ADAPTIVE METHOD OF EYE BLINK ARTIFACT SUPPRESSION IN EEG

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Electroencephalography (EEG) is the neurophysiologic measurement of the electrical activity of the brain recorded by electrodes placed on the scalp. It is used to receive information about the underlying brain activity and to detect pathological signs. Unfortunately EEG is often contaminated by non-cerebral activities that can add false information to the signal or can suppress valid information. There are two major categories of artifacts: technical and physiological. The main interest lies in removing physiological artifacts, such as eye-movements, muscle or cardiac noise. In this article, suppression of blink artifacts is considered.

There are two approaches in blink effect suppression. The first approach is the independent processing of EEG channels like subtracting the filtered electrooculogram (EOG) channel from EEG [1] or using wavelet transform to remove blink artifacts [2]. The second approach uses the correlation of blink functions from different channels. The most widely used methods are methods based on independent component analysis (ICA) [3].

The proposed algorithm assumes that the influence function $I(t)$ is the same for all channels and uses the following blink artifact model:

$$R_k(t) = T_k(t) + \alpha_k I(t), \quad k = 1,..., N,$$

where $R_k(t)$ is the recorded EEG, $T_k(t)$ is clean EEG signal, α_k is a weight coefficient.

The proposed algorithm consists of the following stages:

1. Blink artifact detection using analysis of the EOG.
2. Blink artifact suppression using a method with independent processing of EEG channels.
3. Blink influence function calculation $I(t) = \sum_{k=1}^{N} (R_k(t) - P_k(t))$, where $P_k(t)$ is the EEG reconstructed at the previous stage.
4. Recovering the coefficients α_k.
5. Recovering the EEG: $T_k(t) = R_k(t) - \alpha_k I(t)$.

Psychophysiological tests showed the reliability of the proposed algorithm.

Literature

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