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EEG SIGNAL SYNTHESIS AND RECOGNITION OF INTELLIGENT HEALTH MONITORING IN LONG-TERM SPACE FLIGHT

Abstract

Health monitoring is significantly important for the successful completion of manned space missions, in which EEG emotion recognition is the most practical and effective. To solve this problem, EEG signal synthesis has become an important solution. However, there are three major problems in the EEG signal generation method: 1) the generated signal is difficult to obey the original distribution; 2) Lack of design suitable for EEG signal; 3) The feature extraction ability of emotion recognition classifier is insufficient. The paper proposes an EEG signal synthesis and recognition algorithm based on adaptive layer normalization (AdaLN) in few-shot learning. Different from the unsupervised data generation algorithm, the framework completes the repairs of EEG signals and marks the corresponding labels to realize data generation by conditional generation mode. In this process, in order to prevent feature loss and enhance diversity, the paper only uses a single decoder to generate EEG signals, and the masked signals are input to each layer of the decoder by using AdaLN, so as to preserve the features and generate EEG signals in line with the original distribution. Compared with the existing normalization methods, the method designed in the paper selects the layer normalization to combine the characteristics of EEG signals. Secondly, the convolution layer is used to solve the influence of masked parts and obtain the final style parameters (mean and standard deviation) to normalize the feature maps. This not only introduces the styles of EEG signals, but also improves the convergence efficiency of the model. Finally, this paper designs an EEG emotion recognition network by using structural information and high-level semantics. The network uses the cascade convolution structure to fully retain the low-dimensional structural information, and combines it with high-level semantic information to improve the feature extraction ability and obtain the supplementary information of the generated samples. Then the feature maps input the dense layer classifier to realize efficient and stable emotion recognition. Experimental results show that our framework improves the accuracy of self annotation by more than 10% under small sample tasks. Meanwhile, the EEG signal synthesis optimizes the training of emotion recognition and improves recognition accuracy by more than 5%. AdaLN gets state-of-the-art performances for EEG emotion recognition.