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A Convolutional Neural Network Approach to Schizophrenia Detection Based on Wavelet-Transformed EEG Signals

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Abstract

The paper introduces a novel method for detecting schizophrenia by analyzing electroencephalography (EEG) signals using convolutional neural networks (CNNs). Schizophrenia, a serious mental health condition, is often diagnosed through subjective clinical assessments, which can lead to inconsistent or delayed outcomes. To address these challenges, the proposed approach leverages EEG, a non-invasive technique with high temporal resolution for recording brain activity. The method begins by preprocessing the raw EEG data with Independent Component Analysis (ICA) to remove noise and artifacts such as eye blinks, muscle movements, and electrical interference. Then, Continuous Wavelet Transform (CWT) is applied to extract key features, capturing both temporal and spectral information crucial for distinguishing between healthy individuals and those with schizophrenia. These features are fed into a CNN, which excels at handling the 2D time-frequency representations of EEG data, automatically extracting features and identifying patterns in complex, high-dimensional data. The CNN model was trained on a public dataset containing EEG recordings from schizophrenia patients and healthy controls, achieving a classification accuracy of 94.77%, outperforming traditional machine learning methods like Support Vector Machines (SVM) and Random Forests, which rely more heavily on manually crafted features.

Keywords: EEG, Convolutional Neural Network, Deep learning, Schizophrenic disorder

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