

SmartHort 2019

The role of robots and humans working together

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WAGENINGEN
UNIVERSITY & RESEARCH



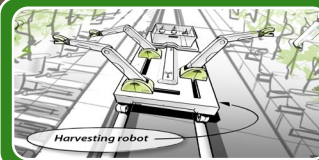
AGRO FOOD ROBOTICS



Optimal breeding performance



More & better with less resources



Hands-free production



Objective quality control



Smart & high quality food processing

Vision

Learning
(AI)

AGRO FOOD
ROBOTICS

Spectral

Robotic
systems

Team Agro Food Robotics



+ vacancies

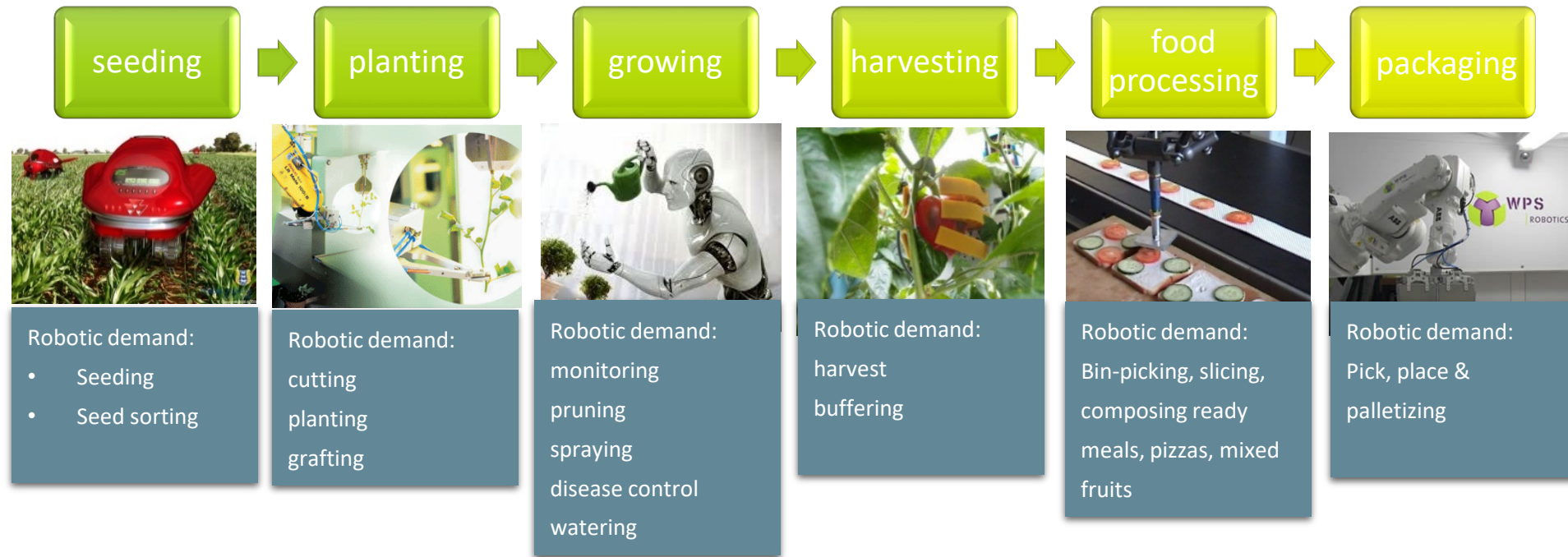
Challenges in food production



Drivers to produce food using robotics, IT & vision



Demand for robotics in agri/food



Automated Guided Vehicles



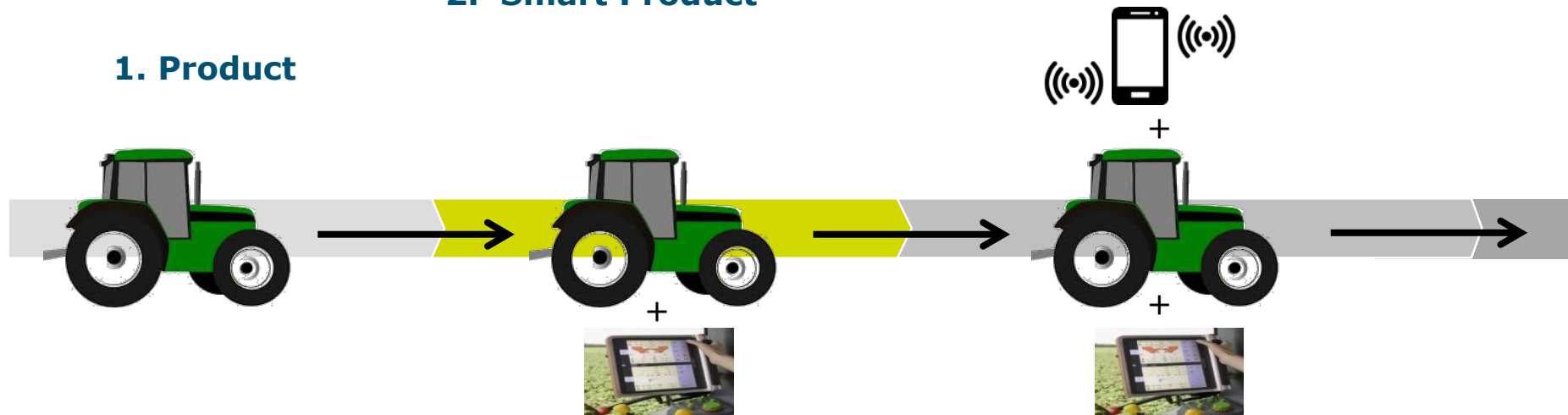
Industrial revolution(1/2)

(according to Porter and Heppelmann, Harvard Business Review, 2014)

3. Smart, connected product

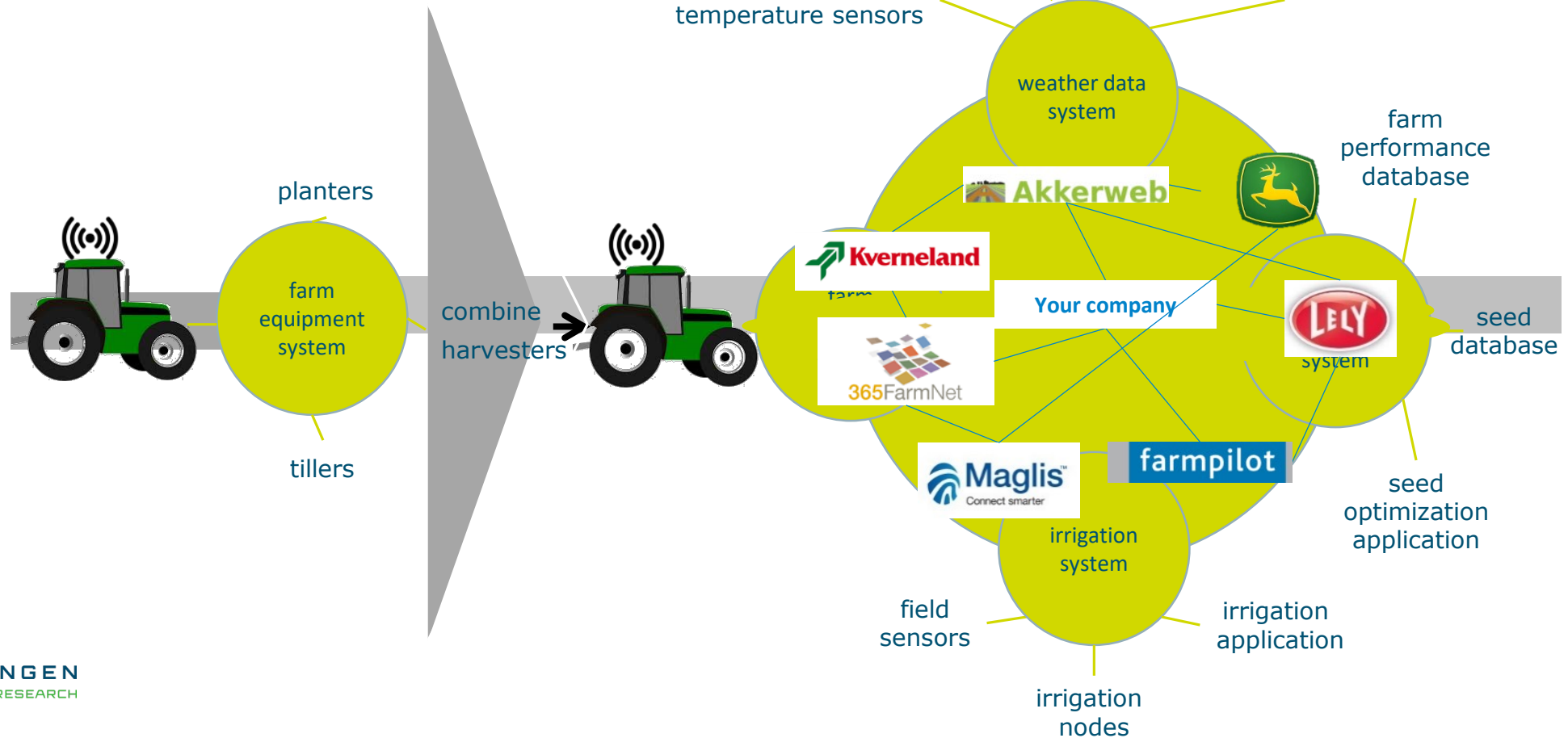
2. Smart Product

1. Product



Industrial revolution Business Review, 2014)

4. Product system



Field phenotyping



Next to AGV/UAV more complex actuation



Weeding



2D Fenotyping IRS





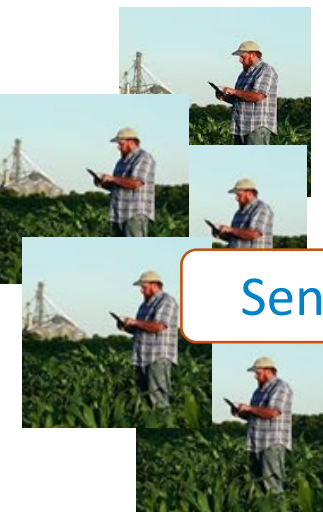
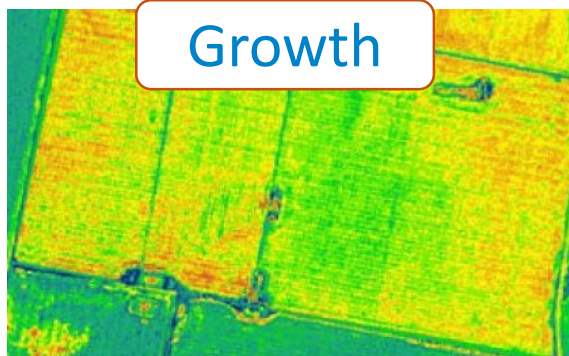
Sensors

Add-on

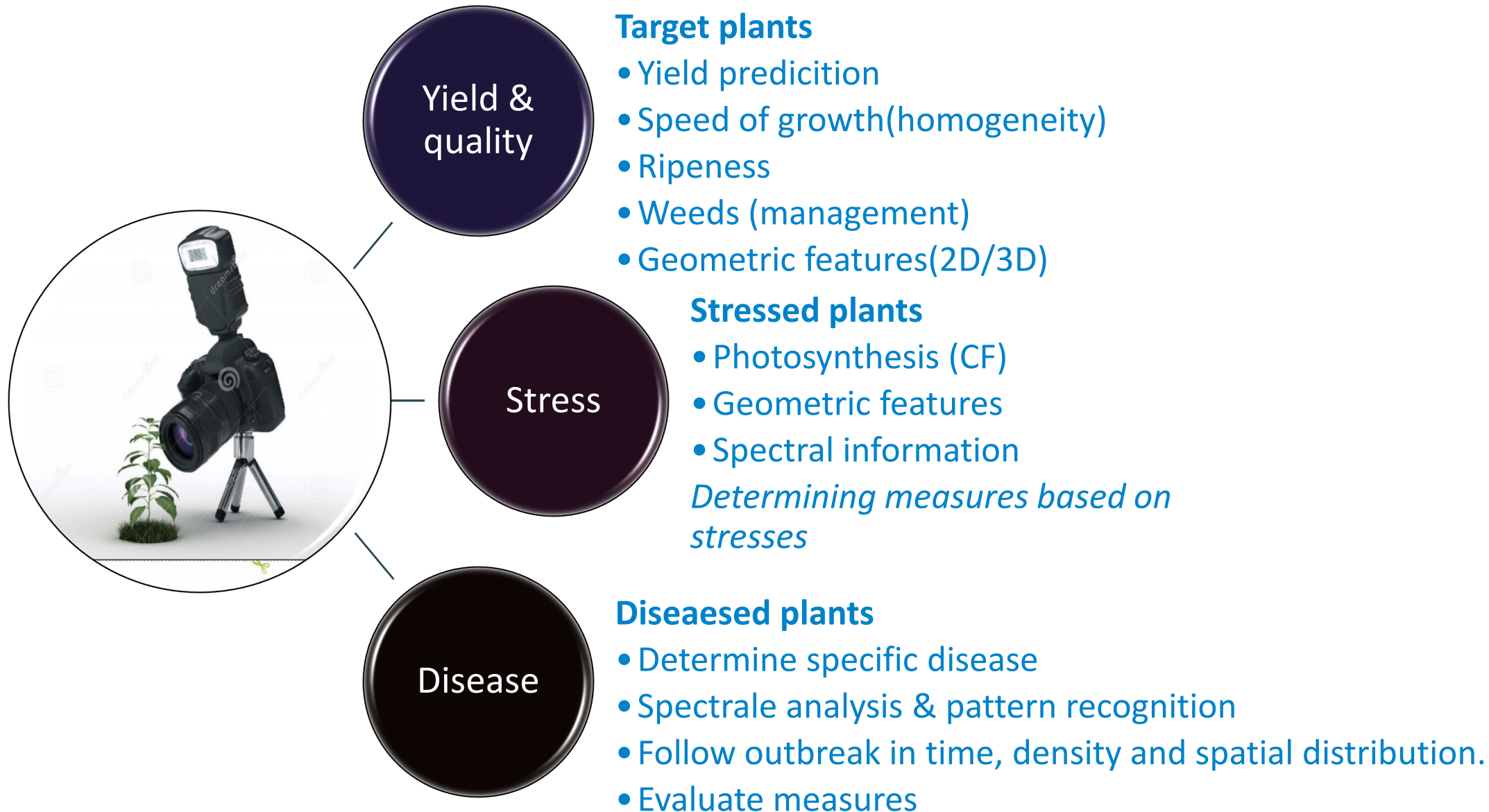
FULLY AUTOMATIC
HOEING MACHINE
- PUMPKINS 2016

Growth

Weeds



Use of image technology



Modification Pluk-O-Trak

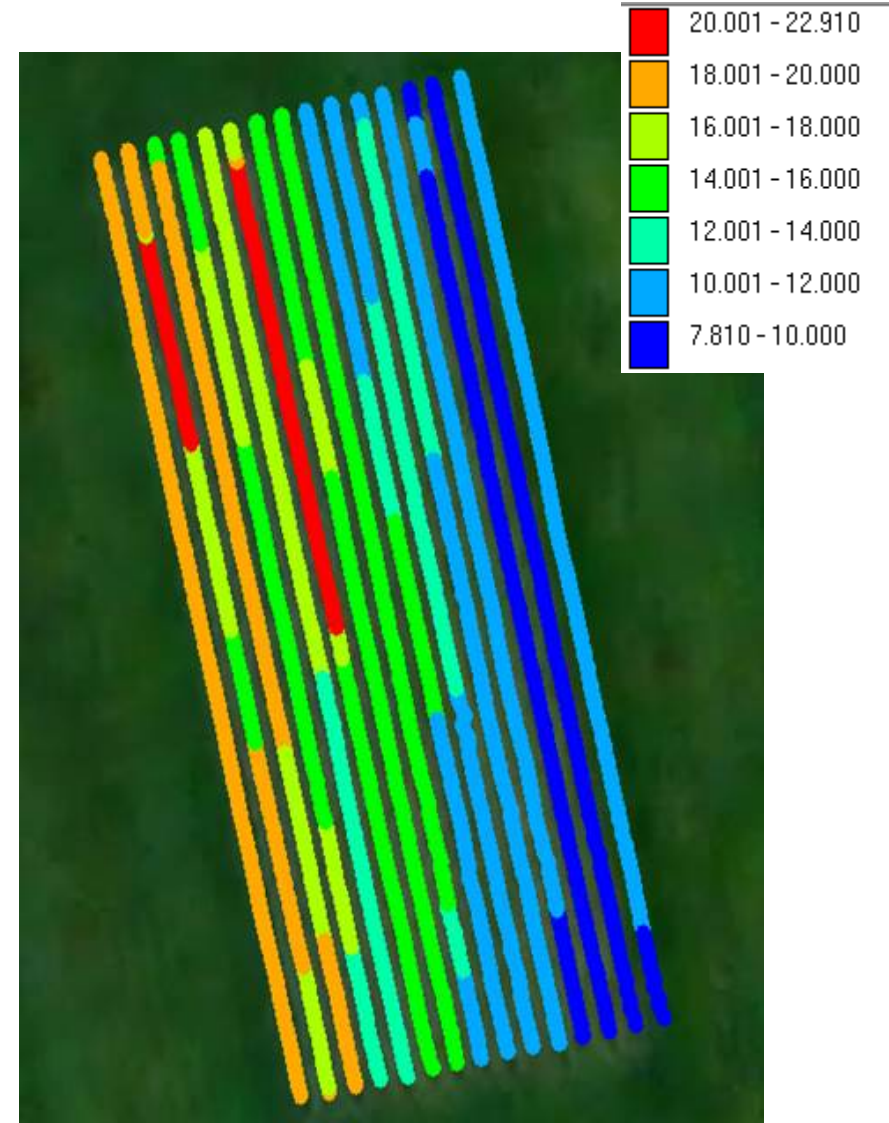


Positions fruit bins in orchard



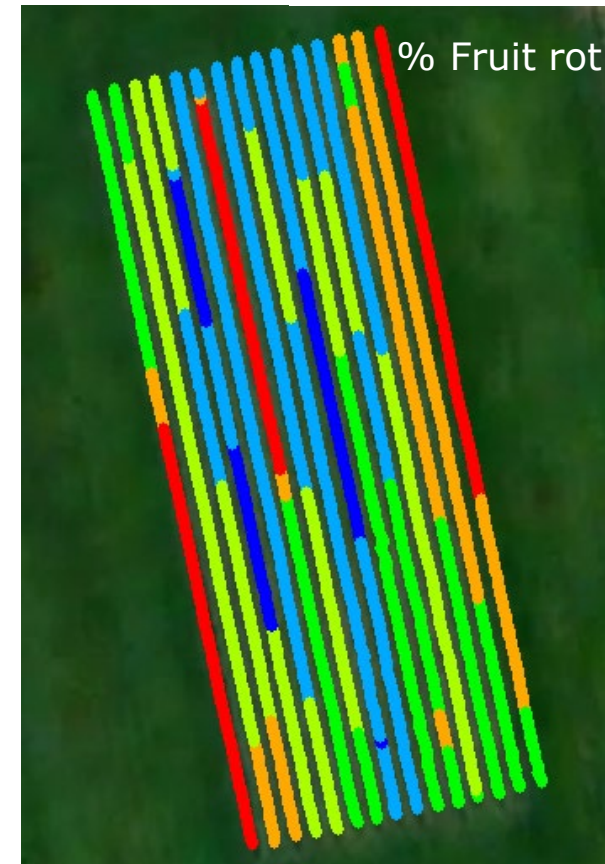
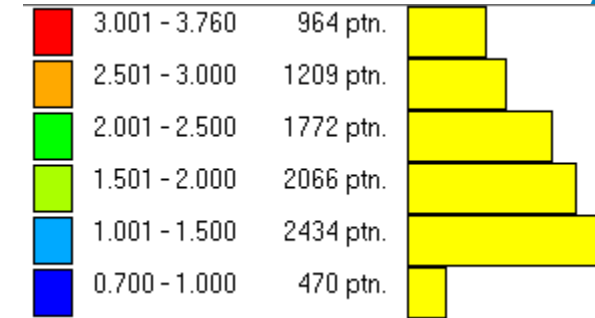
Harvest Pluk-O-Trak

- Harvest in kg/m
- Analysis of production differences



Information grading line

- Information individual apple
 - Number of apples with fruitrot,
 - Weight and size
 - Blush area and blush intensity, back color, size,
 - Bruises, skin defects, internal disorders, hail damage,
 - Quality classification

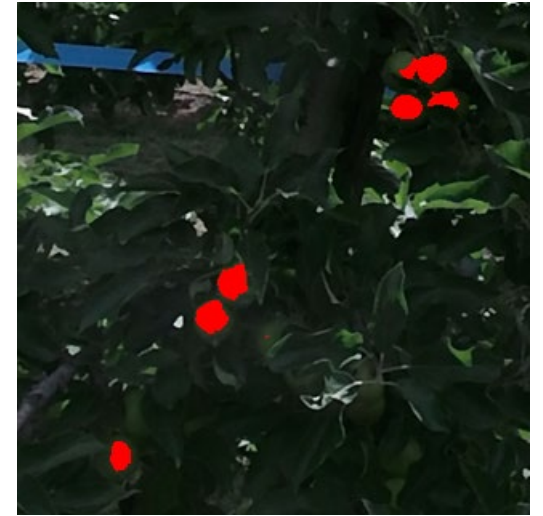
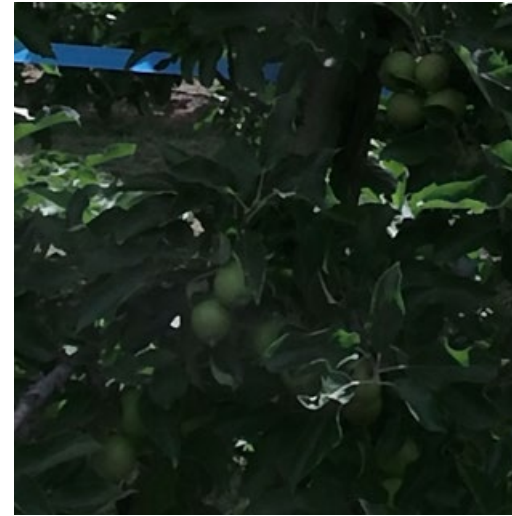


Hightech sensing

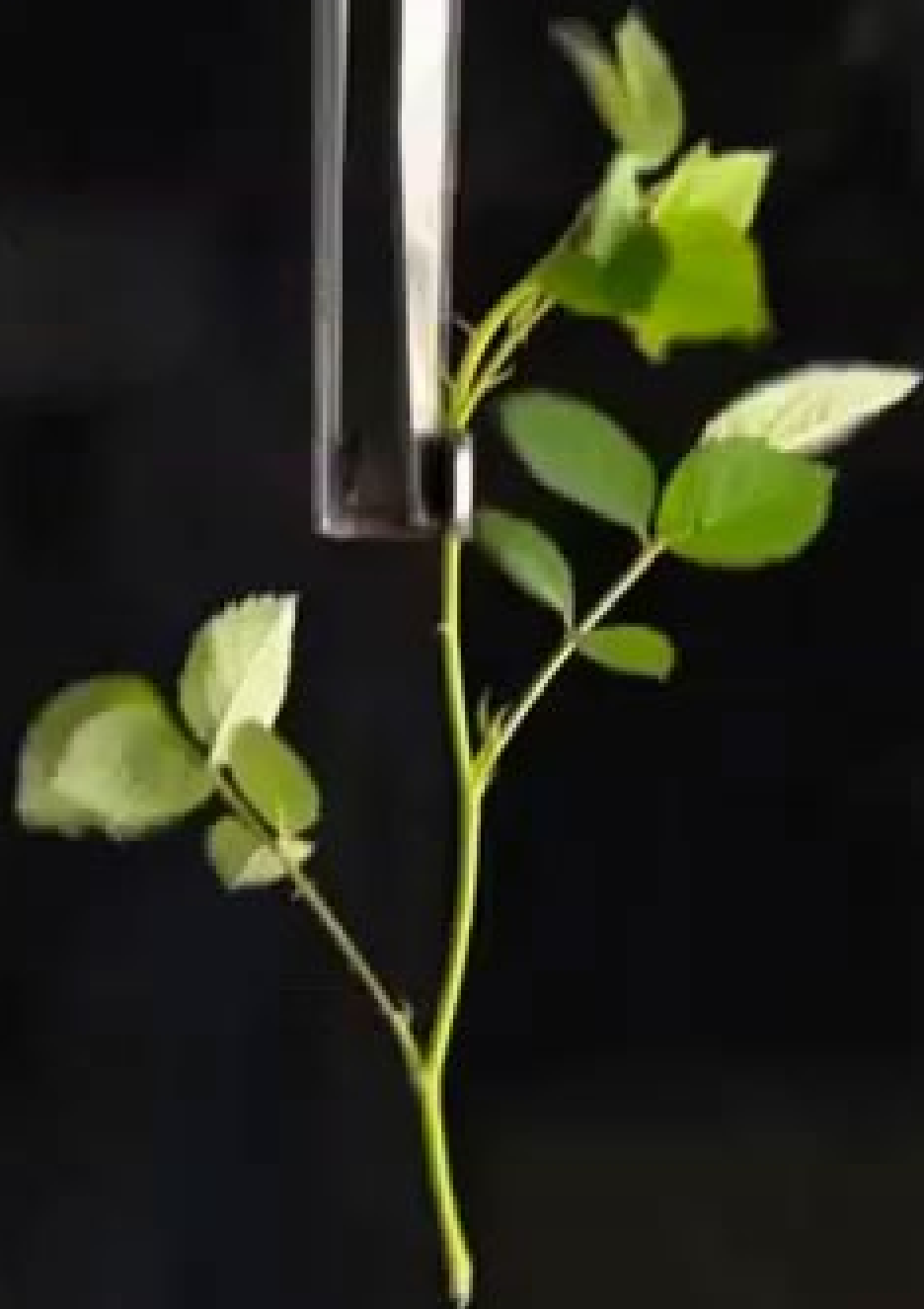
- Blossom detection with deep learning algorithms



Hightech sensing

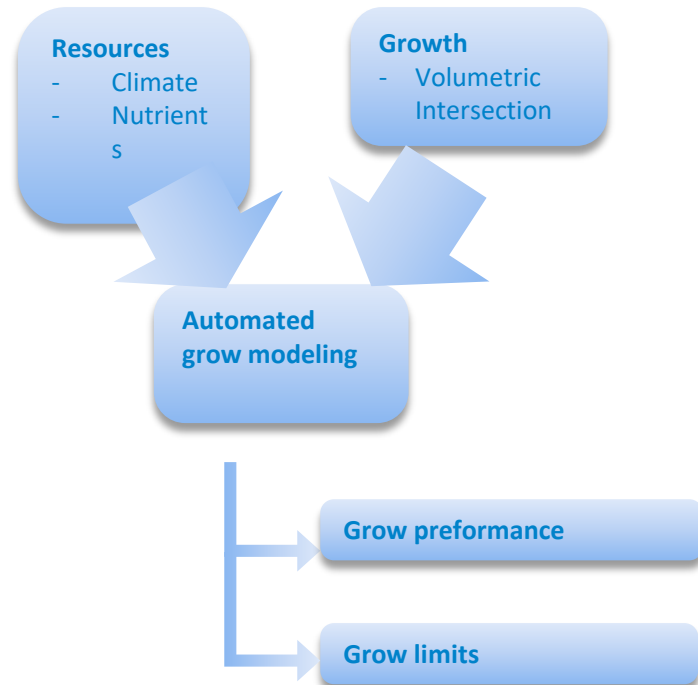




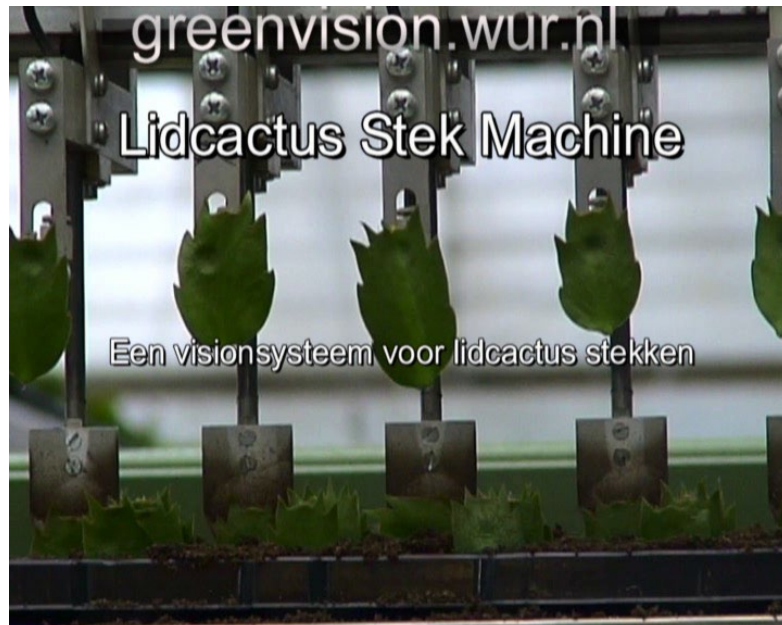


Future perspective

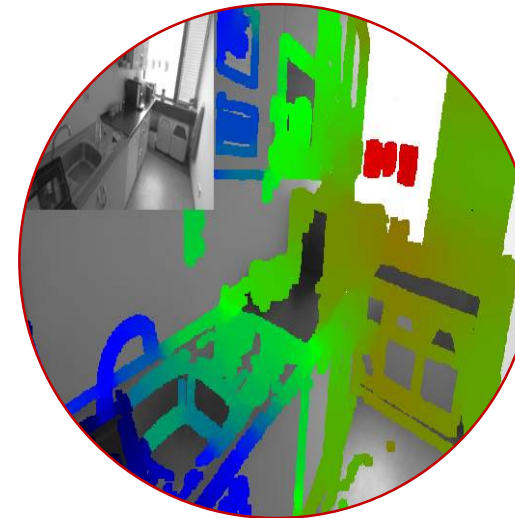
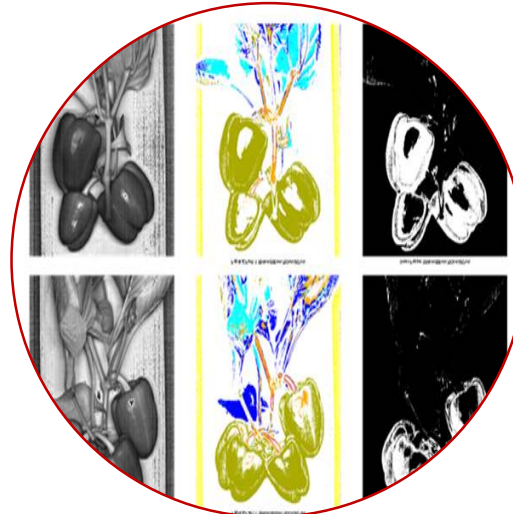
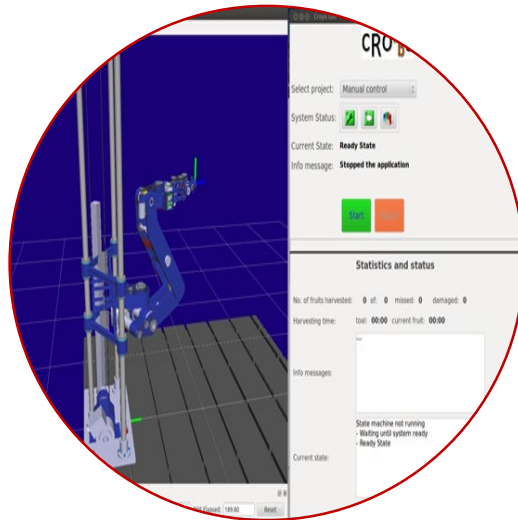
- Automated growth modeling



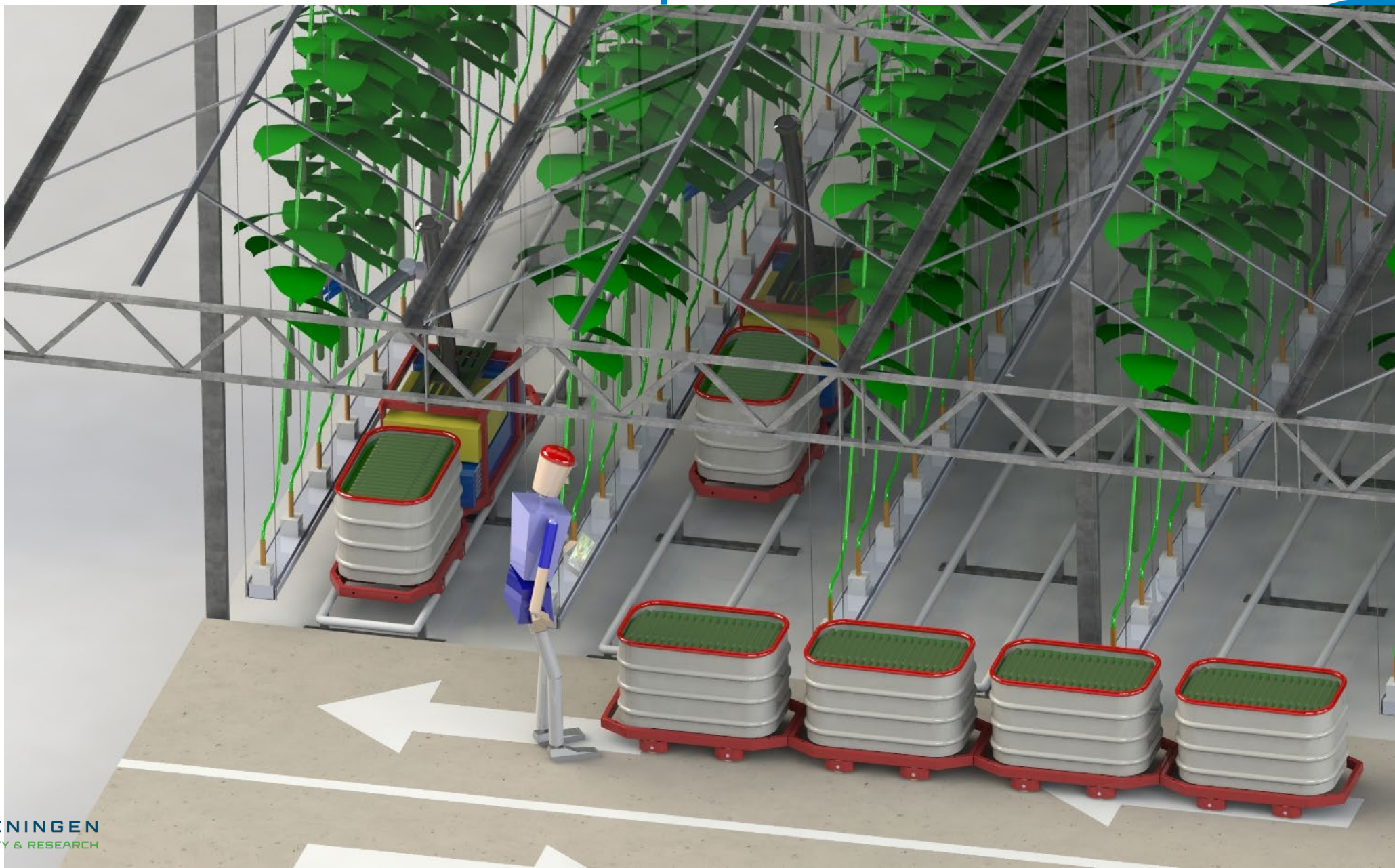
Robots in Greenhouses



Oogst robots - fundamentals



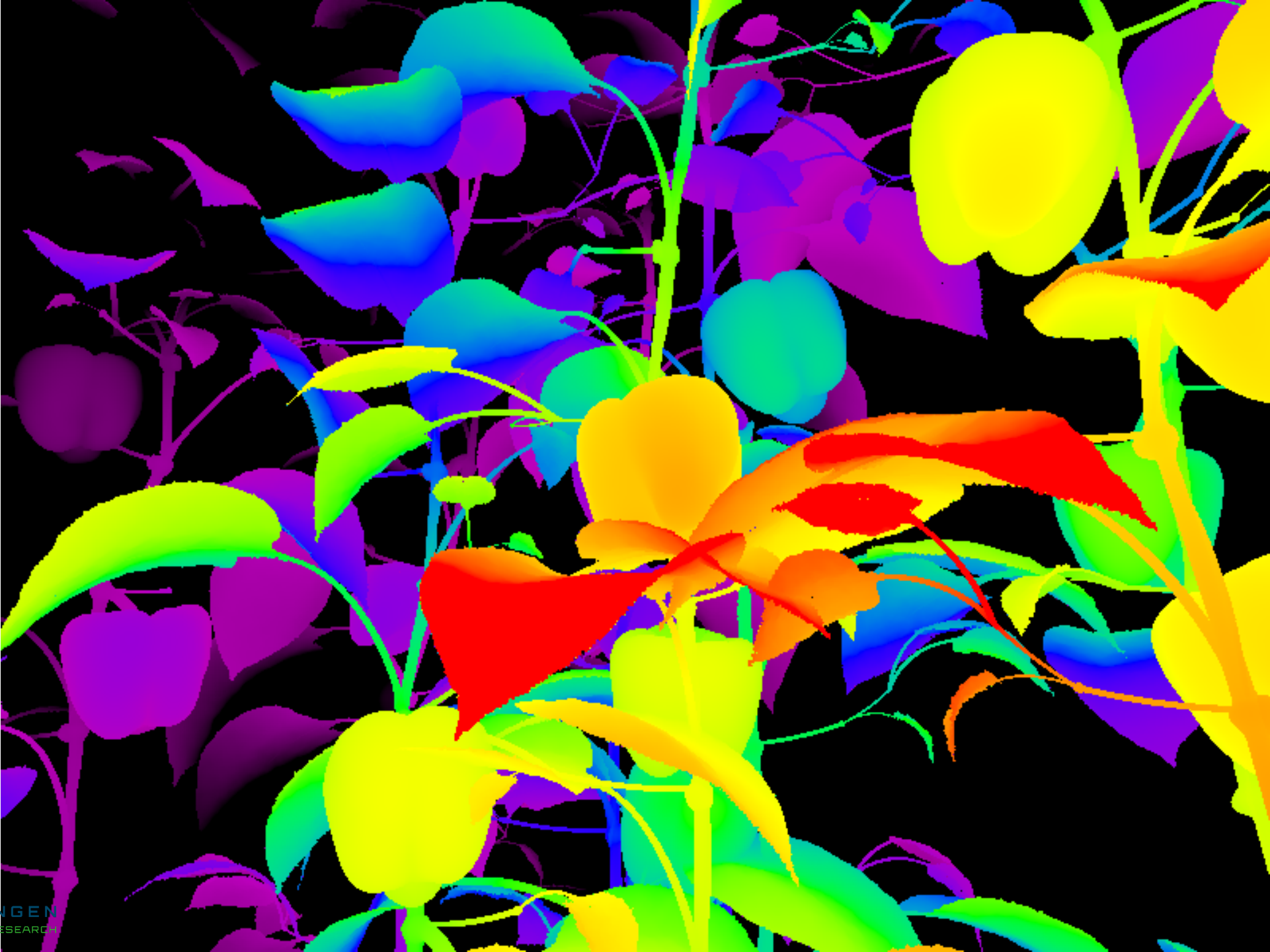
Human in the loop





The Good Dinosaur, Pixar, 2015





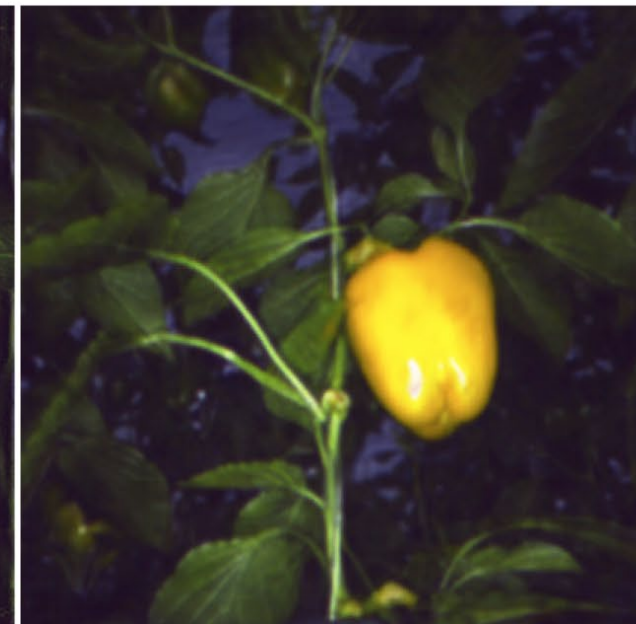
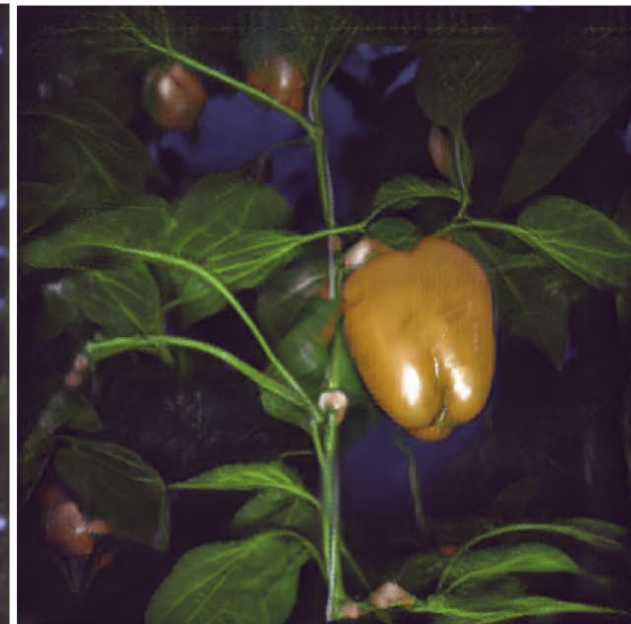


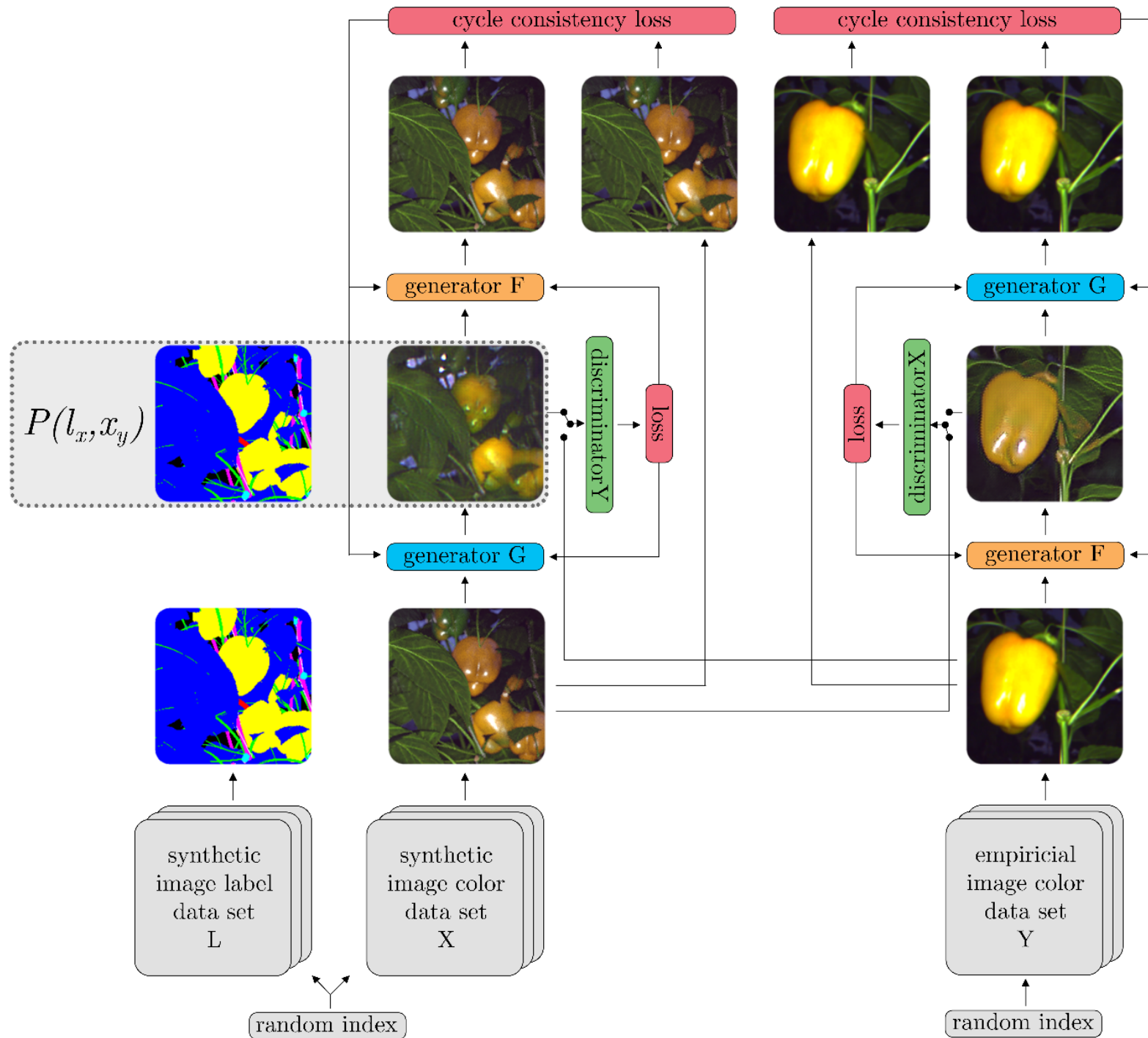
apple → orange



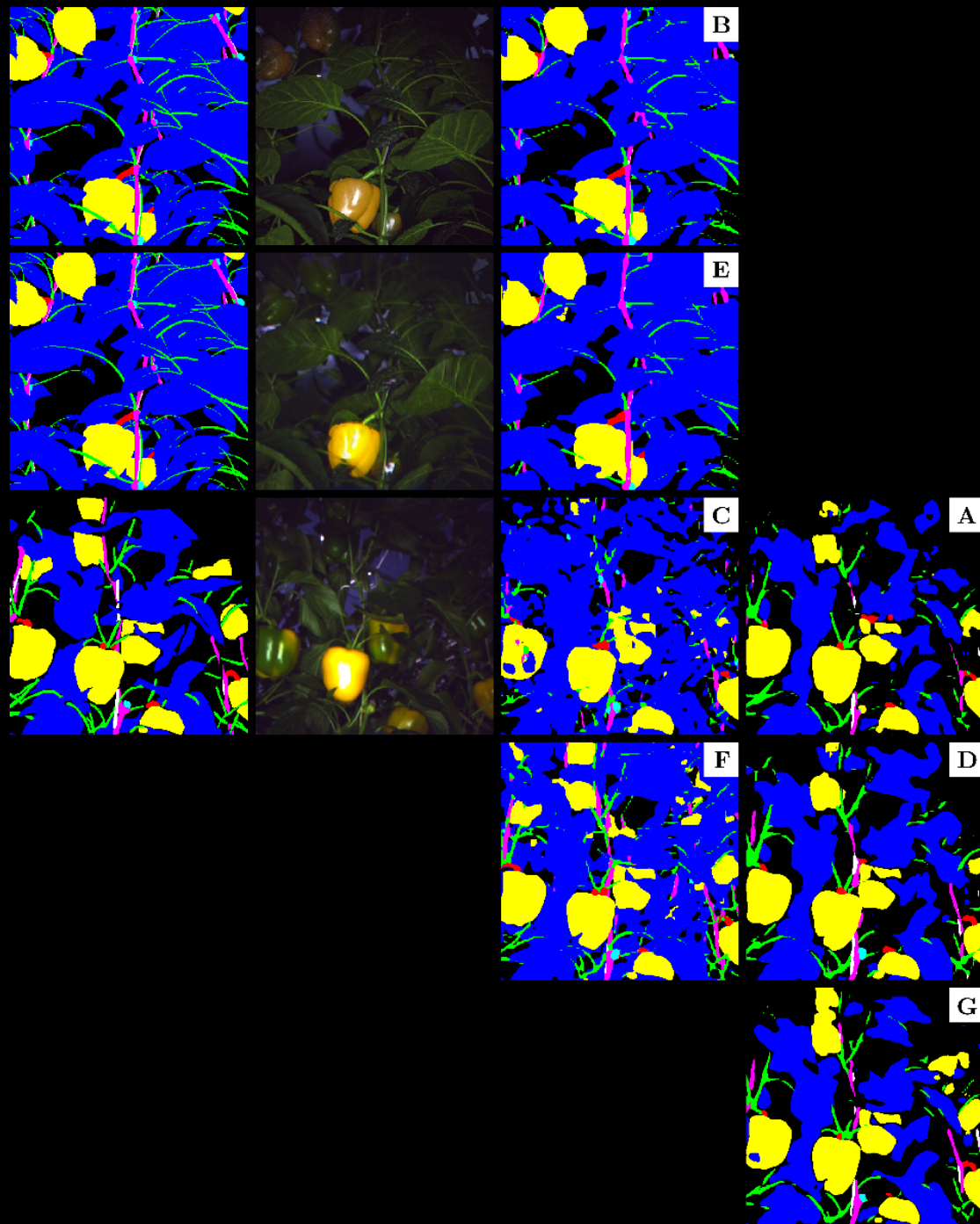
orange → apple

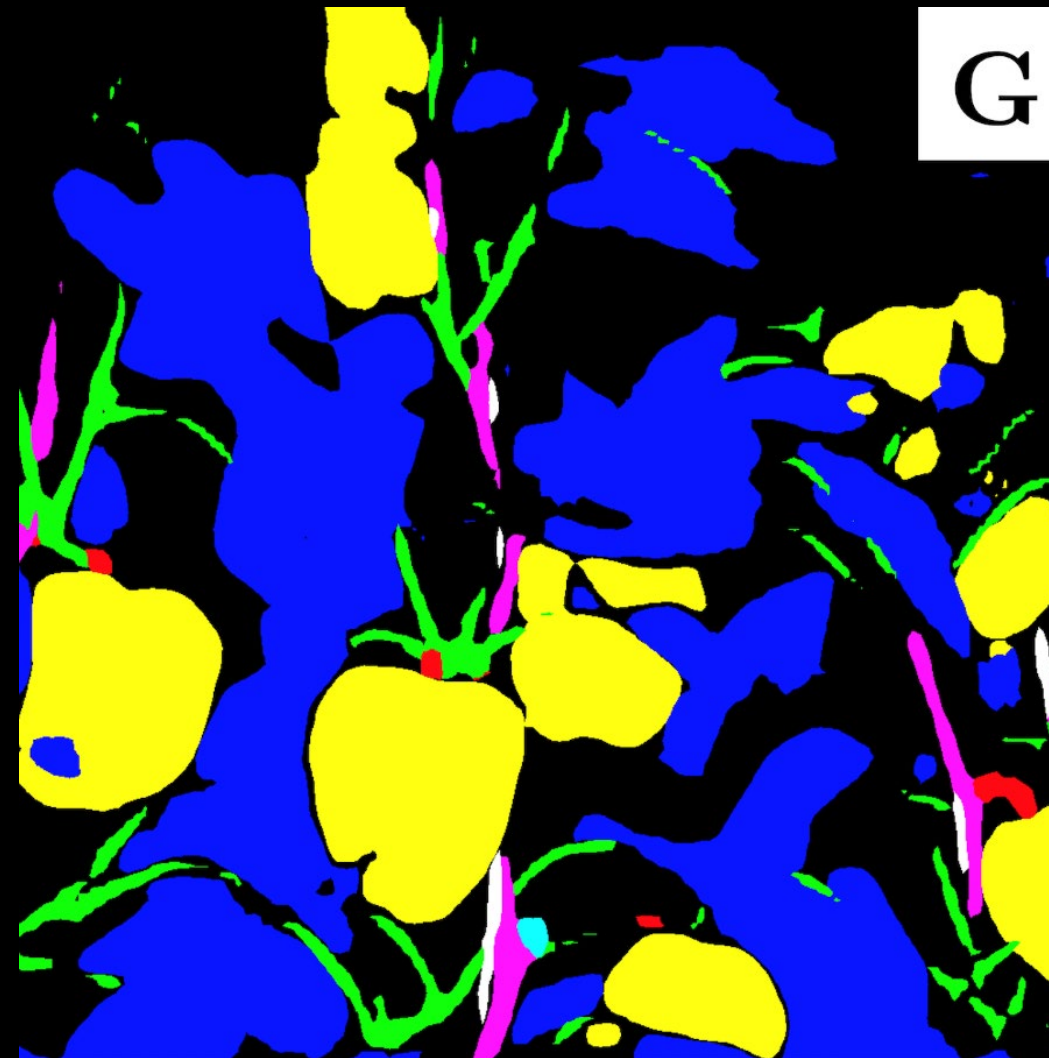




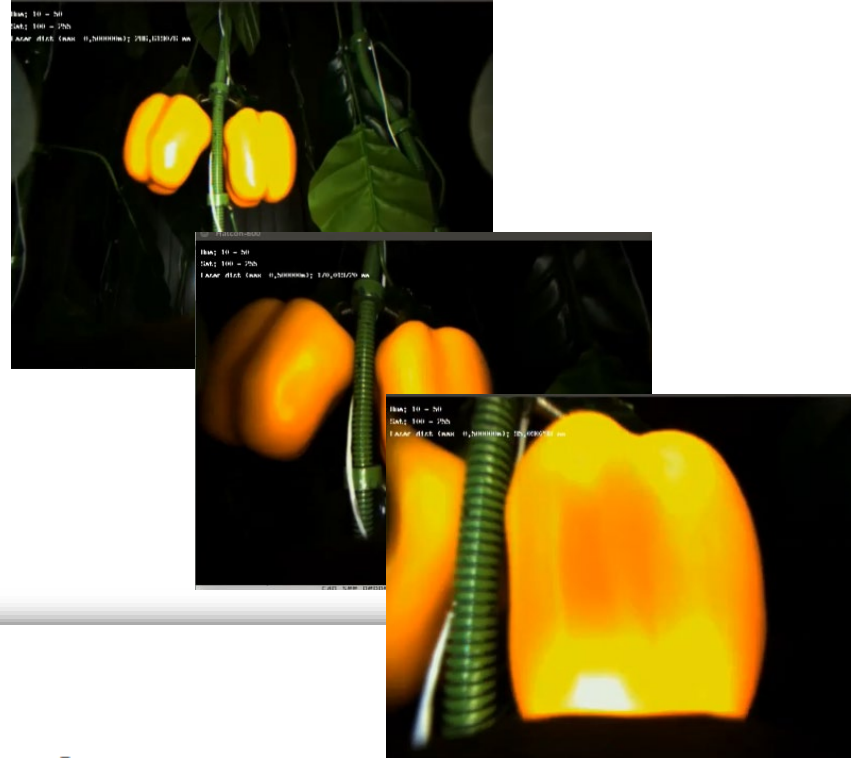








- A modular software framework was developed and implemented for eye-in-hand sensing and robot motion control.



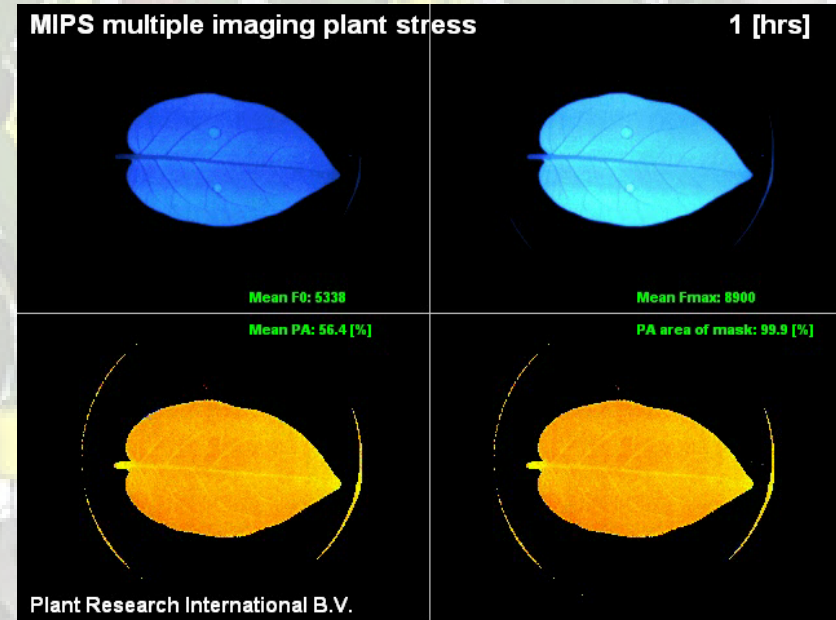
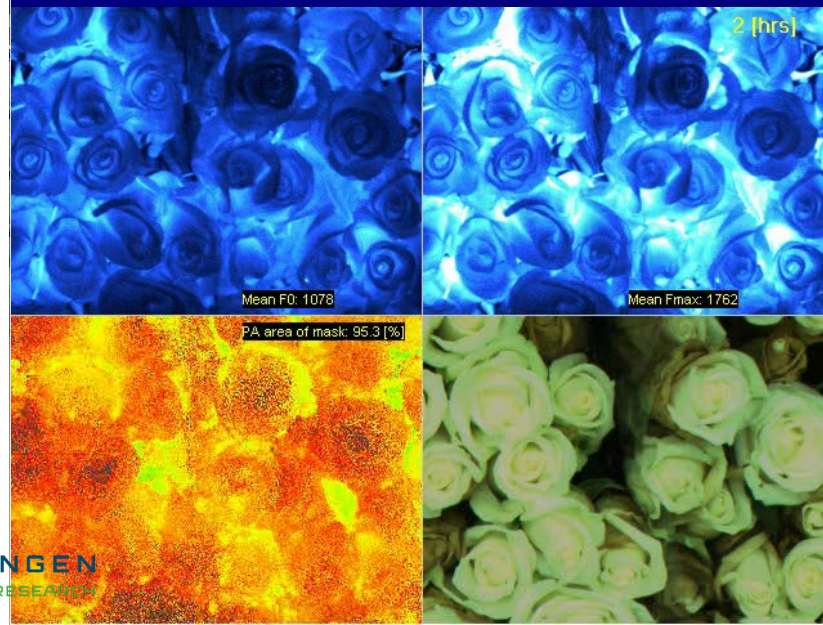
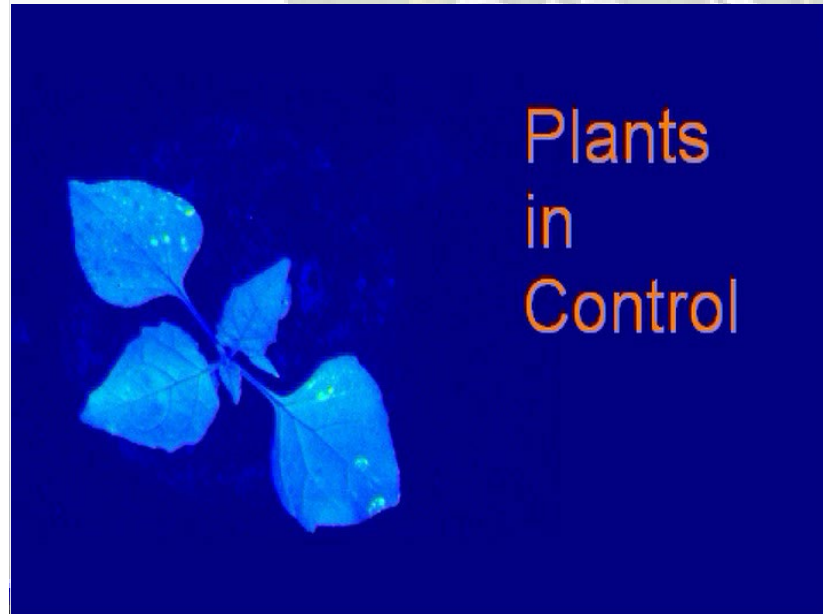
Design of an eye-in-hand sensing and servo control framework for harvesting robotics in dense vegetation

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^b Wageningen University & Research Centre, Greenhouse Horticulture, P.O. Box 644, 6700 AP, Wageningen, The Netherlands
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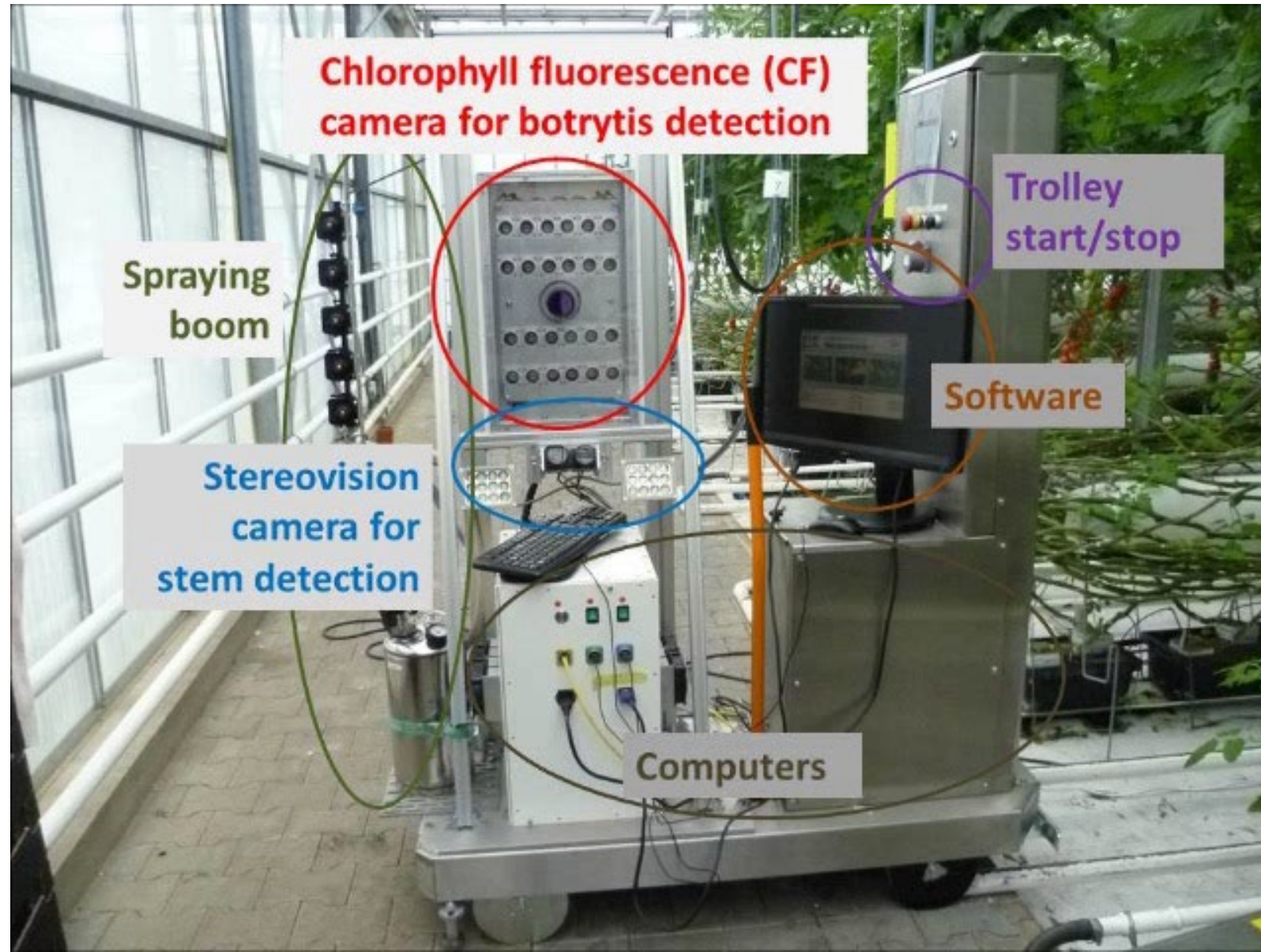


Laboratory testing at Umeå University

Ziekte, plagen en product rijpheid



Ziekte en plagen detectie



Pest & disease detection



Trimbot2020



x4



Thanks for the attention
Enjoy Horticulture

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