Cyber-Physically Assistive Clothing to Reduce Societal Incidence of Low Back Pain

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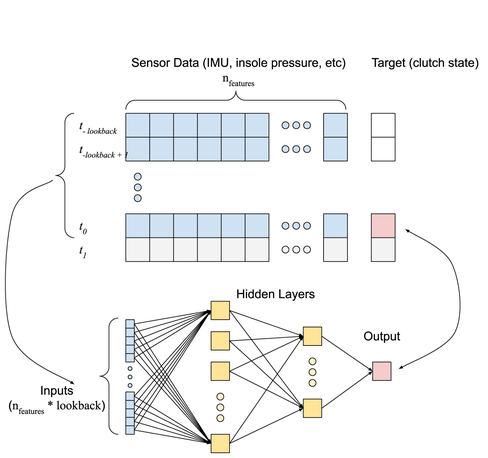
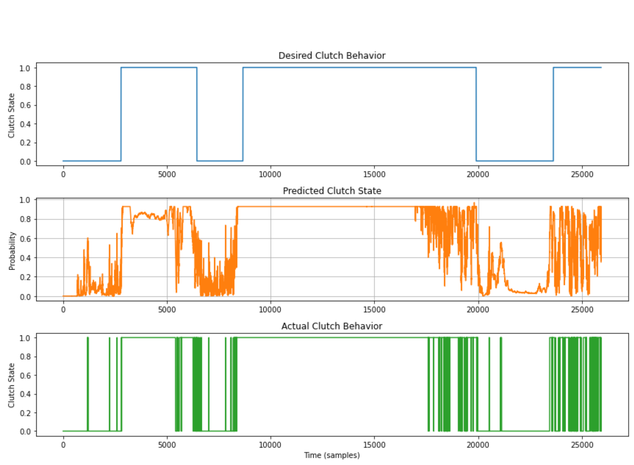
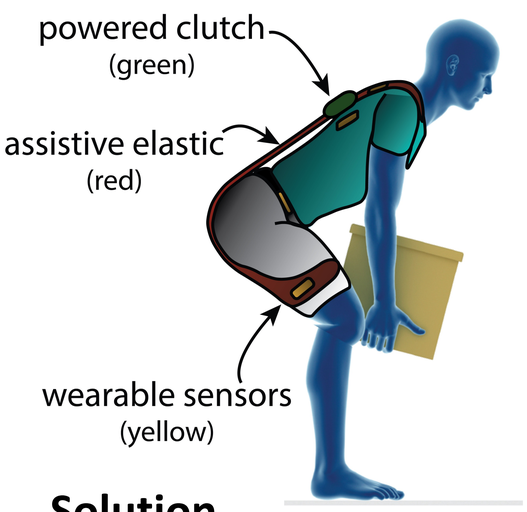
Our vision is to create lightweight, low-profile, smart, assistive clothing that monitors how people move, assesses injury risk, relieves back strain when help is needed, & stays out of the way the rest of the time

Challenges

(1) Selecting types and locations of sensors embedded in clothing
(2) Minimizing actuator bulk/weight and power demands for daily use
(3) Real-time monitoring and assessment of back injury risk
(4) Coordinating device behavior with user movement, needs and intent
(5) Achieving extremely high control accuracy needed for user acceptance







Scientific Impact

Due to the multifaceted nature of this project, this research has the potential to impact:

- Musculoskeletal biomechanics
- Exoskeletons & human augmentation
- Machine learning & sensor fusion methods for wearables
- Low back pain prevention & care
- Soft robotics

Solution

We are developing cyber-physically assistive clothing (illustration above), which is a type of quasi-passive, mode-switching exosuit that uses wearable sensors and ML-based control (figures on the left) to coordinate device behavior with user movement and needs. The device aims to relieve back strain during lifting and bending tasks, and otherwise integrate seamlessly into daily life and allow full freedom of movement.

Impact on Society

Practical, effective, and scalable solution to monitor low back health, and reduce back fatigue and injury risk resulting from overuse

Quantifying Impact

Reductions in damage and injury risk of the low back will be estimated using biomechanical analysis and ergonomics assessment tools

Outreach

An educational video on this research was produced and sent out to K-12 schools as part of an outreach program that reached >350 students

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