

NRI: Robotic Harvest-Aiding Orchard Platforms

S. Vougioukas¹ (PI), G. Kantor², D. Slaughter, F. Fathallah

¹University of California, Davis

²Carnegie Mellon University



Carnegie Mellon University

Manual fruit harvesting

A labor-intensive operation associated with:

- Carrying and climbing 16-ft ladders;
- Carrying heavy picking bags.



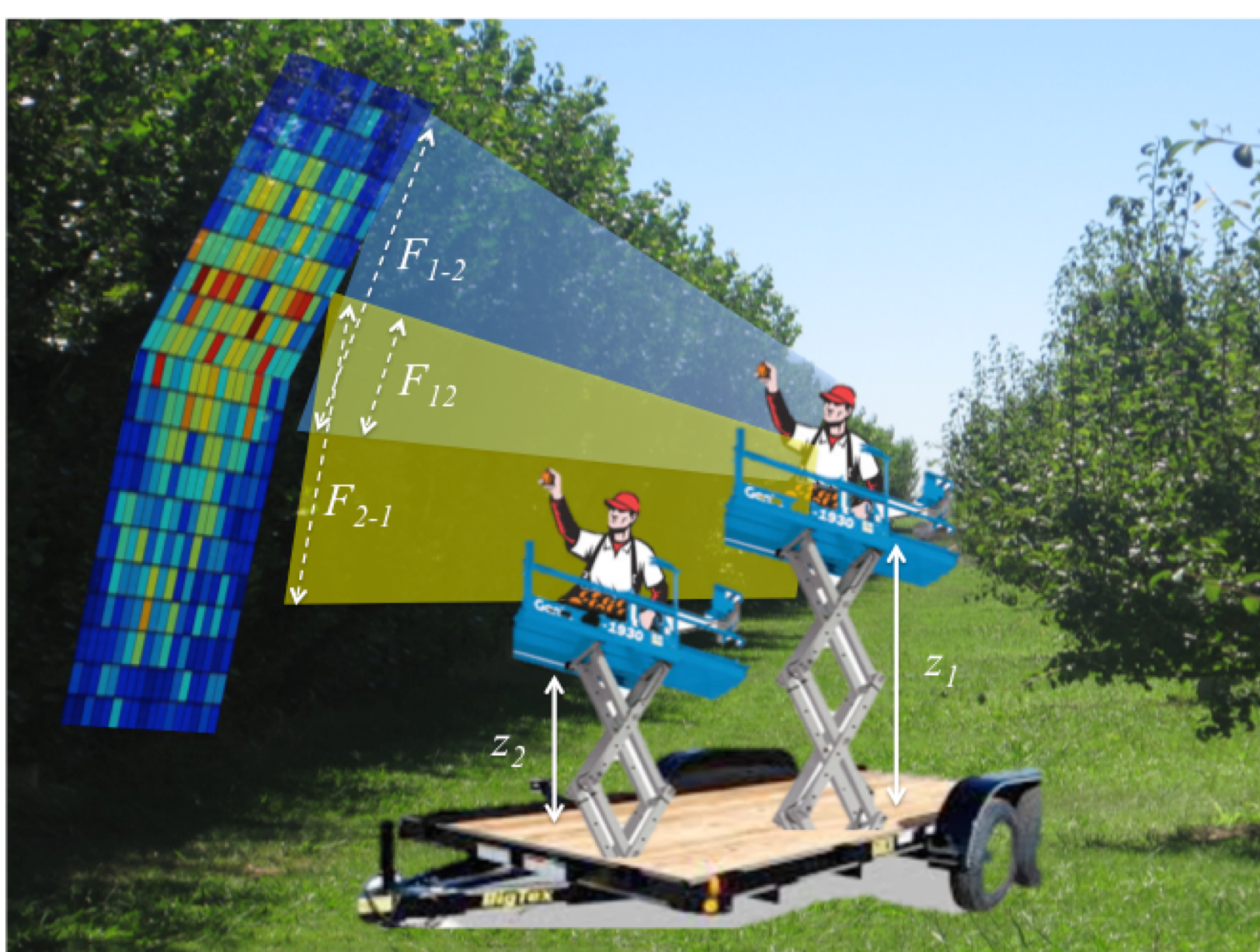
Platform-aided fruit harvesting

- Harvesting at fixed zones along tree heights.
- Harvesting throughput is severely limited** by:
 - Mismatch between non-uniform fruit distributions and workers' picking speeds;
 - Time spent for manual platform control.



GOAL: Co-Robotic Orchard Platforms

- Robotic platforms maximize harvesting efficiency by model-based control of:
 - Picker vertical positioning;
 - Platform speed.

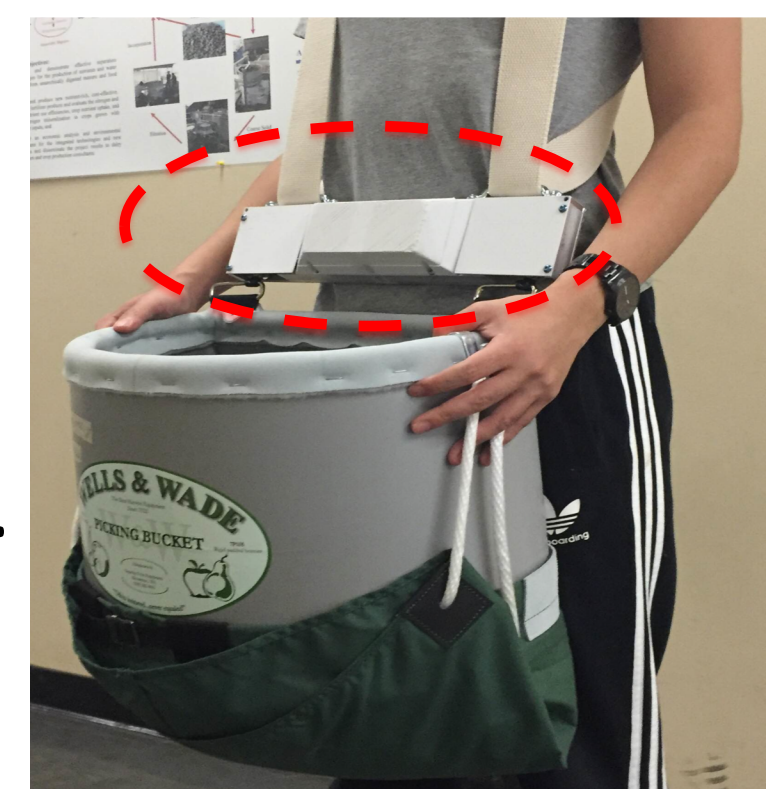


Approach

- Perception system estimates incoming fruit-density and each worker's picking speed.
- Optimizing controller governs picker lift elevations and platform speed to maximize machine throughput.
 - Matches picker speeds to incoming fruit flow.

Status

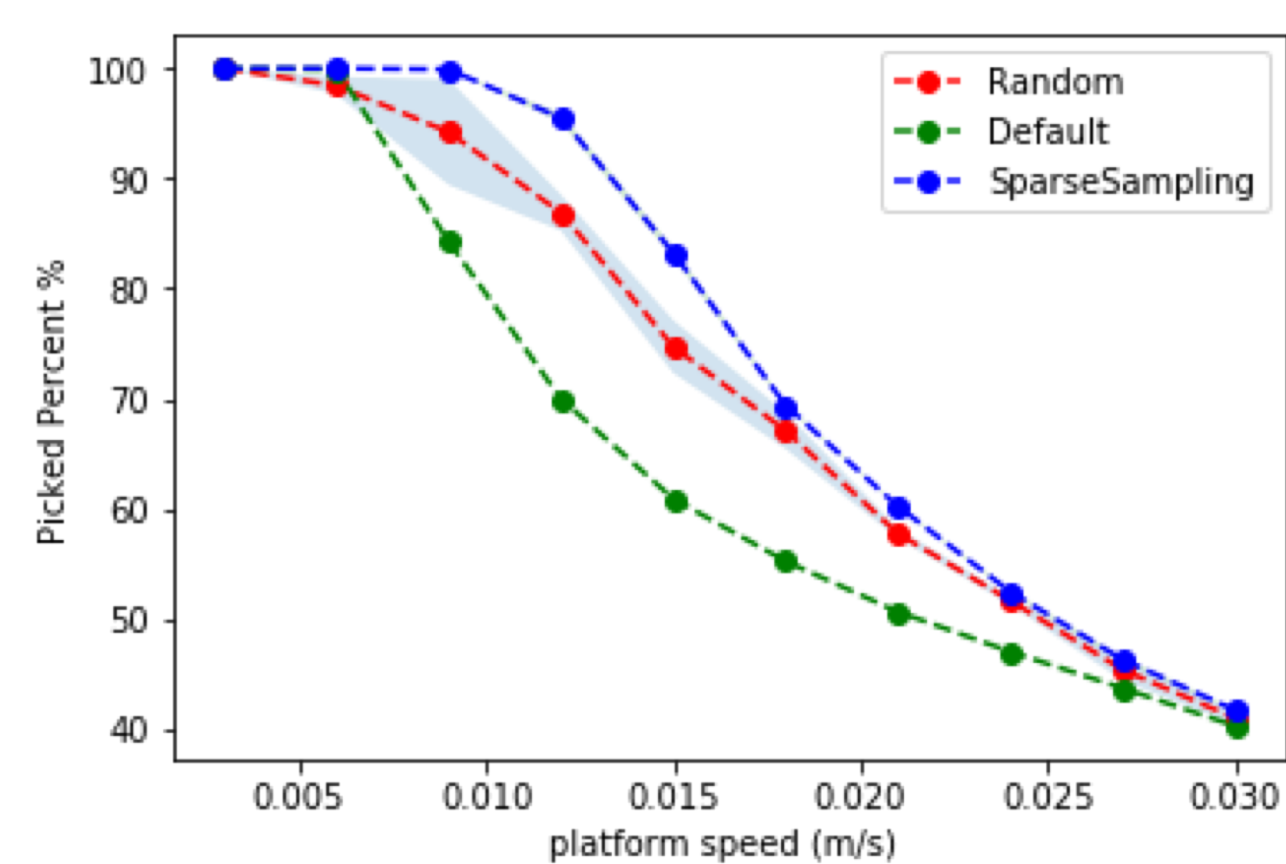
- An instrumented picking bag was developed that monitors fruit picking rate (1.8% RMS error).



- Stereo camera estimates incoming fruit locations.



- Platform retrofitted with computer-controlled hydraulic cylinders for lifting individual pickers.
- Real-time optimizing controller uses *Monte-Carlo sparse sampling* search to control picker lift elevations and maximize throughput.



- Harvest experiments in California apple orchards.

