Scientific/Clinical Workshop

Workshop Title

Challenges in Rehabilitation Based on Hybrid Neuroprosthesis

Workshop Responsible

Satoshi Endo (Technical University of Munich)

Speakers

Satoshi Endo, Aaron Yurkewich, Hector Lopez Carral, Carmen Krewer, Chiara Höhler, Emilio Trigili¸ Thierry Keller, Hossein Kaviani, Patrick Schneider, Lucille Cazenave

Attendee Engagement

The planned presentations will take an interactive format where the demonstrations of the rehabilitation devices complement the oral presentations. In addition, we plan to dedicate a half of the workshop for brainstorming sessions to identify existing technologies which may be enriched with hands-on experience of the technologies by the participants.

Abstract

With the introduction of new robotics and automation technology, we have seen many changes in the rehabilitation of neurological patients, where various forms of robotic tools have allowed users to engage in extensive training in much more efficient manners. While clinical evidence supported robotic rehabilitation being at least as effective as conventional rehabilitation, existing physical and cognitive human-robot interaction strategies limit users acceptability and a wider adoption of such devices in applications. In particular, they are often not portable, difficult to adapt to different patients populations and, only available in research-intensive rehabilitation hospitals.

A representative case is active exoskeletons that have gathered large attention as a neurorehabilitation device, as they can directly support movements of the users despite the fact that the device becomes considerably bulky for fully assisting users. Nevertheless, recent research suggests that wearability and training efficiency can be improved if the users motor functions are actively assisted with functional electrical stimulation in addition to the guidance by the exoskeleton. Such hybrid neuroprostheses are advantageous because the stimulation actives the user motor and sensory neurons directly and indirectly, and when combined with the robots haptic force provides a congruent multisensory feedback experience. Stimulating muscles also reduce the exoskeletons load, allowing it to be smaller, lighter and cheaper. In complement, the exoskeleton relieves stimulation requirements, allowing for a more comfortable and less fatiguing therapy. There are many challenges to overcome for such systems in terms of hardware designs, control methods, and clinical applications. This workshop offers interactive sessions for the participants to experience and discuss about frontier research centred on advancements of hybrid neuroprostheses for a use in stroke rehabilitation.