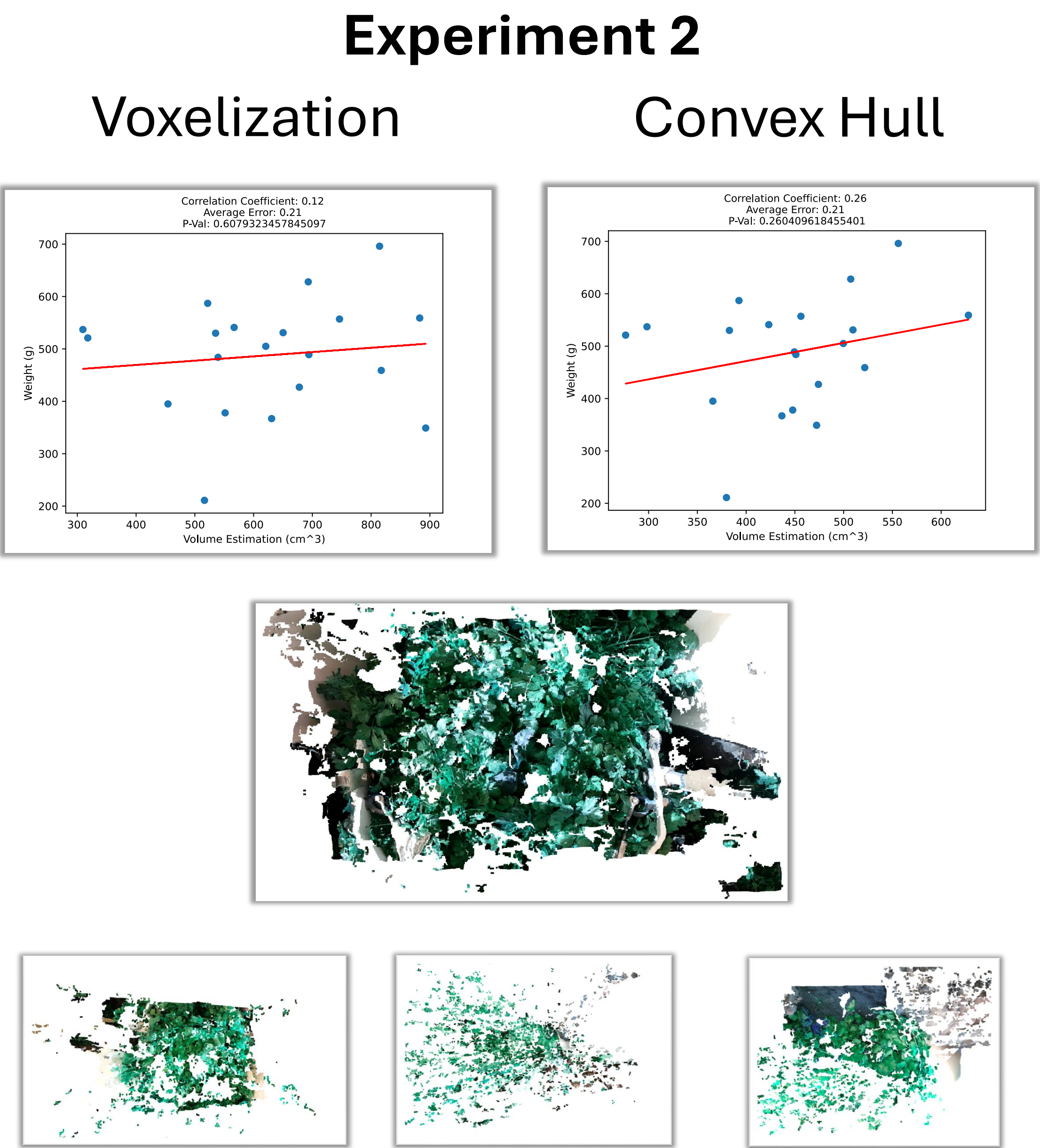
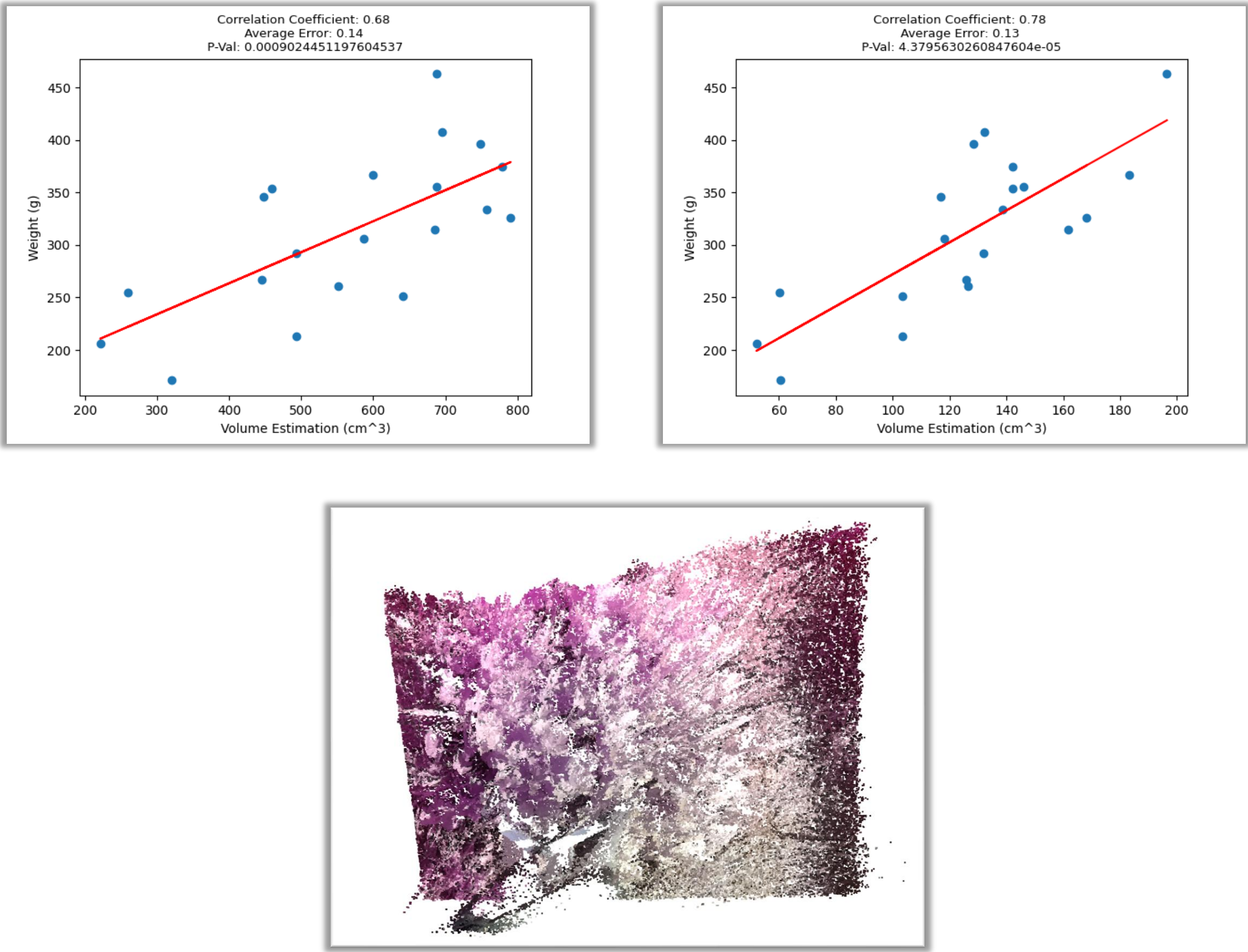


Experiment 1

Voxelization

Convex Hull



The Amiga



Garret Castro
Team Lead
Algorithm Development, UI/UX/GUI
Designer, Back-End Developer,
Programmer, Notetaker

Hans Guillen
UI/UX Designer
Database Designer/Developer,
Computer Vision Engineer,
Notetaker, Communications Lead

Nick Mount
Data Engineer
Back-End Developer, Programmer,
Team Coordinator/Conflict
Resolution Manager, Notetaker

Jason Yuen
Technical Lead
Algorithms Development
Notetaker, Front-End Developer,
Back-End Developer, Database
Designer, Programmer, Tester



We used depth cameras on a modular robot to estimate cilantro harvest yields.

Crop Yield Estimation via Robotic Image Capture

Team Big Farma (CSE-302) Members:

Garret Castro, Hans Guillen, Nick Mount, Jason Yuen

Mentors:

SupHerb –David Sieperda, Blaine Weber

UCM Experimental Smart Farm (UCM ESF) – Daniel Royer

(Special thanks to the teams at the UCM ESF and UCM Makerspace)

Our System

Our goal was to predict cilantro harvest weight using cameras mounted on the Farm-ng Amiga robot: the Oak D W PoE and the OAK D SR PoE Time of Flight (ToF).

These cameras were used to capture point cloud images of the cilantro. We analyzed the point clouds in two ways: 1) by using voxels and 2) by using the convex hull and density. Finding the coefficient that maps volume to weight through linear regression allows us to predict weight from volume.

We made captures using various camera setups on a diverse set of cilantro to varying success. From each experiment, we collected twenty 20”x40” patches.

Experiment 1 @ UC Merced Smart Farm

Cameras: 1 ToF camera

Mount: Tripod

Correlation Strength: $p < 0.001$

Compared to commercial conditions, the cilantro was sparser and had more weeds than typical commercial conditions. The sparseness reduced occlusion, thus likely leading to a more accurate result. The Time of Flight (ToF) cameras have a better resolution than the cameras available to use in Experiment 2.

Experiment 2 @ SupHerb Farms

Cameras: 3 Oak D W PoE cameras

Mount: Amiga Robot

Correlation Strength: $p > 0.05$

Cilantro had additional water weight from moist environmental conditions. Oak D W PoE cameras proved to have much lower resolution than ToF cameras.

Results/Discussion

While the first experiment yielded statistically significant results, the second experiment did not. Here are the two possible explanations, excluding a systemic error, in our believed order of decreasing likelihood:

1. The Oak D W PoE cameras are too low resolution to accurately estimate volume.
2. The correlation is too weak to detect in small samples.

Future Work

More data is needed to find correlation through noise, and more experiments with the ToF camera are needed for more quality data.

If successful, data can be collected and estimations can be made automatically on the Amiga’s computer, with the Amiga using its self-navigation through the field.

