

Systematic Review

A Systematic Review of Techniques for Artifact Detection and Artifact Category Identification in Electroencephalography from Wearable Devices

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Abstract

Wearable electroencephalography (EEG) enables brain monitoring in real-world environments beyond clinical settings; however, the relaxed constraints of the acquisition setup often compromise signal quality. This review examines methods for artifact detection and for the identification of artifact categories (e.g., ocular) and specific sources (e.g., eye blink) in wearable EEG. A systematic search was conducted across six databases using the query: (“electroencephalographic” OR “electroencephalography” OR “EEG”) AND (“Artifact detection” OR “Artifact identification” OR “Artifact removal” OR “Artifact rejection”) AND “wearable”. Following PRISMA guidelines, 58 studies were included. Artifacts in wearable EEG exhibit specific features due to dry electrodes, reduced scalp coverage, and subject mobility, yet only a few studies explicitly address these peculiarities. Most pipelines integrate detection and removal phases but rarely separate their impact on performance metrics, mainly accuracy (71%) when the clean signal is the reference and selectivity (63%), assessed with respect to physiological signal. Wavelet transforms and ICA, often using thresholding as a decision rule, are among the most frequently used techniques for managing ocular and muscular artifacts. ASR-based pipelines are widely applied for ocular, movement, and instrumental artifacts. Deep learning approaches are emerging, especially for muscular and motion artifacts, with promising applications in real-time settings. Auxiliary sensors (e.g., IMUs) are still underutilized despite their potential in enhancing artifact detection under ecological conditions. Only two studies addressed artifact category identification. A mapping of validated pipelines per artifact type and a survey of public datasets are provided to support benchmarking and reproducibility.

Keywords: EEG; artifact detection; artifact identification; artifact removal; wearable



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