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Intelligent EEG Signal Processing: A Design of NN-based Adaptive Filtering for Artifacts Eradication

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Abstract: *Electroencephalogram (EEG) signals are widely used for brain activity analysis, but the presence of motion artifacts can significantly degrade disease diagnosis results. This paper proposes a novel approach to eradicate detected motion artifacts using a neural network (NN) based adaptive filter. The study considers EOG and EMG based motion artifacts databases. The performance of theintelligent adaptive NN filter is evaluated using a back propagation based NN as a gradient descent problem. Parametric evaluation of various EEG data for artifacts removal methods is also proposed. The study suggests using NN-based de-noising to increase signal intensity after artifacts elimination. SNR and RMSE calculations are employed to evaluate the performance of NN-based adaptive filtering algorithms. The proposed NN filter is capable of accurately learning the data and eliminating the impact of EOG amplitude peaks. Quantitative results demonstrate that the proposed method offers significant improvement in PSNR of 6 dBand PSD performance over existing approaches, with PSD improvement nearly 0.15 over ICA and 2.4 times more than CCA. The study concludes that the proposed NN-based filter is an effective approach for removing motion artifacts from EEG signals while preserving the underlying brain activity, making it suitable for accurate disease diagnosis.*

Keywords: Electroencephalogram (EEG), Motion Artifacts, Eye blink, Muscular artifacts. Adaptive NN Filter, PSNR

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