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Category: Application and clinical integration

Workshop Title: Predictive Systems and Algorithms in Robot-Assisted Rehabilitation: Latest Developments and Challenges

Organizer(s): Cristian Camardella

Speaker(s): Riener, Robert, ETH Zurich
Lambercy, Olivier, ETH Zurich
Johnson, Michelle University of Pennsylvania
Camardella, Cristian, Scuola Superiore Sant'Anna
Patton, James, Rehabilitation Institute of Chicago
Watanabe, Tetsuyou, Kanazawa University

Workshop Time: 08:15 - 09:45

Attendee Engagement: Participants will gain insights into how predictive systems work in clinical applications, from a practical perspective, understanding what a good input set could be, what a good output can be set to obtain useful information on future health conditions of patients, and on what algorithms and models can be used for this purpose. The participants will be engaged with live quizzes after each talk (using Kahoot or similar tools) and a final brainstorming session in which the audience will be asked to share their experiences, their setup and/or their potential existing dataset, starting an open discussion about how they could use it to perform predictions, feeding a research line through exchange of ideas, networking and interests share.

Abstract: Rehabilitation robotics has emerged as a crucial field in modern healthcare, offering advanced tools for patient recovery and assessment, particularly for individuals with motor and cognitive impairments. The integration of predictive systems within rehabilitation robotics is transforming the way personalized therapy is designed, enhancing outcomes through data-driven approaches and offering tools for decision support to the clinical staff. This workshop aims to explore key topics related to the development, implementation, and optimization of predictive systems and algorithms in rehabilitation robotics, with an eye on the characterization of patients population which represent a key factor for an appropriate assessment of motor and cognitive recovery.

The workshop will address the following topics:

- **Predictive Models for Patient Progression:** discussion on how statistical inference, machine learning and AI-driven models can be used to predict or to classify patient recovery trajectories, allowing for tailored rehabilitation programmes.
- **Kinematic, Kinetic, Clinical, and Demographic Data Analysis for Outcome Prediction:** an exploration of how sensor data from robotic systems can be analyzed to predict patient motor and cognitive performance, and their predictive importance evaluated in the light of Explainable AI practices.

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- **Decision Support Systems:** analysis of systems that suggest/apply modifies to robotic devices' working parameters, aiming at increasing or decreasing exercises' difficulty and maximizing recovery potential.
- **Clinical Integration and Validation of Predictive Systems:** challenges in translating predictive models from research to clinical practice will be discussed, focusing on the validation, safety, and ethical considerations of using AI-driven systems in real-world rehabilitation settings.

This workshop will bring together leading experts in rehabilitation robotics, machine learning, biomechanics, and clinical practice.