Leveraging EEG and Signal-to-Noise Ratio Augmentation for Advanced Stress Detection

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Abstract

Student stress has emerged as a significant concern, requiring prompt identification to avoid serious repercussions. Unlike conventional EEG stress detection approaches that rely on feature extraction, our work introduces a novel combination of SNR-based augmentation with ShallowConvNet recognised for its simplicity and efficiency. Utilising the StressDB-UIA1 dataset, EEG data from 31 subjects were examined under stress and non-stress situations. The research tackles the issue of restricted EEG data availability by utilising Signal-to-Noise Ratio (SNR)-based augmentation, replicating noise levels of 10 dB, 15 dB, and 20 dB. This augmentation strategy improves model robustness and generalisability to real-world situations. The results shows that ShallowConvNet, when trained on SNR-augmented datasets, attains enhanced accuracy and Area Under Curve (AUC) metrics, with peak performance recorded at 20 dB SNR (83.69% accuracy, 0.921 AUC). SNR-based augmentation is apparent in enhancing EEG classification and emphasise ShallowConvNet's capability for real-time stress monitoring, facilitating prompt interventions and mental health support systems. © 2025 IEEE.

Author keywords

augmentation; dataset stressDB-UIA1 I; electroencephalography; non-invasive stress monitoring; raw EEG signal; shallowconvnet; signal-to-noise ratio; stress prediction

Indexed keywords

Engineering controlled terms

Biomedical signal processing; Electrophysiology; Feature extraction; Stresses

Engineering uncontrolled terms

Augmentation; Dataset stressdb-UIA1 I; EEG signals; Noise ratio; Non-invasive stress monitoring; Raw EEG signal; Shallowconvnet; Signal to noise; Stress monitoring; Stress prediction

Engineering main heading

Electroencephalography; Signal to noise ratio

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