USER TRAINING FOR PATTERN-RECOGNITION BASED MYOELECTRIC PROSTHESES USING A SERIOUS GAME

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ABSTRACT

Individuals with upper-limb deficiency who are fitted with a prosthesis are normally trained in the use of such device. This is even true for individuals who are fitted with a myoelectric prosthesis that uses control algorithms based on pattern-recognition, despite the intent of pattern-recognition control of exploiting "intuitive" phantom movements. Conventionally, training individuals for pattern-recognition control usually involves an expert who guides the user to produce electromyogram (EMG) signals that optimize pattern recognition. In the training the individual is stimulated to adapt their EMG signals as to make them more distinct in terms of the resulting patterns. To achieve this, for instance, small movements can be added to the basic pattern, such as flexing the little finger during open hand. Although training improves online accuracy it still involves considerable trial and error. Moreover, expert guidance is currently done based on visual perusal of EMG patterns or features thereof and not based on specific metrics characterizing those EMG signal patterns. Rather than using intuitive phantom movements for control, we instead propose to use those phantom movements which are most distinct in terms of EMG. To find the set of phantom movements that provides the most distinct EMG activation patterns, we propose to use a serious game. Using a game, we can train individuals to make EMG patterns distinct while performing them in a robust manner. This game is controlled using the EMG captured from 8 electrodes positioned around the forearm. Inspired by the work of Radhakrishnan et. al and Pistohl et. al, the EMG from each electrode is mapped to a direction of the game avatar in the 2D environment. We hypothesize that this training will make individuals utilize their EMG activation space to a greater extent and become better at generating only EMG activity at specific electrode sites so that patterns are more distinct.

We are currently conducting an experiment in which 4 experimental groups receive different kinds of training. Group 1 receives conventional training without coaching. Group 2 receives conventional training with feedback. Group 3 receives training with the proposed serious game and group 4 receives training without any feedback (control). The learning effects between groups are analysed using the metrics proposed by Bunderson et al. and the motion test.

REFERENCES

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