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Spatiotemporal Analysis of Visual Evoked Responses Using Dense EEG

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Abstract : A comprehensive study of object recognition in the human brain requires combining both spatial and temporal analysis of brain activity. Here, we are mainly interested in three issues: the time perception of visual objects, the ability of discrimination between two particular categories (objects vs. animals), and the possibility to identify a particular spatial representation of visual objects. Our experiment consisted of acquiring dense electroencephalographic (EEG) signals during a picture-naming task comprising a set of objects and animals’ images. These EEG responses were recorded from nine participants. In order to determine the time perception of the presented visual stimulus, we analyzed the Event Related Potentials (ERPs) derived from the recorded EEG signals. The analysis of these signals showed that the brain perceives animals and objects with different time instants. Concerning the discrimination of the two categories, the support vector machine (SVM) was applied on the instantaneous EEG (excellent temporal resolution: on the order of millisecond) to categorize the visual stimuli into two different classes. The spatial differences between the evoked responses of the two categories were also investigated. The results showed a variation of the neural activity with the properties of the visual input. Results showed also the existence of a spatial pattern of electrodes over particular regions of the scalp in correspondence to their responses to the visual inputs.

Keywords : brain activity, categorization, dense EEG, evoked responses, spatio-temporal analysis, SVM, time perception
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