

The Dawn of Al-Assisted Deep Strawberry Learning

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Self-Introduction

- Assistant Professor of ABE at GCREC
- Education and training
 - BS, MS in Computer Science
 - PhD in Bio Ag Engineering
 - Postdoc in wheat breeding
- Joined UF in October 2021
- Research AI for plant breeding
- Extension AI applications for crop sensing and production practices



The Power of Al

- Al is changing our life.
 - Robot, content recommendation, ChatGPT...
- Al in Ag.
 - "Muscle" Automation and robotics
 - "Eye" Smart sensors and machine vision
 - "Brain" Models for prediction and decision support

"Just as electricity transformed almost everything 100 years ago, today I actually have a hard time thinking of an industry that I don't think AI will transform in the next several years."



– Andrew Ng

How Can AI Advance Plant Breeding?



AI-Powered Phenomics for Plant Breeding

Primary objective: providing plant breeders with decision support tools to expedite the development of superior varieties.

Augment predictive accuracy	Prediction models, explainable AI	Offer comprehensive info for selection, examine the validity of prediction models	"Brain"
	仑		
Improve trait reliability	Computer vision, machine/deep learning	Enhance measurement precision, quantify complex traits, mitigate human bias	"Eye"
	仑		
Increase selection intensity	Automation, robotics, smart sensing	Expand breeding populations, minimize phenotyping labor and time expenses	"Muscle"

AI-Assisted Applications for Strawberry Breeding

Strawberry runners, flowers, and fruits detection



- Strawberry growth condition monitoring and analysis
- Strawberry biomass prediction

- Objective
 - Accurate quantification of strawberry plant parts (runners, fruit, and flowers) through AI-assisted machine vision
 - Selection support for breeding
 - Yield estimation and prediction



- Flowers
- Mature fruit
- Immature fruit
- Runner

- Ground imaging systems, 2023-2024
 - Amiga, all electric micro-tractor, Farm-ng, CA
 - 2 cameras, 4K video recording at 30fps
 - Covered by a shade sail





Wai Shar

Will Haxton Kai Shen



 Multi-object identification and segmentation through YOLOv8-based deep convolution neural network





Prediction demo using the 2024 model



• Runners quantification error analysis





7. Background (light/tire print/dead stem), 2.34%

6. Double count, 3.51% -



- 5. Calyx was identified as runner, 7.02%
- 4. Overlap runners, 7.60%









8. Stake blocked runner, 1.17%



9. Runner out of the frame, 0.58%



1. Missed runners, 37.43%



2. Leaf stem was identified as runner, 28.07%



Dr. Xue Zhou

- Future work
 - Improve model prediction accuracy
 - Increase camera viewing angles
 - Detect more traits, such as disease and nutrient deficiency





Dr. Xue Zhou

AI-Assisted Applications for Strawberry Breeding

- Strawberry runners, flowers, and fruits detection
- Strawberry growth condition monitoring and analysis FSGA



• Strawberry biomass prediction

- Objective
 - Large-scale field mapping by aerial (drone) imaging.
 - Phenome Insight a web application developed for field map generation and visualization, and analysis of strawberry growth conditions.





Dr. Chang Zhao Dr Asst. Prof. Ext Agronomy



Dr. Wael Elwakil Extension Faculty

• Phenome Insight – field map generation and visualization

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• Phenome Insight – VI calculation and hotspot analysis

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Plant R1 B1 22.9

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- Future work
 - Enrich more AI functions in Phenome Insight, such as strawberry ulletcanopy area segmentation and parts detection





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nt R1 R1 Pear















Liyike Ji



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AI-Assisted Applications for Strawberry Breeding

- Strawberry runners, flowers, and fruits detection
- Strawberry growth condition monitoring and analysis
- Strawberry biomass prediction

Strawberry Biomass Prediction

- Objective
 - Non-destructively estimate strawberry plant volume as a major quantitative factor for biomass prediction





Strawberry Biomass Prediction

• 3D virtual environment of strawberry field in late Feb. 2024



Strawberry Biomass Prediction

- Biomass prediction preliminary result
 - DPC-A-SfM and DS-A-GS, 2023-2024, 18 genotypes × 2 reps



Kai Shen

Take Home

- AI has demonstrated significant potential in revolutionizing agriculture.
- A successful AI application = Talents + Computility + Data
- There are still bottlenecks in leveraging AI techniques.
 - Data integration from fragmented information to decision support
 - Data ownership
 - Data integrity and reliability trust in AI applications

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- Collaborators
 - Dr. Chang Zhao (Agronomy) and Dinesh Chowdary Gogineni



Florida Strawberry Growers Association **



