Category: Development and Implementation of Technology

Workshop Title: Natural interfacing and embodiment of assistive and rehabilitation technologies

Workshop Organizer(s): Patricia Capsi-Morales, Dario Farina, Cristina Piazza

In person Speaker(s):

- Prof. Micera, Silvestro, Ecole polytechnique fédérale de lausanne
- Prof. Huang, Helen, NC State/UNC
- Prof. Muceli, Silvia, Chalmers University of Tehcnology
- Lock, Blair, Coapt
- González, Jose, Ottobock
- Þorsteinsson, Freygarður, Ossur

Workshop Time: 08:15 - 09:45

Attendee Engagement:

This workshop will start with a theoretical overview of essential physiological principles necessary for embodiment. Then, we will have an introduction to neural interfacing and future perspective exiting in literature. Industrial partners (Coapt, Ottobock and Ossur) will then introduce their work and perspective of the market, as well as limitations for more advanced control techniques in a panel discussion that will address specifically the clinical and industrial translation. There, the advantages and disadvantages of devices will be objectively and pragmatically evaluated.

The panel (titled: Translation to clinical practice and industry, Moderators: Cristina Piazza, Patricia Capsi-Morales and Dario Farina) will bring together 6 panelists with different perspectives on how embodiment and more advanced techniques for natural interfacing are being developed and could be used. These will include scientist and industrial partners for an overview of the current limitation of the translation of these prototype technologies into product for out-of-the-lab use. It will address a series of themes that are either commonly faced and can be controversial but are important to the advancement of creating efficacious assistive or rehabilitation solutions that are naturally integrated into users.

Some of the themes are:

- Open challenges and future perspectives for the translation of advanced control techniques?
- Possible standard assessments and enhance the sense of embodiment of technologies.
- Difficulties on learning and teaching clinicians and therapist about novel control solutions.

The final part of the panel discussion will include questions from the audience to favor interaction.

Abstract:

Organizers: Cristina Piazza (TUM), Patricia Capsi-Morales (TUM) and Dario Farina (ICL)

Exploring the natural pathways of humans for the interfacing with technologies is a necessary step to overcome existing boundaries on their acceptance and full integration of assistive or rehabilitation robotics. The term embodiment is often used as a metric of the progress made in

prosthetic technologies, as well as a hallmark for user acceptance. Embodiment is believed to contribute to the awareness of the device features, reduction of cognitive load and increase the volition of its use.

Among aspects influencing in human-robot interfaces, the adequate detection of human intentions and robust control of prostheses is essential. Making these technologies practical and available to patients with motor deficits requires overcoming real-world challenges, such as physical and physiological changes, that result in variations in EMG signals, and systems that are unreliable for long-term use. Significant progress has been made in literature towards the clinical application of human-machine interfaces (HMIs) based on electromyographic (EMG) signals. These include advanced pattern recognition, regression, or factorization methods. In addition, high-density EMG sensors has permitted the transition from classic selective and invasive recording systems to decomposition algorithms able to discriminate between individual motor unit action potentials. These solutions study the available motor control information content for the development of natural neural–machine interfaces that could result in the ability to control and coordinate multiple number of degrees of freedom of robotic aids.

This workshop consists of a hybrid version that includes both scientific and industrial communities' vision on neural interfacing for rehabilitation technologies with presentations and an interactive panel discussion.