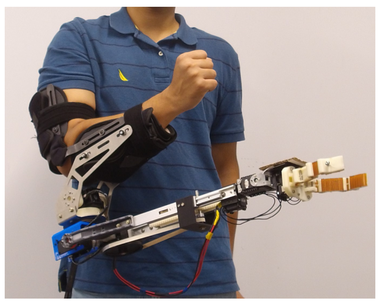
NRI: FND: Collaborative Control for Wearable Robots: Human-Robot Collaboration and Biomechanical Trajectory Optimization

Guy Hoffman, Cornell University

This year's achievements focused on the human-robot collaborative and ergonomics aspects of the wearable robotic arm. We have developed autonomous predictive behaviors for joint activities between the human and the robotic arm. We also used muscle-fiber simulation to find trajectories that exert less load on the wearer.

Key Challenges

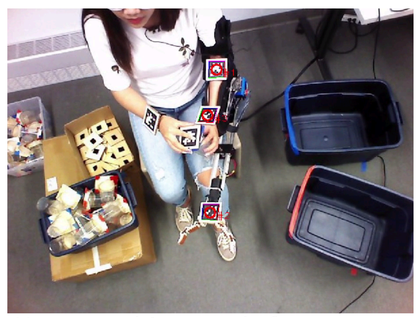
- How to predict a human's activity to control a wearable robotic arm for more fluent collaboration?
- How does this predictive control affect collaboration?
- What are the effects on muscle loads of working with the wearable robotic forearm (WRF)?
- How can the arm plan a more ergonomic trajectory?



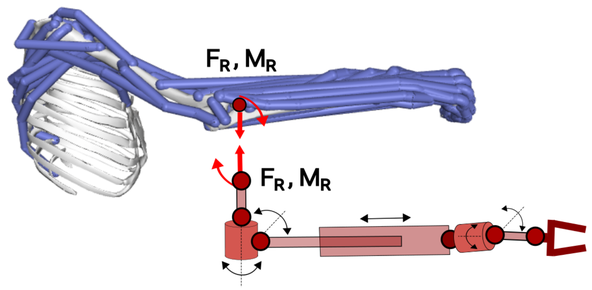
Scientific Impact

- New algorithms for human-wearable collaboration
- Better tools to analyze ergonomic impact of wearable robotics
- New controller planning algorithms to minimize muscle load in wearable robotics.

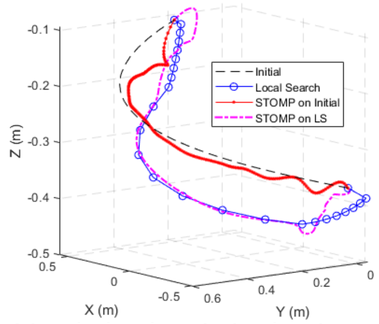
Solution



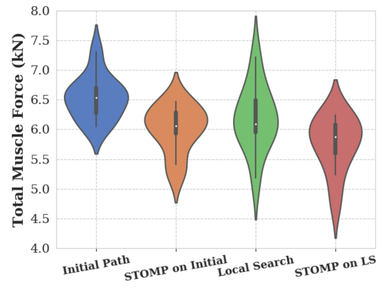
Human-subject study for autonomous wearable interaction.



Muscle fiber simulation in conjunction with mechanical model of supernumerary robotic arm



Muscle-load optimized trajectory using STOMP variant



Decrease in muscle-load with the proposed ergonomic planning algorithm

Impact on Society

- More usable wearable robotics (WR)
- Safer and more ergonomics WR
- For manufacturing, logistics, and construction

Impact on Outreach and Education

- 1st Workshop on Supernumerary Robotic Limbs
- Position paper galvanizing the community.

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