# ANDANTE Autonomous Weeding System

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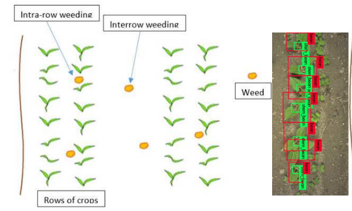
## Overview & Setup

**Objectif**: implement a low-consumption, low-latency computer vision system in an autonomous intra-row weeding robotic tractor able to:

1. Identify and localize crops in fields
2. Perform real-time detection for in field weeding
3. Achieve high accuracy detection to avoid crop destruction

The artificial vision block of the autonomous weeding consist of:

- 3 megapixels RGB camera
- White LED panels lighting
- Enclosed in a "dark chamber" for controlled illumination
- Connected to a weeding tool for real-time weeding




## Technology

Platform 4.1a / ASIC 2.1

Development of a simulated environment:

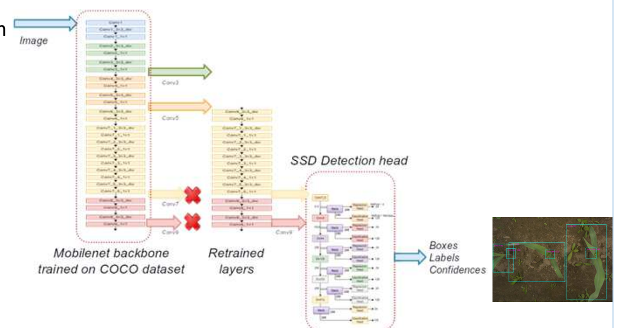
- Adapting our network architecture in PyTorch to the network used on the platform
- MobileNet V1 as network backbone, SSD as detector head

➡ Insufficient detection accuracy when using encoder trained on COCO dataset
This training set contains a limited number of plant images

Modifications made on the architecture:

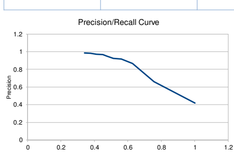
- Duplication of the encoders to partially retrain the last layers of the backbone

➡ Detection accuracy improvement




## Results

| KPI Name | Current system | Simulated | Difference |
|---|---|---|---|
| AP50 | 86.3% | 84.6% | - 1.7% |
| AP75 | 44.8% | 52% | + 7.2% |



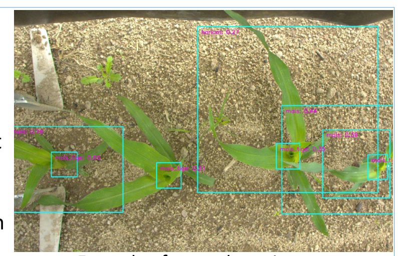

Precision: 0.9
Recall: 0.6

Previously, the weeding system was running on a Nvidia Jetson Xavier, providing with reference accuracy results

Satisfactory accuracy for plant detection:

- Similar or better accuracy in the simulation compare to current
- High precision and correct recall

➡ Expected to have efficient weeding without crops destruction



Example of crops detections

## Impact

Reducing the cost of the weeding system

Reducing power consumption and internet dependency for smart agriculture sensors

## Progress beyond SoA

Experimented with separated encoder-decoder architectures for creating multi-task networks

## Lessons learned

Pre-trained encoders have mediocre performance on images containing crops

New architecture was proposed to allow partial retraining of the last layers of the network backbone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AI for New Devices And Technologies at the Edge

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