National Technical University of Ukraine "Kyiv Polytechnic Institute"

Electronics and Nanotechnology

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Application of wavelet transform to artifact detection in EEG signal

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Abstract – **The paper considers the task of identifying electrooculogram in the EEG signal and reconstructs the original signal using discrete wavelet transform.**

Keywords – **discrete wavelet transform, EEG, electrooculogram**

I. INTRODUCTION

Electroencephalographic analysis is one of the most important methods for assessment of brain activity. However electroencephalograph registers not only the signal coming from the cerebral cortex. Typically, it contains components that are not directly related to the activities of brain, is an artifact in relation to the useful signal and their amplitude can be several times larger. Therefore, an analysis of the electroencephalogram (EEG) requires a preliminary signal processing.

II. METHOD OF DETECTION ARTIFACTS IN EEG USING WAVELET TRANSFORM

In recent time in the publications devoted to finding and classifying artifacts in the EEG signal using wavelet transform appeared [1, 2]. In this paper using of a new method of searching electrooculogram (EOG) and reconstruct cleaned original signal using discrete wavelet transform of EEG is proposed.

As a mother function to analyze the EEG signal Daubechies wavelet of second order was used. Normal EOG wave frequency is 1-3 Hz, but at flutter eyelids frequency can reach 4-6 Hz. Therefore, the decomposition of the signal with a sampling rate of 256 Hz will be performed up to eight levels and analysis of coefficients for 5^{th}-8^{th} levels was done.

EEG signal processing by the following steps is proposed:

1. Decomposition of original signal to 8^{th} level.
2. Localization of EOG by identification of those values of detail coefficients that exceed a threshold value for this level.
3. Zeroing the detail coefficients corresponding of the estimated artifacts space on 5-8 levels and the corresponding approximation coefficients at the last level of decomposition.
4. Signal reconstruction.

Fig. 1 shows a fragment of the real EEG signal with two EOG artifacts. The result of the wavelet transform is shown on Fig. 2. Decomposition was done to level 8.

Fig. 3 shows the reconstructed EEG signal after removing the artifacts.

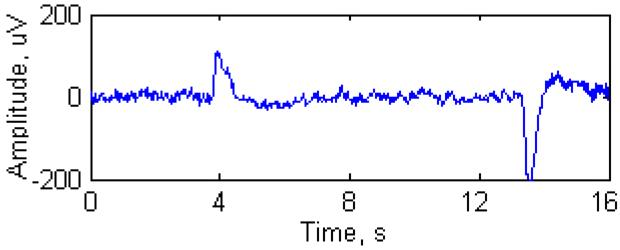

Fig. 1 Initial EEG signal

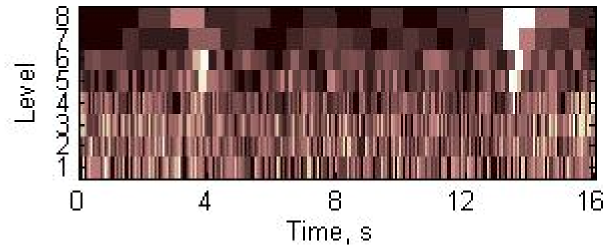

Fig. 2 EEG scalogram

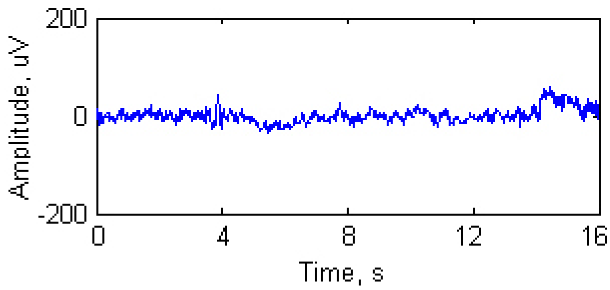

Fig. 3 Reconstructed signal

III. CONCLUSION

In this paper the use of discrete wavelet transform to detect artifacts in the EEG signal and its reconstruction after removal of artifacts is proposed. The results of applying this method to real signals have shown that it is working good enough for practical applications.

The results of this work will be used in constructing the automated system purification of EEG signal from physical and biological artifacts.

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