

# 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 montage (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](https://github.com/otoolej/burst_detector).

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

## Overview

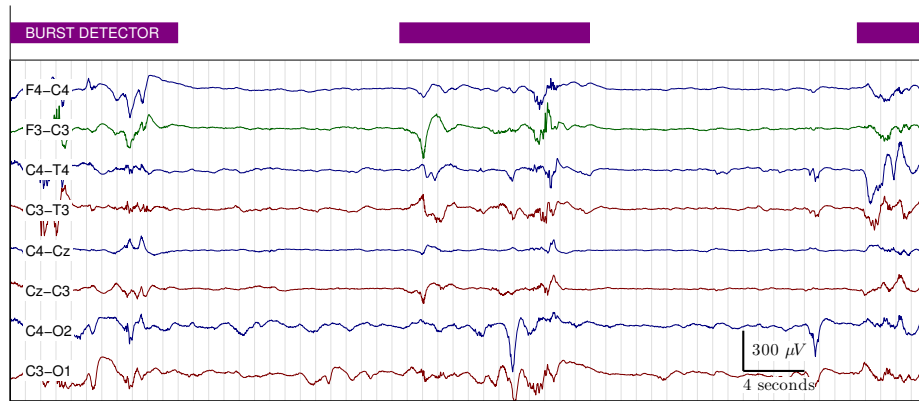


Figure 1: Example of burst detector (purple annotation) on channel F3-C3

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;
```

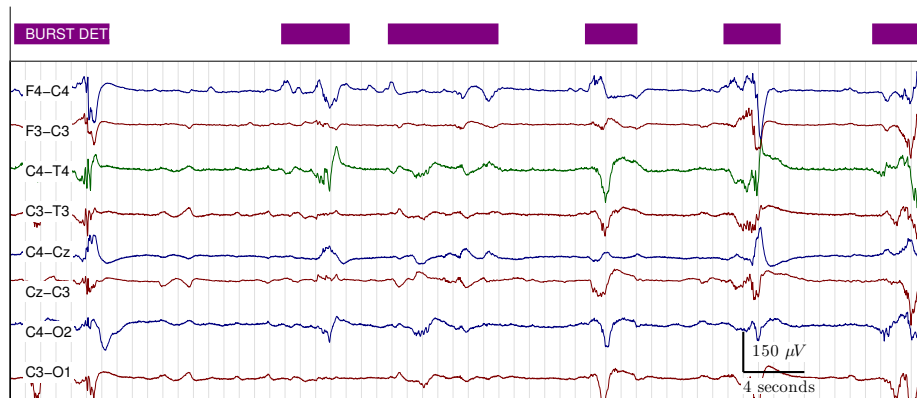


Figure 2: Another example of burst detector on channel C4-T4

## 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.

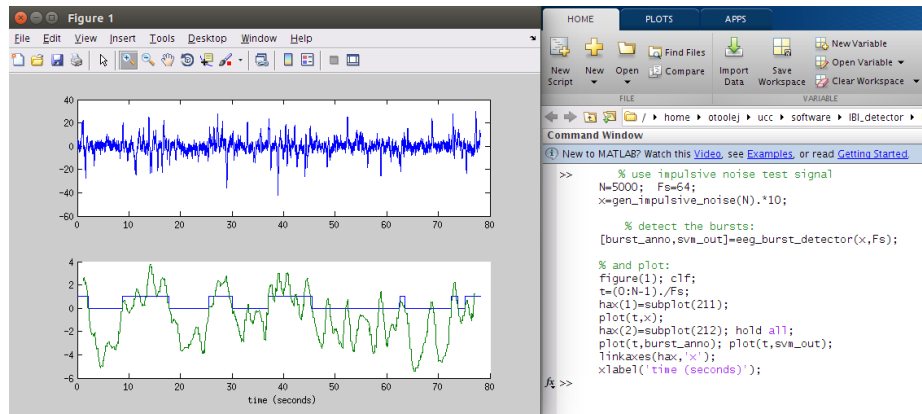


Figure 3: Burst detector (in Matlab environment) for impulsive noise test signal

## 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

John M. O’ Toole

Neonatal Brain Research Group,  
Irish Centre for Fetal and Neonatal Translational Research ([INFANT](#)),  
Department of Paediatrics and Child Health,  
University College Cork,  
Cork University Hospital, Room 2.19 Paediatrics Building,  
Cork, Ireland

## Licence

---

Copyright © 2015, John M. O' Toole, University College Cork All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- Neither the name of the University College Cork nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

This software is provided by the copyright holders and contributors “as is” and any express or implied warranties, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose are disclaimed. In no event shall the copyright holder or contributors be liable for any direct, indirect, incidental, special, exemplary, or consequential damages (including, but not limited to, procurement of substitute goods or services; loss of use, data, or profits; or business interruption) however caused and on any theory of liability, whether in contract, strict liability, or tort (including negligence or otherwise) arising in any way out of the use of this software, even if advised of the possibility of such damage.

---