Counting Sheep with Drones: A Feasible AI Solution for Outdoor-Based Farming

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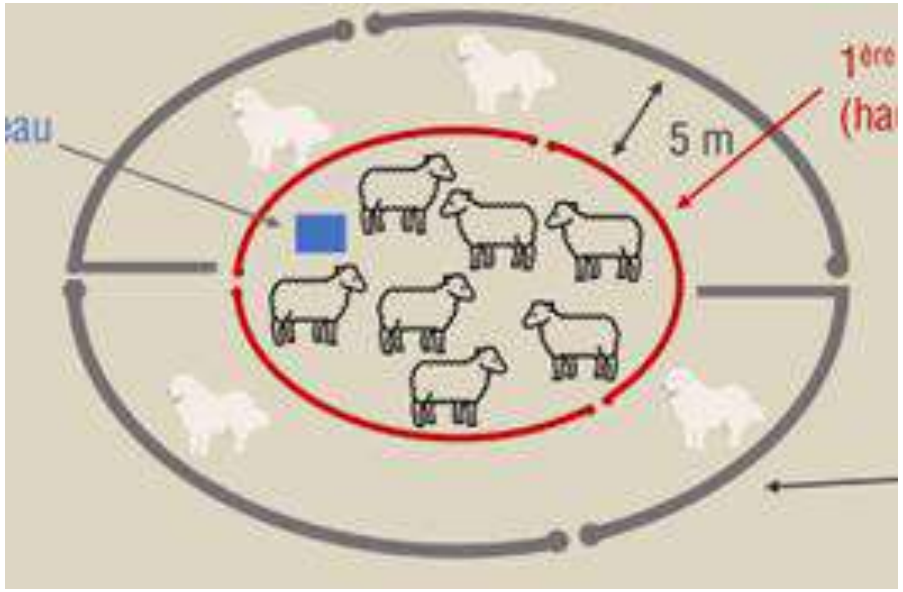
Exploitation Agricole Carmejane
La réussite au cœur des Alpes du Sud

Pastoral sheep farmer have very few efficient tools to count their flock

Manual or RFID counting need a constraint system



Night enclosures to protect the flock from predators are now the norm in France

Have I gathered my entire flock, or have some been left behind, vulnerable to predators for the night?

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Lets use drone and computer vision to count them

Use of YOLOv8 without any fine-tuning

The image databases mainly consists of human point-of-view images.

A piece of carrot cake ?

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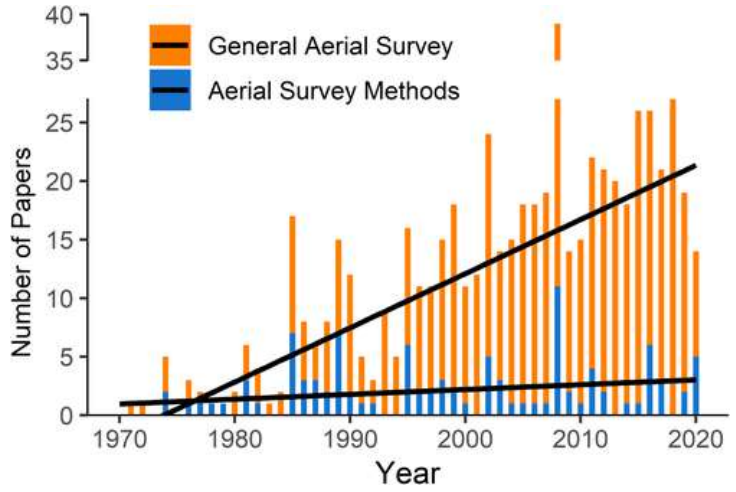
The challenge of aerial computer vision AI ?



Errors in aerial survey count data: Identifying pitfalls and solutions

Kayla L. Davis, Emily D. Silverman, Allison L. Sussman, R. Randy Wilson, Elise F. Zipkin

First published: 18 March 2022 | https://doi.org/10.1002/ece3.8733 | Citations: 11

vegetation-induced occlusion

Moving animals in large areas to survey

An old challenge in Ecology

Same challenges but higher accuracy expectations in sheep farming

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Objectives

- Establish a usage framework to enhance the robustness of AI-based counting
- Develop a computer vision for counting sheep

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 fo 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

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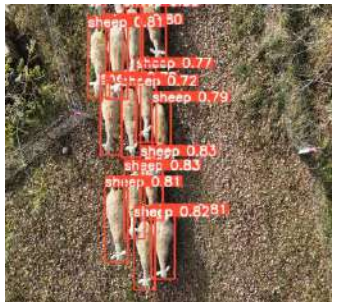
Pipeline

Sheep images capture by drone

Sheep detection by computer vision algorithm



Tracking and counting on a video

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Pipeline

Sheep images capture by drone

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Sheep detection by computer vision algorithm

Tracking and counting

Byte track algorithm

Detection model training: difficulty in finding relevant data

Roboflow universe
- Annotated sheep datasets
- Only white sheeps
- Lack of environmental diversity

ICAERUS 1st dataset (available on Zenodo)
- Images and video of sheep from UAV flies
  - Used Annotated images: 974
  - Annotated videos: 4 (less than 30 sec, 9 frames/sec)

Our dataset:
4814 annotated images from Roboflow Universe
4 videos from ICAERUS dataset (639 images)

Results


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Results

Detection model performance:

mAP:	0.89
Precision:	0.89
Recall:	0.79

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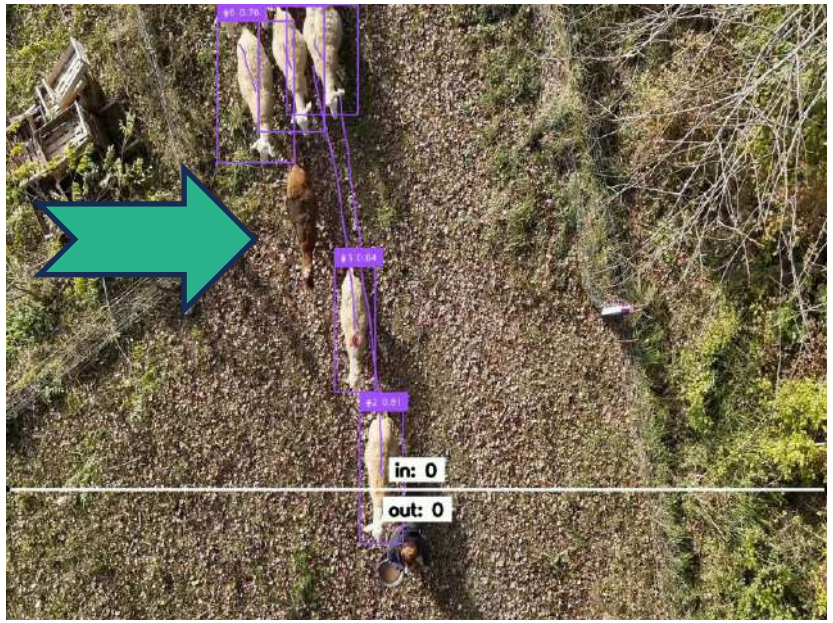
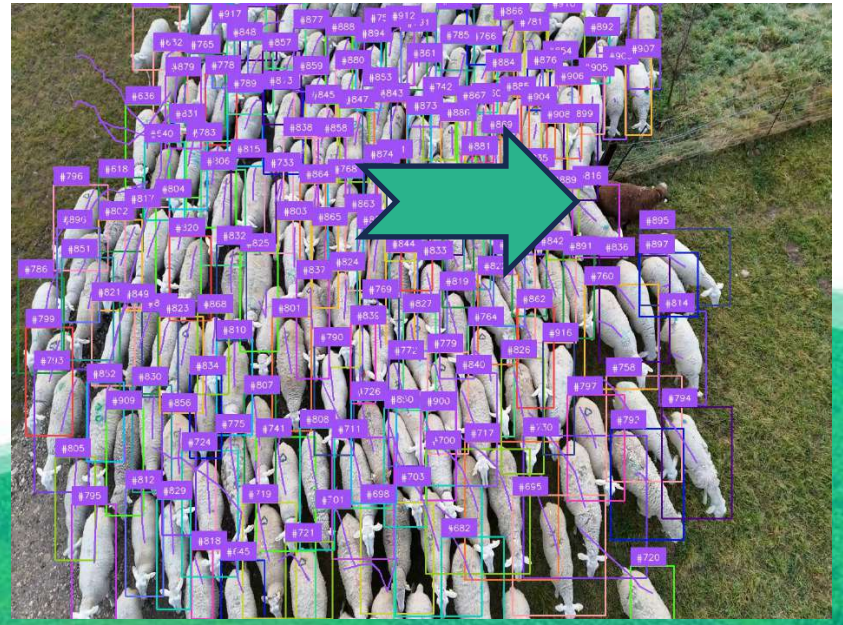
Results

- **Tracking failure in scenarios where animals are densely clustered.**
  - Other tracking algorithms to test
- **Counting performance:**
  - 8% of false negatives ==> specially for dark colored sheep





Perspectives

- **Small ruminant model (sheep and goats) to improve detection of colored sheep**
- Targeted data collection and annotation

Most of the progress are expected from the detection stage. Full of variance training dataset (animals and background colors) are the key for robust detector !

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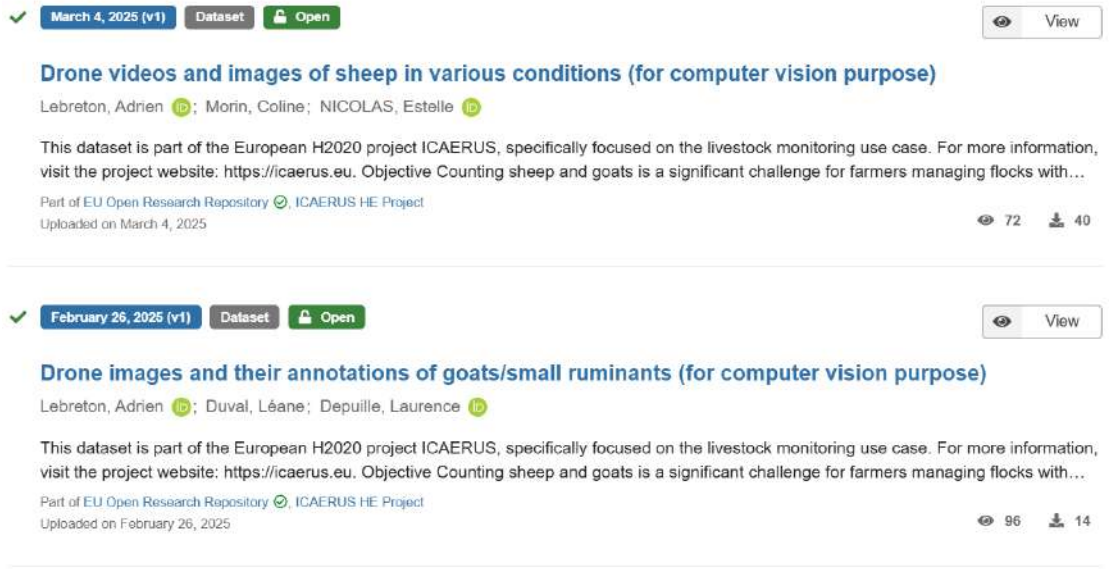
Key take-aways

- **AI Computer vision can significantly benefit even the most extensive livestock systems if designed pragmatically**

- **Delivering robust AI solutions requires:**
  - A clearly defined and operational usage framework (which can be constrained if needed)
    - Maximized representation of variance of what can be found in the usage scenarios in the training dataset
      - Synergies and data sharing is the key to collect data variance

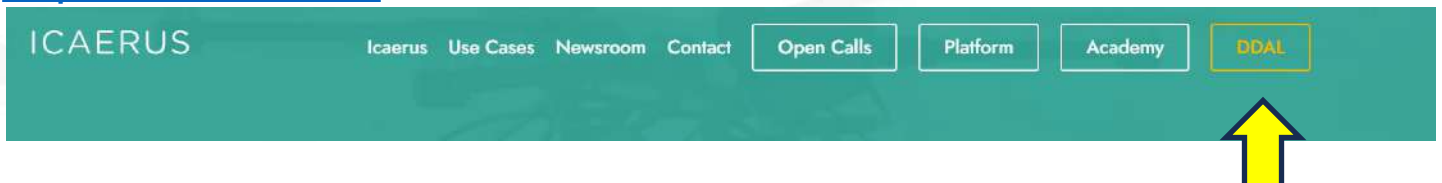
A call for data sharing !



Many data already available with and without annotations

Synergies needed to develop and annotate these datasets

https://icaerus.eu/



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Innovations and Capacity building in Agricultural Environmental and Rural UAV Services

Thanks for your attention !

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Reach me on Linkedin