EOG signal processing module for medical assistive systems

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Abstract:
Electrooculography (EOG) is one of the occulography methods used for the estimation of eye orientation. These signals, generated by eye movements, can be used in an efficient way as input in different control systems. So, the signal processing of the EOG signal is a key point when performing complex tasks, for instance, in a Human-Machine Interface (HMI). In this sense machine learning algorithms allow patterns in data to be identified, and then, to predict future actions using those patterns that have been learned. This paper presents a signal processing module for EOG signals, applying Wavelets Transform (WT) as a denoising procedure and AdaBoost as a machine learning algorithm.

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I. Introduction

The eye can be modeled by a dipole between the cornea (positive potential) and the retina (negative potential) which causes an electric field around the eyeball. EOG is based on the saccadic eye movements that are characterized by a quick shift of gaze (of both eyes) from one point of fixation to another. In this manner, when there is eye movement, a differential potential results relating to the magnitude of rotation and its amplitude changes depending on the angle through which the eyeball is moved. When the eye ball is moved to either side, the voltage remains positive or negative (depending on electrode placement) and returns to zero when looking straight ahead. It allows the development of controlling systems using the eye movements as primary input. For instance, control of a lower limb active prosthesis [1], a wheelchair [2], or a Human-Machine Interface (HMI) with assistive tasks [3].

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