SEARCHING FOR OPTIMAL CHANNEL CONFIGURATION AND NUMBER IN MULTICHANNEL MYOELECTRIC PROSTHESIS CONTROL

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INTRODUCTION: A higher number of intuitively controllable functions in myoelectric forearm prostheses might be obtained using pattern recognition and multichannel configuration. However, it is unknown what configuration is optimal. We tested dependency of channel configuration and number on the performance of an eight-motion classifier.

METHODS: EMG signals of 8 wrist and hand motions from 10 able-bodied subjects were collected using a grid of 4x10 monopolar electrodes. Three approaches were applied: 1) forming channel-subsets (varying length of 1 to 12) by selecting channel pairs corresponding to six specific muscle regions; 2) a sequential forward selection algorithm, which starts with an empty subset and successively adds the channel that yields a maximum increase of the classification performance, until performance does not improve anymore; 3) selection of circumferential arrays, using all (10) and every other channel (5) in a circumference of the grid as channel-subsets. Using RMS over 150ms-signals of each selected electrode, nearest neighbor classifiers were trained and tested. Classifier performances were calculated for both average reference (AR) and bipolar (BP) derivation for all three approaches.

RESULTS: For the muscle-specific configuration, optimal result was obtained with 5 BP channels: 97.6% accuracy. For the selection algorithm, optimal result was obtained with 6 AR channels: 97.5%. The circumferential selection of 10 AR channels gave 98.2% and 5 BP channels 96.17%.

DISCUSSION: Increasing channel number up to 4 improved performances substantially for all configuration approaches. After that, performances increased minimally. Although a BP 5-channel muscle-specific configuration seems to be the optimal number and configuration, it requires 10 electrodes on the forearm. In this respect, an AR 10-channel circumference configuration might also be optimal.

CONCLUSION: For this set of contractions, no substantial differences in classifier performance were found for the different approaches and derivations when using 5 or 6 channels. The circumferential array is the most practical way of positioning electrodes.

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Presenter bio-data:

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