



# Drone-Based AI System for Automated Sheep Counting Using Detection and Tracking Models

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# Counting sheep is not easy

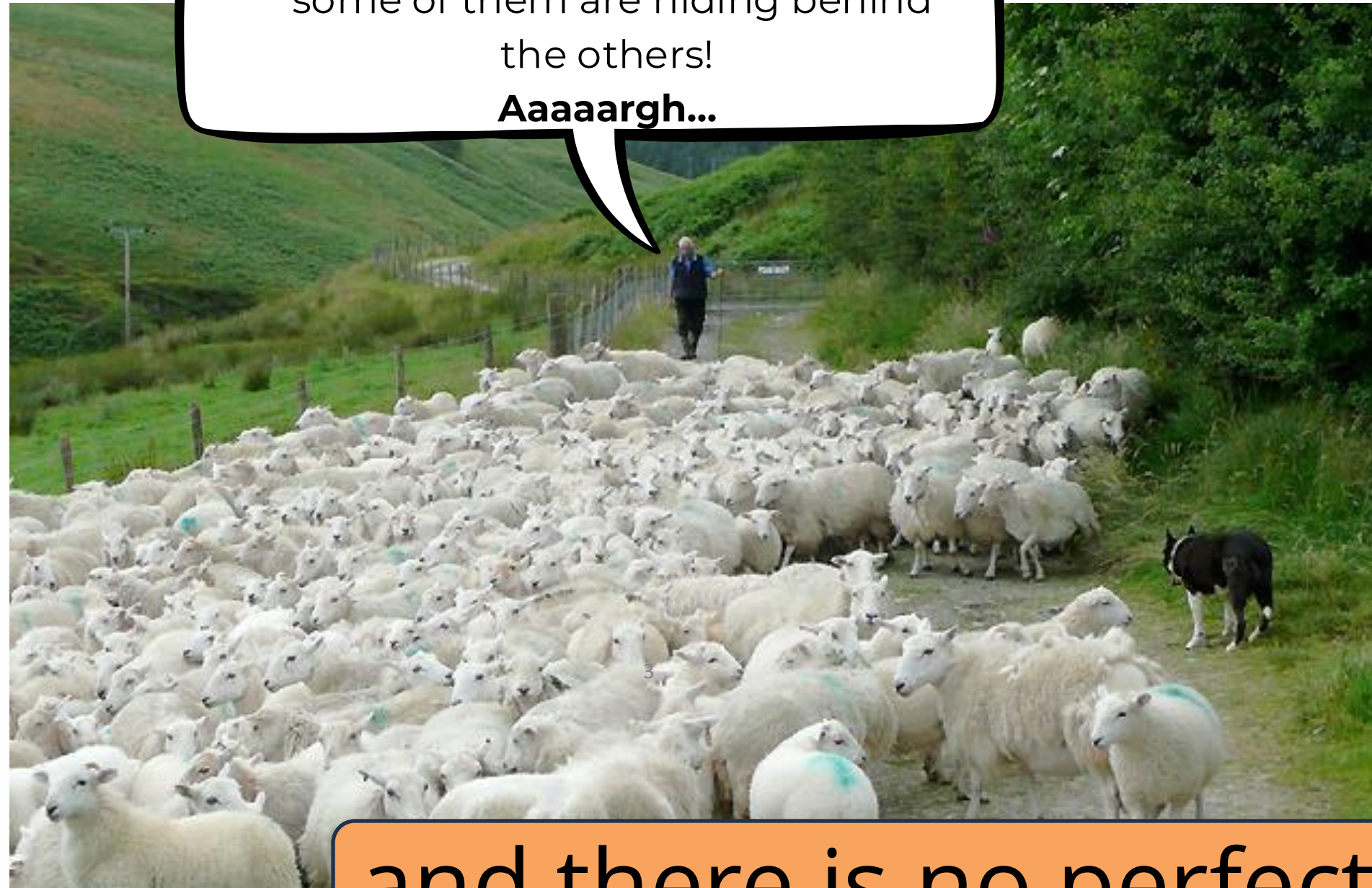
Alright, is everyone  
here ?



[wikipedia](#)

# Counting sheep is not easy

66 ? no wait 67! Oh no  
some of them are hiding behind  
the others!  
**Aaaaargh...**

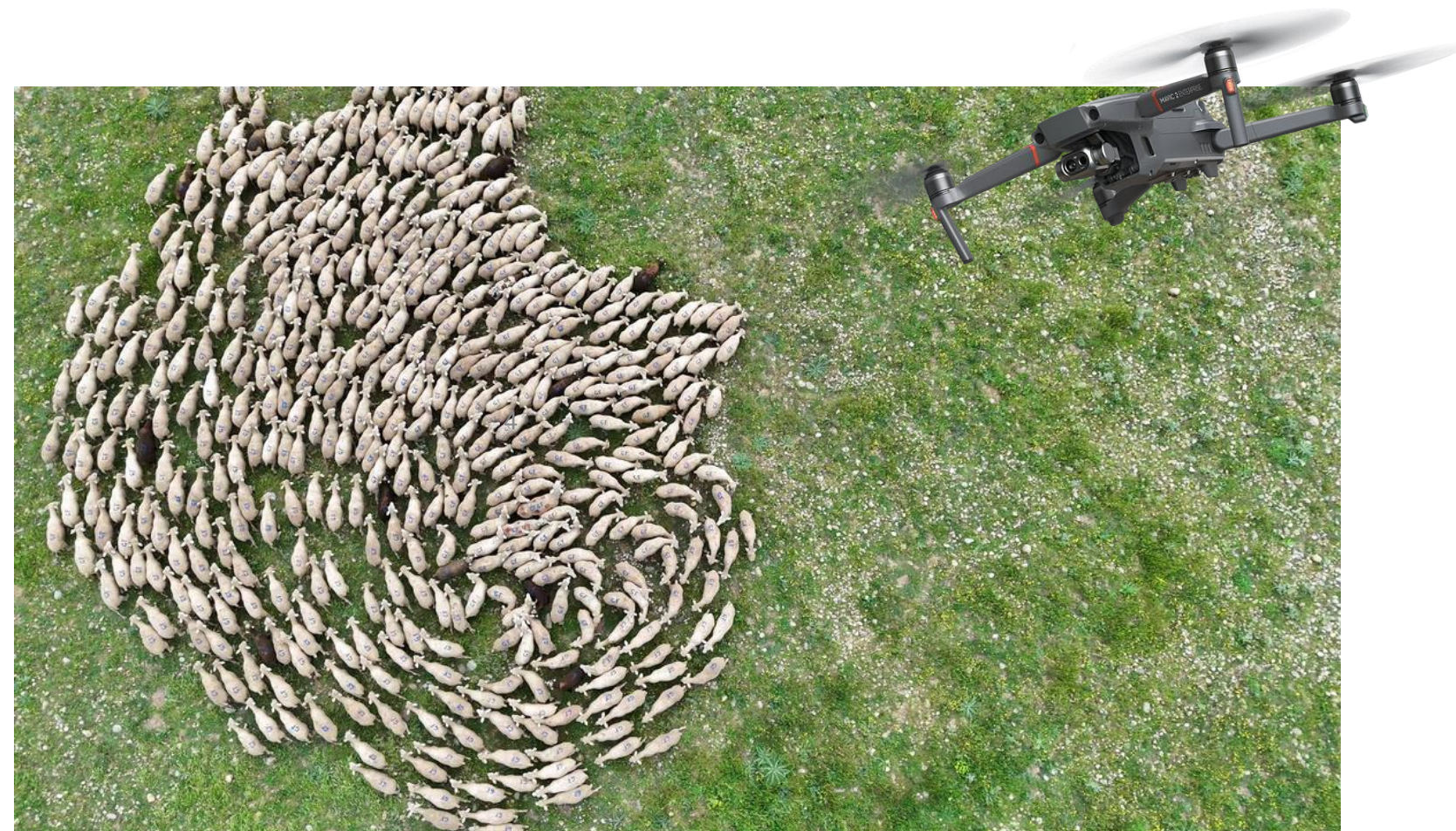


[wikipedia](#)

and there is no perfect method

# Combining drone image and computer vision

- Use the bird's-eye view to get a better look at the flock of sheep
- Develop a computer vision for counting sheep



# Choosing a drone filming protocol



## Initial protocol :

UAV cartography of an area of grassing sheep

## Challenges:

- Extensive areas
- Trees
- Proximity of animals
- Same shape and color

**Not suitable for a part of livestock systems**

# Establish a usage framework to enhance the robustness of AI-based counting



- **Low altitude (5-10m)** to be closer to existing data set (human point of view)
- **Top-down or 45-degree oblique camera angle** relative to the counting line to reduce occlusion
- **Key friendly area and key strategic counting :** counting at the gate when the animals are coming back
  - Close to a farmer decision « Do I need to go look for animals in my rangelands tonight ? »

**Switching from a dynamic drone mapping a wide area to a static drone filming animals passing underneath.**

# Pipeline

**Sheep images capture by  
drone**



**Sheep detection by computer vision  
algorithm**



**Tracking and counting  
on a video**



# Pipeline

**Sheep images capture by  
drone**



**DJI Mavic 3 E**

**Sheep detection by computer vision  
algorithm**



**Tracking and counting**



**Byte track algorithm**

# Sheep dataset by UAV capture

10 published datasets with 3803 images and 189 videos

Diversity of animals, grounds, environments, ...

809 annotated images for detection (YOLO format)

14 annotated videos - tracking mode (MOT format)



# Sheep detection model training



## **Roboflow universe (Aerial Sheep and Sheep Gen4)**

Annotated sheep datasets : 14 365 annotations

Only white sheeps

Lack of environmental diversity

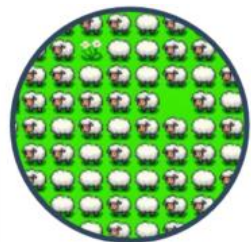


## **1st ICAERUS dataset**

Images and video of sheep from UAV flies

4 433 annotations

Diversity of sheep color, environment



## **Last ICAERUS dataset**

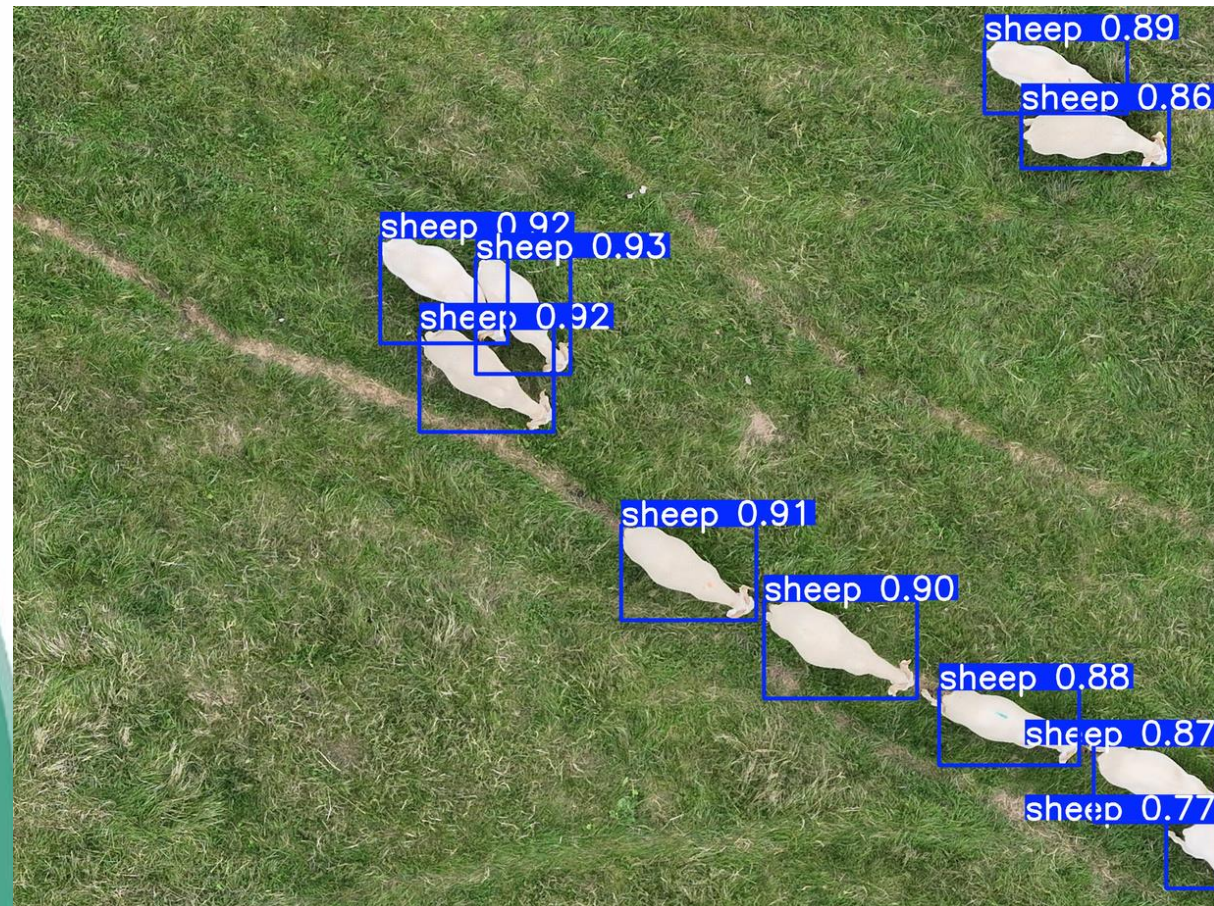
Images and video of sheep from UAV flies

18 018 annotations

Diversity of sheep color, environment

**+ Roboflow Universe dataset**

# Detection models

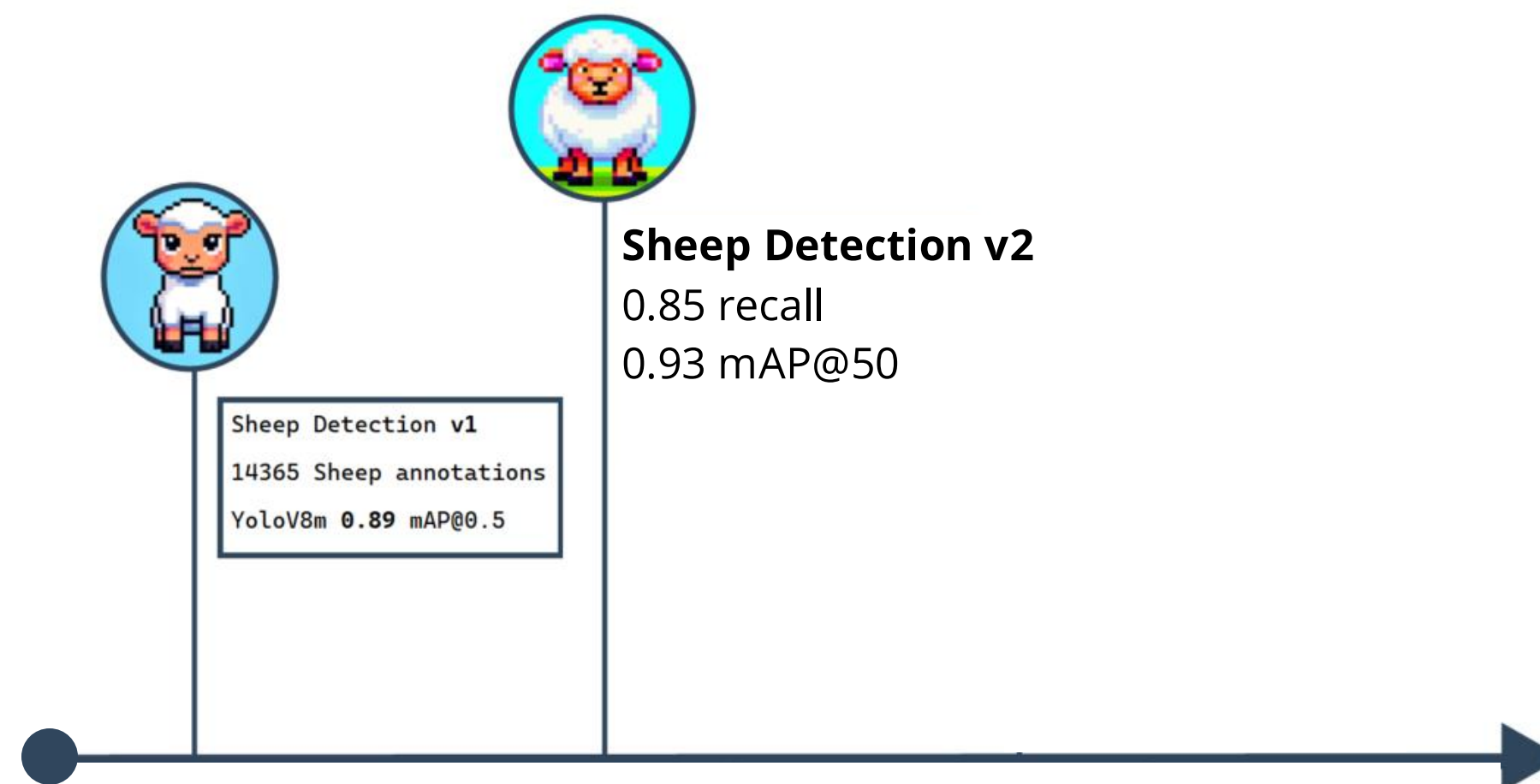
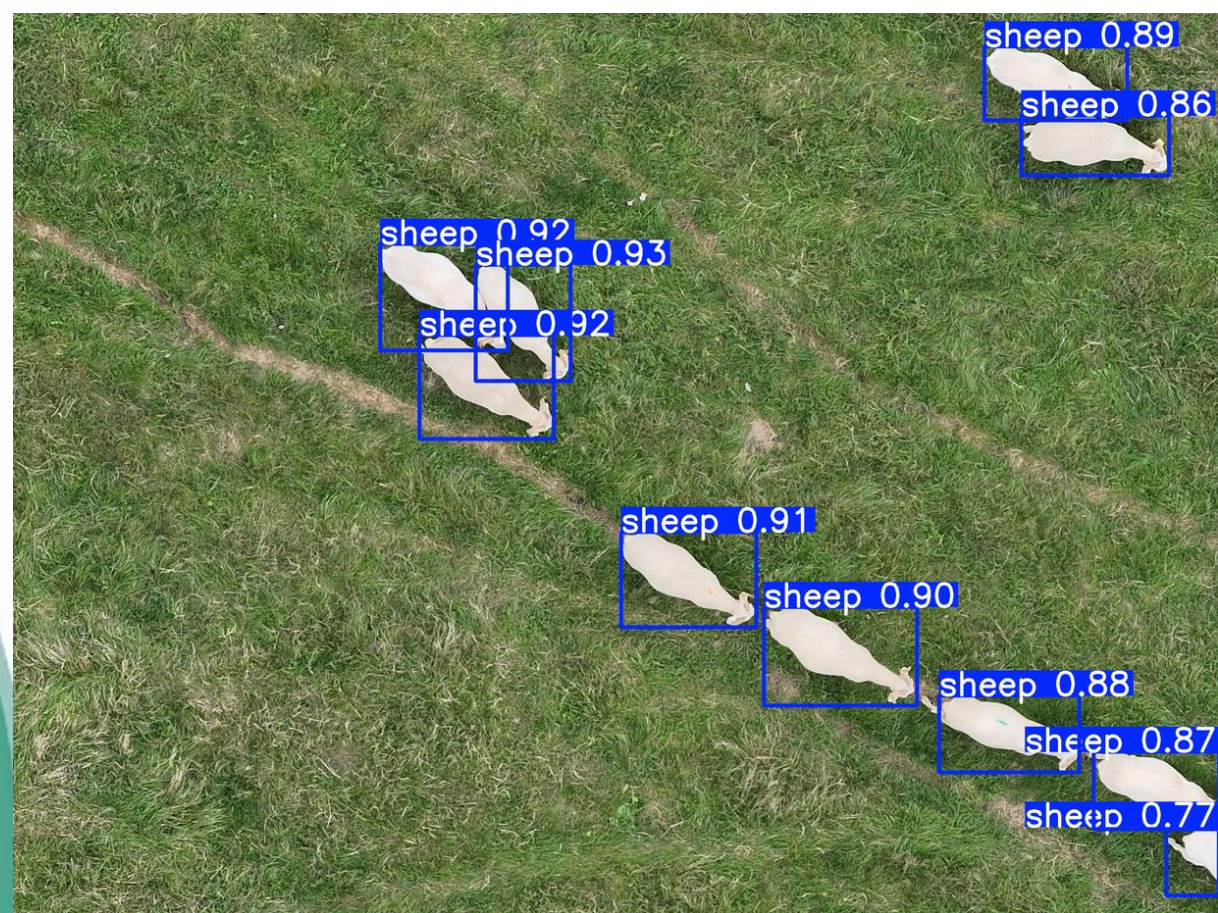


## Sheep Detection v1

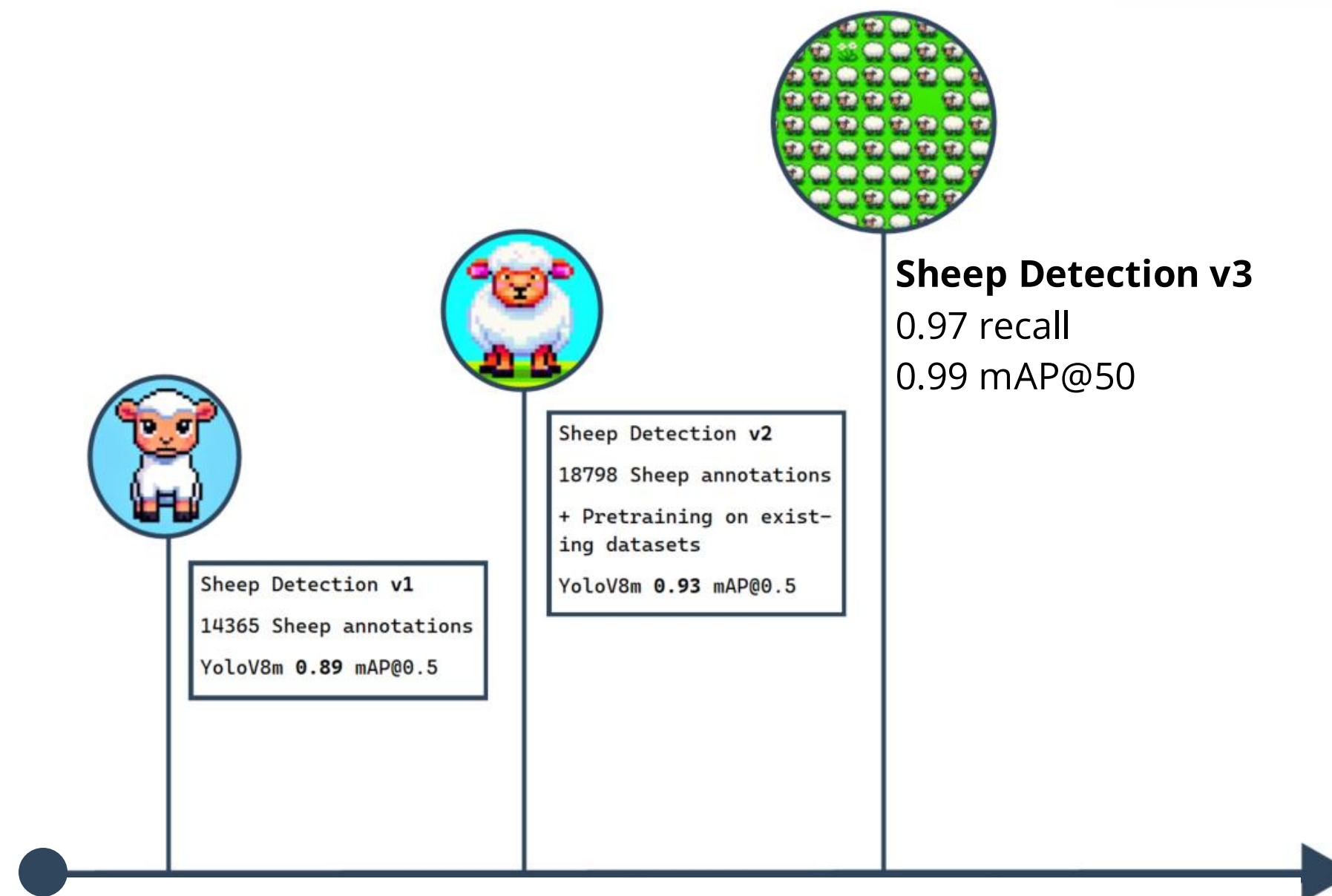
0.83 recall

0.89 mAP@50

# Detection models



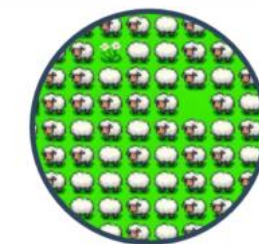
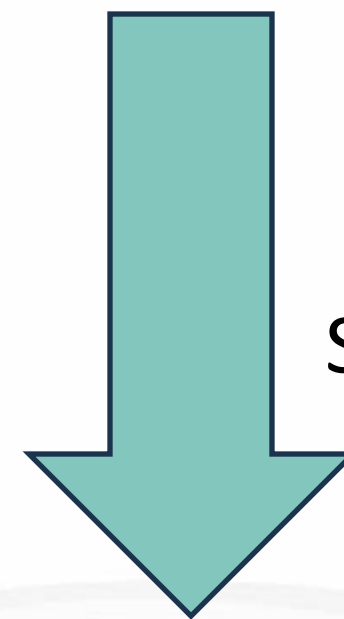
# Detection models



# Sheep detection model testing



Test of detection, tracking and counting on 3 annotated videos of sheep flock passing through a gate



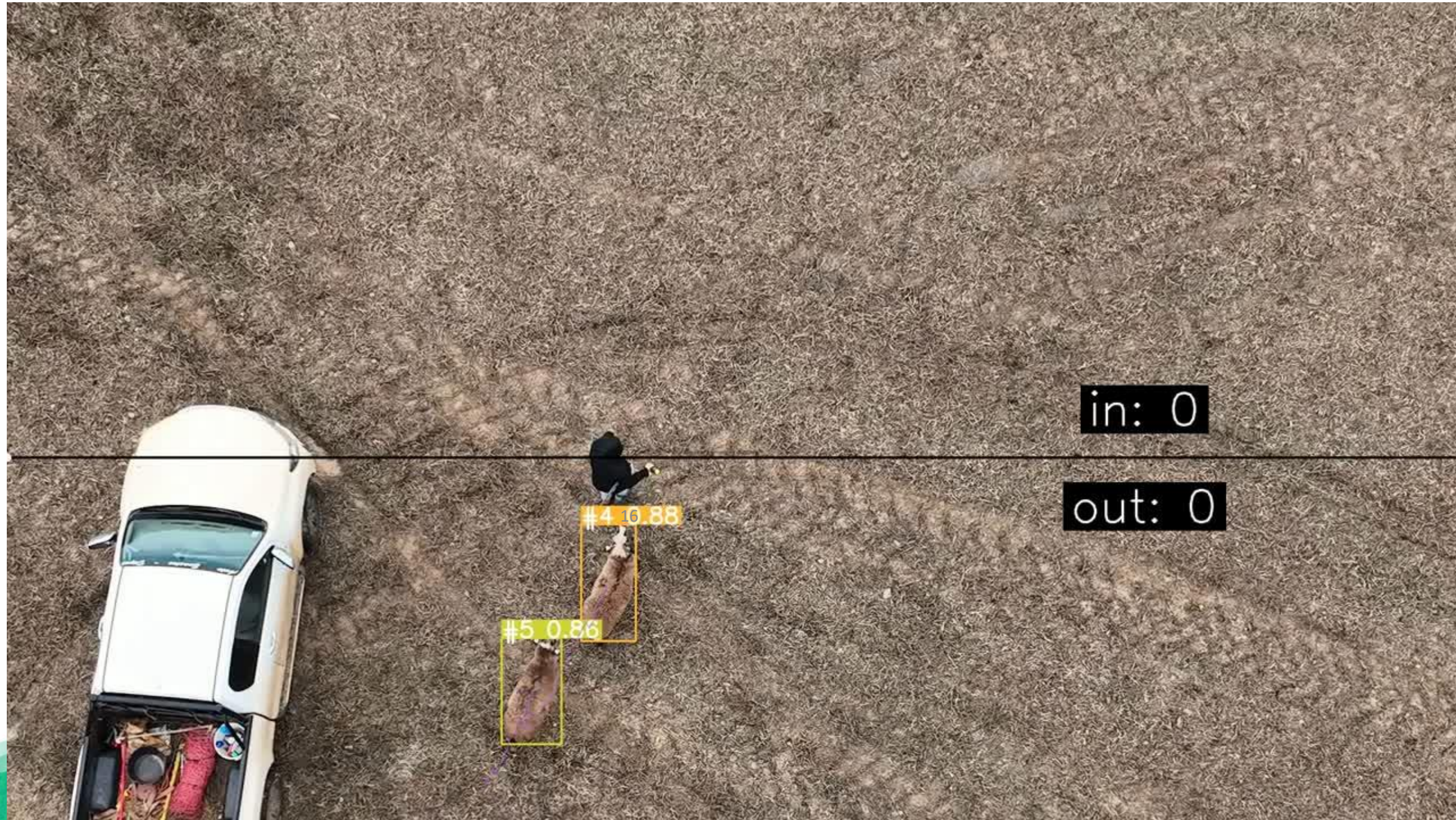
Sheep Detection V3

**Evaluation on gate part**

# Results with sheep detection v3



# Results on tracking and counting



# Sheep counter analysis



On 4 test video:

**Over 99% correct counting**

Miscounting : undetecting colored sheep and detecting dogs

detecting dogs → can be managed, number of dogs known

undetecting colored sheep → more work in progress

# Drone Data Analytics Library (DDAL)

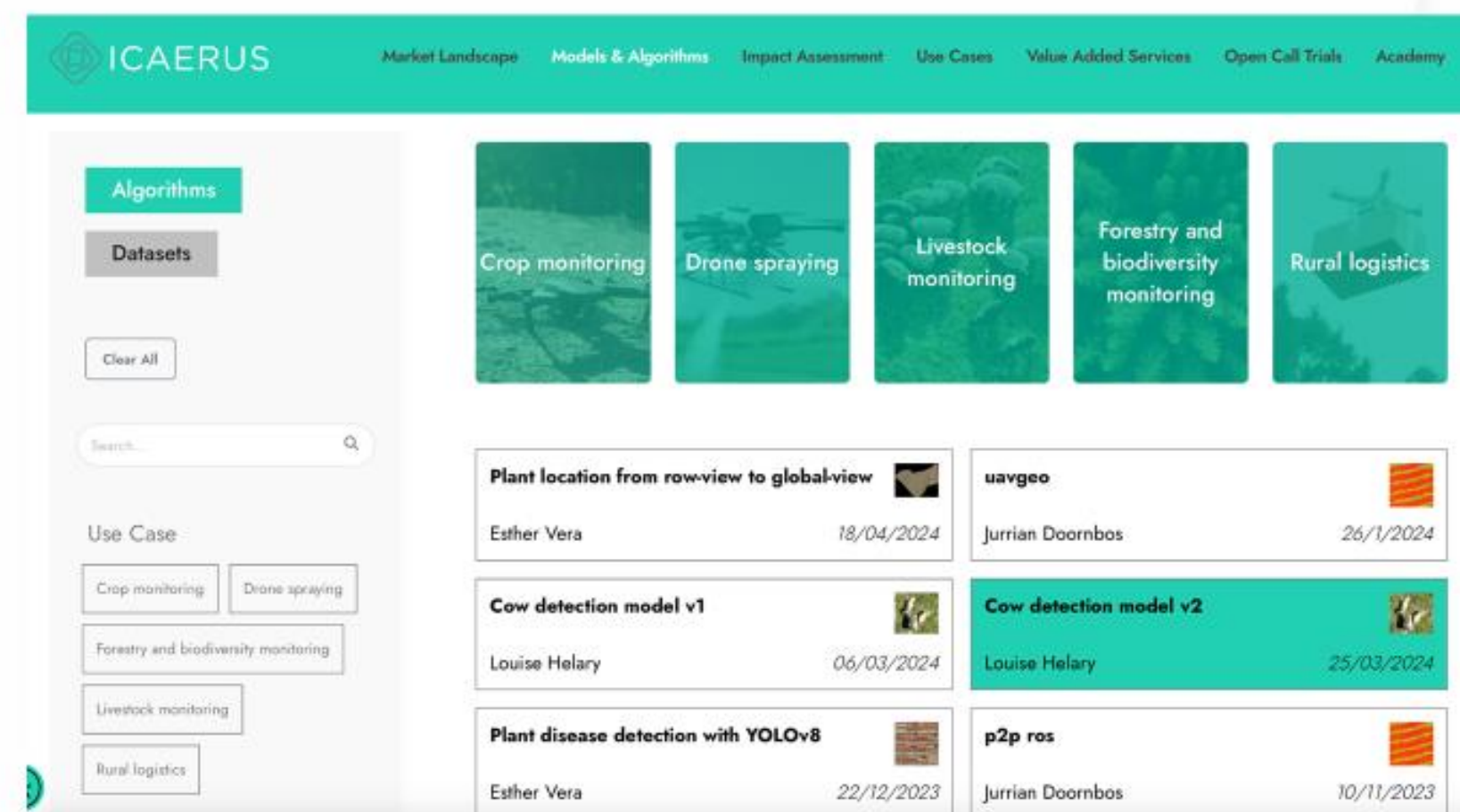
## Models, Algorithms and Datasets

- Integration with GitHub and Zenodo
- Drone-based AI and analytics models
- Open datasets
- Associated Use Cases
- Download links and metadata



## Filtering Capabilities

- UAV/flight parameters
- Sensor parameters
- Environmental variables
- Photogrammetric parameters



# Conclusion

- The shift **from static animal counting to dynamic** analysis opens up new possibilities for more reliable counting through **animal tracking**.
- The proposed protocol appears **promising** for counting sheep in various extensive grazing systems.
- Open-source datasets are **essential** for developing reproducible and robust animal detection models under real-world farming conditions.

# To go further

**Sheep counter = TRL6**

*(Technology demonstrated in relevant environment)*



# To go further

We invite anyone interested to take over this project and bring it beyond the proof-of-concept phase toward a fully accessible solution.



# ICAERUS

Innovations and Capacity building in Agricultural Environmental and Rural UAV Services

## Thanks for your attention !

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