

Toward Automated Strawberry Yield Estimation - Integrating UAV Imaging and AI Models

Xu (Kevin) Wang^{1,2}, Shinsuke Agehara^{1,3}, Wael Elwakil⁴
Santhi Daggubati^{1,5}, Xue Zhou^{1,2}, Weining (Bill) Wang¹

¹ IFAS Gulf Coast Research and Education Center

² Department of Agricultural and Biological Engineering

³ Horticultural Sciences Department

⁴ IFAS Extension Hillsborough County

⁵ Department of Engineering Education

University of Florida

May 6, 2026



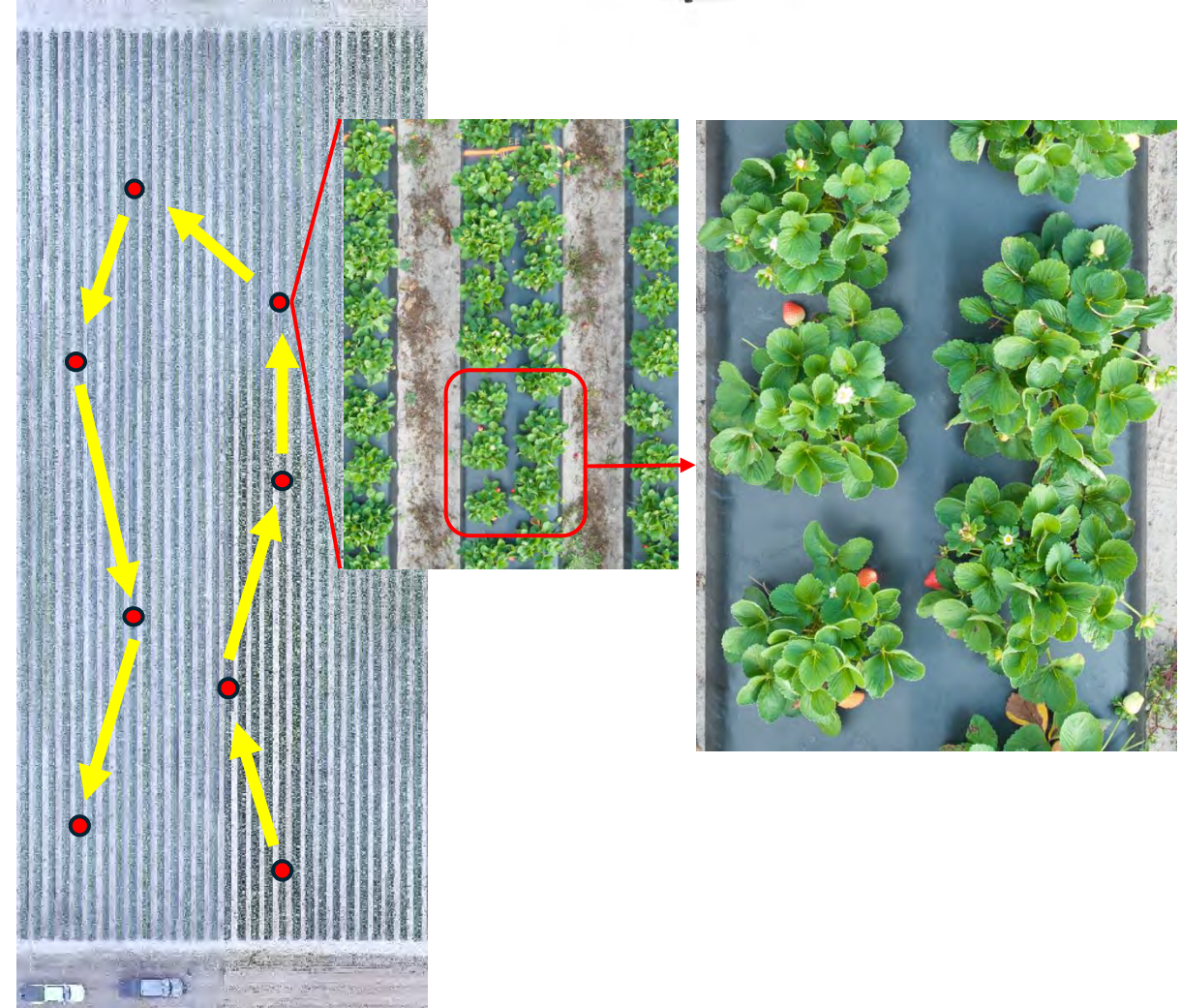
Why yield estimation matters

- Accurate yield estimation
 - Help breeders select high-yielding genotypes
 - Help growers plan harvests, schedule labor, and make smarter marketing decisions
- Counting fruits is the most direct way to estimate yield
- Manual counting is slow and inconsistent, and simply impractical at commercial field scales



Our approach – drones + AI

- Consumer-grade UAVs (drones) with high-resolution cameras
 - Capture top-view images of strawberry fields
 - Flexible and fast
 - Affordable (~\$3K)
 - Minimize crops disturbance

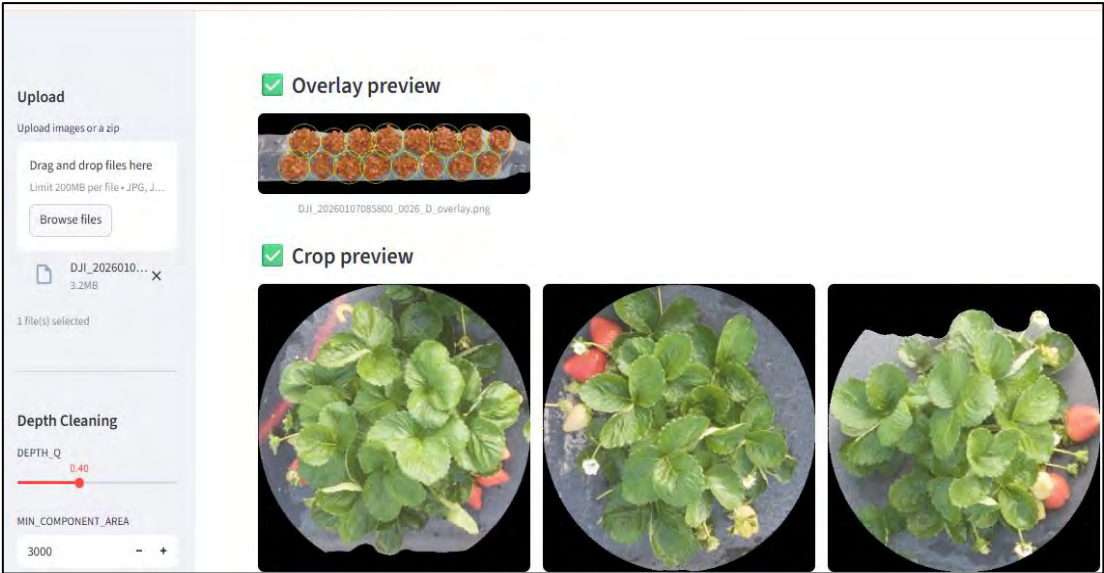


Our approach – drones + AI

Field image collection using drones



Individual plant segmentation – PhenoSeg



Fruit and flower counting – PhenoSnap

Home

- About Strawberry
- About Strawberry Runner
- About Tomato

Model Selection

Model

Strawberry Full Model

Model outputs

Runner · Immature Fruit · Mature Fruit · Flower

Upload Images

Drag and drop files here

Limit 200MB per file • PNG, J...

Browse files

16 images selected

We are not going to save your images.

Classes to include (Counting)

Runner

Results

Per-class counts (images)

class	count
0 Flower	33
1 Immature Fruit	44
2 Mature Fruit	17

- Flower – 33
- Ripe fruit – 17
- Unripe fruit – 44

DJI_20260107085800_0026_D_crop_1_pred.jpg

DJI_20260107085800_0026_D_crop_10_pred.jpg

DJI_20260107085800_0026_D_crop_11_pred.jpg

DJI_20260107085800_0026_D_crop_12_pred.jpg

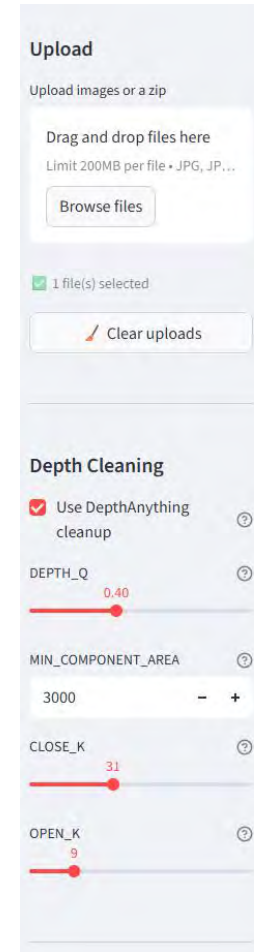
DJI_20260107085800_0026_D_crop_13_pred.jpg

DJI_20260107085800_0026_D_crop_14_pred.jpg

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Application I – PhenoSeg: finding each plant

- Original purpose
 - Identifies and outlines individual strawberry plant canopies from drone images
- Built on two foundational AI models
- Not only for plant segmentation



Upload

Upload images or a zip

Drag and drop files here

Limit 200MB per file • JPG, JP...

Browse files

1 file(s) selected

Clear uploads

Depth Cleaning

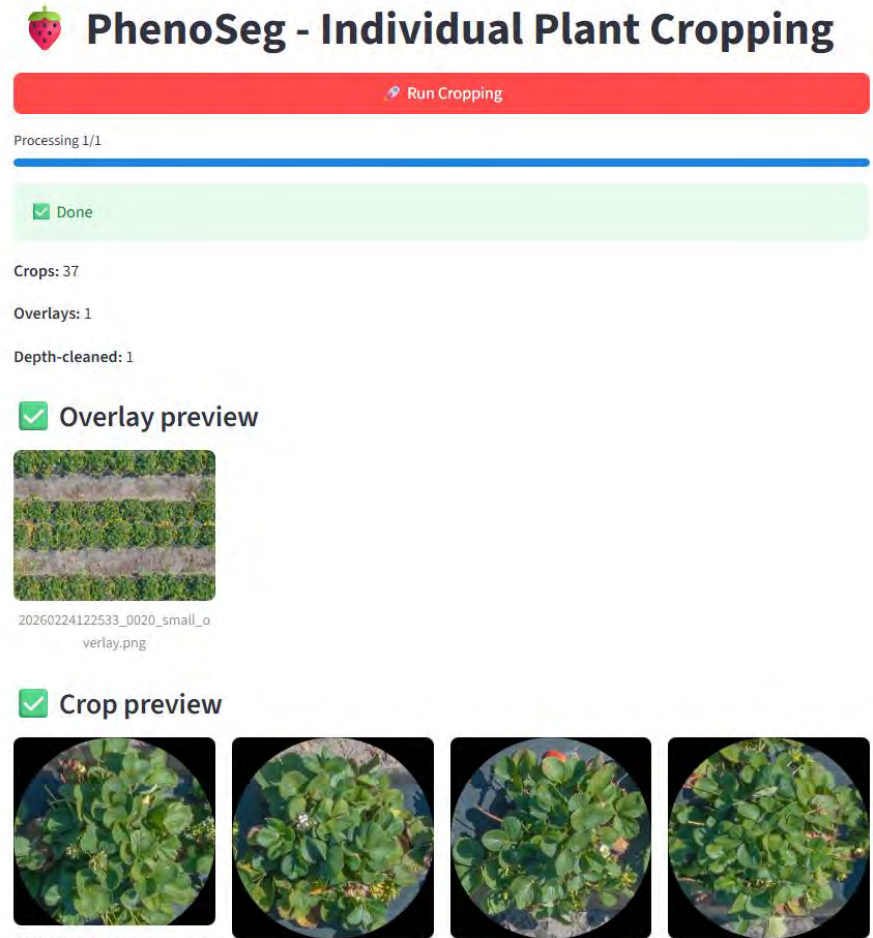
☒ Use DepthAnything cleanup

DEPTH_Q 0.40

MIN_COMPONENT_AREA 3000

CLOSE_K 31

OPEN_K 9



PhenoSeg - Individual Plant Cropping

Run Cropping

Processing 1/1

Done

Crops: 37

Overlays: 1

Depth-cleaned: 1

Overlay preview

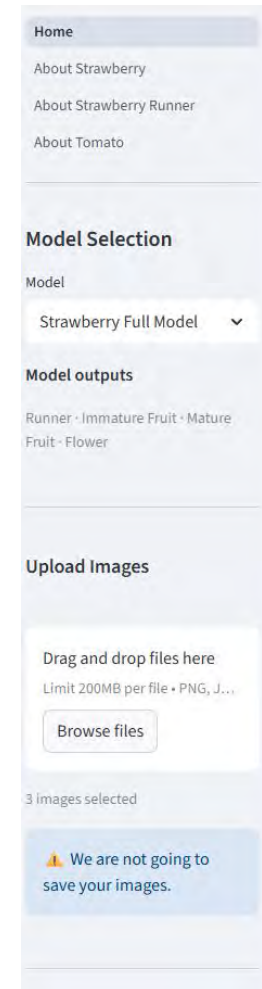
20260224122533_0020_small_overlay.png

Crop preview

Four circular crop preview images showing individual strawberry plants.

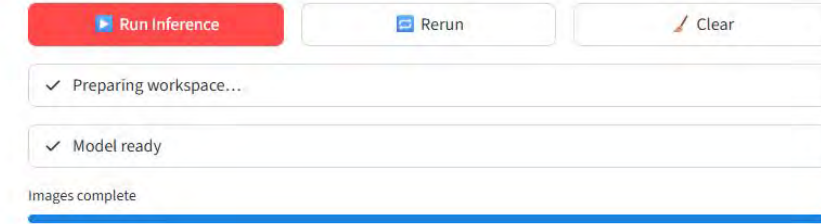
Application II – PhenoSnap: counting fruits & flowers

- Detects and summarizes fruits and flowers at the individual plant level
- Built on a trained AI model (Zhou et al., 2025)
- Detailed user guide is published as an EDIS paper (in copy editing).



PhenoSnap — Phenotyping in a Snap

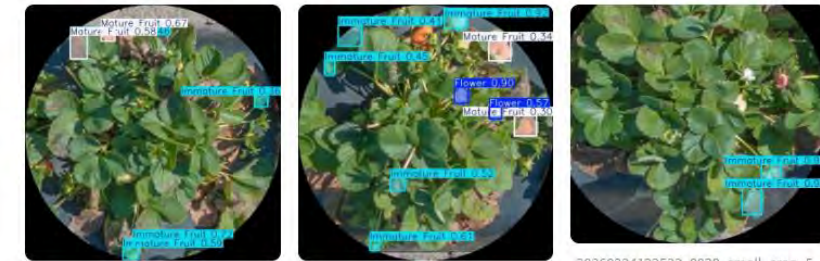
Model Selection → Upload Images → Inferencing → Visualization → Results Export



Results

Per-class counts (images)

	class	count
0	Flower	2
1	Immature Fruit	11
2	Mature Fruit	4



What we learned in Year 1

- The drone + AI workflow dramatically reduces the time and effort required compared to manual field scouting and counting.
- PhenoSeg
 - Plant-level segmentation becomes less reliable when canopies overlap and merge.
 - Shifting to plot-level counts may be a more practical and robust approach at commercial scale.
- PhenoSnap
 - Undercounting increases as canopies become denser later in the season.
 - A fundamental limitation of any image-based system: occluded fruits and flowers simply cannot be detected if they aren't visible to the camera.

Summary and next steps

- Our goals is to help both researchers and growers estimate strawberry yield more efficiently – saving time, reducing labor, and improving estimation accuracy.
- What's next
 - Image acquisition: optimize flight height and timing
 - Fruit ripeness staging: need to develop a protocol
 - Undercount correction: apply data-driven and empirical modeling approaches
 - Researchers and growers feedback: real-world input is essential to refine this workflow.

Acknowledgement



Florida Strawberry Research
and Education Foundation



UF | **IFAS Research**
UNIVERSITY of FLORIDA



Contact: xuwang1@ufl.edu

