



Estimation of Tibialis Anterior FES Envelop for Unilateral Drop Foot Gait Correction Using Machine Learning Techniques

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A control strategy based on machine learning techniques is presented, for gait correction in unilateral drop foot, using functional electrical stimulation (FES). In the presented strategy, the electrical stimulation intensity for the disabled tibialis anterior (TA) muscle is controlled, considering the existing coordination patterns between activities of the ipsilateral ankle TA muscle, and the contralateral ankle plantarflexor (Gastrocnemius(GC)) muscles during normal gait. The coordination patterns describe the quality of simultaneous TA and GC muscles activation, in the opposite legs. Therefore in this paper, a NARX neural network has been trained using the hybrid LMA-PSO training method, to forecast the disabled TA muscle activity based on the input from the healthy calf muscle of the opposite leg. The predicted TA activation is then used to control the TA muscle FES intensity in real time. Seven healthy volunteers participated in the experiments. Surface electromyogram was recorded from TA and calf muscle simultaneously on the opposite legs while walking in different gait frequencies. Results obtained from the controller are quite promising and show impressive generalization ability between subjects.