



We turn ideas into data-driven solutions

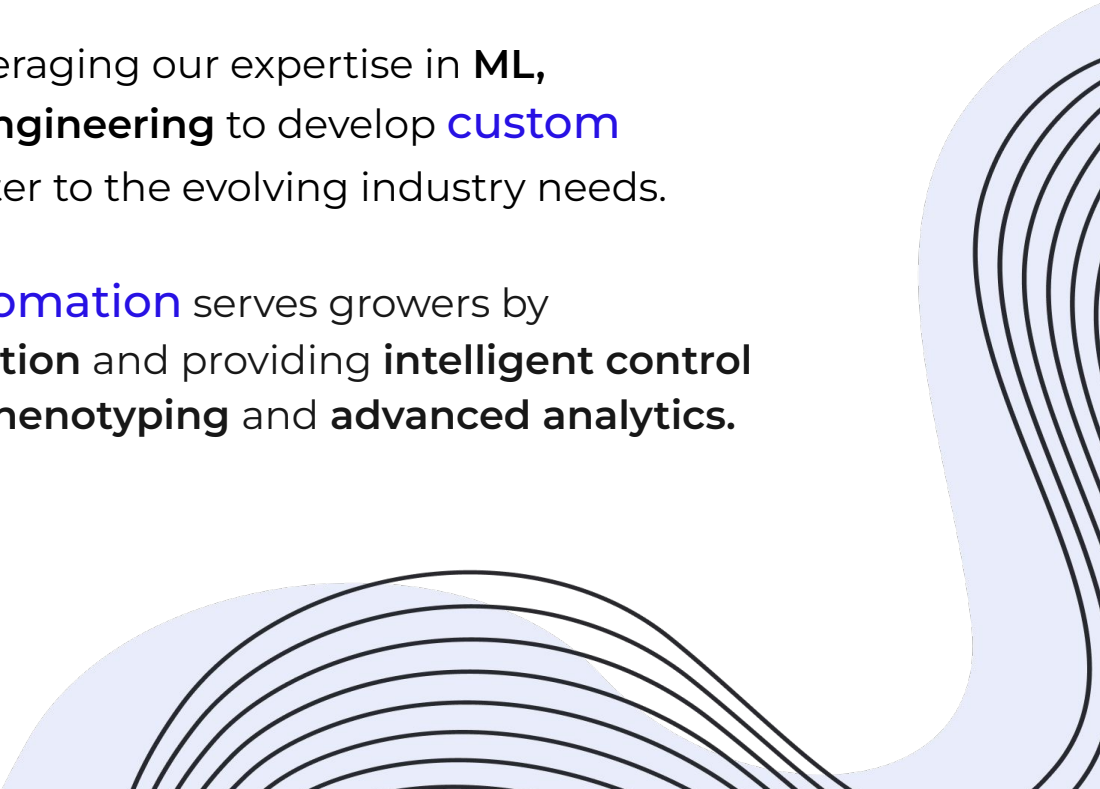
Professional software development and technology consulting

GREENHOUSE AUTOMATION

>>>>>>> IN-DEPTH EXPERTISE

Since 2016, we have been leveraging our expertise in **ML**, **computer vision**, and **data engineering** to develop **custom AgriTech solutions** that cater to the evolving industry needs.

Quantum **greenhouse automation** serves growers by **optimizing energy consumption** and providing **intelligent control** augmented by **automated phenotyping** and **advanced analytics**.

Decorative wavy lines in light blue and black outlines at the bottom right of the page.

>>>>>>>> BACKGROUND

🔗 Global Autonomous Greenhouse Challenge

Amsterdam
Feb 2021 - Jul 2022

Our Data Science team was among the winners, taking **3rd place** for developing the best-performing growing algorithm.

Partners of the event:

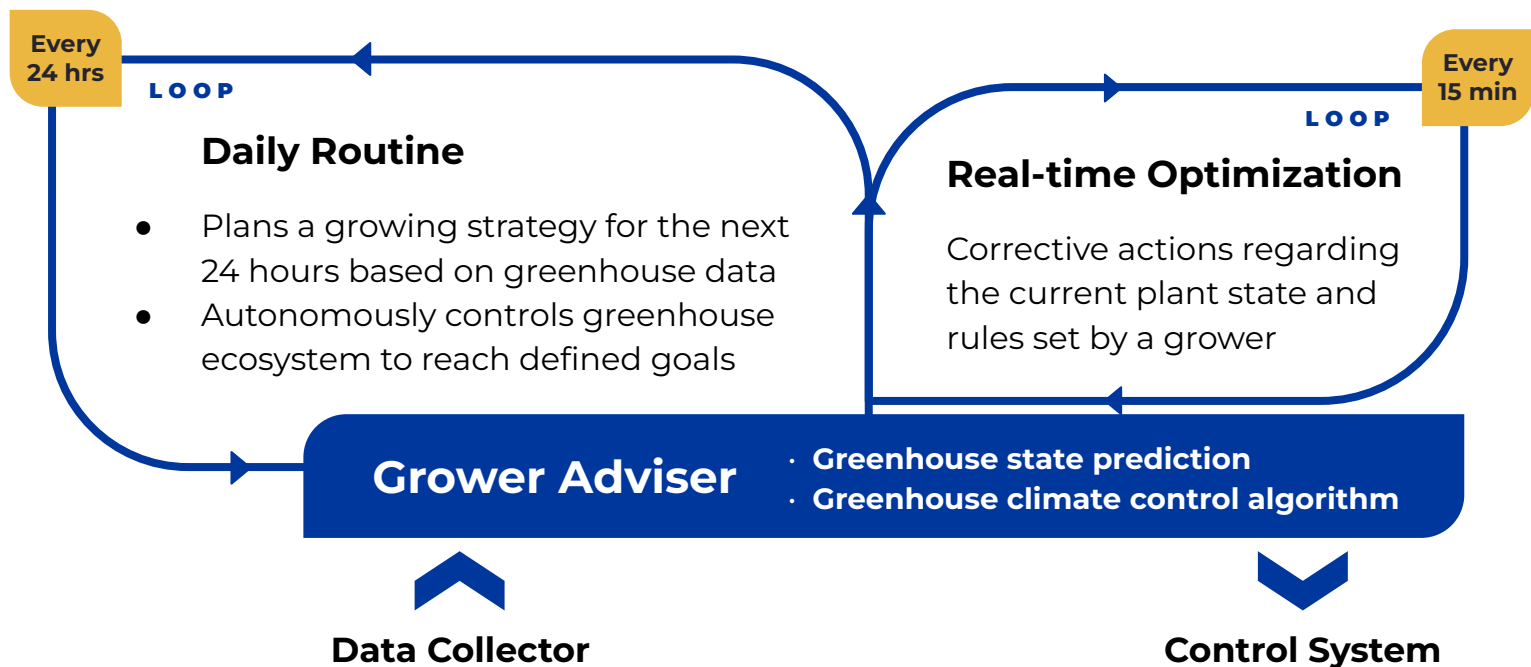
🔗 [Greenhouse Horticulture](#)

🔗 [Wageningen University & Research](#)



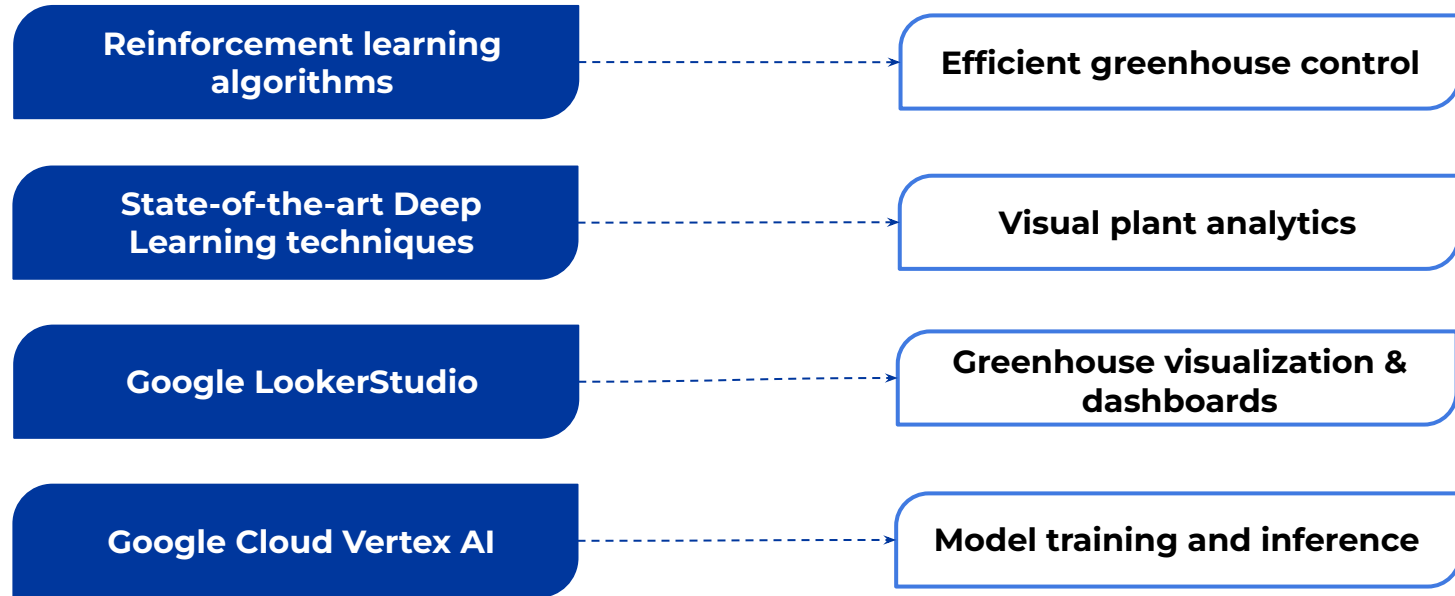
>>>>>>> THE ALGORITHM

We pulled the horticulture experts' knowledge into our reinforcement learning algorithm and got an outstanding solution with recommendations on growth strategy that allowed us to improve greenhouse productivity with minimum human intervention



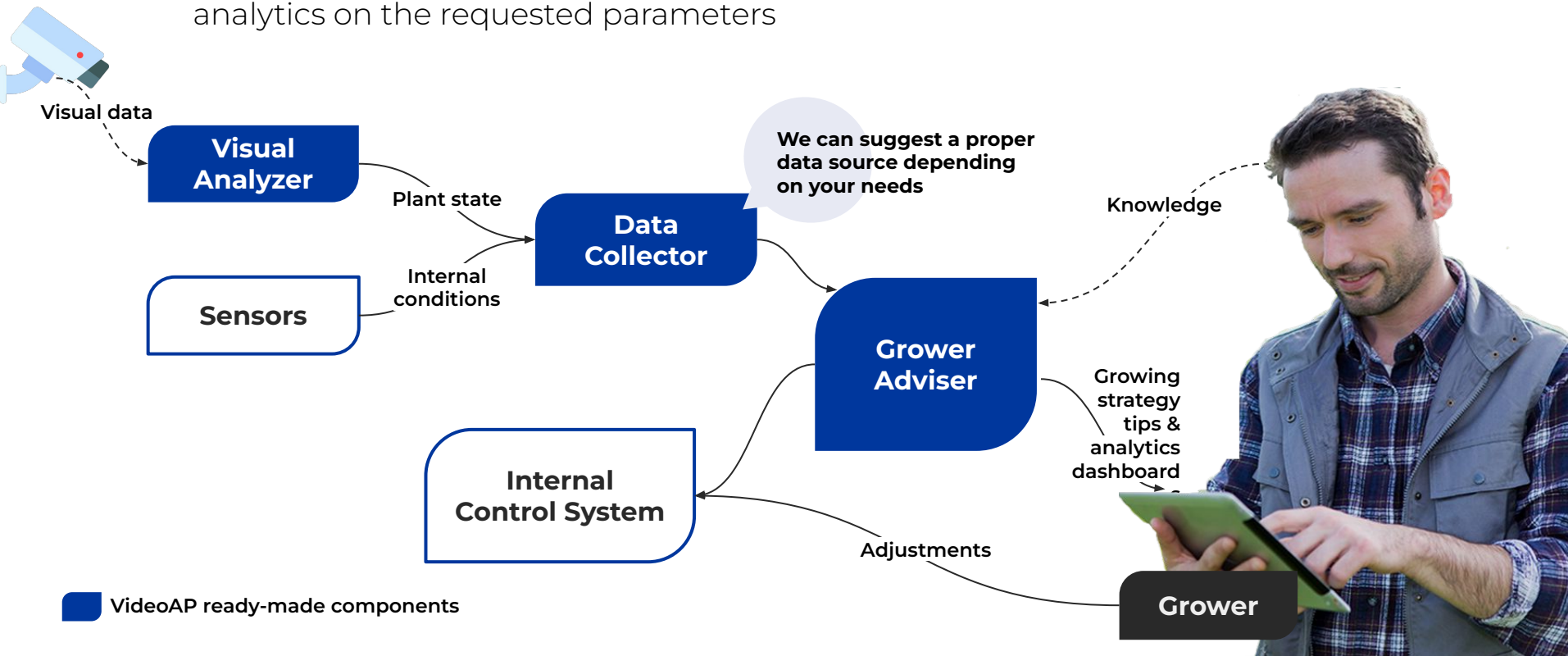
>>>>>>>> OUR TECHNICAL APPROACH

Technologies and tools we use for greenhouse automation solutions



>>>>>>> HOW IT WORKS

We collect data from multiple sources to provide growers with greenhouse analytics on the requested parameters



>>>>>>> AUTOMATED DATA COLLECTION

Time and cost-savvy data collection based on sensors, cameras and Computer Vision

Internal microclimate

- Temperature
- Humidity
- CO2
- PAR

Conditions outside

- Temperature
- Humidity
- Radiation
- Wind speed

Sensor data

Visual plant data

- Plant phenotype
- Growing cycle
- Other observations

Camera data,
Computer vision



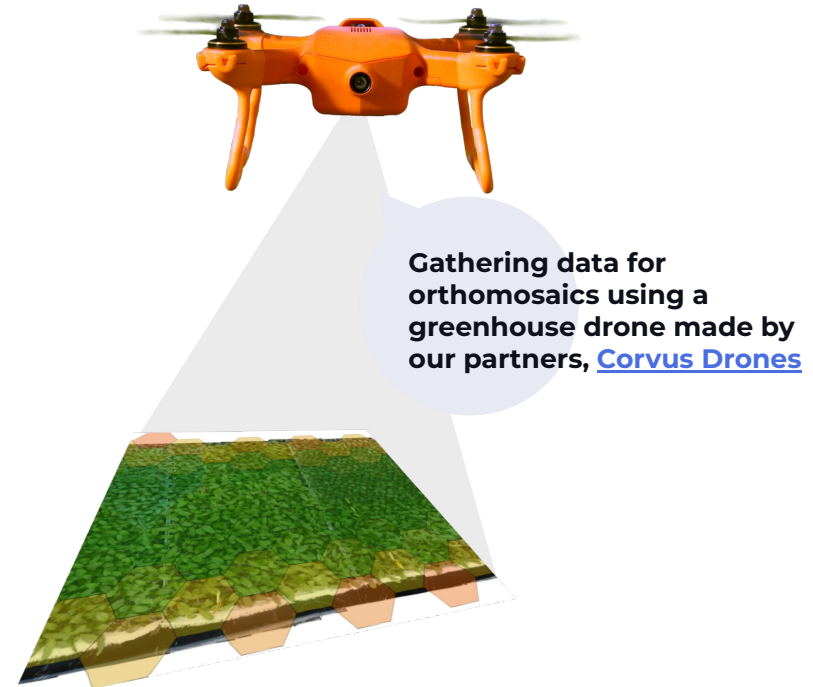
Databases & Integration: Let's Grow,
AutoGrow, Priva or own database

>>>>>>>> ORTHOMOSAIC MAPPING

Comprehensive greenhouse layout representation for efficient resource allocation

Benefits of greenhouse orthomosaic mapping:

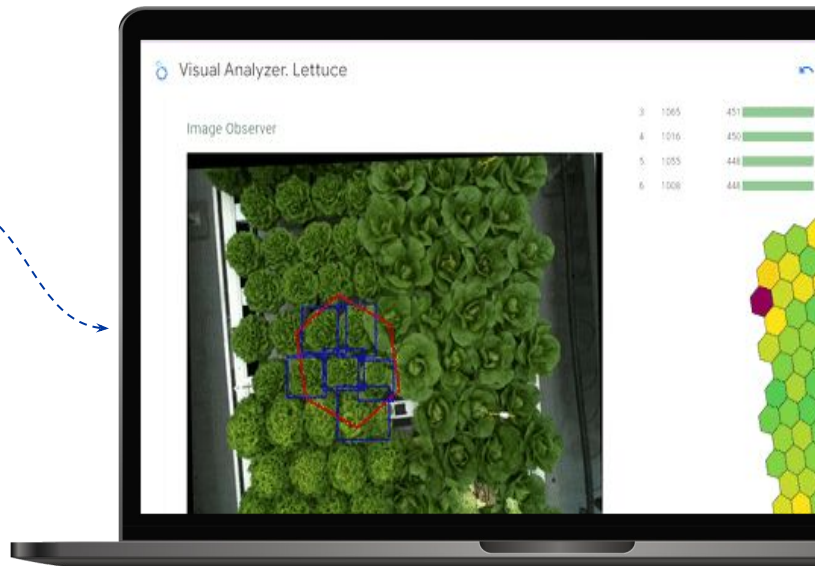
- Facilitates identification of areas with uneven plant growth or potential pest infestations.
- Simplifies monitoring irrigation and nutrient distribution, ultimately optimizing plant health.
- Easy to transform into interactive 3D assets to enhance visualization and analysis capabilities.



>>>>>>>> VISUALIZATION & DASHBOARDS

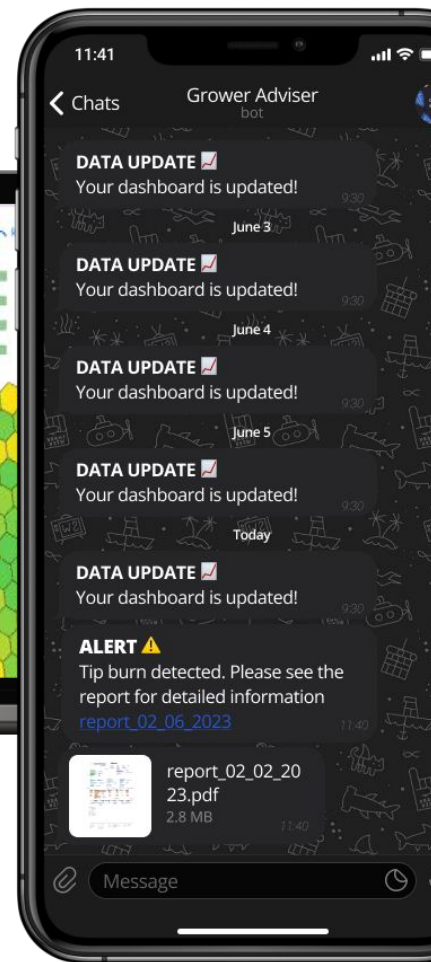
Monitor your greenhouse insights on the web or mobile

Analytics dashboards



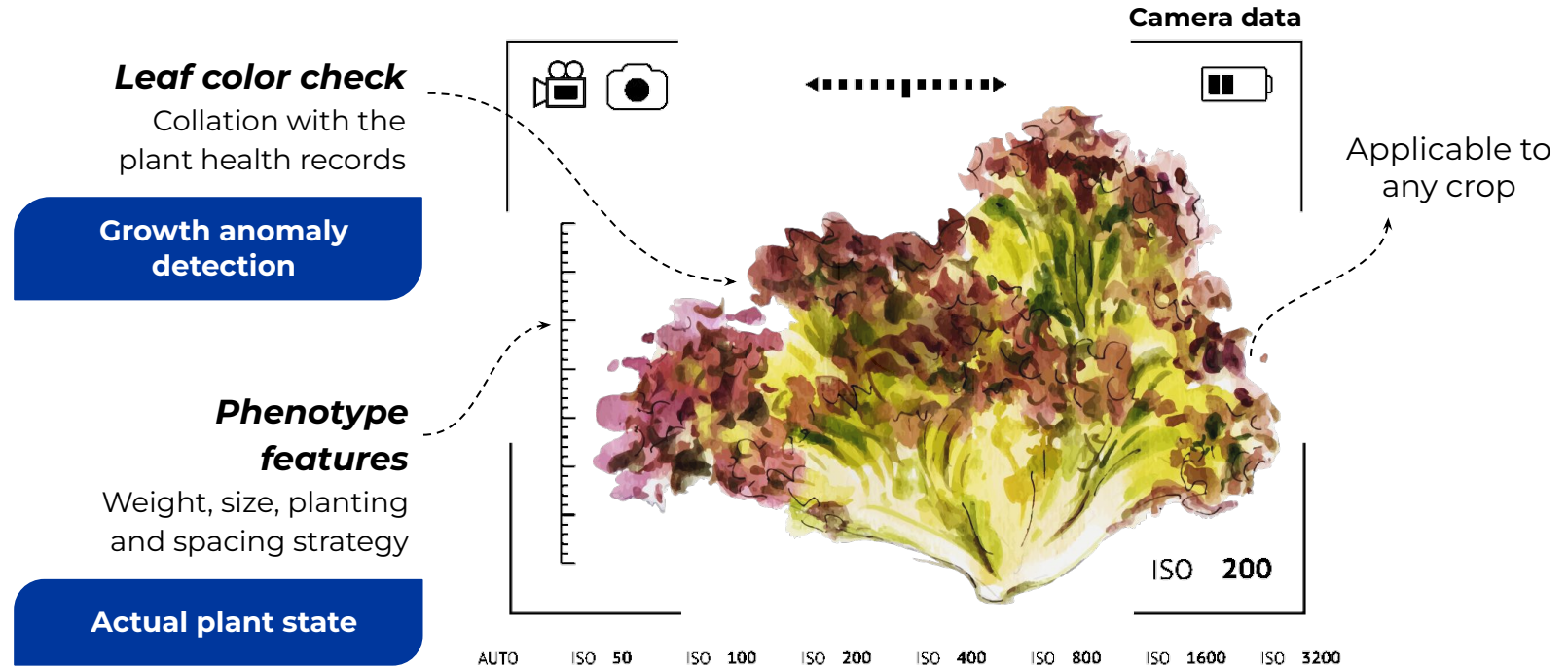
And receive notifications in your favorite messenger

Automated Reports



>>>>>>>> VISUAL ANALYSER SOLUTION

Crop development and anomaly analysis solution for effective planting strategies



>>>>>>> CASE STUDIES

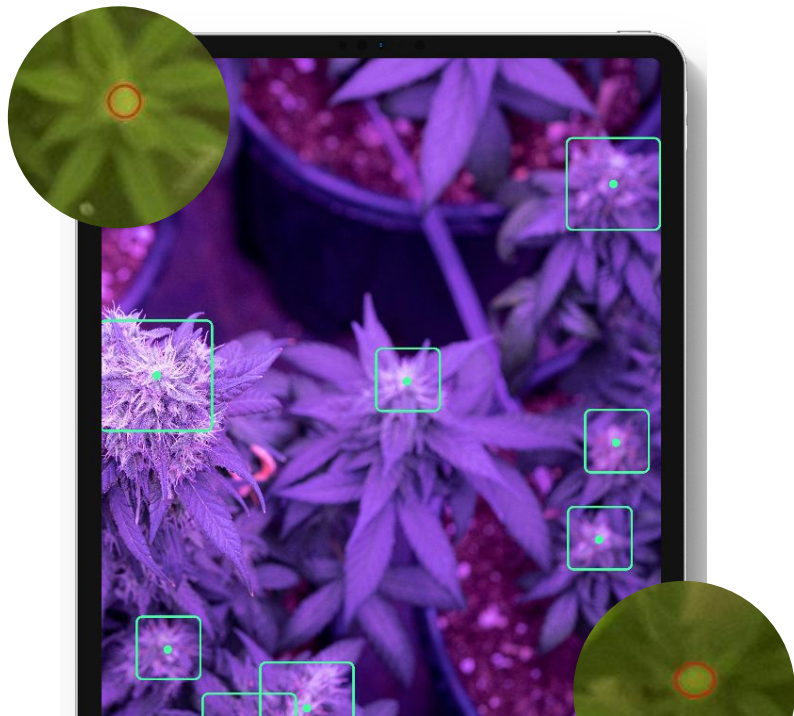
Our experience in [addressing practical business challenges](#).



>>> Hemp monitoring with camera-equipped robots

Use case

When dealing with flowering medicinal plants, **it's crucial to monitor vertex growth and handle anomalies at the early stage** to preserve the crop.



The goal was to detect and identify vertices to gather data on each vertex growth and determine plant aging and anomalies.

Our solution analyzes images from different zones and time intervals to identify growing vertices, measure bud size, and provide insights into growth. The tool uses hourly transmitted images as input to generate analytics on the overall growth process for each vertex.

As a result, we got **90% accuracy in plant vertices detection**, spending 20 seconds analyzing an image with an embedded device.

>>> Rose flowering stage detection

Use case

Rose flowers have the highest oil concentration during their budding stage, which makes it the perfect time to extract rose oils. However, detecting a rosebud is challenging as it hasn't fully bloomed yet.

Our task was to accurately calculate roses per square meter and correctly identify their blossoming stages: bud, partially opened, fully opened, or senescent flowers.

Visual Analyzer processes images to identify roses, removes duplicates and determines the blooming stage with the **mean average percentage error of >5%** for each square meter processed.

The result is stored in the database with a projection on real-world coordinates and visualized as a heat map.



>>> Blueberry biomass & ripeness analysis

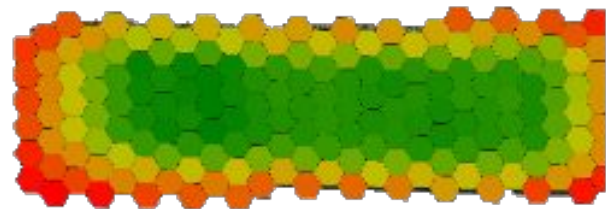
Use case

Aiming to plan harvest and forecast the production efficiently, our client needs to **assess the exact number of blueberries at different ripeness stages** per square meter.

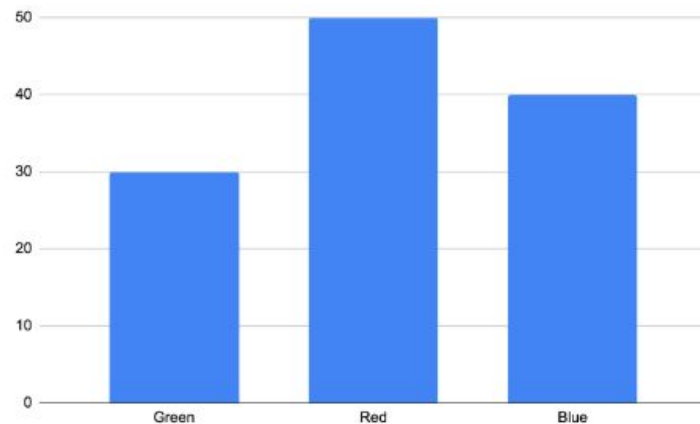
With Quantum's **Visual Analyzer** module, we analyzed greenhouse data captured with drones.

Visual Analyzer has a detector capable of identifying unique features of plants. By processing drone images, it detects each blueberry, removes duplicates, and classifies it by ripeness.

The result is stored in the database with a projection on real-world coordinates and visualized as a heat map, allowing the grower **quickly access areas with ripe berries**.



Blueberry ripeness heat map



Blueberry distribution

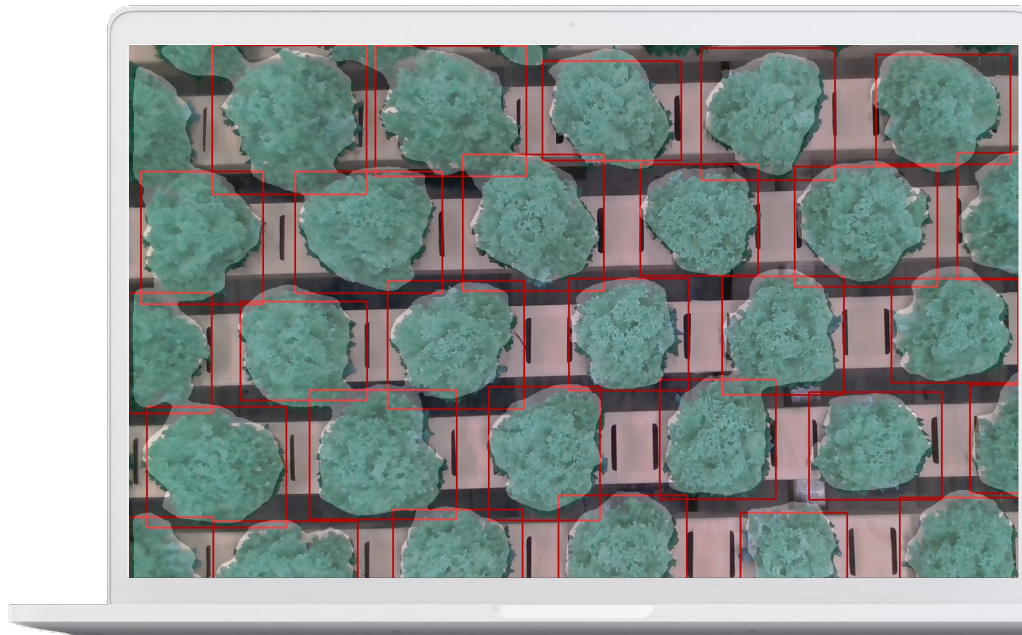
>>> Lettuce autonomous quality assessment

Use case

The client needed an **autonomous greenhouse control system** to reduce human labor and increase overall lettuce production at the same time.

By processing data from RGB and depth cameras mounted inside a greenhouse, Quantum's **Visual Analyser** determine actual crop state data, such as the lettuce height, diameter, and leaf area.

These precise measurements enable superior resource allocation, efficient planting and spacing strategy, accurate growth control, plant density calculation, and prompt anomaly detection.



>>>>>>>> LET'S DISCUSS YOUR IDEAS

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