We help companies solve their data challenges

Professional software development and technology consulting services

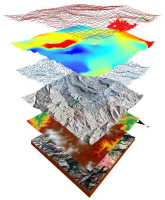
Domain: AgriTech

WE ARE

a global technology partner delivering custom **data science & AI** solutions.

Our broad expertise with data analytics and high-end software engineering skills allow us to deliver insightful & data-driven software products, lessening the development time and budget.

EXPERIENCED IN

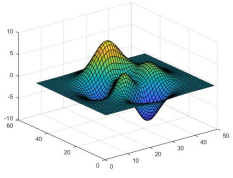


Remote Sensing & Agricultural Drones

Satellite or drone imagery for remote field/pasture observation, condition assessment, and change detection.

IoT Smart Farming

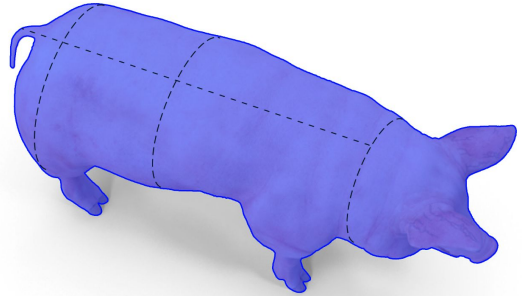
IoT technology for real-time crop/livestock monitoring using sensors connected to the cloud via cellular or satellite network



Advanced Data Analytics

Increase farming productivity with forecasting crop production, improving crop yields, and minimizing waste

DOMAIN EXPERTISE



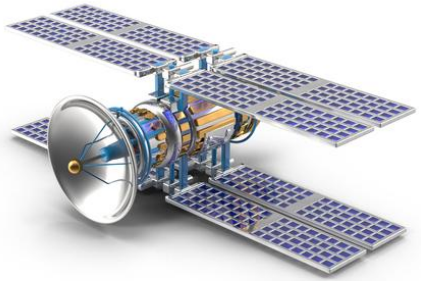
01 — **Precision** farming

- Integration of precision agriculture software into the existing business processes to facilitate proactive data-driven decisions
- Monitoring and evaluating yield health using historical data of field usage, as well as soil condition, and pattern recognition
- Software integration for remote monitoring of agricultural objects using satellite, drone and aerial imagery, geotagging, and other data

02 — **Livestock** management

- Livestock behavior analysis to identify patterns for health monitoring, weight calculation and remote tracking of animal handling
- GIS technologies and ID tags to detect livestock routes and movements, and identify each animal in the herd
- Integration with databases, as well as blockchain, for keeping records about livestock health status and the supply chain
- Weather tracking and disaster alert systems for remote surveillance

DOMAIN EXPERTISE

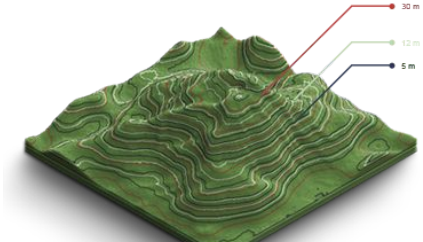


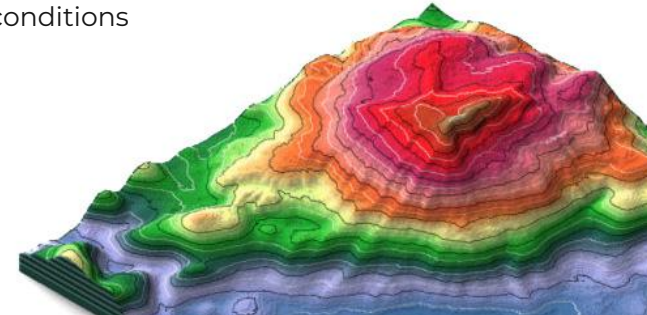
03 Farm operations management

- Optimizing and planning of agricultural procedures based on historical data
- Assessing crop health, detecting anomalies and assisting in decision making
- Forecasting and measuring crop revenue profit by analyzing soil and yield data
- Integrating AgriTech software to aid financial management

04 Land-use management with remote sensing

- Analyzing land use and overseeing crop rotations to keep nutrients and weeds under control
- Monitoring and controlling biodiversity via historical data analysis
- Sustainable management of agricultural land and forests for years to come in changing climatic conditions





GEO ANALYTICAL PLATFORM

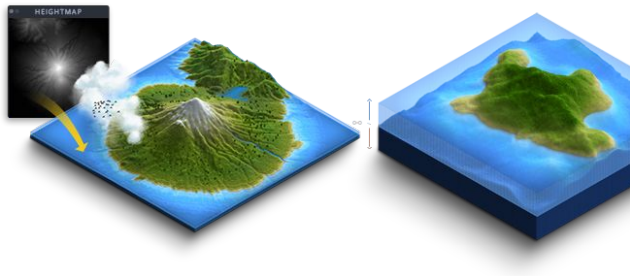
GeoAP provides ready-to-use components to process satellite and drone imagery with AI-powered methods. The platform allows you to cut development time and save up to 60% of your budget

BASIC FEATURES	GEOAP	CUSTOM DEVELOPMENT
Enabling the work with satellite and drone imagery	✓	–
Viewer for calculated results	✓	–
Storing multiple historical results of outputs of various models	✓	–
Delivering results in a standard form via API	✓	–
Mapbox integration	✓	–
From new model development to results in the production	**1-2 days**	**1-2 months**

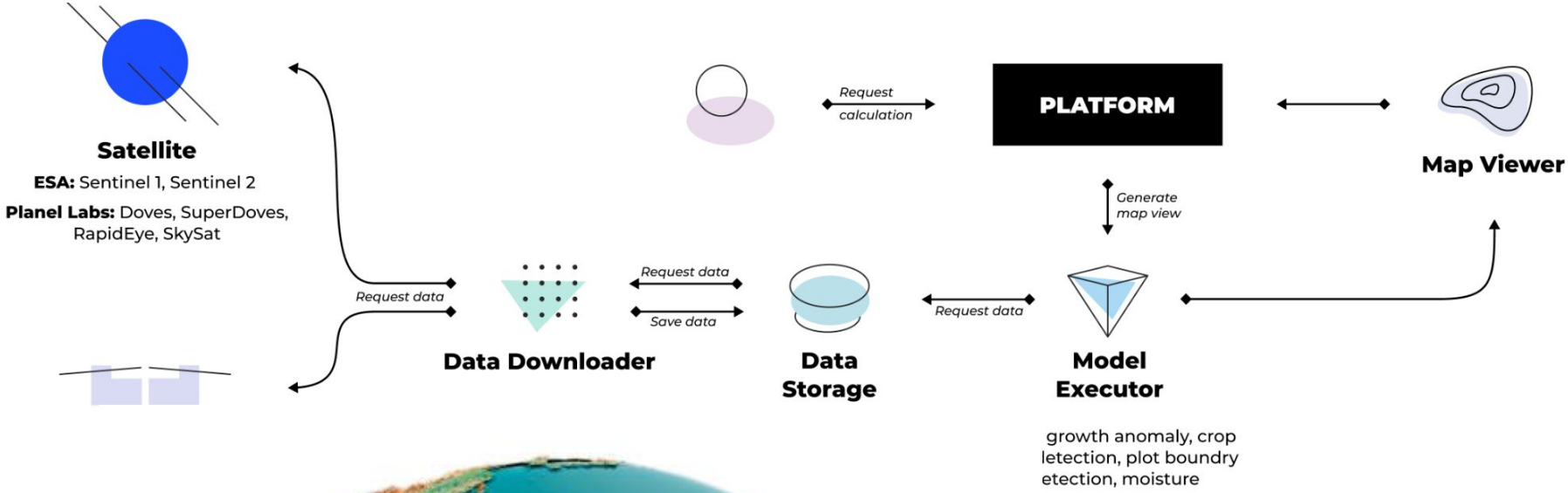
Run custom **ML models** for objects detection

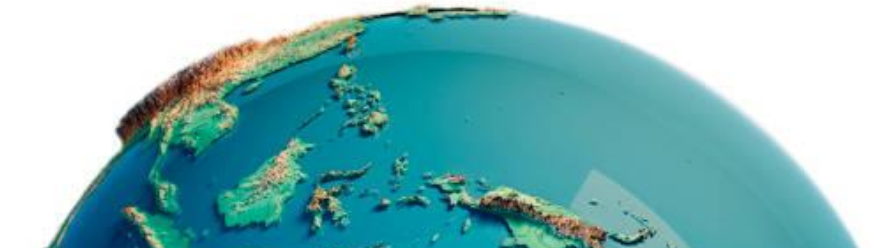
100% ready for integration

Data from various sources with options for modeling



GEO ANALYTICAL PLATFORM





BACKGROUND

20+ **ML & AI** engineers

15+ **YEARS** of leaders experience

150+ **PROJECTS** delivered

200+ **ENGINEERS** in the network

AMONG OUR CLIENTS

SeeTree,
Israel

FarmSee,
Israel

Agricam,
Israel

Robert Light,
USA

Manna Irrigation,
Israel

World Sensing,
Spain

FSIGHT,
Israel

SERVICE MODELS

END-TO-END development

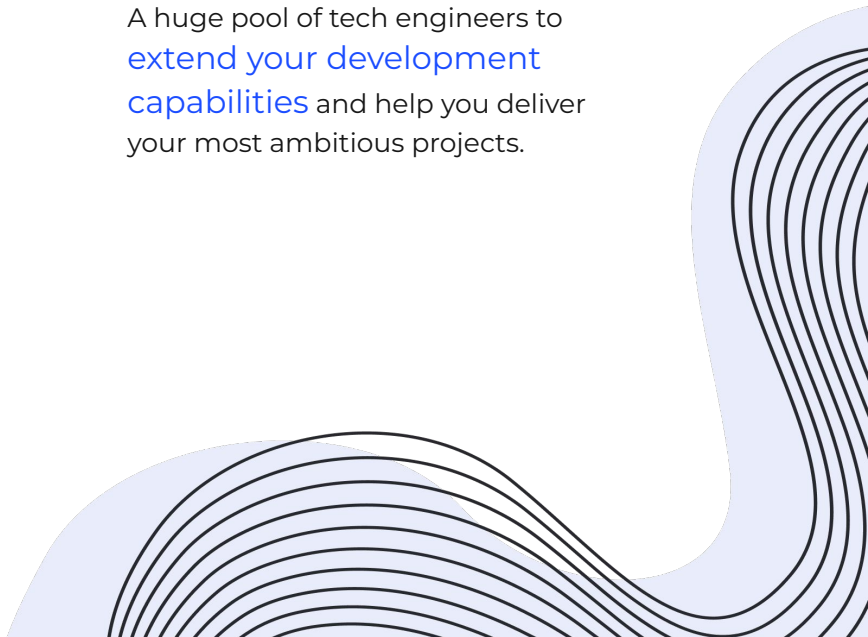
Full-cycle development services and support in diverse tech stacks. The agile approach we're using will help you reduce costs and increase productivity.

DEDICATED TEAM for your project

A huge pool of tech engineers to extend your development capabilities and help you deliver your most ambitious projects.

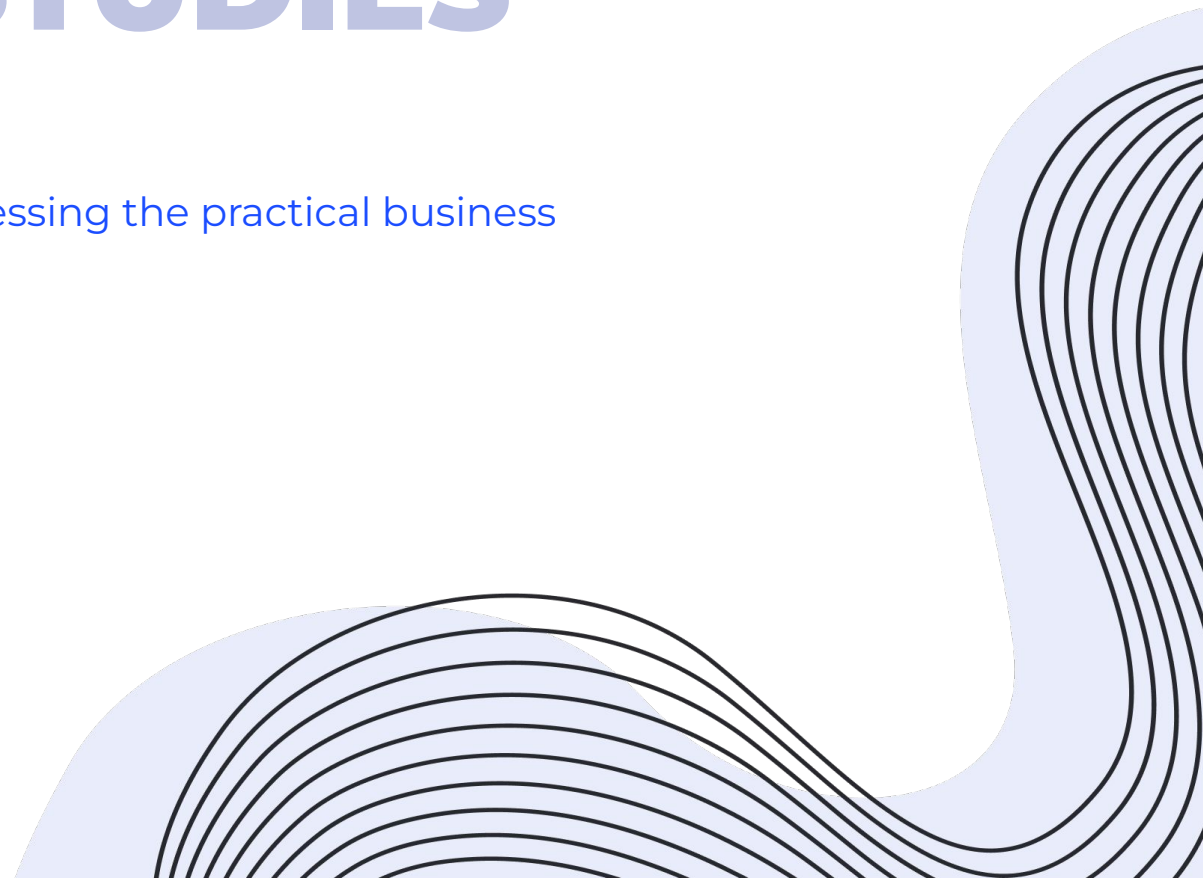
STARTUP lifecycle support

We're experienced in supporting startups throughout different stages – from research projects to building MVP.



CASE STUDIES

Our experience in addressing the practical business challenges.



REMOTE SENSING & ML FOR SMARTER AGRICULTURE

Case study #AgriTech #computer vision #ML #remote sensing #data analytics

About the client

Leading AgriTech company that develops an end-to-end service for monitoring and optimizing the health conditions and productivity of trees.

Business challenge

The client's primary intent was to give farmers a **solution for automatic ripe fruit detection**. To do that, he started developing a technology for the early-stage detection of anomalies and diseases at two levels: an individual tree and the entire plantation.

After building the basis for the solution, the client **partnered with Quantum** to implement more features, fix ones that were working incorrectly, and cover the data science part of the project.

REMOTE SENSING & ML FOR SMARTER AGRICULTURE

Learn more ➔

Case study #AgriTech #computer vision #ML #remote sensing #data analytics

Project overview

Quantum extended the client's in-house AI team responsible for multisensor data operational services. Our R&D team created a prototype using an ML model to identify fruits, categorize fruit trees, and assess tree health using multispectral drone imagery.

- **Image preprocessing.** To provide farmers with identical geo-aligned (accuracy up to 6 cm) images and the ability of delayed site recognition, we align drone imagery using built-in sensors, then stitch and substitute drone and satellite imagery.
- **Orchards decomposition.** Some models recognize every band of trees and each tree in it. The resulting data set can be divided into subsets stratified by the number of fruits in the image.
- **Growth analysis** helps monitor each tree, compare its status with the normal vegetation life cycle, recognize and calculate fruits, and smoothly make additional measurements.
- **Proprietary models** used for decision-making support, saving time, reducing costs, and providing easy farm business management.

Summary

Quantum made a prototype capable of detecting ripe fruits and assessing tree health with *nearly a human level of performance*. In addition, we improved the accuracy of data analysis and forecasting, thereby **increasing farm productivity by more than 40%.**

TRACKING PLANET DEFORESTATION WITH CLEARCUT AN OPEN-SOURCE WEB PLATFORM

Learn more →

in cooperation with

SOCIETY FOR CONSERVATION GIS

Case study #AgriTech #computer vision #GIS #remote sensing #open-source

The mission is to provide **continuous analysis of logging information** to people and/or organizations that use geographic information systems (GIS) and scientists to conserve natural resources. *Developed in cooperation with the ecological organization SCGIS.*

Project overview

ClearCut is a web **platform for tracking deforestation** with remote sensing, computer vision, and ML. The platform **automatically considers forest conditions, finds cleared land, and provides change reports** via email, collecting satellite data every 3-5 days, thus enabling environmentalists to react faster.

After identifying the subject area and existing segmentation issues, we focused on developing the required ML models and server/client-side setup. Integration with external services for satellite image access was somewhat challenging. These services were either paid or required significant modifications.

Multi-channel satellite data also required extra processing, such as imagery normalization, merging, or figuring additional channels (NDVI). Advanced calculations were nearly impossible, considering the image size (10000x10000 px) and RAM limitations. We had to split them into smaller portions saving intermediate results. Finally, there were multiple markup flaws affected the model accuracy.

Summary

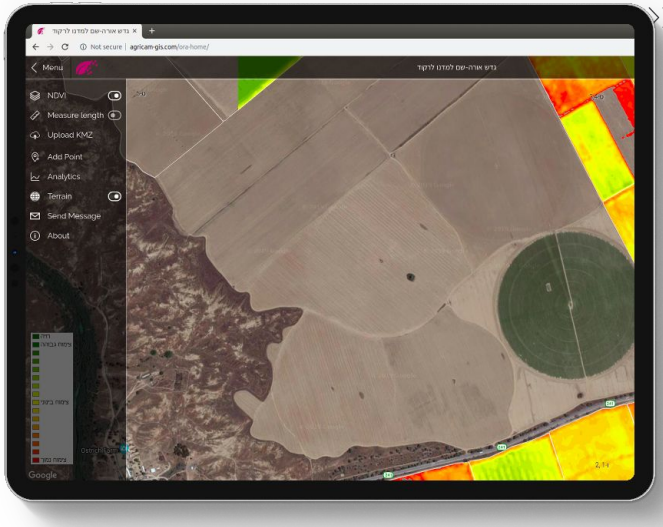
Users receive detailed information about changes in deforestation for each land parcel. Environmental organizations can now **analyze information and correct inaccuracies or ancient data regarding the state of deforestation, thus being able to react in time**.

CLOUD-BASED PRECISION AGRICULTURAL PLATFORM

Learn more ➔

Case study #cloud #infrastructure #ML #IoT #remote sensing

Modern agriculture has a **growing demand for risen land productivity while reducing production costs**. Farmers need a reliable, yet cost-effective way of fetching data to increase their yields. The client reached Quantum to address this challenge.



Project overview

A **cloud platform** that allows users to **process valuable data**, including field indexes and crop data, and **handle anomaly situations**, such as cloudiness and overcast. Our solution consists of two main components:

- **Service hosted at Amazon EC2** automatically finds the latest Landsat Sentinel datasets that can be used to carve the required areas of interest (AOI), calculate vegetative indices (NDVI), and convert assembled data into raster images uploaded to the Amazon S3.
- **A web application** that arranges our analytics platform with geospatial measurement tools and formerly assembled statistical data on top of the Google Maps layer.

Additionally, we've enabled our service to connect with statistical data from Google Earth Engine to obtain even more statistics. Depending on location, the data is revised avg every 3-5 days.

Summary

Quantum's team managed to help individual farmers and organizations interested in evaluating agricultural growth performance to **successfully address common agrarian challenges**, using satellite and drone data.

FRUIT CROP PREDICTION & BIOMASS CALCULATION

Learn more ➔

Case study #AgriTech #computer vision #data analytics #remote sensing

An accurate forecast of yields ahead of harvest is vital for any agricultural business. The client sought to **lower expenses with more efficient resource planning**, reaching Quantum to provide advanced field analytics.

Project overview

Our team has created a **web app to convert agricultural drone imagery into GUI, allowing users to target a specific area for further analysis**. We used computer vision and artificial intelligence to forecast fruit ripeness by calculating the number of fruits in particular field sites and assessing their biomass.

Given the client already had a platform containing agricultural drone data, we started by developing an automatic fruit recognition system. First, we built a model based on DEM data to identify plant height. Then, we extracted all data points and merged them into objects using LAS data.

Contrasting a small plant coated with the shadow of its more giant neighbor was challenging — drone imagery contains artifacts, such as low image overlap or shadows. To overcome this issue, we had to ***increase the number of observational field flights to cover various daylight conditions***.

After successful biomass classification, we split the results into usable (fruit and hay) and futile (to be disposed of), finally being able to indicate the amount of biomass growing under the same field conditions.

Summary

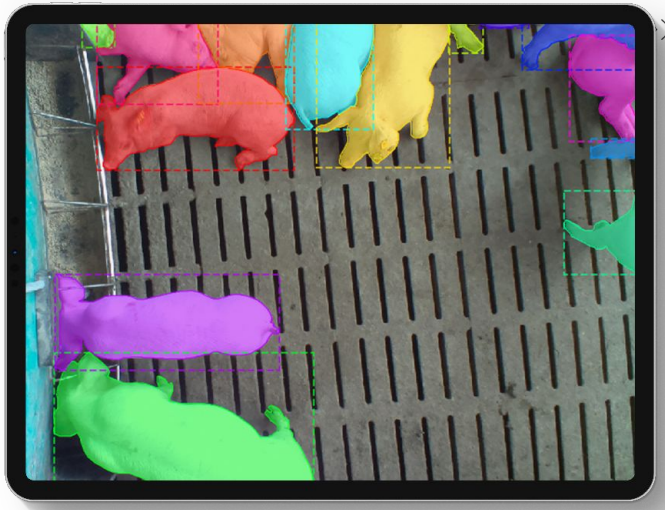
Quantum's team delivered a viable web application, helping the client **meticulously plan his further steps for efficient biomass management**.

SMART LIVESTOCK MANAGEMENT PLATFORM

Learn more ➔

Case study #AgriTech #computer vision #data science

Despite leading the AgriTech sector, the Israeli livestock industry has experienced many outbreaks. The client strived to help farmers **achieve optimization on every stage of pig farming process** and hired Quantum to develop a **real-time livestock management tool**.



Project overview

We started with creating ML algorithms for image processing and a web-service for handling the live stream video. A service receives, then transfers the camera data wirelessly to the cloud for the subsequent processing. Data processing pipeline:

- ID tags detection and identification
- Pigs detection using instance segmentation NN
- Linking detected tags with pigs; nailing the best result through filtering
- Identification of the trunk, head, and legs using semantic segmentation NN
- Pig weight prediction using nonlinear regression with an output of the previous step as input
- Storing outcomes in the database

The platform performs diagnostics, alerting if health, weight distribution, feeding, or other issues with the stock occur, **minimizing human interactions, thus increasing the biosecurity and the accuracy of growth management.**

Summary

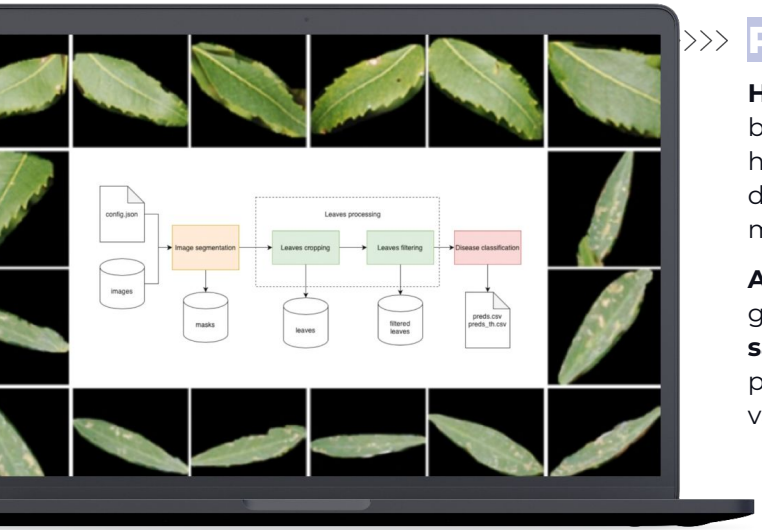
Quantum's team built a platform capable of performing the diagnostics and alerting if health, weight distribution, feeding, or other issues with the stock occur. By minimizing human interactions, we **increased the biosecurity and the accuracy of growth management.**

SMART PLANT MONITORING SYSTEM FOR DATA-DRIVEN DECISIONS

Learn more ➔

Case study #AgriTech #computer vision #deep learning #AI #ML

The client reached Quantum to **automate the manual labor of gardeners** observing cannabis plants with an **advanced greenhouse management system** capable of providing harvest insights and early-stage diagnostics.



Project overview

Hemp flower detection using camera shots from the indoor farm to distinguish between two phases of the hemp growth cycle and gain insight on when to start/stop harvesting. We started with the data preparation, splitting images into 3 types, depending on the cannabis growth stage. Then, we trained several object detection models, reaching **80% accuracy**.

Automated plant health assessment for detecting hemp disease symptoms, such as gray/yellow-ish leaves, rash/stains on the leaves, etc. Relying on this data, the staff can **save nearly 25% of the crop**, providing timely treatment or withdrawing the affected plants. Our team created a model capable of processing 11 types of leaves with a metric value of **up to 90%.** The pipeline had the following stages:

- RAW image segmentation for leaves detection
- Leaves processing to extract valuable data for each leaf found.
- Disease classification to detect and analyze multiple symptoms.

Summary

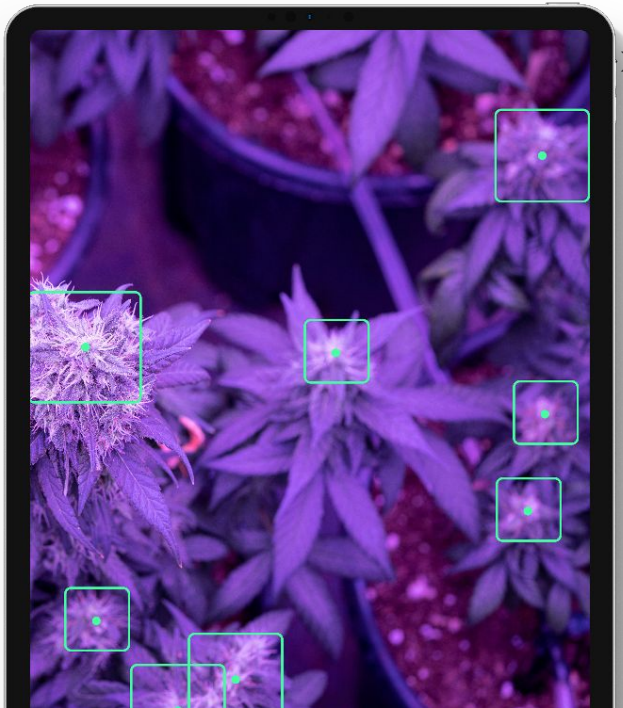
Quantum's team applied the latest computer vision techniques for image processing to address the two main challenges of detecting flowers and health evaluation, **gaining 80-90% accuracy**.

AUTOMATIC GROWTH TRACKING SYSTEM FOR MEDICAL PLANTS

Learn more ➔

Case study #AgriTech #computer vision #computer science #IoT #data analytics

Despite leading the AgriTech sector, the Israeli livestock industry has experienced many outbreaks. The client strived to help farmers **achieve the optimal livestock population** and hired Quantum to develop a **real-time livestock management automation tool**.



Project overview

In dealing with blooming plants, it's vital to track the process of vertex growth, handling anomalies at the top level with further analysis and improvement.

Quantum's team created a **computer vision tool capable of detecting and identifying growing vertices**, which took hourly transmitted images as input and provided detailed analytics of the overall growth process as each vertex develops. A one-week image gap turned out to be the most reasonable for both change detection and tracking. We spent about 12 hours on transfer learning for 30,000 iterations using **YOLO** to achieve **high accuracy and fast processing speed**.

The vertex tracking process was challenging. Plants constantly change the direction of their growth instead of developing strictly upward, forcing us to re-identify the same peaks over time. Having split the image into sectors, we built a map to find the particular vertex by comparing the search result with the previous photo. **Vertices detection with 90% accuracy** took about 20 seconds per shot. The solution was deployed on Jetson TX2.

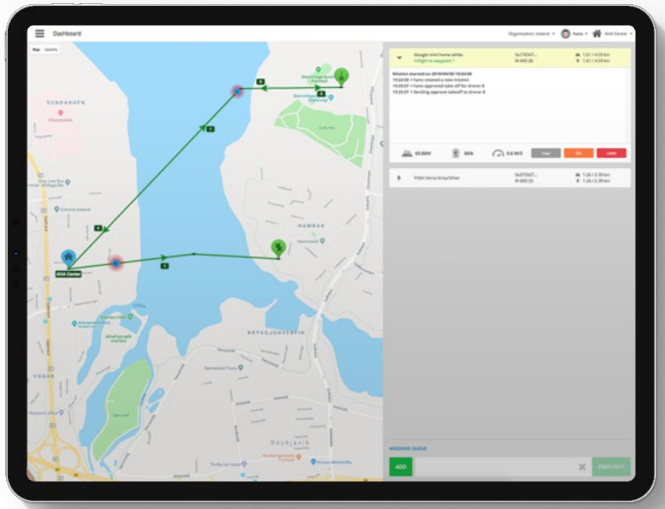
DRONE DELIVERY PLATFORM WITH ADVANCED ROUTE MANAGEMENT

Learn more →

Case study #computer vision #geo solutions #R&D

Quantum's team created an advanced yet easy-to-use online dashboard that brings together **all the tools you need to manage your fleet of delivery drones**. The client already had the MVP and hired us to develop the second production-ready version.

Project overview



Our team started with an **architecture upgrade**. The main challenge was to split the monolith into microservices to make the system's connections and transactions **swift and capable of running in real-time**. Additionally, we rebuilt the infrastructure to **handle critical situations** like when the service crashes or the connection is lost. The final version had the following features:

- **Advanced route management** allows users to define flight routes by adding unlimited way-points.
- **Smart way-points** to define various actions across routes, land with or without approval, and fly between trees and other obstacles.
- **Detailed reports** for each mission, including complete telemetry data, flight playback, server logs, and flight controller reporting.
- **Automatic preflight check** to check an entire system before the flight, verifying hardware readiness, flight route availability, weather conditions, and more.

SPATIAL-TEMPORAL ASSETS CATALOG FOR AGRICULTURAL CORPORATION

Case study #data science #geo solutions #AgriTech #remote sensing

Until now, agronomists had to manually check satellite imagery captured from diverse angles in distinct weather conditions to identify crop fields, which affected the crop anomaly response rate. The client reached Quantum, aiming to provide farmers with **timely, field-level insights about crops and their conditions** based on daily satellite imagery and unique map layers.

Project overview

We used **Planet's stream with daily, 3-5 meter resolution imagery** to reach the highest quality. The project was divided into two parts:

- Building a **reliable ingestion pipeline**
- Creating a **catalog to store and manipulate the data**

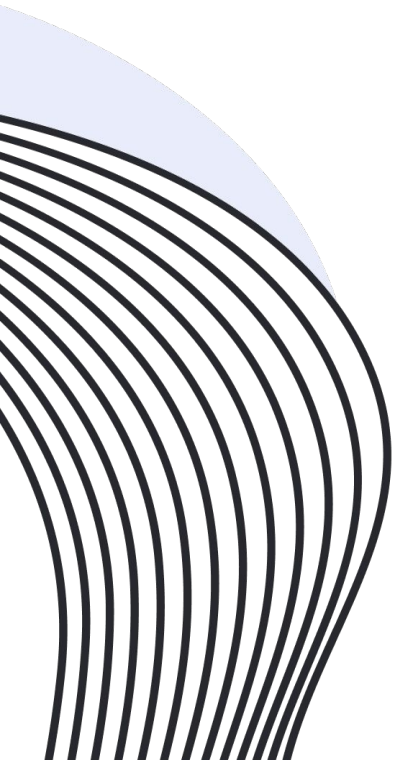
First, we had to convert the users' areas of interest *(AOI)* into a simplified geometry for being able to search for Planet imagery that might contain those areas. Once we identified the required AOIs, they could be transferred to the system. Using a raster processor, we created raster maps of the user's AOIs with the corresponding metadata and stored them in a catalog.

Due to the complex multi-stage processing system, it was crucial to have a **robust infrastructure** to support the pipeline, processor, and catalog, **balancing processing speed and operational costs**. We've added ElasticSearch to our catalog to store maps with billions of geo-features, including various indices calculations, imagery with distant cloud layers, and other modules to explore the required data, like geo-specific queries.

Summary

Quantum's team created a **scalable, elastic Spatial-Temporal Assets Catalog** that would store billions of geo features. The imagery in the catalog is processed in a way to ensure easy-to-read field maps that would allow further crop health monitoring leaning on historical data.

WHY QUANTUM



HYBRID AGILE management

Combining various methodologies allows us to speed up the delivery by adopting the most reasonable approaches.

CUTTING-EDGE technologies

Using innovative technologies allows us to deliver high-quality results

R&D projects

Investing in research and development allows us to stay ahead of the competition and inspire our clients

WORLDWIDE presence

Having offices in Europe, Israel and US gives our clients financial and legal assurance

LET'S DISCUSS YOUR IDEAS

GET IN TOUCH

welcome@quantumobile.com