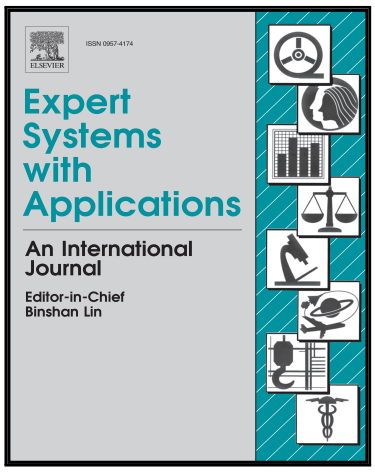

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Brain-computer interface for workload estimation: assessment of mental efforts in learning processes

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ABSTRACT

To assess the current mental state of an individual, several monitoring systems have been developed. In this paper, we explore the possibility to exploit information recorded noninvasively from the human cortex to develop a brain-computer interface (BCI) able to estimate brain workload and the mental efforts during a cognitive task. The EEG-based workload classifier presented in this paper combines a power spectral density (PSD) analysis and a statistical criterion. The proposed classifier is applied in the context of distance education and online course platform through two experimental protocols. The first one proposes solving a set of matrices products using pen and paper, while the second one proposes answering problems of logic mathematics on a computer-based learning environment. Experimental results show that the averaged accuracy of distinguishing changes in the theta [4-7 Hz] (θ) band is 79%. For the alpha band [8-11 Hz] (α) the averaged accuracy reached 78%. Based on this classifier, we demonstrate that θ and α powers in central, and posterior sites decrease with the increase in difficulty level of the cognitive task. The accuracy of correct decisions obtained from our results are significantly enhanced while comparing our investigation to some similar works from literature. In the realm of intelligent expert systems, our work results represent a first step to an implementation of an intelligent system for the evaluation of reeducative therapies to be used in physiotherapy centers for children with cognitive disorders as it is the case for Cerebral Palsy.

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