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EMG Pattern Classification Using Hierarchical Network Based on Boosting Approach

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Extended abstract: Bioelectric signals such as electromyograms (EMG) pattern classification have been used to devise elaborate human-machine interfaces for people with physical disabilities. In the recent years, various EMG pattern classification methods have been proposed. In particular, a probabilistic neural network, which estimates the probability density function of patterns, has been proven to be an efficient and important method for pattern classification. Tsuji et al. proposed a feedforward PNN, a log-linearised Gaussian mixture network (LLGMN). The LLGMN has been successfully applied to pattern classification of bioelectric signals, such as EMG and electrocardiograms, and has been used to develop human interface applications, such as prosthetic devices, EMG-based pointing devices and so on.

However, if the structure of LLGMN is fixed at an unsuitable value, the LLGMN training cannot avoid convergence to a local minimum for some initial parameters and training data. Also, in other classification methods, the estimation approach of suitable parameters and structure is important. In order to overcome these problems, there has been growing interest in a boosting approach for the construction of classification systems with simple classifiers. A general boosting procedure can combine inaccurate and simple classifiers to improve the discrimination accuracy of a classification system.

In this paper, an EMG pattern classification method is proposed based on hierarchical pattern classification based on boosting approach. In this method, the LLGMN is utilised in order to create a simple and weak classifier. The proposed method can estimate the number of LLGMNs corresponding to the pattern complexity, according to statistical information. By using boosting approach, it is expected that the structure of the classification network can be estimated automatically corresponding to the complexity of the EMG patterns. To examine the classification capability and the accuracy of the proposed method, phoneme classification experiments were carried out with four subjects. In these experiments, the proposed method achieved higher classification performance than traditional method using a single LLGMN.