



Scientific/Educational Workshop

Workshop information

Workshop responsables :

Renaud Ronsse
Massimo Sartori

Workshop title :

Human-robot synchronization for assistive technologies

Workshop goals :

This workshop focuses on the need for human-robot synchronization (HRS) for a new class of assistive technologies that can act in concert with the human body. It will pursue 3 goals:

- Informing about the synchronization mechanisms taking place within the nervous system; and computational methods for their synthesis.
- Translating HRS methods to rehab and assistive robotics.
- Awarding laureates of the “Louvain Bionics HRS software challenge” and hosting presentations of their developed methods.

Abstract :

Synchronization is a central feature in human-robot interaction, especially when both entities need to perform movements in synergy. This is particularly relevant for assistive robots connected in parallel (exoskeletons) or in series (artificial limbs) to human biological limbs. In such cases, robots have to support or augment the human user without hindering the intended movement. This requires to timely detect the user's motor intention and continuously adapt to rhythmic motor features that vary with time (step/stride length, phase, frequency, etc.). Achieving this is central to enable the robotic system to be perceived as a natural extension of the body. Synchronization is also a fundamental mechanism in the human and animal nervous system. Cortical regions communicate with each other by synchronizing their firing patterns, while spinal Central Pattern Generators and synergies are thought to play a prominent role for coordinating – and thus synchronizing – large sets of muscles involved in a large repertoire of motor tasks.

This workshop is organized in 4 sessions. Session 1 will provide a biological perspective to synchronization mechanisms found in the human and animal nervous system. The basic hypothesis is that assistive robotic needs to synthesize and mimic biological synchronization mechanisms in order to be successfully applied to humans. Session 2 will present computational approaches for synthesizing such bio-inspired mechanisms. Session 3 will focus on translational approaches to neurorehabilitation and assistive robotics. Finally, Session 4 will award laureates of the “Louvain Bionics Human-Robot Synchronization Challenge” (see “Additional comments”). The challenge winner and runner-up will receive a cash award and be offered to present their developed methods. This will move the workshop beyond the classical presentation-based paradigm and will provide direct insights into relevant HRS problems and solutions.

Speakers:

C. Miall
M. Capogrosso
V. Cheung
M. Sartori
R. Ronsse
H. Vallery
D. Reinkensmeyer