Wearable Robotics for Gait Training

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Abstract:
Walking decline in older adults can be caused by age-related deficits in gait or neurological disorders such as stroke and Parkinson's disease. Many community-dwelling older adults with no neurological disorders exhibit abnormal gait patterns that can lead to an increased risk of falls, fear of falls, and loss of mobility if they remain untreated. Individuals with walking problems often consider gait training to recover at least part of their ability. Current gait training methods involve therapists assisting patients and may require patients to visit therapy centers frequently. The healthcare system is not designed to allow sufficient time on task with physical therapist supervision, and home-based training is critical to producing lasting and effective results. In addition, gait training methods often focus on improving leg movements and overlook the role of arm movements, despite the fact that walking is a complex task that requires highly coordinated leg and arm movements. Wearable robots offer great potential to address these challenges and promote individualized training in natural and functional settings such as home and community. This talk will present novel systems and approaches for gait training, monitoring, and functional assistance at home. A novel wearable haptic system will be presented that enables home-based motor learning exercises in older adults with gait deficits. Next, the inclusion of appropriate arm swing in gait training via wearable devices to enhance whole-body responses will be discussed. The development of a three-axis force sensor for kinetic gait analysis, an assistive glove for helping users with grasping tasks, and a three-wheeled mobility assistive device to enable outdoor activities for older adults will be briefly discussed. Finally, the plans for future research, teaching, as well as diversity, equity, and inclusion will be presented.

Biography:
Babak Hejrati is an Assistant Professor of Mechanical Engineering and an Associate Member of the Center on Aging and the Institute of Medicine at the University of Maine. He received his Ph.D. in Mechanical Engineering with a focus on wearable robotics from the University of Utah in 2016. He was a postdoctoral research fellow at Biodesign Lab and Wyss Institute for Biologically Inspired Engineering at Harvard University before joining the University of Maine in 2017. His research is focused on dynamic systems and control, wearable robotics, biomechanics, and human-robot interactions. His research aims to bridge robotics and biomechanics by utilizing concepts in human-robot interactions, motor learning, and neuroscience to improve users' gait and mobility. He is also interested in applying his expertise in dynamic systems and control to the areas of renewable energy and robotic additive manufacturing. Babak's research is supported by the National Science Foundation (NSF), the Department of Energy, and the U.S. Army Engineer Research and Development Center. He is a recent recipient of NSF CAREER Award from the Disability and Rehabilitation Engineering Program and the Early Career Teaching Award from the College of Engineering at the University of Maine.

***This seminar counts towards the ME 600 seminar requirement for Mechanical Engineering graduate students.**
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