

# Using Computer Vision for Precision Thinning Models in Apples

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**Abstract:** Thinning fruit early in the growing season is necessary to maintain fruit size and quality in the current production year and sufficient flower and fruit production in the following year. Thinning models that predict how much fruit will naturally fall off the tree can help growers reduce the use of thinning chemicals, which are costly and harmful to the environment. However, data collection to gather the necessary model input is onerous. This project will use computer vision and robotics to automate the data collection process, allowing growers to use thinning models at scale to better inform thinning decisions.

## Challenges:

- Current fruitlet size measurements are manual, which poses a barrier to adoption by growers
- AI-enabled feature extraction can detect and measure fruitlet sizes in images, but high-occlusion tree canopies make finding suitable image viewpoints difficult

## Solution:

- Measure fruitlet sizes from stereo images
- Deploy camera on a robot to collect measurements at scale
- Active perception: 3D canopy modeling and fruit search within canopies

## Broader Impact:

- Increase adoption of fruit thinning models
- Financial: reducing input costs for growers
- Environmental: reduce carbaryl applications, which has been associated with pollinator disruption
- Inspiring hands-on robotics/science projects for CMU's Girls of Steel K-12 program

## Scientific Impact:

- Fruitlet measurements collected at scale may enable novel thinning models, such as modeling size distributions over large populations instead of tracking individual fruitlets
- Novel methods of modeling and searching cluttered 3D environments will be developed

