The Classification of Wink-Based EEG Signals: The Identification on Efficiency of Transfer Learning Models by Means of kNN Classifier

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ABSTRACT

One of the earliest methods to observe the brain dynamic is through Electroencephalogram (EEG) brain signal. It is widely known as a non-invasive, reliable, and affordable way of recording the brain activities. It has become the most wanted way of diagnosis and treatment for mental and brain neurogenerative diseases and abnormalities. It also one of the most appropriate signals in Brain-Computer Interfaces (BCI) applications. BCI frequently used by neuromuscular disorder (post-stroke) patients to aid them in activities of daily living (ADL). In this study, the adequacy of various TL models, i.e., NasNetMobile, and NasNetLarge in extracting features to classify wink-based EEG signals were investigated. The time-frequency scalogram conversion of the Right Wink, Left Wink, and No Wink based on EEG signals was carried out through Continuous Wavelet Transform (CWT) algorithm. The features that were extracted through Transfer Learning (TL) models were fed into a number of k-Nearest Neighbors (kNN) classifier models to determine the performance of various feature extraction methods to classify the winking signals. The input data are divided into training, validation, and testing datasets via a stratified ratio of 60:20:20. It was shown through this study, that the features extracted by means of NasNetLarge were more efficient compared with NasNetMobile. The Classification Accuracy (CA) of training dataset through NasNetLarge pipeline is 98% which was higher compared to NasNetMobile through the kNN model which consists of k-value of 2 and Minkowski Distance. The validation and testing CA attained through NasNetMobile and NasNetLarge models are 100%. Therefore, it could be concluded that the proposed pipeline which consists of CWT-NasNetLarge-kNN is suitable to be adopted to classify wink-based EEG signals for different BCI applications.

KEYWORDS

EEG; BCI; CWT; Transfer Learning; Machine Learning; kNN

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