The Control Concept for Upper Limb Exoskeleton

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June 2, 2021

JNRH 2021, 17-18 June, Angers.

abstract

Taking care of children suffering from myopathy is necessary because this disease gradually reduces the movement abilities of the lower and upper limbs. These children can use a wheelchair to get around and thus compensate for the lower limb impairment. For the upper limbs, the solution of an exoskeleton is an attractive solution to carry out the essential gestures of everyday life such as drinking, eating, or even writing. The purpose of this work is the control of an exoskeleton dedicated to an arm by using EMG signals. These EMG signals are recorded during the performance of several basic movements, amplified and filtered. The main advantage of EMG-based control is the ability to detect the user intention to make a movement even when the user is not able to produce it. Several features are identified and used as inputs for a fuzzy neural network (NN) algorithm. This algorithm is able to recognize the intended gesture and estimate the angular trajectories of the shoulder and the elbow. The difference signal between the predicted and the actual angles of the assisted arm is then computed and used as input in the dynamical simulations for obtaining, through the Lagrangian formulation, the torques needed for actuating the exoskeleton. The perspective of the work is to develop this strategy for more complex arm movements, coupling shoulder and elbow. It also would be interesting to investigate the robustness of the strategy with respect to physical parameters such as friction, weight, inertia moment, etc.