

# fNIRS-EEG BCIs for Motor Rehabilitation: A Review

Jianan Chen<sup>†</sup>, Yunjia Xia<sup>†</sup>, Xinkai Zhou, Ernesto Vital, Alexander Thomas, Rui Loureiro, Robert Cooper, Tom Carlson, Hubin Zhao<sup>\*</sup>

<sup>\*</sup> Correspondence: Hubin Zhao: hubin.zhao@ucl.ac.uk

## 1. Supplementary Tables

**Supplementary Table S1.** Signal pre-processing pipelines in reviewed fNIRS-based BCI studies

Author/Years (★clinical)	Pre-processing
★Holper et al., 2010 [29]	<ul style="list-style-type: none"> <li>7<sup>th</sup> order Chebyshev low-pass</li> </ul>
Schurholz et al., 2012 [30]	<ul style="list-style-type: none"> <li>Wavelet-MDL;</li> <li>zero-phase Chebyshev type II low-pass filter (0.5 dB ripple, 40</li> </ul>
Zimmermann et al., 2013 [31]	<ul style="list-style-type: none"> <li>2<sup>nd</sup> order Chebyshev type II low-pass filter (40 dB attenuation, 0.5</li> </ul>
Thanh Hai et al., 2013 [32]	<ul style="list-style-type: none"> <li>Savitzky–Golay filter</li> </ul>
★ Rea et al., 2014 [33]	<ul style="list-style-type: none"> <li>wavelet-MDL;</li> <li>Gaussian low pass filter with 4-</li> </ul>
★ Lee et al., 2017 [34]	<ul style="list-style-type: none"> <li>4<sup>th</sup> order Butterworth band-pass</li> </ul>
Trakoolwilaiwan et al., 2017 [35]	<ul style="list-style-type: none"> <li>DWT;</li> <li>10-level wavelet decomposition with a Daubechies mother func-</li> </ul>
★ Khan et al., 2018 [36]	<p>Implemented 6 different filters for performance comparison:</p> <ul style="list-style-type: none"> <li>Kalman Filter;</li> <li>Wiener Filter;</li> <li>Gaussian Filter;</li> <li>Hemodynamic response filter;</li> <li>Band-pass filter;</li> </ul>
★ Lee et al., 2019 [37]	<ul style="list-style-type: none"> <li>MACD filter</li> </ul>
A et al., 2020 [38]	<ul style="list-style-type: none"> <li>4<sup>th</sup> order Butterworth band-pass filter (0.01–0.2 Hz);</li> </ul>
★ Hamid et al., 2022 [39]	<ul style="list-style-type: none"> <li>low-pass filter (0.5 Hz);</li> <li>high-pass filter (0.01 Hz)</li> </ul>

**Supplementary Table S2.** Signal pre-processing pipelines in reviewed fNIRS-EEG-based BCI studies

Author/Years (★clinical)	fNIRS Pre-processing	EEG Pre-processing
Leamy et al., 2011 [23]	<ul style="list-style-type: none"> <li>low-pass filter (0.5 Hz);</li> <li>high-pass filter (0.01 Hz)</li> </ul>	<ul style="list-style-type: none"> <li>high-pass filter (1 Hz)</li> </ul>
Fazli et al., 2012 [24]	<ul style="list-style-type: none"> <li>3<sup>rd</sup> order Butterworth low-pass filter</li> </ul>	<ul style="list-style-type: none"> <li>band-pass filter;</li> <li>CSP-based filter</li> </ul>
★ Khan et al., 2014 [40]	<ul style="list-style-type: none"> <li>Gaussian low-pass filter;</li> <li>wavelet transform</li> </ul>	<ul style="list-style-type: none"> <li>band-pass filter (4-35 Hz)</li> </ul>
Jawad Khan et al., 2014 [41]	<ul style="list-style-type: none"> <li>Gaussian low-pass filter;</li> <li>wavelet transform</li> </ul>	<ul style="list-style-type: none"> <li>band-pass filter</li> </ul>
Koo et al., 2015 [42]	<ul style="list-style-type: none"> <li>EMA filter</li> </ul>	<ul style="list-style-type: none"> <li>Butterworth filter;</li> <li>CSP-based filter</li> </ul>
Yin et al., 2015 [43]	<ul style="list-style-type: none"> <li>5<sup>th</sup> order Chebyshev type II low-pass filter (0.1 Hz)</li> </ul>	<ul style="list-style-type: none"> <li>5<sup>th</sup> order Chebyshev type II low-pass filter (125 Hz);</li> <li>band-pass filter (5 to 45 Hz);</li> <li>Laplacian filter</li> </ul>
Buccino et al., 2016 [44]	<ul style="list-style-type: none"> <li>4<sup>th</sup> order IIR Butterworth filter (0.01-0.2 Hz);</li> <li>High-pass filter</li> </ul>	<ul style="list-style-type: none"> <li>4<sup>th</sup> order IIR Butterworth band-pass filter</li> </ul>
Li et al., 2017 [45]	<ul style="list-style-type: none"> <li>4<sup>th</sup> order Butterworth band-pass filter (0.01-0.2 Hz)</li> </ul>	<ul style="list-style-type: none"> <li>3<sup>rd</sup> order Butterworth band-pass filter (1-45 Hz)</li> </ul>
Chiarelli et al., 2018 [46]	-	<ul style="list-style-type: none"> <li>zero-phase 2<sup>nd</sup> order Digital Butterworth filter (8-30Hz)</li> </ul>
★ Wang et al., 2019 [47]	<ul style="list-style-type: none"> <li>band-pass filter (0.01-0.2 Hz);</li> <li>moving average outlier removal</li> </ul>	<ul style="list-style-type: none"> <li>band-pass filter (0.5-100 Hz);</li> <li>band-stop filter (50 Hz);</li> <li>CAR</li> </ul>
Ghonchi et al., 2020 [48]	<ul style="list-style-type: none"> <li>band-pass filter (0.01-0.5Hz)</li> </ul>	<ul style="list-style-type: none"> <li>band-pass filter (0.5-35Hz)</li> </ul>
Chen et al., 2022 [49]	<ul style="list-style-type: none"> <li>band-pass filter (0.01-0.2Hz)</li> </ul>	<ul style="list-style-type: none"> <li>3<sup>rd</sup>-order Butterworth filter (0.5-35Hz)</li> </ul>

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