripts, which makes the software portable, cross-platform application.
The programming language and scripts combined are a powerful noncommercial license with high performance to analyze huge amounts of data.

Data Processing

The data is processed by Machine algorithms based on hidden Markov models and deep learning are used to learn mappings of EEG event to diagnoses.
The inputs are file formats for archival and exchange of sleep and EEG data (multichannel raw data)
The machine training is responsible for reliably labeled the files with different labels and generate a vary set of views that help in decision making.

Interface Integration

Demo is driven by its interface, a generic environment structured encompassing the interface in which specific functions were implemented.
It's also contextual rather than linear: the multiple features from the software are not listed in long menus, the interface is very intuitive for whose knowledgeable about the EEG features; they are accessible only when needed, they haven't the typical pop-up menus, which let the interface more intuitive and fast to be understand.

Views

The application offers different views according to the needs. Waveform, spectrogram, montage, all of them with specific approaches that facilitates the understand of the patient data, without massive work from the neurologist part.

Summary .

- Application for EEG analysis with a friendly user interface.
- Reliably and replicate data processing.
- Big data and machine learning offer the potential to deliver much higher performance solutions.