

THE APPLICATION OF IMAGE PROCESSING IN AGRICULTURE

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2 OUTLINE

Crop Management

Detection &
management of pest;
Weed detection;
Crop monitoring

Crop Robots

Autonomous forestry
vehicles;
Harvesting robot

Crop Diagnostics

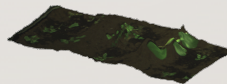
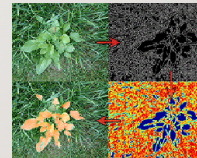
Identify disease,
nutrient deficiency,
insect feeding
patterns, or weeds

Sorting & grading

Fruits & vegetable
sorting to improve the
market quality

3 CROP MANAGEMENT — PRECISION WEEDING

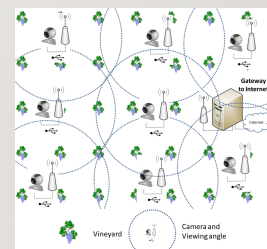
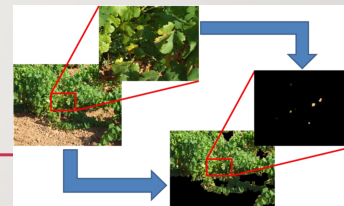
- Application — the management of weeds in maize fields
- Methodology
 - Capture images by cameras installed at a drone or remote controlled aircraft
 - Identify the locations of the crucial parts of the weeds(dense & sparse)
 - Determine weeds information from the structure of surface (3D tech)
- Objective
 - Control weed growth
 - Implement precision spraying of herbicides or heat-treatment
 - Benefit economically and environmentally



<http://www.dronehuas.com/agricultural-drones/>

4 CROP MANAGEMENT — VINEYARD MONITORING

- Application — A Wireless Sensor Network for Vineyard Monitoring That Uses Image Processing
- Objective
 - Monitor any unusual status of grapes
 - Decide when to fertilize , and what type of fertilization to use
 - Determine irrigation time
- Methodology
 - Detect deficiency, pest or disease through the observation of stems, grapes and leaves
 - Utilize wireless sensor network to notify the problem to the farmers(IEEE 802.11 a/b/g/n)

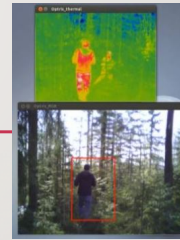


Vineyard monitored by cameras in Spain

Jaime Lloret_etc

5 CROP ROBOTS

- Application — autonomous forestry vehicles
- Objective
 - Identify obstacles such as trees, stumps, stones, and holes in the ground
 - Detect and avoid humans nearby
- Methodology
 - Use object recognition in regular color image camera
 - Analyze temperature difference in images - thermal camera



6 CROP ROBOTS — HARVESTING/PICKING ROBOT

- Application — Sweet Pepper Robot
- Reasons and objective
 - Big demand to automate labor
 - Skilled workforce does not accept repetitive tasks in harsh climate conditions
 - Only used in greenhouse harvesting (outdoor has much more challenge)
- Methodology
 - A wide-range of disciplines are available — Horticulture, horticultural engineering,, machine vision, sensing, robotics, etc.
 - Image processing
 - Identify fruits and analyze their degree of ripeness
 - Locate the precise location of pepper
 - Face harsh condition challenge — changing light conditions, presence of dust, extreme temperatures, wind variations

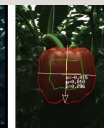
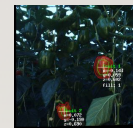


ICT ROBOT OF EU

<http://www.sweetpepper-robot.eu/>

7 CROP ROBOTS — HARVESTING/PICKING ROBOT

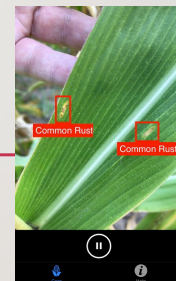
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<http://www.sweetpepper-robot.eu/>

8 CROP DIAGNOSTICS

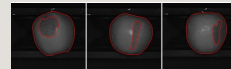
- Application — AI Crop Diagnostics
 - Pocket Agronomist App
 - Use state-of-the-art AI
 - Identify various agronomic issues in crops from live video(e.g. disease, nutrient deficiency, insect feeding patterns, or weeds)
 - Learn more about the causes of the issue, potential treatments and a prognosis moving forward
- Advantages
 - Powerful — trained over one million images
 - Practical — no internet connection required
 - Performance — on-device processing allows for crop diagnostics from live video at 30 fps.
- VIDEO: https://www.youtube.com/watch?time_continue=54&v=kWA6vIxpXbg



<http://agrculturalintel.com/pocket-agronomist/>

9 SORTING & GRADING — APPLE

- Application — SORTER Vision System
 - Non-destructive, precise and efficient
 - Utilize visible light spectrum & infra-red light
- Methodology — recognize external and internal characteristics
 - External: size, color, damage and deformities
 - Internal: flesh or seed damage
- Challenge
 - Hard to detect all changes under the fruit-peel
 - Structural changes appeared after few days
 - Difficult to distinguish and locate the stalk and core



10 SORTING & GRADING — ORANGE

- Application — Orange classification
 - Used in factory assemble line
 - Binary classification (defective oranges or good)
 - Deal with visual light RGB image
- Methodology
 - Deep learning - CNN, Tensorflow
 - Image processing – segmentation, object representation & recognition



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