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Presentation title:

# Sensorimotor control meets surgical robotics - a model of the surgeon can benefit patients

Abstract:

In robot-assisted minimally invasive surgery (RAMIS), a surgeon manipulates a pair of joysticks that teleoperate instruments inside a patient's body to achieve precise control of movement, tissue manipulation, and perception. Despite many advantages for both the patient and the surgeon, the full potential of RAMIS and other teleoperation applications is yet to be realized. During everyday interaction with the external world, our brain graciously deals with a similar task – fine manipulation and perception with outdated and noisy information that arrives from multiple sensors. Hence, I posit that employing models and theories about how our sensorimotor system performs these tasks could help bridge major gaps currently impeding the realization of RAMIS full potential. I will present recent results of our human behavioral and machine learning studies to uncover the kinematic signatures of human movements while executing surgical tasks with virtual and real objects and how they change across different time scales following adaptation and skill acquisition. I will then discuss how we harness these findings to eventually improve the control of surgical robots, the assessment and advancement of surgical skill, and ultimately, the well-being of patients.

Short CV:

Ilana Nisky received the B.Sc (summa cum laude), M.Sc. (summa cum laude), and Ph.D. in Biomedical Engineering from the Department of Biomedical Engineering, Ben-Gurion University of the Negev, Israel, in 2006, 2009, and 2011, respectively. She is currently an associate professor in the Department of Biomedical Engineering, Ben-Gurion University of the Negev, where she is the head of the Biomedical Robotics Lab. She is also the principal investigator on rehabilitation with haptic interfaces at the Neuro Negev Lab - Translational Neurorehabilitation Lab. She was previously a visiting academic fellow in the Department of Engineering, University of Cambridge, and a postdoctoral research fellow in the Department of Mechanical Engineering, Stanford University. She is the recipient of the 2021 Neural Control of Movement Society Early Career Award and the 2019 IEEE Robotics and Automation Society Early Academic Career Award. Her research interests include human motor control, haptics, robotics, human and machine learning, teleoperation, and robot-assisted surgery. Nisky has authored more than 80 scientific publications in peer-reviewed journals and conference proceedings, and numerous abstracts in international conferences. She served as an executive committee member of the EuroHaptics Society 2014-2018, and is a board member of the Israeli Society for Medical and Biological Engineering. She is a Senior Member of IEEE, a member of the Society for the Neural Control of Movement, the Society for Neuroscience, Technical Committee on Haptics, and American Physiology Society.