Robotica (2014) volume 32, pp. 1189–1190. © Cambridge University Press 2014
doi:10.1017/S0263574714002537

Editorial

Foreword for special issue on rehabilitation robotics and human–robot interaction – ROBOTICA

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The demand for motor rehabilitation is growing apace with the graying of the population. The utilization of robotic devices in sensorimotor rehabilitation therapy has received increased attention during the last decade. Despite the growing interest in using robotic devices for rehabilitation of sensorimotor function, their widespread use remains somewhat limited by a number of factors, including the assessment of the true cost-to-benefit ratio relative to other types of rehabilitation approaches and parameters that would optimize their long-term efficacy. Understanding human sensorimotor control and brain plasticity can provide insight into the design of robot hardware and controllers with the appropriate *reference* or *desired output*. On the other hand, the control of the physical interaction of the therapeutic device with the subject to effectively accelerate recovery is of paramount importance. This special issue focuses on the current state of knowledge about sensorimotor control and brain plasticity, models of sensorimotor functional recovery, and use of intelligent robot controllers to provide robotic-assisted therapy for motor rehabilitation.

This special issue includes studies that describe the development, optimization and testing of robotic devices and exoskeletons used for both upper[1,2,9,10,11,12,14,15] and lower limbs.[4,6,8] Methods for quantifying and improving sensorimotor control are also discussed.[3,13] The technology and control of hardware physically interfaced with human subjects for rehabilitation is studied providing directions for future applications.[7] Finally, an additional contribution focuses on the use of robots in a social assistive manner for individuals with cerebral palsy.[5]

Although the studies included here represent the state of the art of robotic systems to be used in sensorimotor rehabilitation, there are several issues that still remain open. It is the opinion of these Guest Editors that the technological advancement in the field of rehabilitation robotics is mature enough to make the transition to the clinic. Actuators with inherently low mechanical impedance provide the necessary safety for these applications. However, how robotic intervention should be tailored to the subject-specific needs remains an open question. More specifically, a model-based approach to robot-assisted therapy is needed. Model-based approaches are successfully used in many engineering fields, and can provide a more controllable and predictable performance. Model-based therapies are therefore the next big challenge for the field of sensorimotor rehabilitation. Multi-disciplinary teams of researchers with expertise in control, system identification, robotics, neurophysiology, and neuroscience are well positioned to provide the solutions to those challenges in the near future.

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