Enhancing EEG Signals Classification using LSTM-CNN Architecture

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Abstract

Epilepsy is a condition that disrupts normal brain function and sometimes leads to seizures, unusual sensations, and temporary loss of awareness. Electroencephalograph (EEG) records are commonly used for diagnosing epilepsy, but traditional analysis is subjective and prone to misclassification. Previous studies applied Deep Learning (DL) techniques to improve EEG classification, but their performance has been limited due to dynamic and non-stationary nature of EEG structure. In this paper, we propose a multi-channel EEG classification model called LConvNet, which combines Convolutional Neural Networks (CNN) for spatial feature extraction and Long Short-Term Memory (LSTM) for capturing temporal dependencies. The model is trained using open source secondary EEG data from Temple University Hospital (TUH) to distinguish between epileptic and healthy EEG signals. Our model achieved an impressive accuracy of 97%, surpassing existing EEG classification models used in similar tasks such as EEGNet, DeepConvNet and ShallowConvNet that had 86%, 96% and 78% respectively. Furthermore, our model demonstrated impressive performance in terms of trainability, scalability and parameter efficiency during additional evaluations.

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