-In general, the bandwidth of the sEMG signals induced by muscle activations is considered to be

20–450 Hz.

"" identifying the frequency distribution of the artifacts, then removing those artifact components from artifact-contaminated signals in the frequency domain, and finally reconstructing the artifact-free

signals in the time domain”

There are three parameters for the ACSR filter: (1) window length when segmentally analyzing the artifact-dominant signal to extract artifact features (i.e., window length, N); (2) size of the overlap between the windows (i.e., overlapping window, t), and (3) total time length of artifact-dominant signals that is used for filter training (i.e., time length for training, NS). In this paper, window length (N), overlapping window (t) and time length for training (NS) were set as 200 ms, 100 ms, and 3 s, respectively.

(WORK ON 1 PARAMETER AT TIME)

1-Specifically, to examine the influence of the window length (N) on the filter performance, the window length was changed from 100 ms to 800 ms in increments of 50 ms, while keeping the other two parameters constant (t = 100 ms, NS = 3 s)

2-the overlapping window (t) was changed from 0 ms to 199 ms in increments of 1 ms, while unchanging the other two parameters (N = 200 ms, NS = 3 s)

3-. Lastly, time length for training (NS) was explored from 0.5 s to 6 s in increments of 0.5 s, while keeping the other two parameters constant (N = 200 ms, t = 100 ms).

Some results:

* reduction of the 95% of the noise and
* muscles on the thigh (RF, VL, MH) had significantly greater noise amplitudes compared to those of the muscles on the shank
* noise significantly increased as higher tSCS intensities were applied
* . As the window length increased (from red to blue line), the filtered signals showed higher RMS amplitudes at the phase of muscle deactivation (e.g., signals at 7.5 s) indicating that a greater amount of signal remained unfiltered. This result implies that longer window lengths resulted in a higher frequency resolution, and the complicated frequency distribution of artifacts is likely to be overfitted to the training signals with non-stationary artifacts.
* While there were minimal differences among the filtered signals, as size of the overlapping window increased (from red to blue line), the graphs slightly shifted toward the right side (i.e., temporal delay). This result indicates that an elongated overlapping window setting might cause temporal offset of the filtered signal.
* In general, a longer time length for training allows to detect more variation of artifacts in the reference signal, which might lead to improved filter performance. However, it should also be considered that extending the time length of training might increase the risk of rejecting muscle-induced signals because a subject might unintentionally contract muscles during this period.

ACSR PROS:

1. ACSR filter does not have these limitations because it automatically identifies artifact characteristics and does not need prior knowledge about stimulation conditions. Also, the filter only subtracts magnitude of the signal originated from artifacts while keeping those originated from muscle activity

ACSR LIMITATIONS:

* ACSR filter was designed with the assumption that the artifact characteristics would be constant throughout a single data set
* The second limitation is that the reference signals (i.e., artifact-dominant signal), in which the artifact component is trained, include stimulation artifacts as well as sEMG activity induced by maintaining standing posture. However, as stated in the method section (section 2.3.1, Supplementary Materials S2), the signal amplitude solely induced by standing posture was substantially smaller compared to the signal amplitude induced by walking