Microsoft Kinect-Based Artificial Perception System for Control of Functional Electrical Stimulation Assisted Grasping

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References:
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Abstract:
We present a computer vision algorithm that incorporates a heuristic model which mimics a biological control system for the estimation of control signals used in functional electrical stimulation (FES) assisted grasping. The developed processing software acquires the data from Microsoft Kinect camera and implements real-time hand tracking and object analysis. This information can be used to identify temporal synchrony and spatial synergies modalities for FES control. Therefore, the algorithm acts as artificial perception which mimics human visual perception by identifying the position and shape of the object with respect to the position of the hand in real time during the planning phase of the grasp. This artificial perception used within the heuristically developed model allows selection of the appropriate grasp and prehension. The experiments demonstrate that correct grasp modality was selected in more than 90% of tested scenarios/objects. The system is portable, and the components are low in cost and robust; hence, it can be used for the FES in clinical or even home environment. The main application of the system is envisioned for functional electrical therapy, that is, intensive exercise assisted with FES.

Keywords: