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
- Weeds

Sorting & grading
- Fruits & vegetable sorting to improve market quality
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

CROP MANAGEMENT — VINEYARD MONITORING


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)
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 challenges )

• 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

http://www.sweeper-robot.eu/
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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=kW4jV1aVpbg
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