# FEASIBILITY OF INDEPENDENT COMPONENT ANALYSIS (ICA) FOR SEPARATION OF EMG ARTIFACTS FROM EEG FEATURES USED IN BCI OPERATION

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EMG contamination is a well-recognized problem in EEG studies, particularly those relying on automated measurements. The goal of this study was to test the possibility of online artifact correction in BCI studies using ICA.

Spectral and topographical criteria for EMG identification were studied in 25 healthy adults intentionally producing EMG artifacts by weak (15±3% of maximal) contractions of the frontalis or temporalis muscles (raising eyebrows or jaw clenching). Identification and correction of unintentionally produced artifacts was performed on the data collected from two BCI users during 10 training sessions. ICA decomposition was performed using an information maximization neural network algorithm on 64 scalp-recorded signals having 25-min duration. The resultant 64 Independent Components (IC) were identified by their time courses (IC activations) and topographical distributions (IC projections). Offline artifact correction was performed by removing a subset of ICs reflecting artifactual sources and reconstructing the record from the residual non-artifactual components. Simulation of the online artifact correction was performed by applying an ICA-derived spatial filter obtained from one experimental session to new data.

Offline artifact correction based on ICA appeared to be highly effective for blinks and eye movements. Independent components reflecting muscle artifacts could be identified by their time courses and spectral and topographical distributions and removed from the data. However, a number of ICs from each data set were identified as a mixture of EEG and EMG activities. Online muscle artifact correction is possible by filtering out a set of ICs reflecting predominantly EMG sources. The ICA-derived spatial filter cannot be exported from one subject to another one due to individual differences in the sources generating artifacts. The results may aid development of new artifact detection procedures for BCI studies, particularly those focused on frontel EEG electrodes, which are most vulnerable to EMG contamination.

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