عنوان مقاله:

EMG-based Estimation of Wrist Motion Using Polynomial Models

محل انتشار:

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خلاصه مقاله:

Background: Myoelectric control is a method of decoding the motor intent from the electromyogram (EMG) data andusing the estimated intent to control prostheses and robots. This work investigates estimation of the wrist kinematicsfrom EMG signals using polynomial models. Due to their low complexity, polynomial models are potentially the perfectchoice for EMG-kinematics modeling.Methods: Ten ablebodied individuals participated in this study, where the EMG signals from the forearm and thewrist kinematics from the contralateral wrist were measured during mirrored contractions. Two sets of EMG featureswere employed including the time domain (TD) set, and TD features along with autoregressive coefficients (TDAR).Polynomial models of order 1 to 4 were applied to map the EMG signals to the wrist motions. The performance wasdirectly compared to that of a multilayer perceptron (MLP) neural network.Results: The estimation accuracy of the wrist kinematics improved with increasing the order of the model, but saturatedat the 4th order. When using the TD set, the MLP significantly outperformed all polynomial models. However, whenusing the TDAR set, the polynomial models' performance improved so that the 4th order model performance was notsignificantly different than that of the MLP in two DoFs, although it was lower than MLP in one DoF.Conclusion: These results indicate that polynomial models are not as effective as more complex models such asneural networks, in learning the highly nonlinear mapping between the EMG data and motion intent. However, using asufficiently high number of various EMG features, would reduce the mapping nonlinearities, and thereby may increasethe polynomial models' performance to levels similar to those of complex black box models.Level of evidence: I

کلمات کلیدی:

EMG, Machine Learning, myoelectric control, polynomial