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ORIGINAL ARTICLE

DETECTION OF SCHIZOPHRENIA FROM EEG SIGNAL – AN EXTENDED DEEP LEARNING FRAMEWORK USING 1D-CNN AND CNN-LSTM ON SMALL DATASET

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ABSTRACT

Schizophrenia (SZ) is a complex neuropsychiatric disorder that significantly impairs cognition, behavior, and perception. Electroencephalography (EEG) provides a non-invasive, cost-effective means to capture brain activity, but due to the multichannel, high-dimensional nature of EEG data, manual diagnosis remains challenging. In this extended study, we investigate the performance of deep learning (DL) frameworks, specifically 1D Convolutional Neural Networks (1D-CNN) and hybrid CNN-LSTM architectures, for automated detection of SZ using a small EEG dataset comprising 14 SZ patients and 14 healthy controls. We design two variants of 1D-CNN and CNN-LSTM, analyze their performance using extensive cross-validation, and introduce additional experiments such as ablation studies and statistical significance testing. Evaluation metrics including accuracy, precision, recall, specificity, F1-score, and AUC-ROC demonstrate that the proposed CNN-LSTM models outperform other architectures, achieving up to 99.35% accuracy. Our findings confirm the potential of hybrid deep learning models in robust SZ identification, even with limited data, paving the way for scalable and generalizable EEG-based diagnostic tools.

Keywords: Schizophrenia, detection, EEG signal, 1D-CNN, CNN-LSTM, small dataset.