Robotics in crop farming - pest monitoring approaches using machine learning and machine vision techniques

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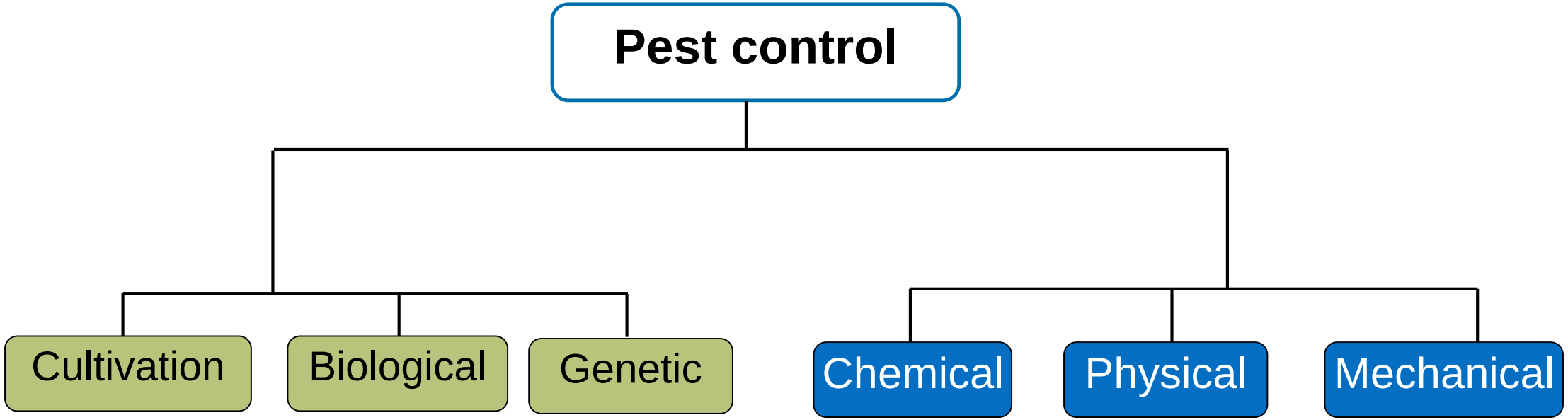
Insect pests

- Feed on crops
- Reduce yield
- Transmit plant viruses
- …


Pest control
Cultivation
Biological
Genetic
Chemical
Physical
Mechanical

Collecting machine

Colorado Beetle Catcher (FieldWorkers)

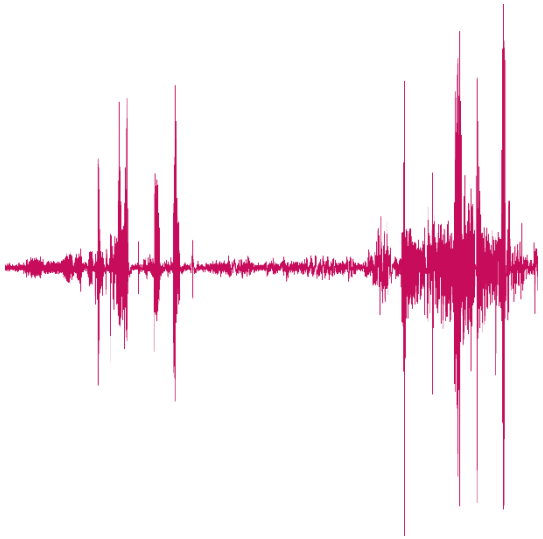
https://www.fieldworkers.nl/en/

Collecting machine

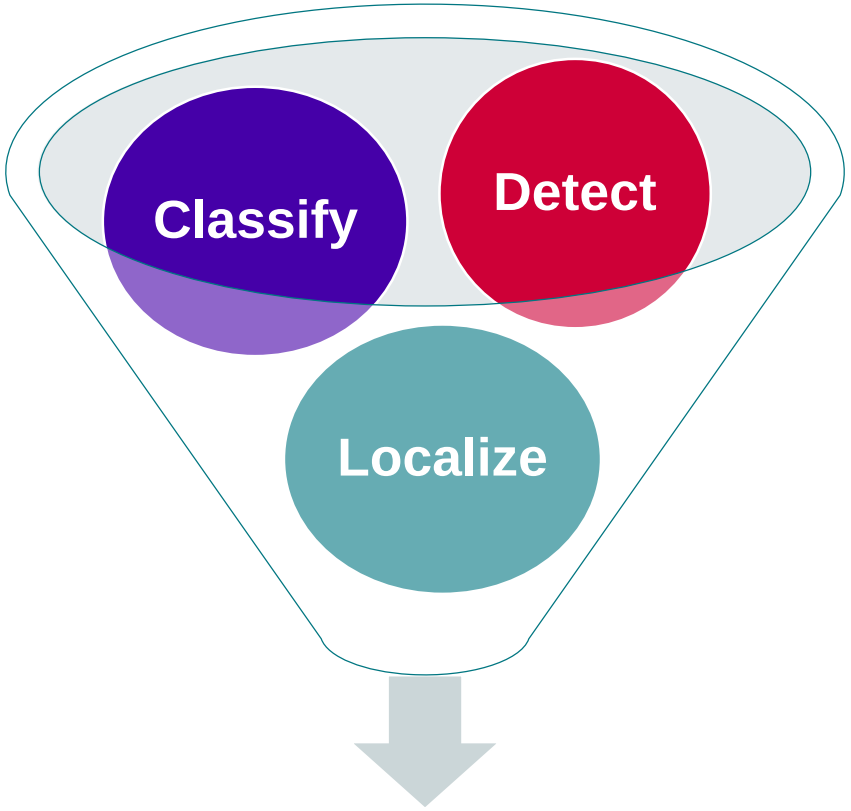
https://www.fieldworkers.nl/en/

Digital tools

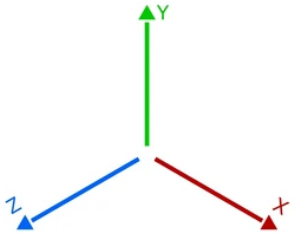
- Traps with camera or microphones
- Pest data
- Population

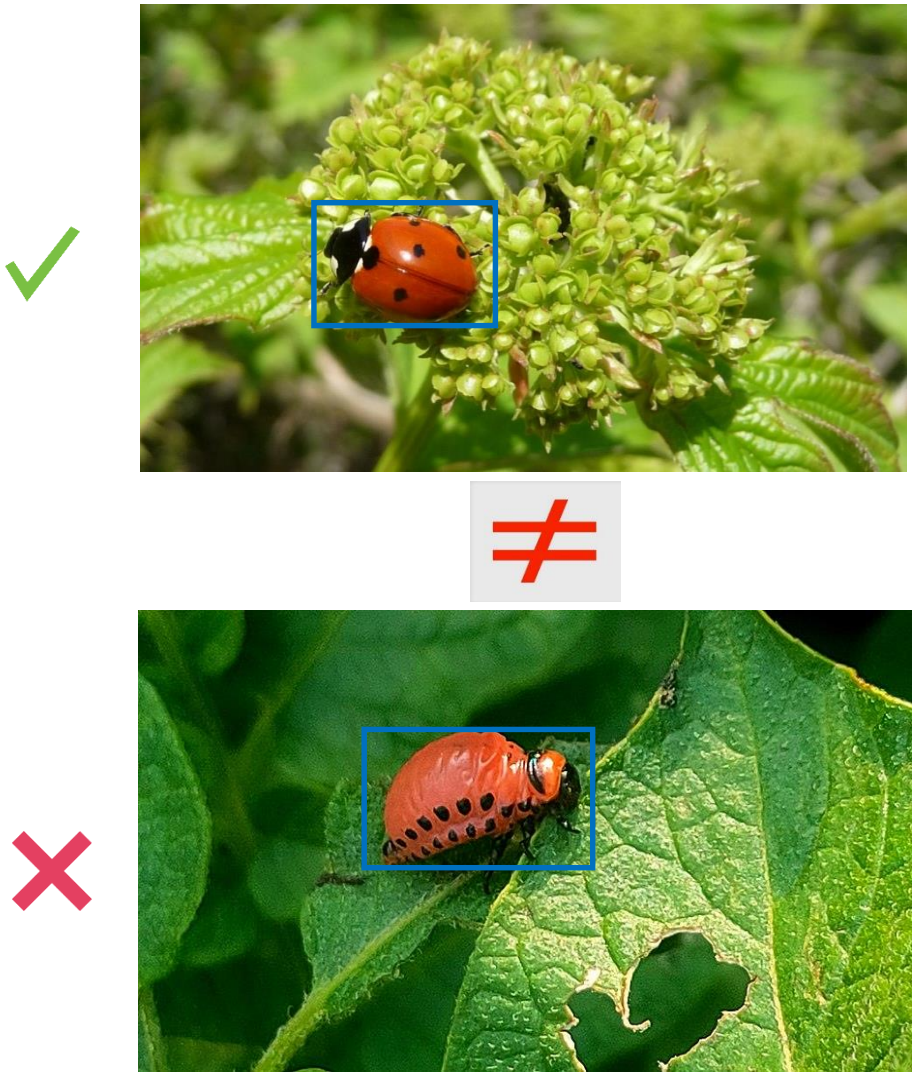


Smart system



Automatic





Digitalization- robot

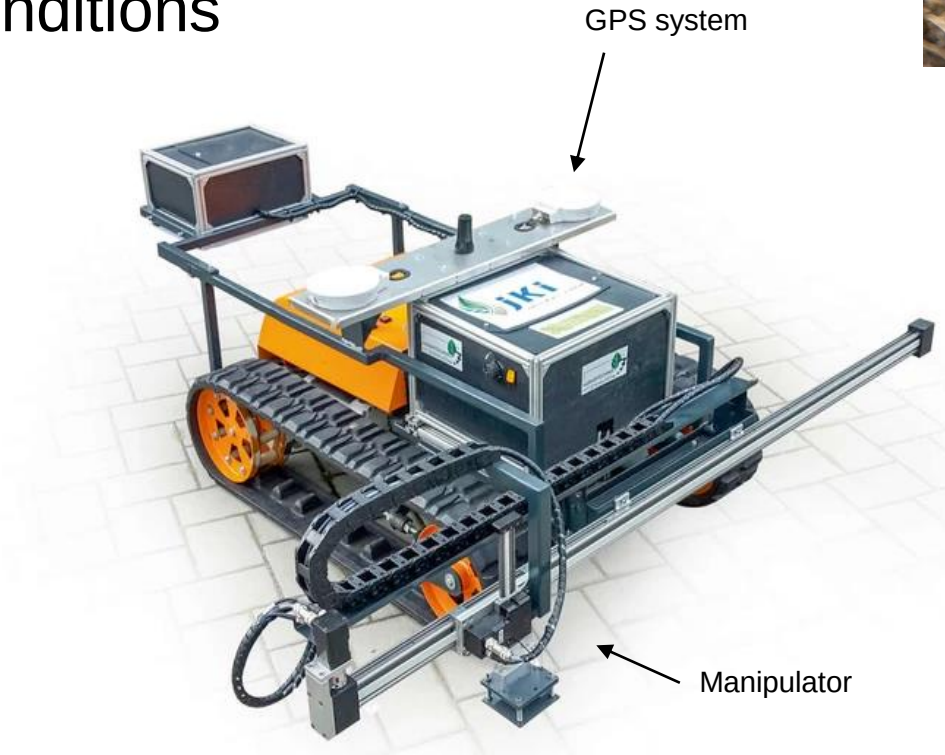
- Collect pest insects
- Autonomous

=

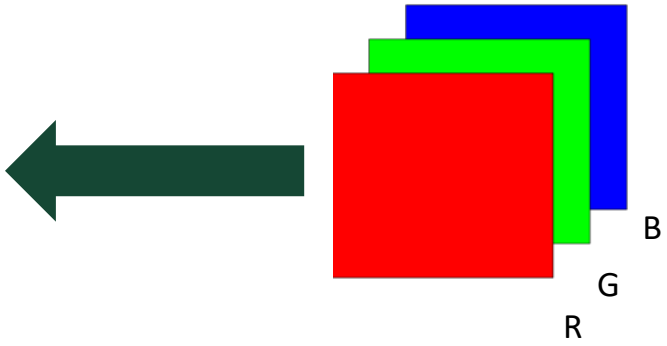
Perception → **Control** → **Actuator**

Robot- slug control

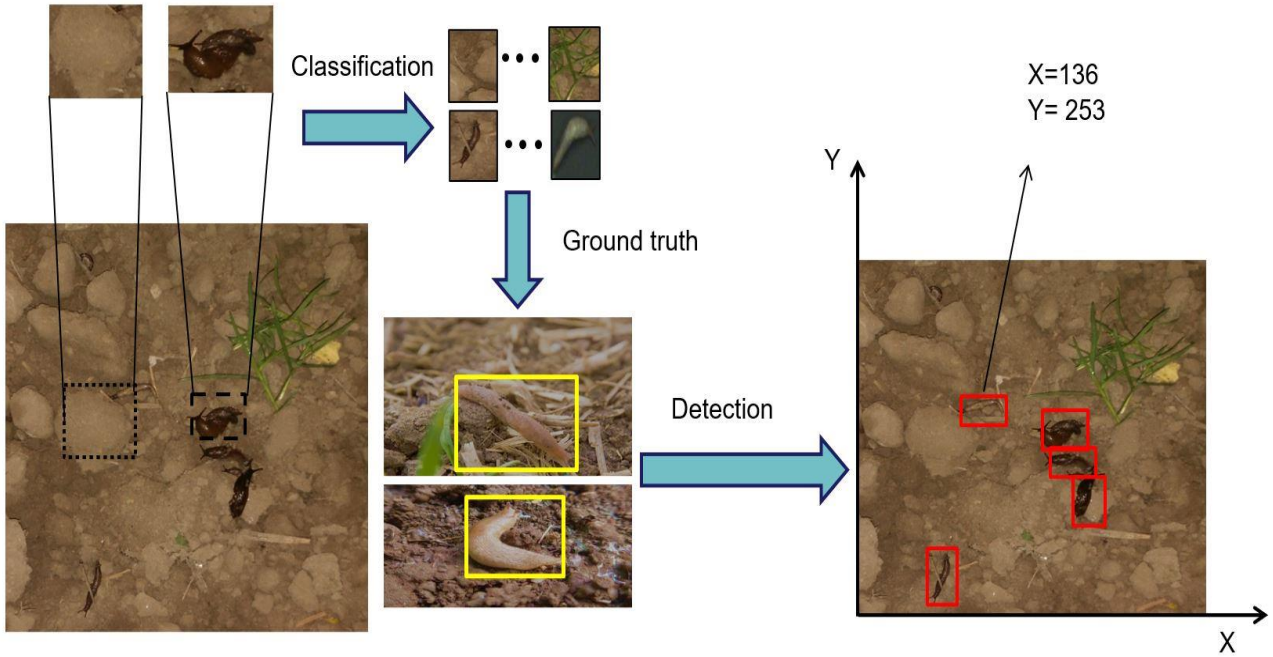
- ✓ Slug pellets
- ❖ Harm beneficials
- ❖ Fail due to weather conditions



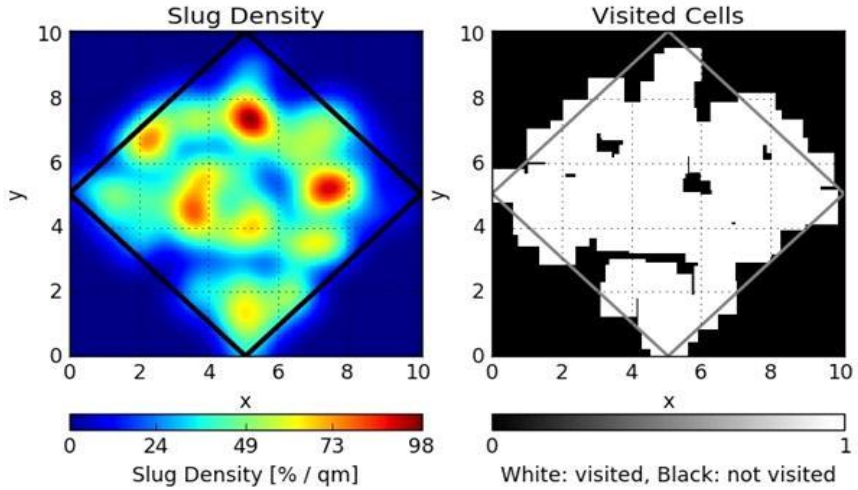
Slug detection



Slug detection

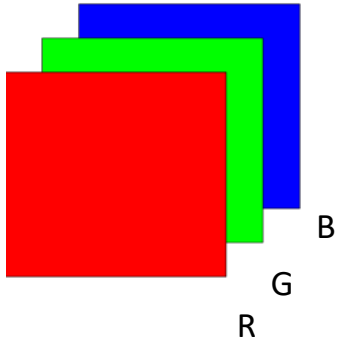


Deep learning



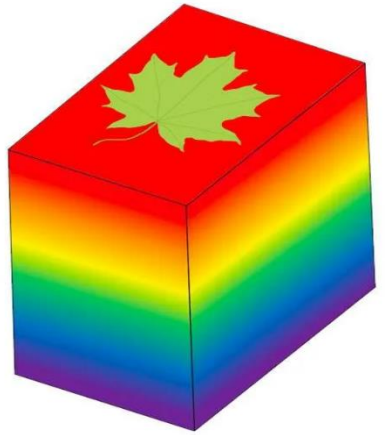
Slug detection

Optical techniques

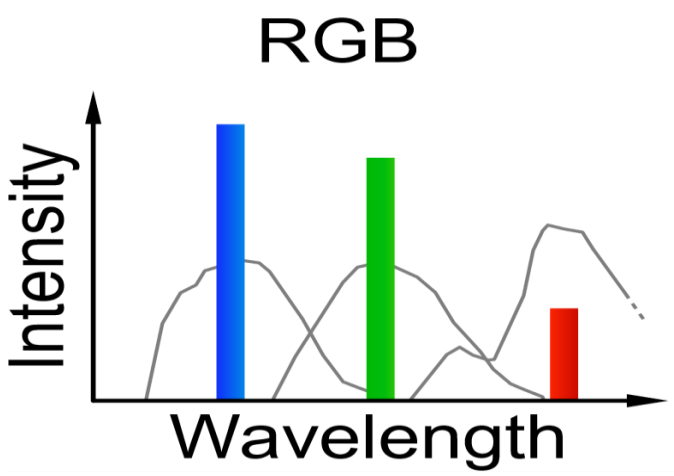


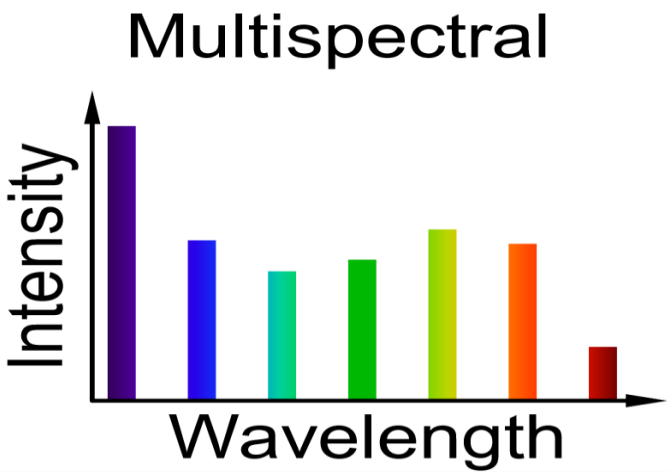
Colour image

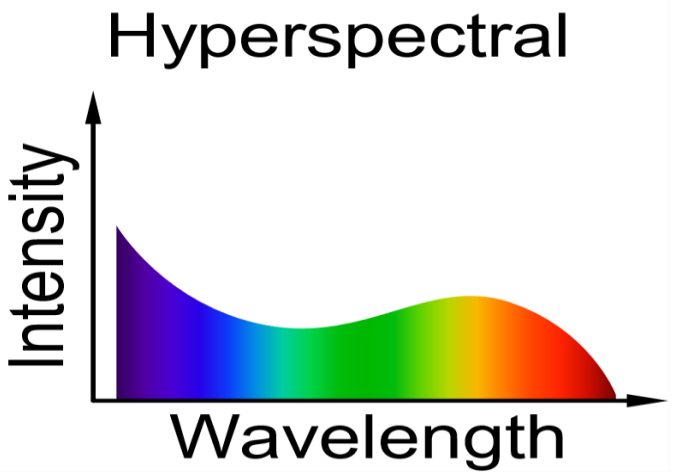
Multispectral



Hyperspectral

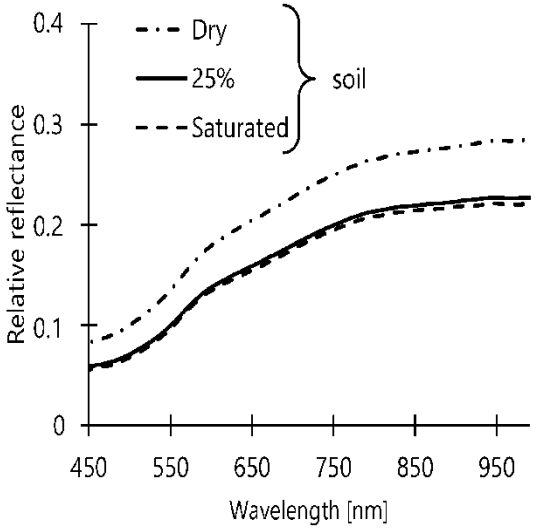


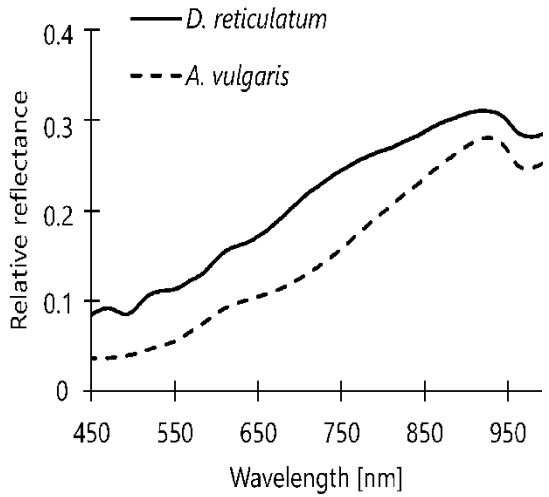




Band selection

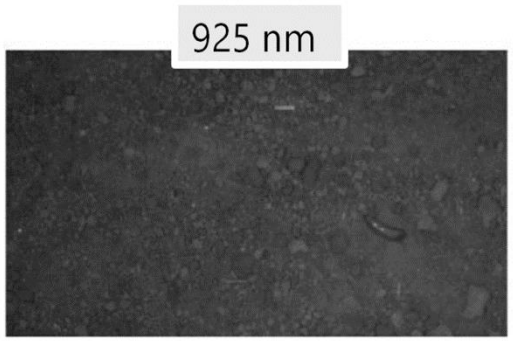
Vis-NIR (396–1010 nm)

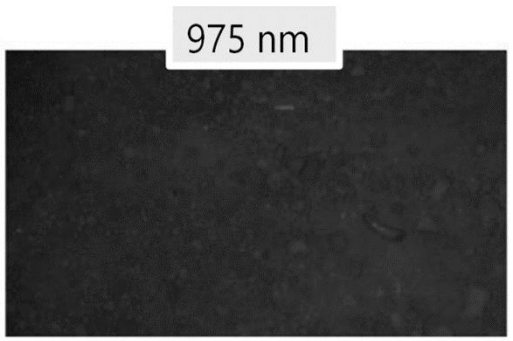


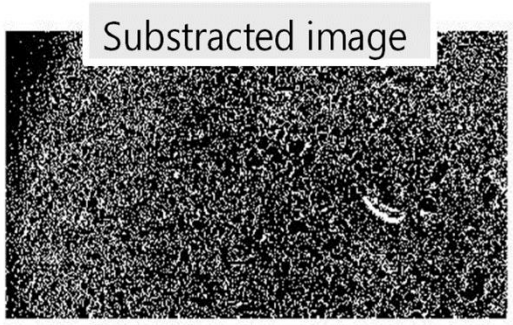


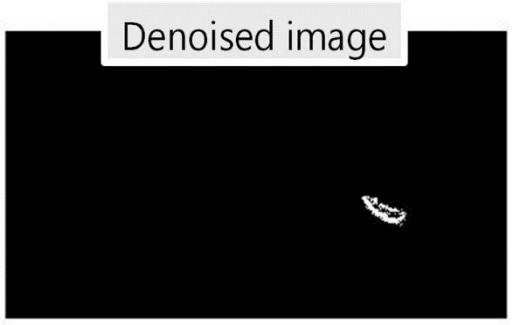
https://doi.org/10.3390/horticulturae8010077

Change filter

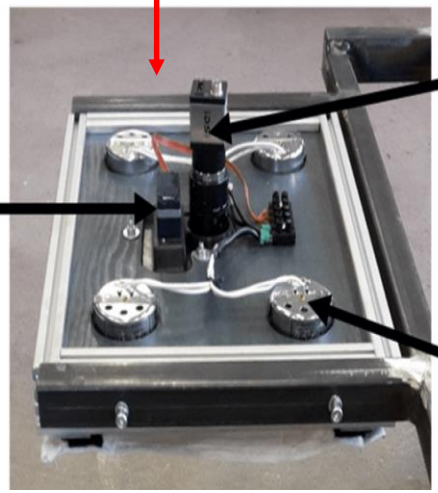








Narrow bandpass filters



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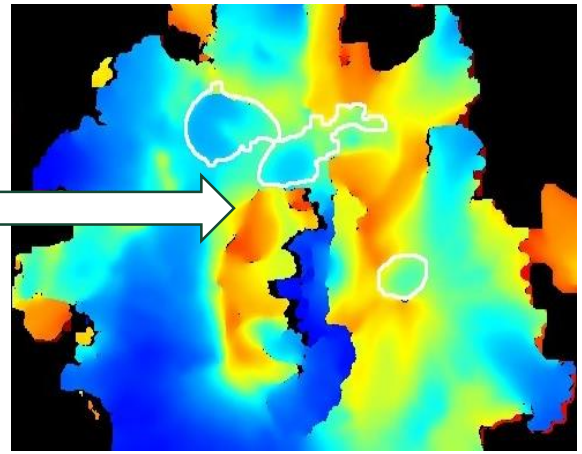
Slugs over crops

- Depth and colour images (perception and localization)
- Finding x,y,z coordinates (location of slugs)

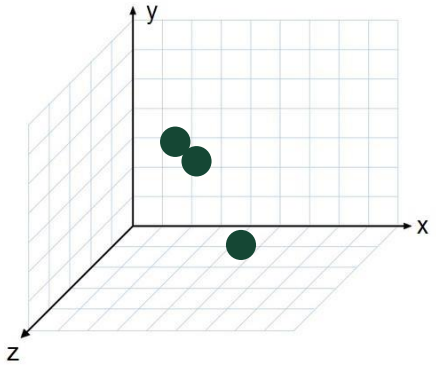
Slugs over crops

- Machine learning/image analysis→ slug detection

Detect

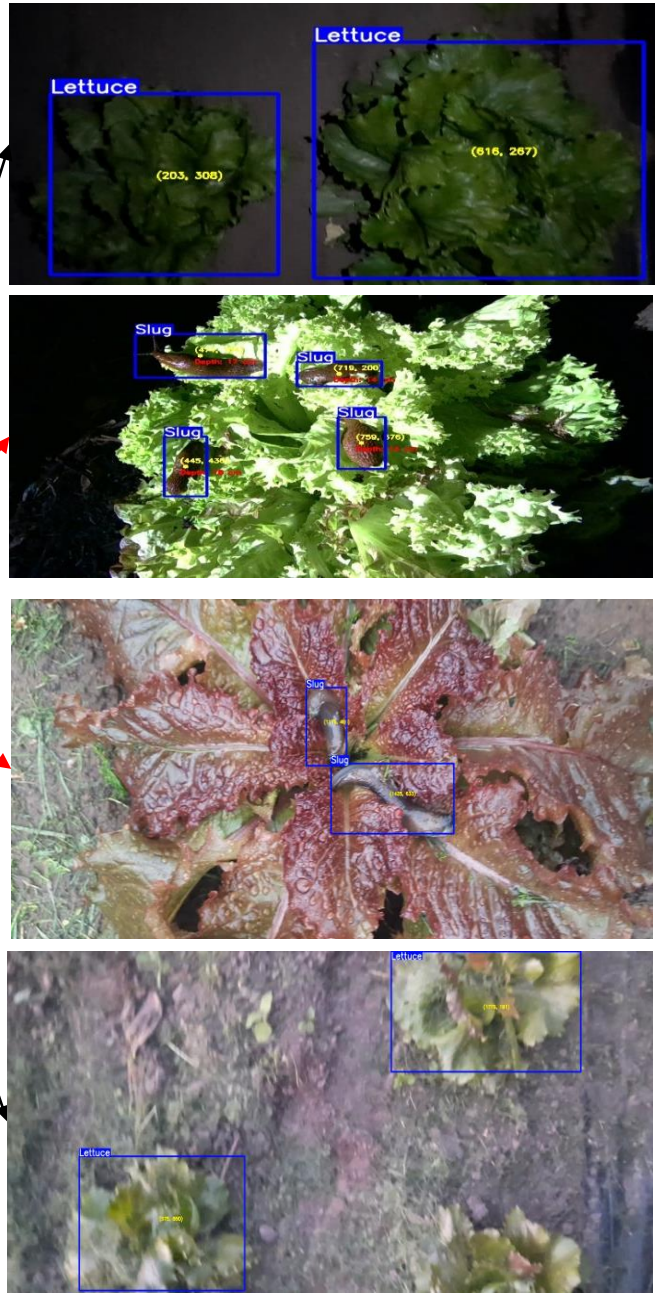


Distance



Object detection

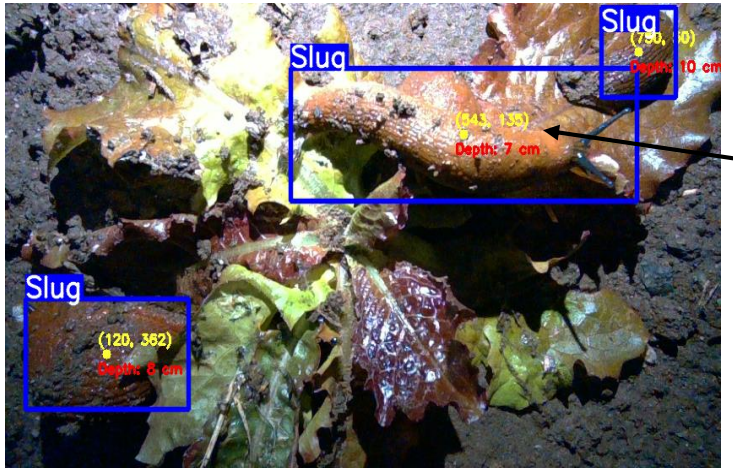
Deep Learning



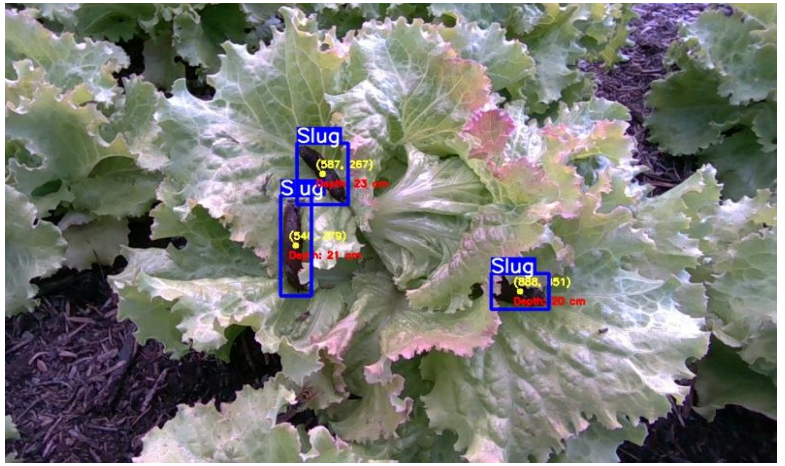
Night-time

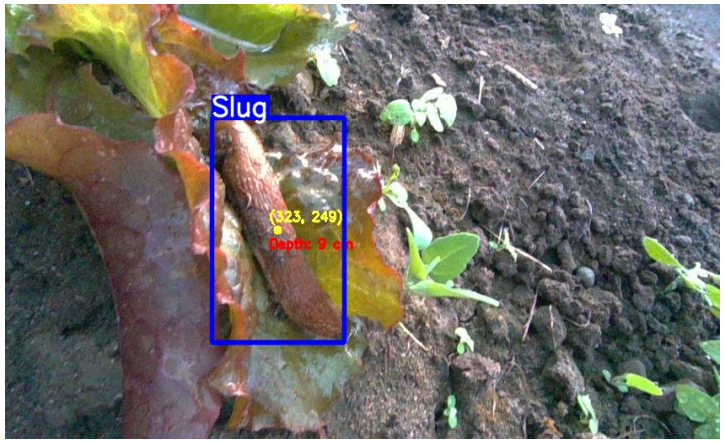
Day-time

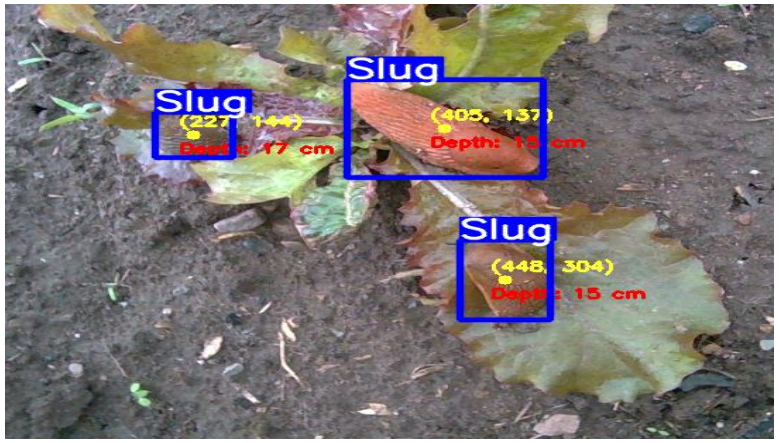
Slug detection (x,y,z)



x, y, z







Detection of slugs in complex situations

SLU

Bundesministerium für Ernährung und Landwirtschaft

Bundesanstalt für Landwirtschaft und Ernährung

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DigiPlus Digitalisierung in der ökologischen Landwirtschaft

Hessische Staatsdomäne Frankenhausen

KommTek

Projects: MsrBot, DigiPlus, MORE-bot

Thank you for your attention

Email: abozar.nasirahmadi@slu.se

Refrence

https://www.fieldworkers.nl/en/

https://www.specim.com/

https://www.edmundoptics.com/

https://en.ids-imaging.com/

https://doi.org/10.3390/horticulturae8010077

https://collab.dvb.bayern/display/TUMzfp/Hyper-+and+multispectral+imaging

https://www.intelrealsense.com/

https://doi.org/10.1007/s10340-020-01309-4

https://metos.at/de/homepage/

https://doi.org/10.1016/j.protcy.2016.05.243

https://doi.org/10.5194/isprs-archives-XLIII-B2-2021-825-2021