Understanding Human Perception in Manipulation and Locomotion Skills

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Human motor performance is a key area of investigation in biomechanics, robotics, and machine learning. Understanding human neuromuscular control is important to synthesize prosthetic motions and ensure safe human-robot interaction. Building controllable biomechanical models through modeling and algorithmic tools from both robotics and biomechanics increases our scientific understanding of musculoskeletal mechanics and control. The resulting models can consequently help quantifying the characteristics of a subject's motion and in designing effective treatments, like predictive simulations and motion training. My objective is to explore how neural control dictates motor performance in humans by developing a portable, soft, cyber-physical system and a computational framework - which incorporates real-time robotics-based control, AI-based perception and learning, and OpenSim's musculoskeletal models. In this talk, I will present the modeling, control, and simulation components of this new framework with two examples on human manipulation and locomotion skills. The presented framework has promise to advance the field of rehabilitation robotics by deepening our scientific understanding of human motor performance dictated by musculoskeletal physics and neural control. Automated and real-time motion improvement and retraining, facilitated with such frameworks, promise to transform the neuromuscular health, longevity, and independence of millions of people, utilizing a cost-effective approach.

Biography

Dr. Emel Demircan obtained her Ph.D in Mechanical Engineering from Stanford University in 2012. She is an Assistant Professor of Mechanical and Aerospace Engineering and Biomedical Engineering at California State University, Long Beach. She was a postdoctoral scholar at Stanford Computer Science and a visiting assistant professor at University of Tokyo. She is also a part-time scientist at Lucile Salter Packard Children's Hospital Gait Analysis Lab at Stanford University. Dr. Demircan's research focuses on the application of dynamics and control theory for the simulation and analysis of biomechanical and robotic systems. Her research interests include experimental and computational approaches for the study of human movement, rehabilitation robotics,sports biomechanics, human motion synthesis, natural motion generation in humanoid robotics and human motor control. In 2014, Dr. Demircan established an IEEE RAS Technical Committee on "Human Movement Understanding." She is actively collaborating with clinical, athletic and industrial partners and is involved in professional and outreach activities within the IEEE Robotics Society (RAS).

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