Case Study

Smart Agriculture
Intel® Geti™ Platform

Small Robot Co uses Intel® Geti™ Platform for efficient modelling to create more sustainable crops

Small Robot Co is using Intel's CV AI platform to create fast and flexible vision solutions to allow farmers to manage their crops more effectively, saving time and money while improving sustainability.

At a glance

- Intel Geti platform delivers a fast, efficient method of identifying and labelling crops, before creating modelling solutions for more effective and sustainable farming.
- Custom computer vision models are needed to tackle challenges in adoption of smart agriculture.
- Intel Geti platform empowers data scientists, farmers and developers to harness their expertise to create models and solutions for real-world applications.
- Small Robot Co is also developing innovative solutions for spot fertilizing, de-weeding and yield estimations.

The Challenge: Inability to experiment quickly with huge amounts of data

AI is playing an increasingly important role in many industries around the world, from manufacturing to healthcare. Agriculture, too, has started to adopt AI technologies that make farming more productive, efficient and sustainable.

Helping farmers feed the world while regenerating the planet is the driving force behind Small Robot Co. Their vision is "per plant farming": rather than treating a field of crops together as one entity, they treat each plant individually to reduce external inputs such as fertilizers, pesticides and herbicides.

Machine learning and AI are a crucial part of the per plant farming process, as each plant needs to be not only detected, but also labelled and segmented, to create AI models. This is before bespoke treatment can be carried out on each individual plant. Detections include distinguishing crop plants such as wheat and barley versus weeds.

The challenge for Small Robot Co was that their existing workflows to develop custom CV models were inefficient. Training AI models involved several manual and laborious steps that they didn't have the time or resources to fully automate. Strenuous labelling slowed down the whole process and created bottlenecks of raw data.

Small Robot Co needed a fast, seamless and easy-to-use alternative to label vast amounts of data quickly and use that data to train models, before trying out various use cases efficiently.

The Solution: AI technology out in the field

Small Robot Co's vision for per plant farming was being held back; the processing of data and subsequent training of their AI models was not quick enough. Through an Early Access Program, Small Robot Co collaborated with Intel to utilize its pre-production version of Intel Geti platform to break this bottleneck.

Intel Geti platform allows users to build AI models rapidly, then use them to find solutions for all kinds of agricultural challenges. It reduces the time needed to build these models by taking away the complexities of model development and harnessing greater collaboration between teams, such as data scientists and agricultural professionals. Put simply, it offers a single, intuitive platform that enables data labelling, model training and optimization.

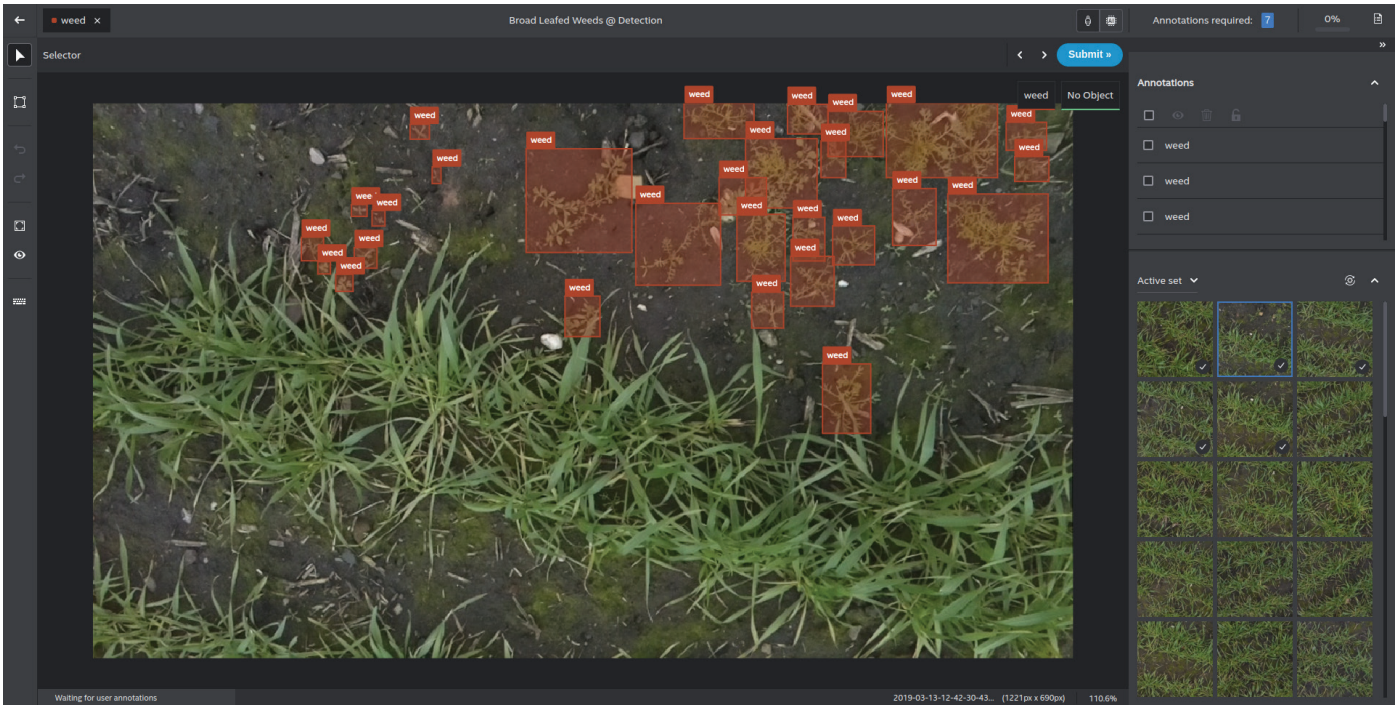


Figure 1. Fast and efficient detection of plants is critical for per plant farming to succeed.

"Per plant farming requires us to do lots of experiments and quickly try out potential use cases. Intel Geti platform streamlines and simplifies our workflow."

- Tom Walters, Small Robot Co

Intel Geti platform uses a type of machine learning called active learning to train convolutional neural network (CNN) models. Active learning makes labelling data and retraining neural network models fast and simple. Users begin by labelling a few dozen images or perhaps a short video, before adding more data as needed. When the system has received its first annotations from the user, it will automatically start training a model. The model guides the user via a process (active learning) to suggest which images would be most productive to learn from next. This interactive, real-time training process enables users to take advantage of data and see results earlier.

For Small Robot Co, this process begins in the field—literally. Robots helping in this type of sustainable farming are equipped with high-resolution cameras. They travel to farms and gather data, taking over 10,000 images per hectare. Its commercial monitoring robot Tom is now in service on UK farms gathering per plant intelligence data. The billions of collected data points are then processed to recognize and label the plants one by one.

The Intel Geti platform has proven revolutionary for all its users, from farmers on-site, to non-developers at Small Robot Co. Models to support new capabilities can be quickly prototyped and tested. These models support use cases, including finding the exact location of weeds, to create a detailed virtual map of the field so farmers can treat their crop in the most effective way.

The treatment process can be manual; however, Small Robot Co is also looking at digitizing the workflow and automating the process. They are trialing a prototype robot that can use the data directly to go out into the field to undertake any actions. The aim is to fully automate the process; a robot can travel to any location in a field where weeds are threatening the crop, for example, and destroy them using a short, sharp electric charge. This non-chemical targeted treatment will eliminate the need for harmful herbicides.

For users, the Intel Geti platform has also proved groundbreaking. Although it uses advanced AI technology, the Intel Geti platform is simple and intuitive enough to allow non-AI audiences to participate in data annotation that quickly trains models to identify weeds from images captured by the robot—and that's just one example. It means users with a close connection to the project can have a deeper role to play in the learning process

In addition to the Intel Geti platform, Small Robot Co is planning to use the Intel® Distribution of OpenVINO™ toolkit in the future to provide a framework to optimize their models to run on Intel® processors at the network edge. The results will then be sent in real time, without having to move large amounts of data to the cloud for processing.

"Where we've detected areas of weeds, we provide a treatment map that allows the farmer to spray herbicide on just that section."

- Tom Walters, Small Robot Co



Figure 2. The robot takes thousands of hi-res images before sending them back for analysis and to begin model training.

"We wanted non-developers to be able to annotate data efficiently, and quickly train models. Intel Geti platform allows us to do all of that."

- Tom Walters, Small Robot Co

Results: Smoothens and streamlines training, learning and deployment

The Intel Geti platform's intuitive user interface made it easy for Small Robot Co to manage their entire model development project in the same platform, from data annotation to training, optimizing performance with the OpenVINO toolkit, to retraining. And because everyone works in the same platform, the results of the training decisions can be seen immediately. Now AI can be used in practical, real-world ways, rarely seen before in challenging agricultural environments.

With its easy-to-use UI, agile model development approach, and innovative technology such as active learning, the Intel Geti platform enabled Small Robot Co to break the bottlenecks of sorting through large amounts of data to rapidly build AI models.



Figure 3. Using coordinates, the robot can locate and destroy any weed without the use of harmful chemicals.

Conclusion: Accelerates the per plant farming process

Thanks to working with Intel Geti platform, Small Robot Co were able to accelerate how their data points were analyzed and labelled.

This led to them being able to carry out more experiments than ever before, as well as increasing the speed of their AI model training and deployment.

Small Robot Co hopes that now that the process has become more streamlined, they can bring their vision of per plant farming to reality on farms sooner.

Learn more about the Intel Geti platform at geti.intel.com, Small Robot Co at smallrobotco.com, and the OpenVINO toolkit at intel.com/openvino

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