CPS Medium: Smart Harvesting – Enhancing automated apple harvesting through collaborative human-machine intelligence

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Summary: CPS networks will provide increased orchard automation success by leveraging human intelligence. We implement CPS networks with collaborative apple harvesting robots to increase yield and minimize worker risk.

Challenge

- Orchard tasks are repetitive, dangerous, and laborious
- Robot harvesting is slow and inefficient (<60% pick rate)
  - Environment: Unpredictable orchard weather conditions
  - Identification: Inadequate machine vision systems
  - Mechanics: Difficult navigation and obstacle avoidance
  - Speed: Complex planning and control

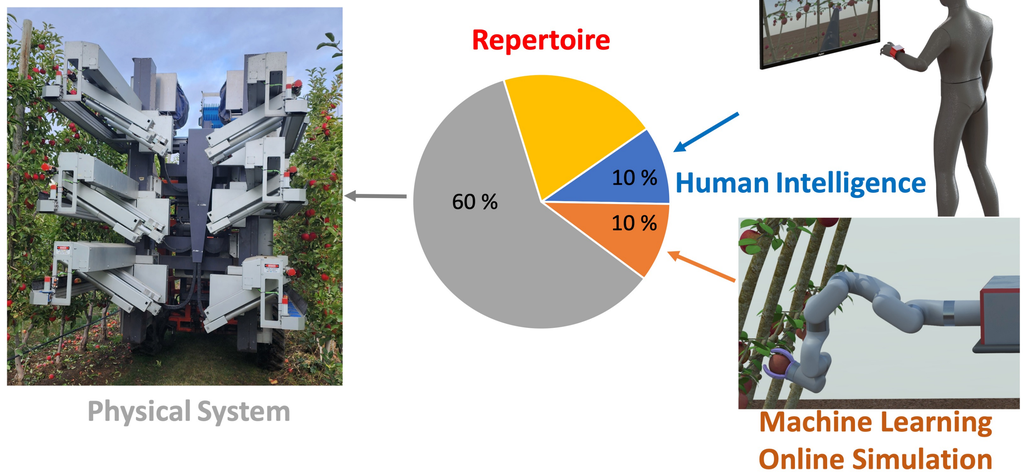
Solution

CPS network that enables humans to participate in collaborative apple robot harvesting to promote learning and optimization

Scientific Impact

- Autonomous crop harvesting that leverages machine learning and human intelligence
- Novel approach for uncertain cases with limited data (perception, decision-making, and actuation)
- Parallel comparison for soft and rigid manipulator planning and control

CPS Network



Broader Impact

- Society
  - Alleviate orchard labor shortage for over 50 local growers
  - Lower cost of produce with 30% increase in harvest yield
  - Reduce worker exposure to hazards and chemicals
- Education & Outreach
  - Recruited and mentored two Hispanic PhD students from orchard-working families
  - Conducted workshops for farmers interested in robotics

MECHANICALLY-INTELLIGENT AUTONOMOUS ROBOTICS (MIAR) LABORATORY

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