Iyer, Darshan, “Improved Evoked Potential Estimation using Iterative Independent Component Analysis”

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The structure of the sources underlying surface recordings of brain activity is very complex, but it is possible to study the dynamical characteristics of brain activation by analyzing responses to external sensory stimulation. Typically, single-trial responses are buried into the more prominent background activity, and thus advanced procedures are needed to extrat the activity of the cortical generators activated only by the experimental task under study. We have developed an iterative procedure that is based on independent component analysis to obtain single-trial estimates of the auditory N100 component, which was acquired using auditory stimulation and a whole-head, 256-channel, dense array recording system. The technique was applied to N100 source localization and normal-schizophrenia classification study based on P50 and N100 components.

Our results show that the proposed methodology can effectively extract only the activity related to the experimental task, while removing artifacts and background activity, and that it can provide improved response estimates when compared to plain ensemble averaging and wavelet transform analysis. Additionally, the sources of the N100 component that were typically localized on the floor of the Sylvian fissure were primarily due to the in-phase responses, whereas the contribution from the out-of-phase responses had an antagonistic effect. Finally, when the same methodology was applied to N100 data from schizophrenia patients, normals could be separated from patients with 93% accuracy, and a sensitivity and specificity of 93% and 92%, respectively. With P50 data, normals could be separated from patients with 97% accuracy, and a sensitivity and specificity of 97% and 96%, respectively.

The above results suggest that the new methodology can serve as a valuable tool in the analysis of brain activity.