Category: Development and Implementation of Technology

Workshop Title: Brain Computer Interfaces for Rehabilitation and Assistance: Moving from the Lab to the Clinic

Workshop Organizer(s): Nicole Wenderoth

In person Speaker(s):

- Guan, Cuntai, School of Computer Science and Engineering, Nanyang Technological University, Singapore
- Millán, Jose del R, Department of Electrical and Computer Engineering and Department of Neurology, The University of Texas at Austin, USA
- Soekadar, Surjo, Clinical Neurotechnology Laboratory, Charite Berlin, Germany
- Ruddy, Kathy, Trinity College Institute of Neuroscience and School of Psychology, Trinity College Dublin, Ireland

Workshop Time: 08:15 - 09:45

Attendee Engagement:

Attendees will be engaged in demos, quick surveys and discussions on technological and clinical needs within the Brain-Computer Interface field. We will particularly focus on usability requirements and facilitators and barriers for translation into the clinical context. We plan to summarize these interactions in form of a workshop statement that will be disseminated via an open science outlet. All attendees are invited to contribute to this statement as co-authors.

Abstract:

Many movement disorders cause severe difficulties in interacting with the environment because signals of the central nervous system are not correctly translated into motor actions, or the sensory consequences of an action are not correctly perceived. Brain-Computer Interfaces (BCIs) are an emerging technology for overcoming these impairments by extracting relevant information directly from brain activity to control specific aspects of the environment and by providing feedback to the patient, thereby closing the action-perception loop.

Early BCIs have been mainly used for assistance, i.e. for overcoming impairment by controlling actuated devices like exoskeletons or wheelchairs or triggering muscle activity via electrical stimulation. Recently, it has been shown that BCIs also represent a new treatment modality for restoration since functional and structural plasticity can be triggered either due to their systematic and repeated use or by bringing the brain into a better state for undergoing plastic changes. During the last years, significant technological advancements have been made in improving portable real-world recordings of neural and non-neural biosignals, developing multimodal decoding strategies and robust control algorithms, and providing multimodal feedback using virtual reality, robotics, or lightweight actuated devices. However, translating BCIs from the laboratory environment into the clinical workflow remains challenging.

This workshop will bring together basic scientists, technology developers and therapists to discuss current and future technological advances in assistive and restorative BCIs, remaining challenges,

evidence-based clinical applications and neurological use cases, e.g. in the context of stroke or spinal cord injury. Live demos will be provided and facilitators and barriers for routine clinical implementation will be discussed together with the workshop attendees.