

Pre-Whitening BRANL

[Purpose of Pre-Whitening]

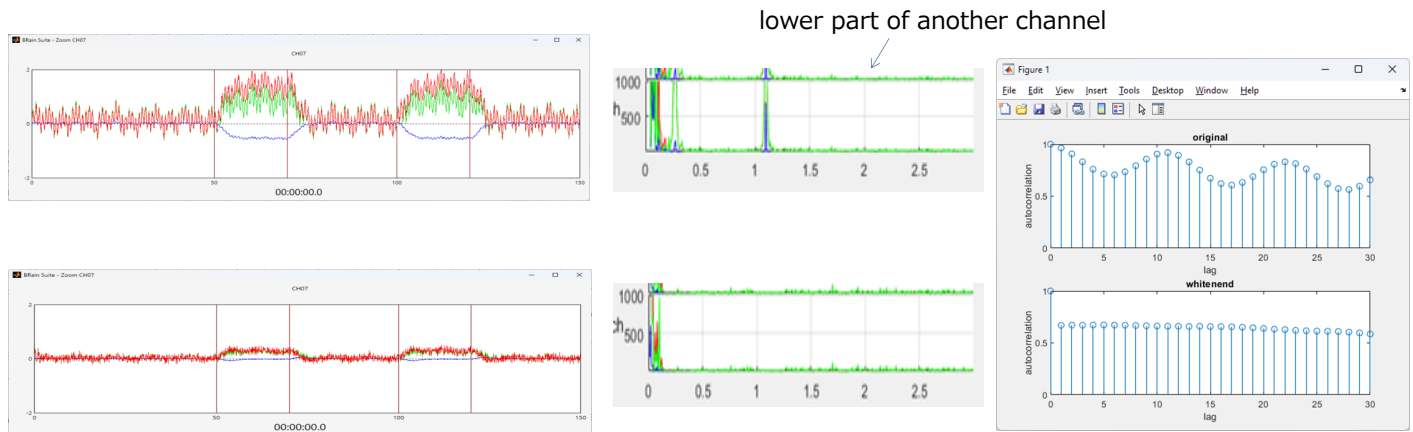
1. To make the noise frequency independent and uncorrelated.
2. To prefilter the data to remove physiological components and motion artifact.

[Merits of Pre-Whitening]

1. Even if you don't know the frequency of physiological noise, autoregressive model extract the frequency and whiten.
2. Low Pass Digital Filter
 - When the frequency of design matrix is set about 0.5[Hz], and cut-off frequency of low-pass is set 0.2[Hz] to avoid respiration, the brain activation will not detected. In pre-whitening, this case does not occur.
 - In digital filter(IIR/FIR), since the phase of point A will become different from the phase of different point B, topography of digital filtered signal is incorrect. filtfilt(IIR) satisfies zero-phase digital filtering. In pre-whitening, this trouble does not occur.

[Analysis Procedure]

1. Calculate the error term (signal) by GLM analysis.
2. Get the whitening filter by "aryule" function (MATLAB).
3. Apply the whitening filter to the measured data and the design matrix.
4. Get the beta value. "regress" or "robustfit" will be used, The outlier influences the robust fit less than the least-squares fit (regress).



The synthesized wave is consisted with cardiac(1.1[Hz]), respiration(0.27[Hz]), Mayer(0.1[Hz]), random and hrf(20[sec] duration). The upper is original (synthesized wave), the lower is pre-whitened wave.

[references]

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