

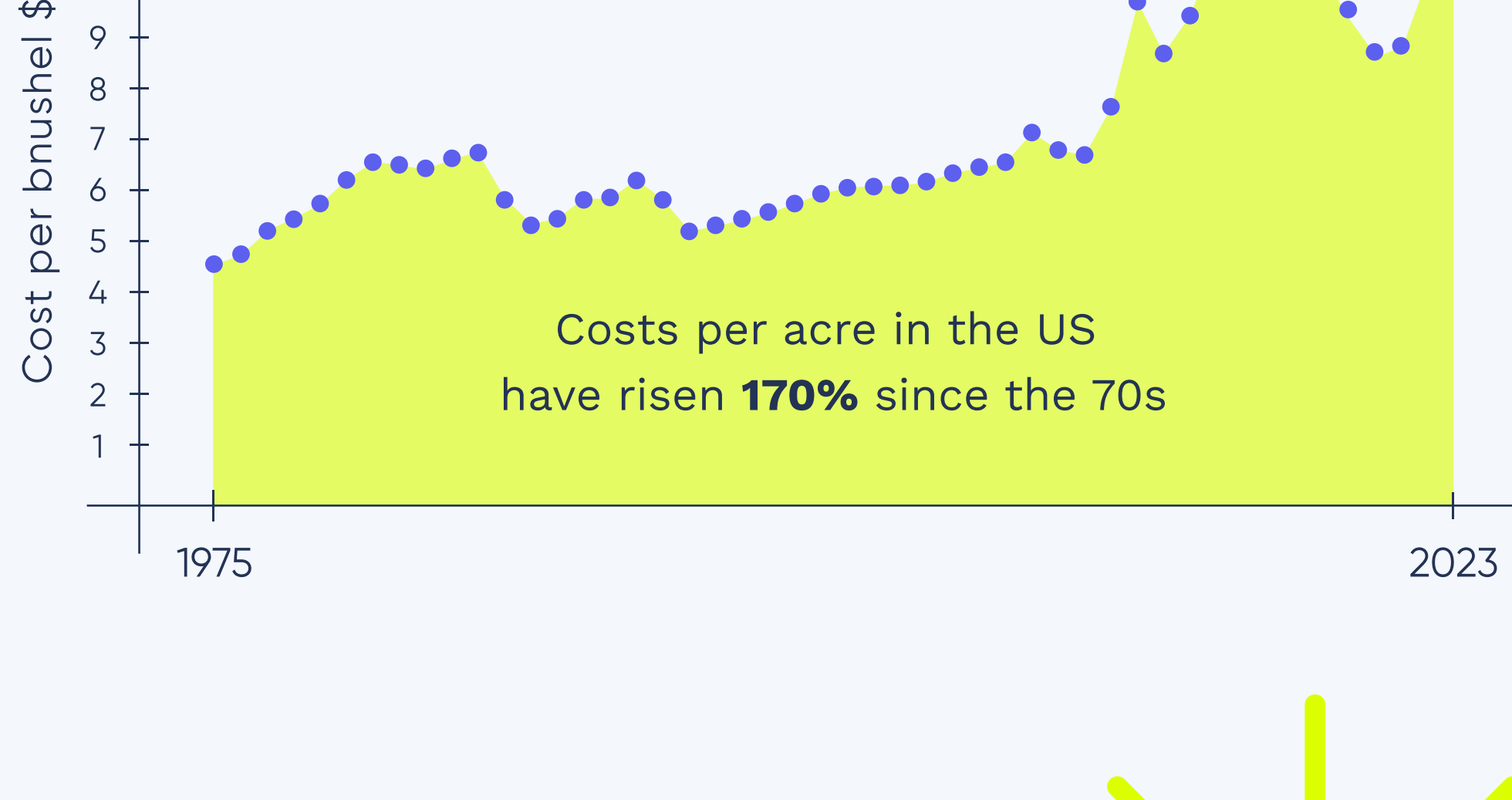
# Precision Agriculture & The Future of Farming with Machine Learning

by Xmartlabs



## Maintaining a plantation has never been more expensive.

This is partly due to the increasing costs of maintaining weed-free fields. Weed detection and control in small and large farms has become a challenge.



## The Real Cost Of Weed Control



### The economic cost



Total cost of planting soybeans per acre

**3 bill.**

Pounds of herbicide are used yearly

**\$6.6 bill.**

Are spent yearly in the US on herbicide

### The damage to the soil

Increased **concentration of herbicides in the soil** was associated with a decrease in its ability to retain water and nutrients.

from **0% to 100%**

in the last 20 years

### Resistance of the weeds

Intense and continuous use of herbicides resulted in the **constant evolution of herbicide-resistant weeds**, which are increasing with time.

**226**

weeds resist

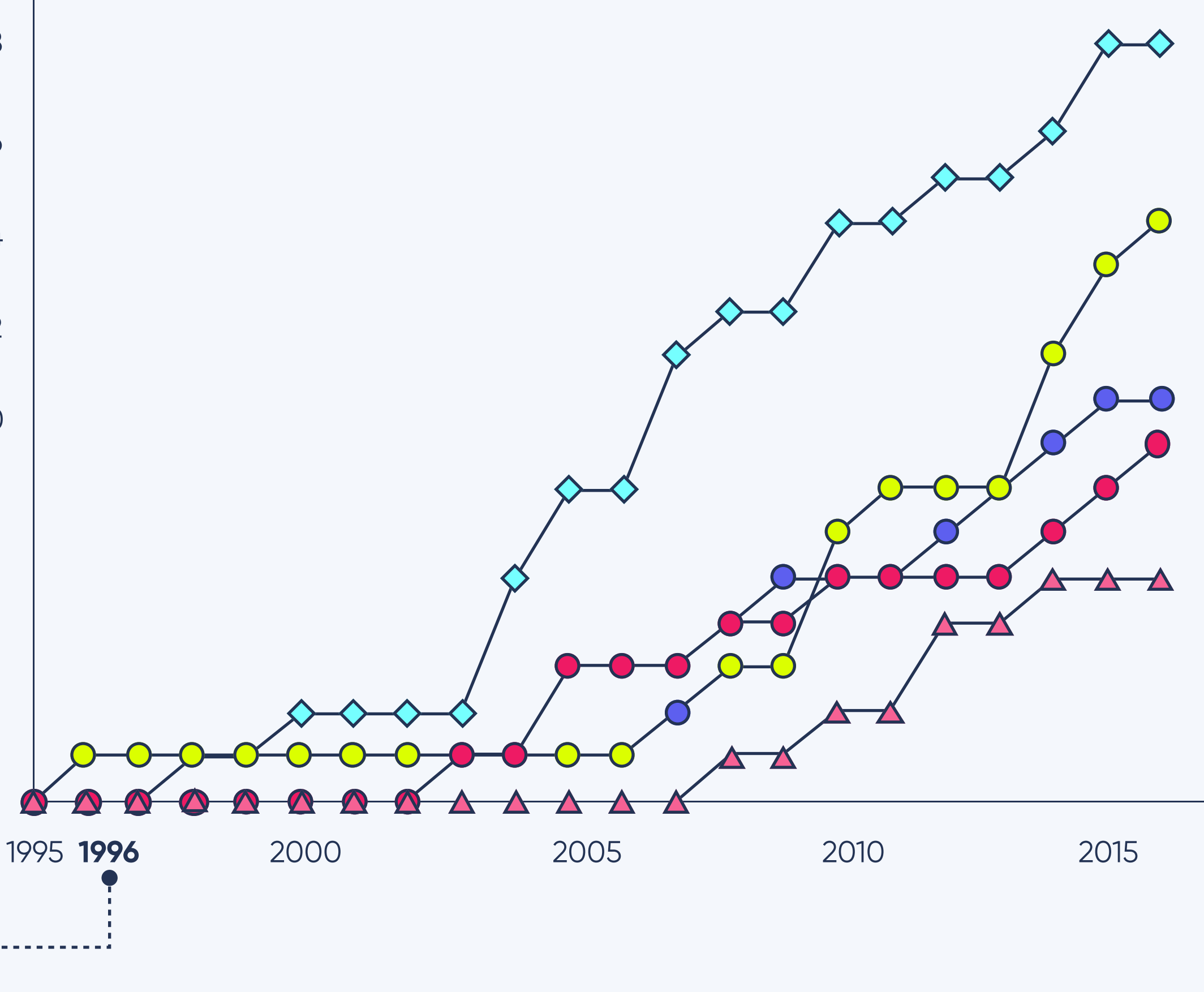
**164**

different herbicides throughout

**71**

countries

### Amount of glyphosate-resistant weed species throughout the years



Roundup Ready crops, the first **glyphosate-resistant crops**, become commercially available.

### How ML can solve these problems?

## Object Detection for detecting and distinguishing types of weeds

Solutions are coming in the shape of **targeted spraying tractors based on deep learning methods**

Deep learning process live images, and locates and classifies different kinds of weeds on the soil, allowing the model to determine the best course of action for each specific case.

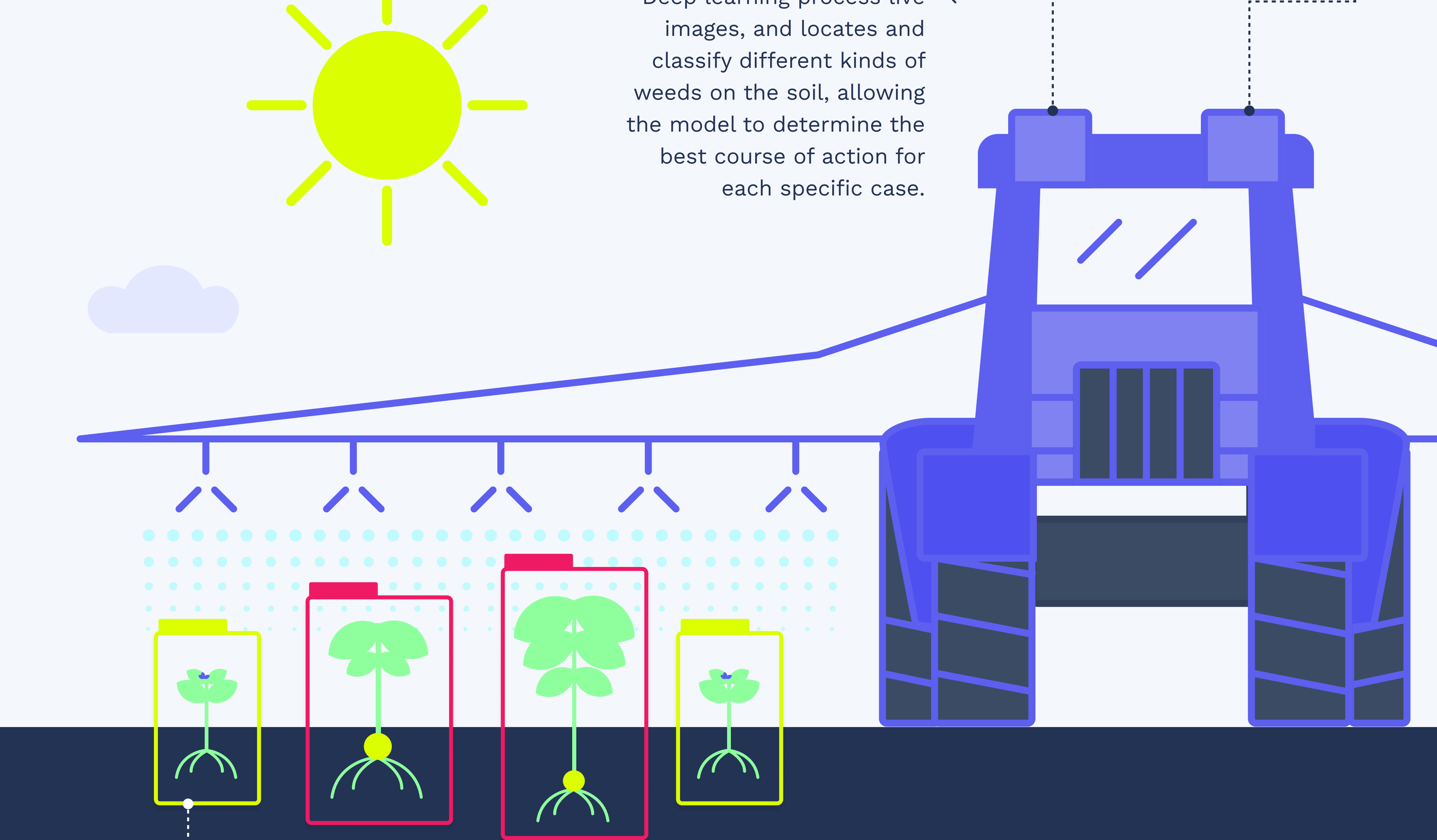
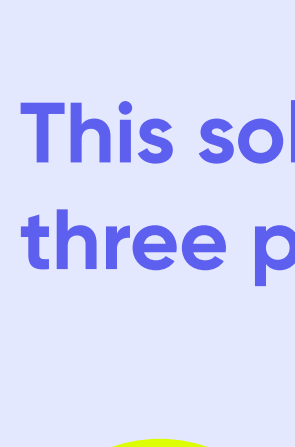


Image classification assigns the image of an object with a class label (tag) and objects localization locates it within the image by drawing a bounding box around it.

### This solution tackles each one of the three problems stated above:



**Rising costs:** By identifying glyphosate-resistant plants, the machine abstains from wasting herbicides on plants that won't respond to them or surfaces that don't need it.



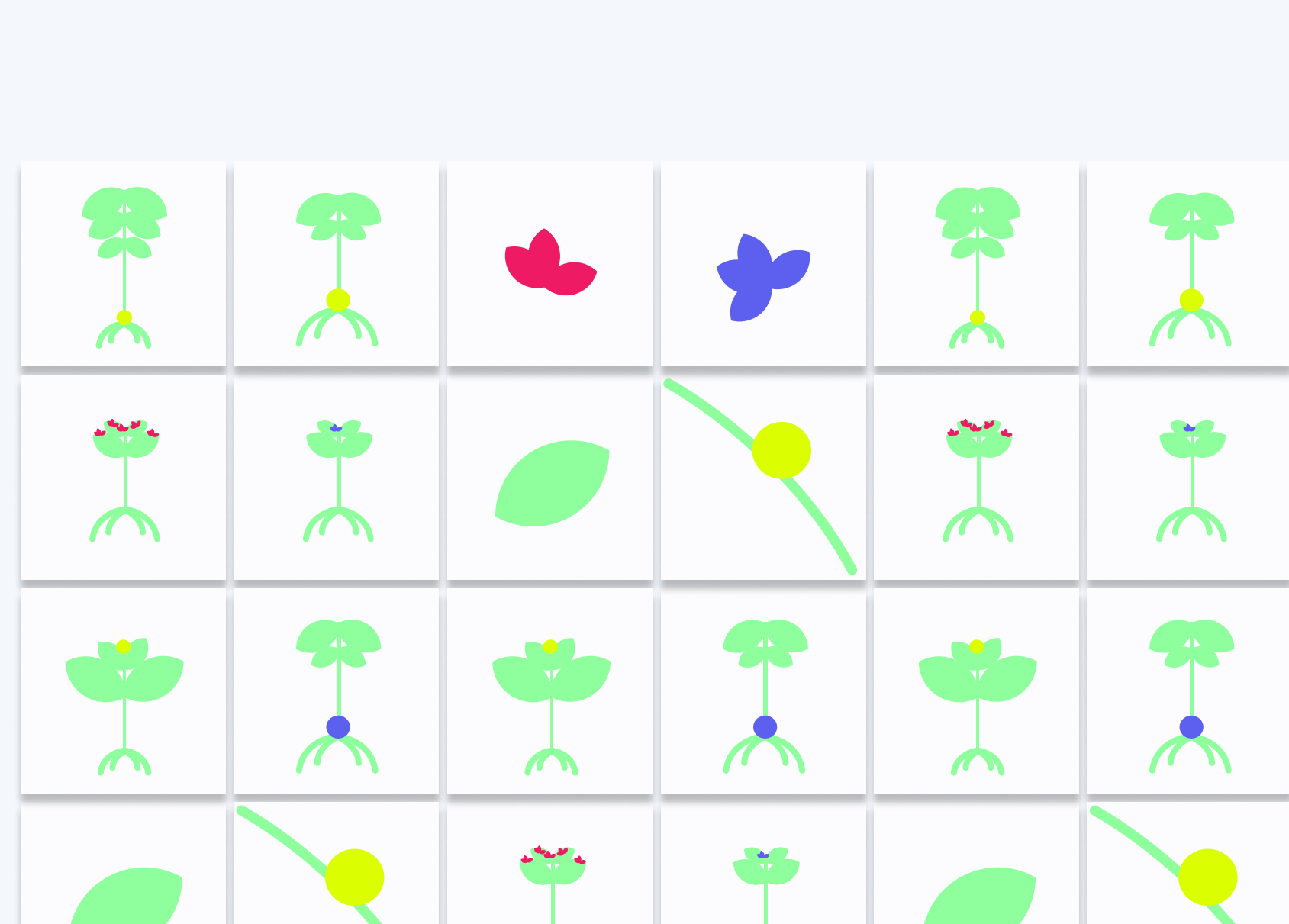
**Glyphosate-resistant weeds:** When the weed is identified as glyphosate-resistant, other herbicides are sprayed in its place, ensuring the most effective treatment is provided.



**Impact on soil:** Spraying only within the weed's space instead of in the whole plantation presents benefits regarding soil contamination by exposing only a small portion of it to the chemicals.

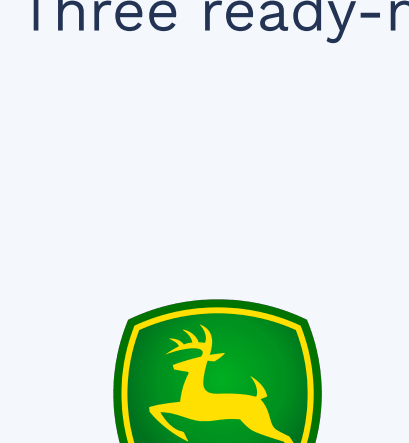
## Datasets for sourcing weed & plant images

Transfer Learning enables us to leverage pre-trained models trained on large datasets like ImageNet, and fine-tune them for specific tasks, such as plant classification. By doing so, we avoid the need to train from scratch, saving time and effort.

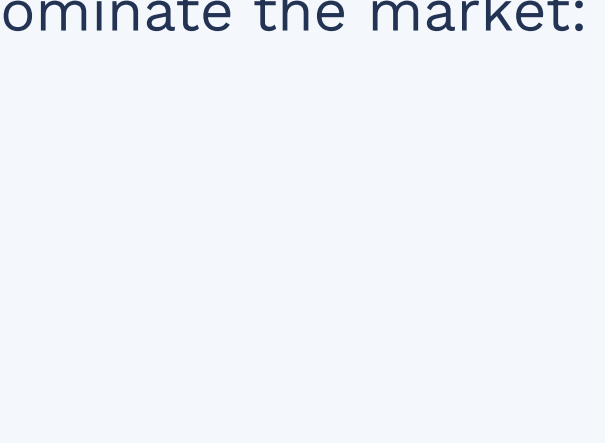


## Current solutions

Three ready-made solutions currently dominate the market:



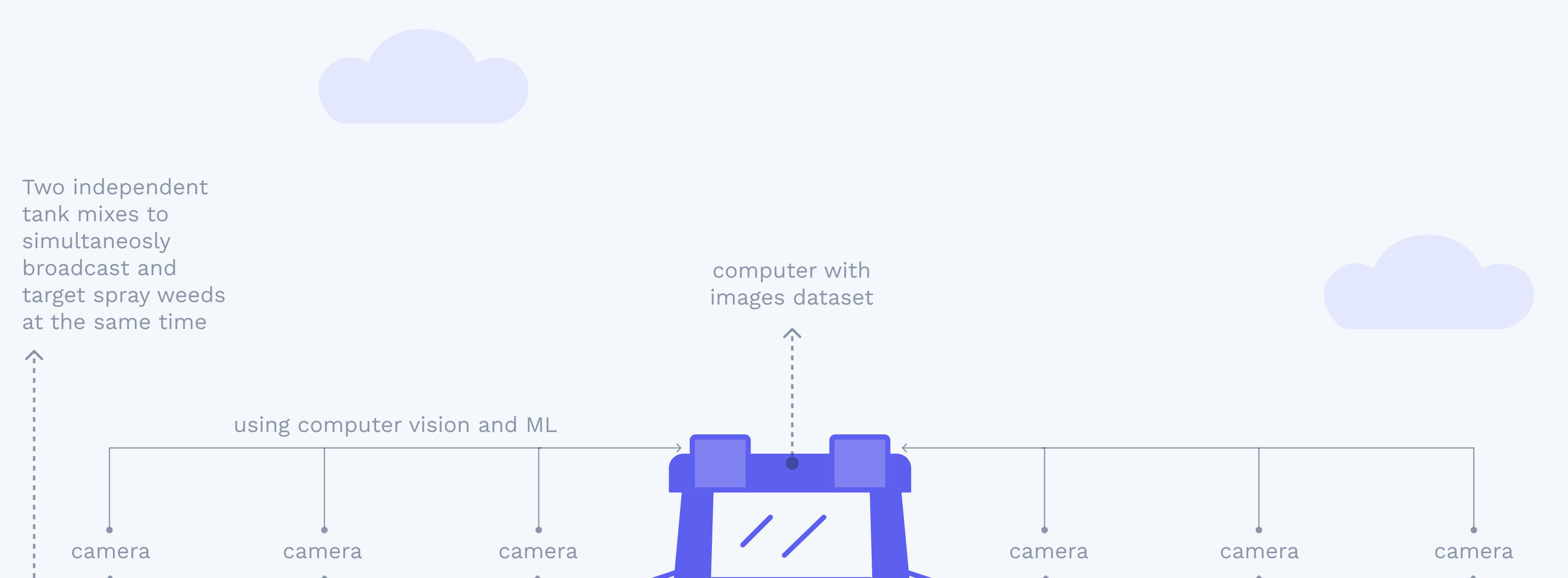
**John Deere's See & Spray™:** Their system detects weeds and uses individual nozzles to precisely target them, resulting in **77% less herbicide usage**. Integrated into their sprayer, it's ideal for plowed grounds but faces challenges on planted terrain due to color differentiation.



**Bosch's Smart Spraying:** Similar to See & Spray™, this system uses cameras and AI to distinguish plants from weeds and applies the right herbicide where needed. It works in various scenarios beyond fallow ground, with impressive speed - spraying weeds in just 300 milliseconds.



**SprAI** is a weed detection system that identifies and maps weeds in real time, allowing farmers to apply herbicides more precisely and efficiently. Its technology is based on a combination of software, AI, cameras, microcomputers, and electrovalves, and it can be installed on any type of agricultural machinery.



Two independent tank mixes to simultaneously broadcast and target spray weeds at the same time

using computer vision and ML

computer with images dataset

camera camera camera camera camera camera

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Using images from your field would be convenient, ensuring accuracy, as plant and weed types vary. **A custom image library verified by field workers could surpass ready-made solutions in precision.**

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