Burst Detector for Preterm EEG

Collection of M-files (computer code) to implement a method to detect bursts on EEG recordings, as described in [1]. Detector uses a linear combination of multiple amplitude and spectral features. Developed and tested on EEG recordings from premature infants (<30 weeks gestational age) using a bipolar EEG montgage (F3-C3, F4-C4, C3-O1, C4-O2, C3-T3, C4-T4, Cz-C3, and C4-Cz). Detector operates on 1 channel only. Requires Matlab or Octave programming environments. Updates can be found at https://github.com/otoolej/burst_detector.

To cite this software, please use reference [1].

Overview

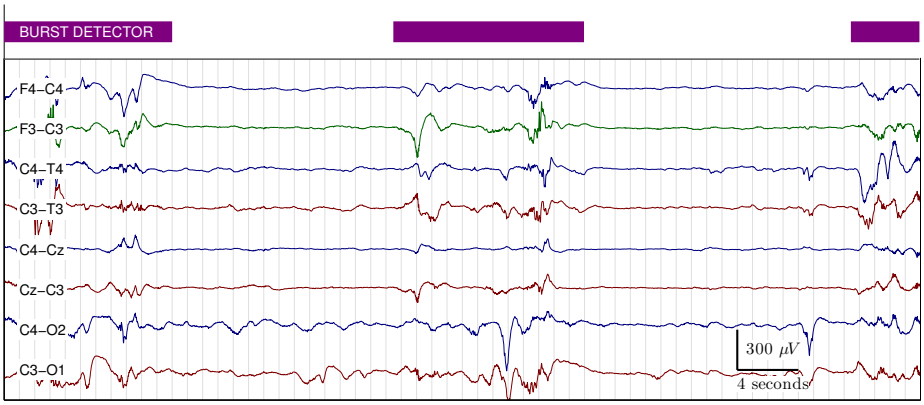

Figure 1: Example of burst detector (purple annotation) on channel F3-C3

A simple method to detect bursts in the EEG of preterm infants. The method was developed by assessing multiple frequency and amplitude features of bursts. Selected features were combined in a classifier (support vector machine). After a feature selection and training procedure, the detector consisted of eight features which are combined in a linear support vector machine. The code here implements this detector, which was trained on annotations from 1-channel of 10 minute EEG recordings from 36 preterm infants.

Quick Start

Set paths in Matlab/Octave, or do so using the `load_curdir` function:

```
>> load_curdir;
```

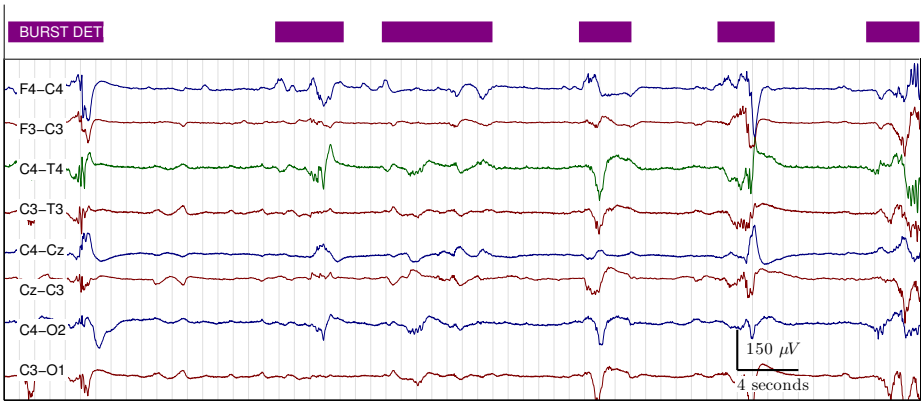

Figure 2: Another example of burst detector on channel C4-T4

Example

```
% use impulsive noise test signal
N=5000;  Fs=64;
x=gen_impulsive_noise(N).*10;

% detect the bursts:
[burst_anno,svm_out]=eeg_burst_detector(x,Fs);

% and plot:
figure(1); clf;
t=(0:N-1)./Fs;
hax(1)=subplot(211); hold all;
plot(t,burst_anno); plot(t,svm_out);
hax(2)=subplot(212);
plot(t,x);
linkaxes(hax,'x');
xlabel('time (seconds)');
```

Files

All Matlab files (.m files) have a description and an example in the header. To read this header, type `help <filename.m>` in Matlab.

Requirements

Either Matlab (R2013 or newer, Mathworks website) with the Signal Processing Toolbox or Octave (v3.8 or newer, Octave website) with the 'octave-signal' add-on package.

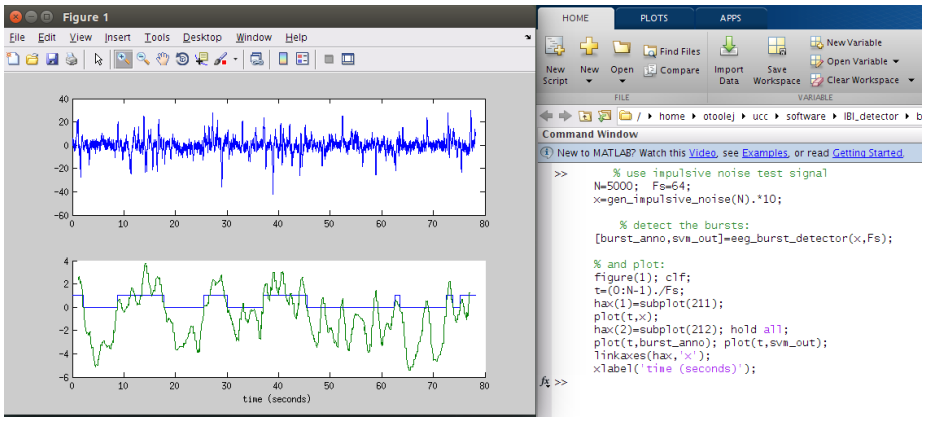

Figure 3: Burst detector (in Matlab environment) for impulsive noise test signal

Test Computer Setup

- hardware: Intel® Xeon® CPU E5-1603 0 @2.80GHz; 8GB memory.
- operating system: Ubuntu GNU/Linux x86_64 distribution (16.10, Yakkety Yak), with Linux kernel 4.8.0-41-generic.
- software: Octave (4.0.3) with 'octave-signal' toolbox and Matlab (R2013a) with Signal Processing Toolbox.

References

1. JM O' Toole, GB Boylan, RO Lloyd, RM Goulding, S Vanhatalo, and NJ Stevenson, "Detecting Bursts in the EEG of Very and Extremely Premature Infants Using a Multi-Feature Approach", Medical Engineering and Physics, in press, 2017.

2. JM O' Toole and NJ Stevenson, "Assessing instantaneous energy in the EEG: a non-negative, frequency-weighted energy operator", In 36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), pp. 3288-3291. IEEE, 2014 { paper | poster | code }

Contact

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