EEG-Based Person Authentication Method with Deep Learning Using Visual Stimulation

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Biometric authentication methods used nowadays still have numerous potential security concerns and can be forged physically. This causes many problems in privacy risks and criminals around the world. As the brain signal has been found to be unique for individuals, electroencephalogram (EEG) signals can be potentially utilizable as an identity discrimination tool, especially since EEG reflects the delicate difference in individuals' mental characteristics. However, the existing EEG-based authentication methods apply only one or few techniques to stimulate the signal and there are some vulnerabilities in limited scope of the study. Also, EEG data are one of the most complex biometrics which can take advantage of deep learning techniques. Therefore, I combined steady-state visual evoked potential (SSVEP) and event-related potential (ERP) features to enlarge the distinction between individuals and apply Long short-term memory (LSTM) network for the analysis. The methods were divided into 3 stages. Firstly, I collected raw EGG data from the 20 subjects, the brain stimulated by 7.5 Hz square SSVEP with targeted and non-targeted Snodgrass-Vanderwart's set of images as ERP stimulus. Afterward, the raw data were pre-processed by notch filter, band-pass filter, and eye blink artifacts removal. Deep learning's RNN architecture used the pre-processed data of individuals for predicting the results. After predicting, the performance was evaluated based on False Acceptance Rates and False Rejection Rates according to Biometric Evaluation Standards. The EEG-based authentication method with visual stimulus demonstrates high verification accuracy and can be applied with some improvement in the future through the use of brain connectivity technique.