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Simultaneous Ocular and Muscle Artifact Removal from EEG Data by Exploiting Diverse Statistics

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Abstract

Electroencephalography (EEG) recordings are frequently contaminated by both ocular and muscle artifacts. These are normally dealt with separately, by employing blind source separation (BSS) techniques relying on either second-order or higher-order statistics (SOS & HOS respectively). When HOS-based methods are used, it is usually in the setting of assuming artifacts are statistically independent to the EEG. When SOS-based methods are used, it is assumed that artifacts have autocorrelation characteristics distinct from the EEG. In reality, ocular and muscle artifacts do not completely follow the assumptions of strict temporal independence to the EEG nor completely unique autocorrelation characteristics, suggesting that exploiting HOS or SOS alone may be insufficient to remove these artifacts. Here we employ a novel BSS technique, independent vector analysis (IVA), to jointly employ HOS and SOS simultaneously to remove ocular and muscle artifacts. Numerical simulations and application to real EEG recordings were used to explore the utility of the IVA approach. IVA was superior in isolating both ocular and muscle artifacts, especially for raw EEG data with low signal-to-noise ratio, and also integrated usually separate SOS and HOS

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