

Multichannel Surface Electromyography Trajectories for Hand Movement Recognition Using Intrasubject and Intersubject Evaluations

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Abstract : This paper proposes a system for hand movement recognition using multichannel surface EMG(sEMG) signals obtained from 40 subjects using 40 different exercises, which are available on the Ninapro(Non-Invasive Adaptive Prosthetics) database. First, we applied processing methods to the raw sEMG signals to convert them to their amplitudes. Second, we used deep learning methods to solve our problem by passing the preprocessed signals to Fully connected neural networks(FCNN) and recurrent neural networks(RNN) with Long Short Term Memory(LSTM). Using intrasubject evaluation, The accuracy using the FCNN is 72%, with a processing time for training around 76 minutes, and for RNN's accuracy is 79.9%, with 8 minutes and 22 seconds processing time. Third, we applied some postprocessing methods to improve the accuracy, like majority voting(MV) and Movement Error Rate(MER). The accuracy after applying MV is 75% and 86% for FCNN and RNN, respectively. The MER value has an inverse relationship with the prediction delay while varying the window length for measuring the MV. The different part uses the RNN with the intersubject evaluation. The experimental results showed that to get a good accuracy for testing with reasonable processing time, we should use around 20 subjects.

Keywords : hand movement recognition, recurrent neural network, movement error rate, intrasubject evaluation, intersubject evaluation

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