CC PUB #231

January 1998

Overcoming Selective Ensemble Averaging: Unsupervised Identification of Event Related Brain Potentials

Daniel H. Lange, Hava T. Siegelmann, Hillel Pratt and Gideon F. Inbar

Department of Electrical Engineering
Technion - Israel Institute of Technology
Haifa 32000, Israel

Abstract

We present a novel approach to the problem of Event Related Potential (ERP) identification, based on a competitive Artificial Neural Net (ANN) structure. Our approach dismisses the need for stimulus- or event-related selective averaging, thus avoiding conventional assumptions on response invariability. The competitive ANN, often described as a *winner takes all* neural structure, is based on dynamic competition among the net neurons where learning takes place only with the winning neuron. In our case, the competition results in the network weights converging to the embedded ERP patterns, thus forming a matched filter bank which can also be utilized for optimal single-trial classification purposes.

The network performance is analyzed via a simulation study, exploring identification robustness under low SNR conditions and compared to the expected performance from an information theoretic perspective. The identifier is applied to real event-related potential data recorded during a common odd-ball type paradigm. For the first time, within-session variable signal patterns are automatically identified, dismissing the strong and limiting requirement of a-priori stimulus-related selective grouping of the recorded data. The results present new possibilities in ERP research.