Research on the application of deep learning techniques using convolutional neural networks (CNN) for emotion recognition through electroencephalogram signals

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Abstract: This study investigates the application of deep learning, specifically Convolutional Neural Networks (CNNs), for emotion recognition using electroencephalography (EEG) signals. While EEG provides a direct physiological correlate of emotional states, its non-stationary and noisy nature poses significant challenges for traditional machine learning methods, which often rely on extensive manual feature engineering. To address this, we propose a deep learning framework that leverages CNNs to automatically learn discriminative spatiotemporal features from raw and minimally preprocessed EEG data. The model architecture is designed to capture local patterns across electrode channels and temporal dynamics. We evaluate the proposed method on a benchmark dataset for emotion classification, focusing on the valence and arousal dimensions. Experimental results demonstrate that the CNN-based approach achieves superior classification accuracy compared to conventional classifiers using hand-crafted features. Furthermore, analysis of the learned feature maps reveals that the network effectively identifies critical frequency bands and electrode locations associated with specific emotional states. These findings confirm the efficacy of end-to-end deep learning for decoding affective states from neural signals, offering a robust and scalable solution for brain-computer interface applications.

Keywords: CNN, deep learning, emotion recognition, EEG signals