A Deep Learning MI-EEG Classification Model for BCIs

Reliable signal classification is essential for using an electroencephalogram (EEG) based Brain-Computer Interface (BCI) in motor imagery (MI) training. While deep learning (DL) is used in many areas with great success, only a limited number of works investigate its potential in this domain. This study presents a DL approach, which could improve or replace current state-of-the-art methods. Here, an end-to-end convolutional neural network (CNN) model is presented, which can be applied to raw EEG signals. It consists of a temporal and spatial convolution layer for feature extraction and a fully connected (FC) layer for classification. The global models were trained on 3s segments of EEG data. Training a subject-independent global classifier reaches 80.10%, 69.72%, and 59.71% mean accuracy for a dataset with two, three, and four classes, respectively, validated in 5-fold crossvalidation. Retraining the global classifier with data from single individuals improves the overall mean accuracy to 86.13%, 79.05%, and 68.93%, respectively. The results are superior to the results reported in the literature on the same data. Generally, the reported accuracy values are comparable with related studies, which shows that the model delivers competitive results. As raw signals are used as input, no pre-processing is needed, which qualifies DL methods as a promising alternative to established EEG classification methods.

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