



Category: Clinical Application of Technology, Lower Limb

Workshop Title: The Challenge of Tuning Robot-Assisted Gait Therapy to Patient's Individual Needs: What to Tune? That's the Question

Workshop Organizer(s): Cristina Bayón, Edwin van Asseldonk and Eduardo Rocon

In person Speaker(s):

- Marchal Crespo, Laura, TU Delft
- Bulea, Thomas, National Institutes of Health
- Van Dellen, Florian, University Children's Hospital Zurich
- Meléndez-Calderón, Alejandro, University of Queensland
- Tagliamonte, Nevio L., Foundation Santa Lucia;

Workshop Time: 08:15 - 09:45

Attendee Engagement:

At the end of the workshop, we will have an interactive discussion with the audience and the speakers on a round table. In this discussion round, will participate speakers from different fields (industry, clinical, academia/research). Bringing together all stakeholders is crucial to further develop the field and really bring the technology to people.

Rather than being a collection of topics, this workshop is carefully structured in a way that the consecutive sessions allow the attendee to perceive the context and get a view of current solutions and future trends in such an exciting field.

Abstract:

Gait impairments resulting from neurological or motor disorders are a global societal problem. Over the last decades, we have seen rapid and extensive developments of robotic trainers and their controllers to enrich the rehabilitation of people, aiming to improve users' walking ability. The goal of robot-assisted gait training (RAGT) is to enhance the effects of functional training by providing increased therapy intensity and adaptive support in a controlled manner. However, after all these years of RAGT development, there has not been a definitive acceptance of robotic devices by the clinical staff.

One of the main problems that limits the maximum exploitation of RAGT is that the scientific community has not acquired yet sufficient knowledge to understand how robotic trainers may be optimally applied to maximize motor skill acquisition and relearning of lost functions. In short, how to optimally personalize the content of the treatment to the needs of the individual patient. This is a consequence of the extreme difficulty to understand and best tune the different combinations of robotic control parameters to tailor the therapy to desired gait changes.

In this workshop, we bring together experts from academia, industry and clinical centers, who will provide an overview of recent developments to optimally and automatically tune robotic control parameters, but even more important, also address the clinical experience of how to personalize these parameters depending on the desired functional goals.

At the end of the workshop these key elements will be addressed in an interactive discussion with the audience on a round table: What are the main challenges to apply RAGT in the clinic? How can



we obtain desired aftereffects with tuning control parameters? Can we extend protocols to be applicable to different robotic devices?... Together, we will provide a better understanding on the optimal choice of control parameter settings to match training goals

Dr. Laura Marchal-Crespo

Towards human-centered neurorehabilitation

Robot-assisted training has the potential to facilitate motor learning and neurorehabilitation, especially when the training is adapted to the patient's special needs. In this talk, the challenge point framework is highlighted as a unifying view on how to guide the design of robotic training paradigms, based on the specific patients' physical and cognitive capabilities and their personal characteristics.



Dr. Thomas C. Bulea

Long-term gait training with the NIH-Agilik exoskeleton in clinical and community settings

This talk will highlight our effort to develop a robotic exoskeleton-based intervention to improve walking function in children with knee extension deficiency, or crouch gait, from cerebral palsy, spina bifida, and muscular dystrophy. The underlying causes of crouch vary across individuals necessitating personalized approaches to applying exoskeleton assistance and resistance for gait training to maximize functional outcomes. We will review the clinical methods used to tailor exoskeleton settings for personalized gait training, introduce initial results of our ongoing clinical trial of extended overground gait training with the NIH-Agilik exoskeleton within and outside the clinical environment, and discuss future directions for exoskeleton use to improve functional recovery in individuals with neurological disorders.



Florian van Dellen

Bridging the gap between studies and real-life practice: Tailoring robot-assisted gait therapy requires specific therapy goals

At the Swiss Children's Rehab, therapists break down the overall goal of improving gait function into multiple subgoals, for example, improving knee extension in the stance phase. The content of robot-assisted gait therapy is then adjusted accordingly. Clinical trials often do not take this clinical reality into account. They tend to be vague when describing therapy content, making it difficult to transfer successful approaches between clinics. Our research shows there is a need for tools to better describe therapy content and to tune robot-assisted gait therapy to match the subgoals.



Dr. Alejandro Meléndez-Calderón

Robot-assisted gait training: from treadmill-based devices to overground exoskeletons

For the past two decades, we have seen the flourishing of several commercial robotic gait trainers, from treadmill-based devices (since ~ year 2000), to more recently, a variety of overground exoskeletons. While there have been enormous advances in research using these devices, the requirements needed for promoting recovery, e.g. active participation and user adaptation, remain a challenge. In this talk I will present our results and challenges when implementing Assist-as-needed control on different type of devices. I will also discuss opportunities of using AI techniques and neuromechanical modelling to tune the robotic assistance.



REHAB WEEK2023

24-28 SEPTEMBER 2023
SINGAPORE



Dr. Nevio L. Tagliamonte

Tuning assistance during exoskeleton-assisted walking

The talk will address the problem of adapting physical assistance during exoskeleton-assisted walking, by analyzing different human-centered aspects deriving from biomechanic, physiological and psychological assessments.

