World Academy of Science, Engineering and Technology
International Journal of Bioengineering and Life Sciences
Vol:9, No:10, 2015

Estimation of Forces Applied to Forearm Using EMG Signal Features to Control of Powered Human Arm Prostheses

Authors : Faruk Ortes, Derya Karabulut, Yunus Ziya Arslan

Abstract : Myoelectric features gathering from musculature environment are considered on a preferential basis to perceive muscle activation and control human arm prostheses according to recent experimental researches. EMG (electromyography) signal based human arm prostheses have shown a promising performance in terms of providing basic functional requirements of motions for the amputated people in recent years. However, these assistive devices for neurorehabilitation still have important limitations in enabling amputated people to perform rather sophisticated or functional movements. Surface electromyogram (EMG) is used as the control signal to command such devices. This kind of control consists of activating a motion in prosthetic arm using muscle activation for the same particular motion. Extraction of clear and certain neural information from EMG signals plays a major role especially in fine control of hand prosthesis movements. Many signal processing methods have been utilized for feature extraction from EMG signals. The specific objective of this study was to compare widely used time domain features of EMG signal including integrated EMG(IEMG), root mean square (RMS) and waveform length(WL) for prediction of externally applied forces to human hands. Obtained features were classified using artificial neural networks (ANN) to predict the forces. EMG signals supplied to process were recorded during only type of muscle contraction which is isometric and isotonic one. Experiments were performed by three healthy subjects who are right-handed and in a range of 25-35 year-old aging. EMG signals were collected from muscles of the proximal part of the upper body consisting of: biceps brachii, triceps brachii, pectorialis major and trapezius. The force prediction results obtained from the ANN were statistically analyzed and merits and pitfalls of the extracted features were discussed with detail. The obtained results are anticipated to contribute classification process of EMG signal and motion control of powered human arm prosthetics control.

Keywords : assistive devices for neurorehabilitation, electromyography, feature extraction, force estimation, human arm prosthesis
Conference Title : ICBM 2015 : International Conference on Biomechanics
Conference Location : Istanbul, Türkiye
Conference Dates : October 26-27, 2015