STUDY OF PERSONAL IDENTIFICATION USING ECG SIGNALS FOR HEALTH CHECKUP

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ABSTRACT

Currently, the second most common cause of death in Japan is heart disease, and this rate is expected to continue to increase. In order to detect this disease at an early stage, research and development of technology to measure electrocardiograms from measurement devices that resemble furniture, such as chairs and toilet bowls, has been conducted in recent years. Since such devices are expected to be shared and used by multiple people, it is necessary to have a function to categorize data for each individual in advance in order to analogize the health condition from the measured ECGs. In a previous study, it was shown that high discrimination performance could be obtained even for data including heart rate variability by extracting features from the measured high-frequency ECG and classifying them using a three-layer neural network. However, the feature extraction and classification used in this study required processing that required a large computational cost. Assuming that the computer specifications are sufficient for embedding in furniture, it is desirable to keep the computational cost as low as possible. In this study, feature extraction and identification were performed on electrocardiogram data of 11 persons obtained from electrodes embedded in the back of a bathtub. In order to achieve low computational cost, we focused on the geometrical shape of the ECGs and created a program to extract 17 different features. By performing individual identification using a linear support vector machine on the obtained features, we verified the impact on the identification rate and computation time compared to neural networks used in previous studies. As a result, the identification rate for resting ECG was approximately 80%, and the time required to train the model was reduced by 99.8% while maintaining an identification rate almost equivalent to that of the neural network. However, the discrimination rate for data in which body motion noise was intentionally mixed by massaging or operating a smartphone during measurement dropped to 30-50%, making it difficult to use for general-purpose identification. To solve this problem, 10 features were selected from 17 features for each combination of data and subjects, and the discrimination rate for each feature combination was calculated. As a result, it was confirmed that using the feature combination with the highest discrimination rate improves the overall discrimination rate to 60-90%.The proposed method enables the construction of an algorithm that can discriminate ECGs measured in the special environment of electrodes embedded in the back of a bathtub with high accuracy and low computational complexity. In addition, it was verified that the proposed method can calculate a high discrimination rate in general for data measured under various conditions by optimizing the feature values.