



Computer-vision based analysis of turkey locomotion

Zhuoshi Wang, S. Huo, H.P. Doekes, P. Langenhuizen, B. Visser,
P.H.N. de With and P. Bijma



Background: measurement of locomotion

Why:



Health
Monitoring



Animal
Welfare



Resource
Management



Behavioral
Analysis

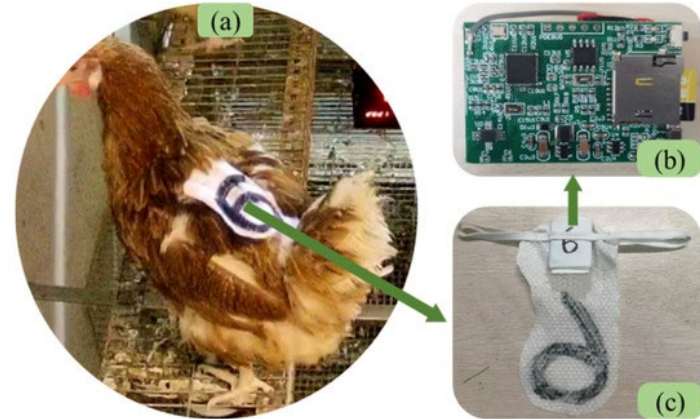


Genetic
Improvement

How:

Human records,
Body-worn sensors

Computer vision?



Background: What does computer vision do?

Computer vision enables machines to interpret and make decisions based on visual data.

Object Detection & Tracking

AI-based: Bounding box/Mask



Marker-based: ArUco markers



Background: Animal tracking in farms

Challenges:

1. Tracking in a large pen
2. Maintain animal identity

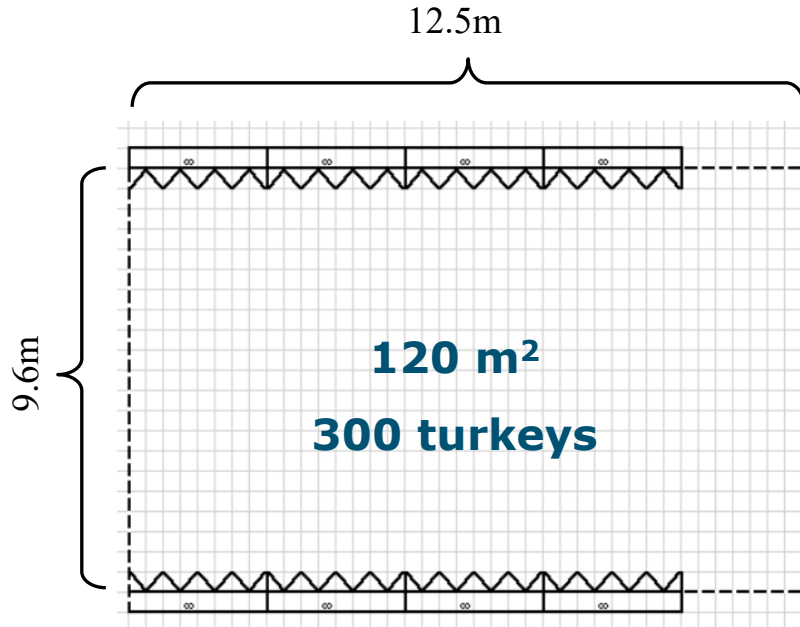
Aim of the study

- 1. Develop a computer vision-based system to track animals (turkeys) in large pens, and derive locomotion parameters from the tracks.**
- 2. Compare AI-based and marker-based tracking algorithm**

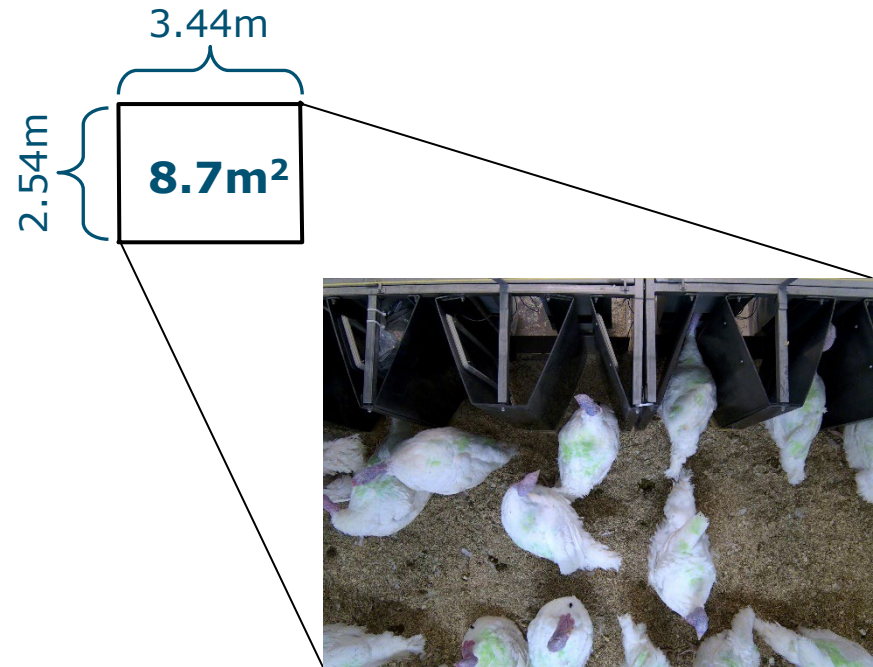
Challenge 1: Tracking in a large pen

Pen & camera setup

The pen



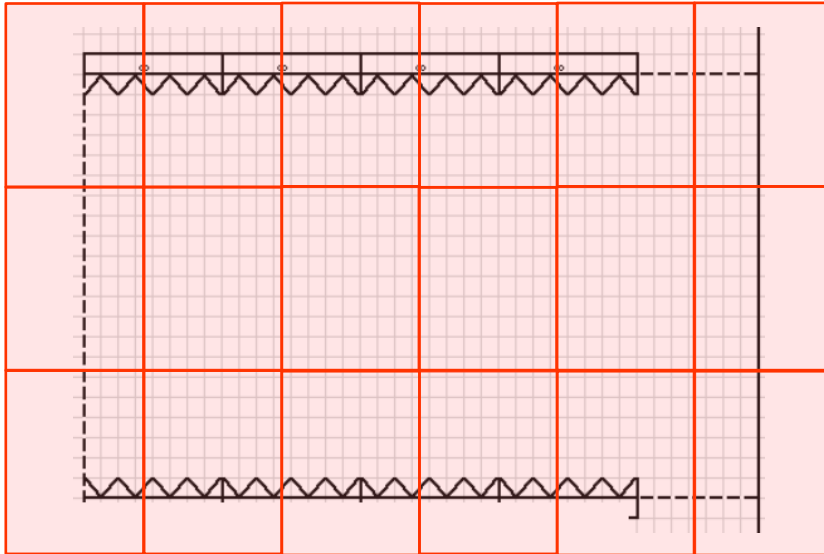
The camera's field of view



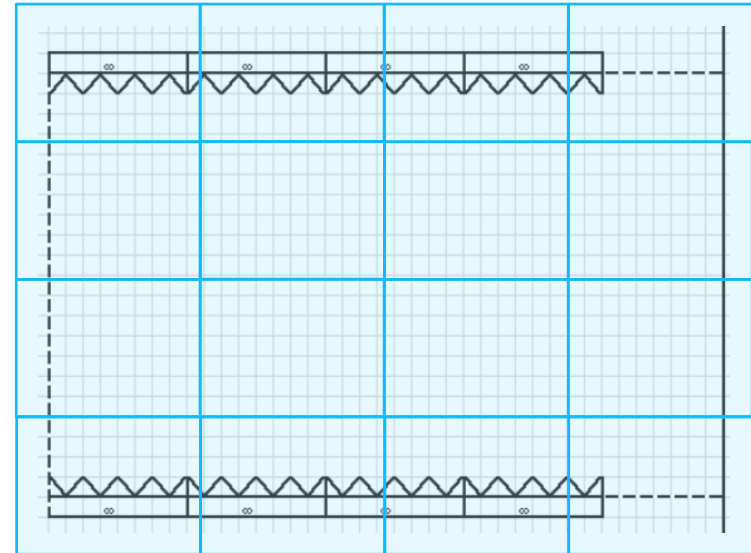
Challenge 1 — scale of the farm

34 Cameras, 2x coverage

Vertical setup: 18 cameras

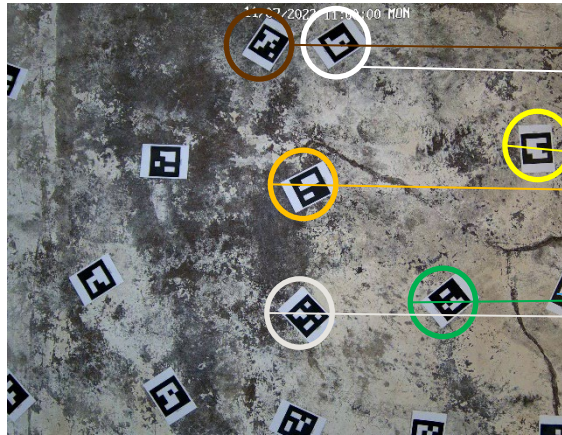


Horizontal setup: 16 cameras

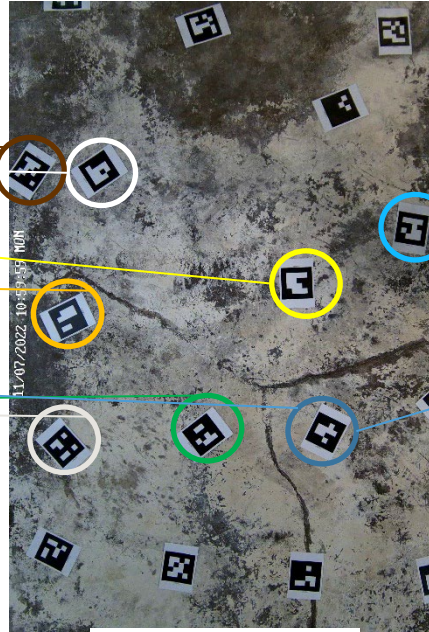


Challenge 1 — scale of the farm

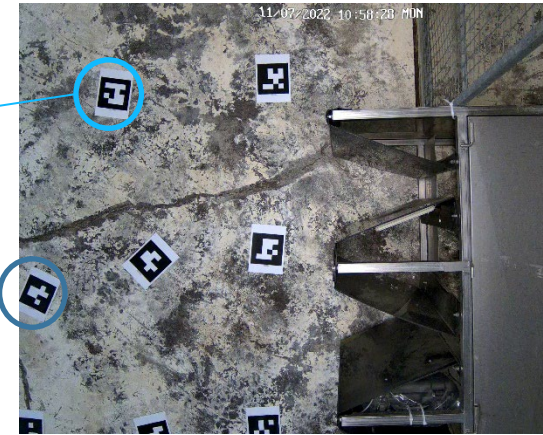
Field of view (FOV) alignment with ArUco markers



Horizontal FOV1

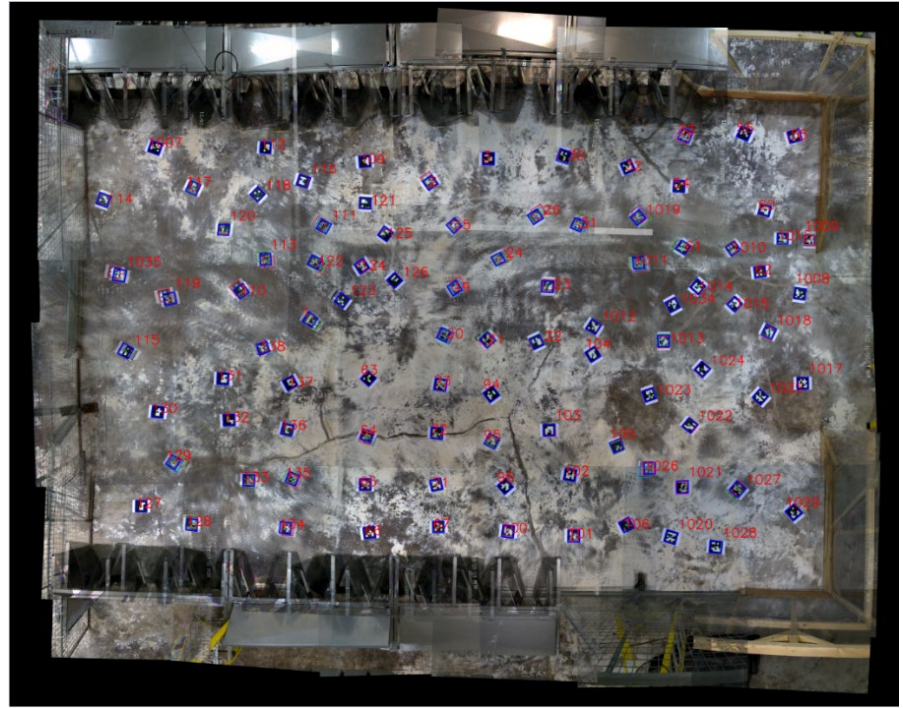
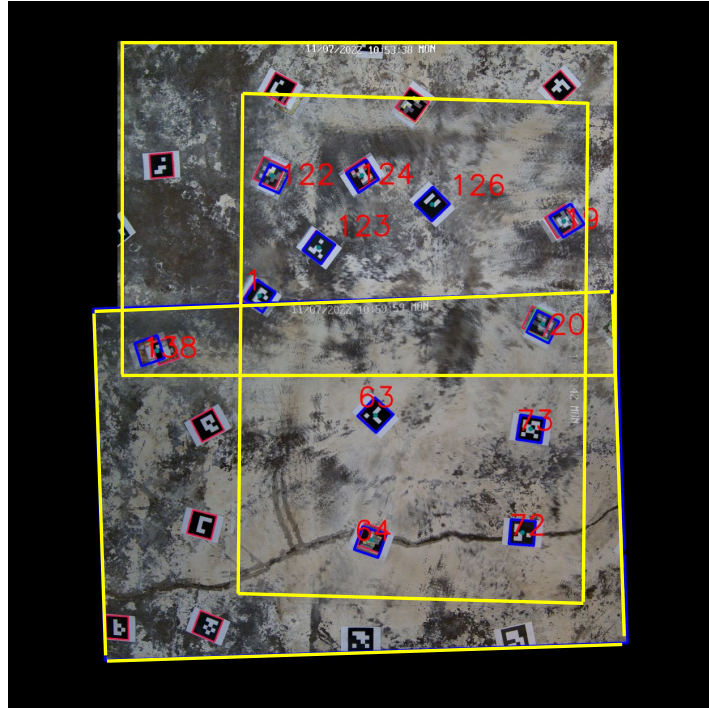


Vertical FOV



Horizontal FOV2

Challenge 1 — scale of the farm



Challenge 1 — scale of the farm

AI-based tracking method:

1. YoloV7 segmentation model
2. tracking based on overlapping ratio

Marker-based tracking method:

Continuous detection of the ArUco marker



Challenge 2: Maintain animal identity

Comparing two approaches

Animal tracking by AI model

Need human **annotation**
for model training and validation

No back packs

Re-identification by overlap

Animal tracking by ArUco Markers

Do **not** require **annotation**

Back packs may **influence the behavior** or fall off

Re-identification by markers

Results: Qualitative

Animal tracking by AI model



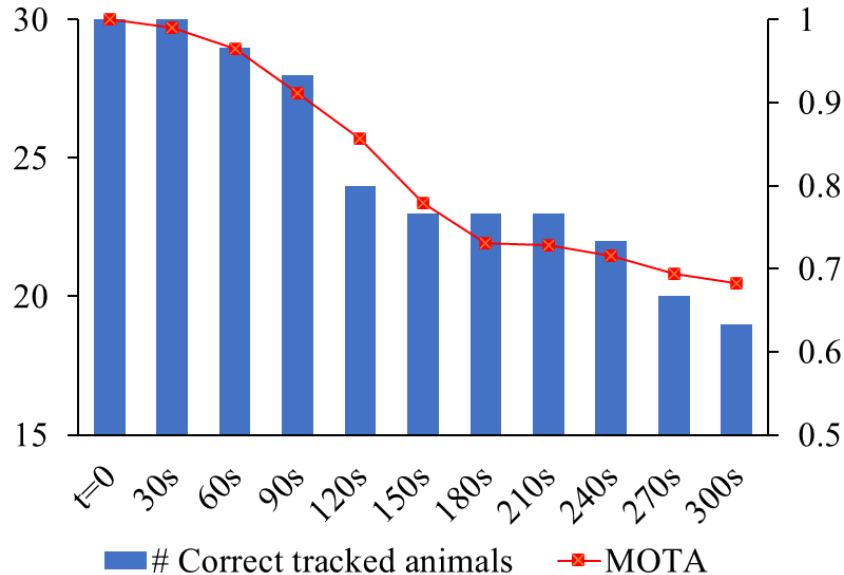
Animal tracking by ArUco Markers



Results: Quality of Tracking

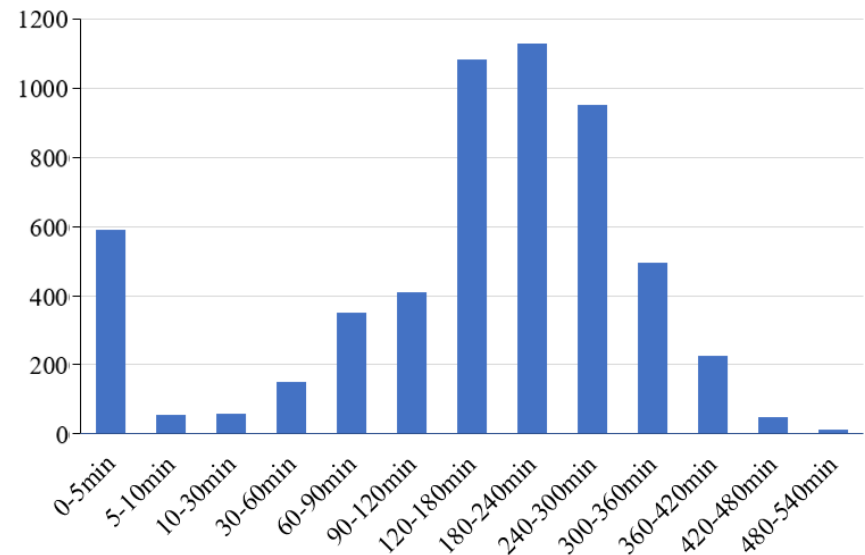
Animal tracking by AI model

(n=30)

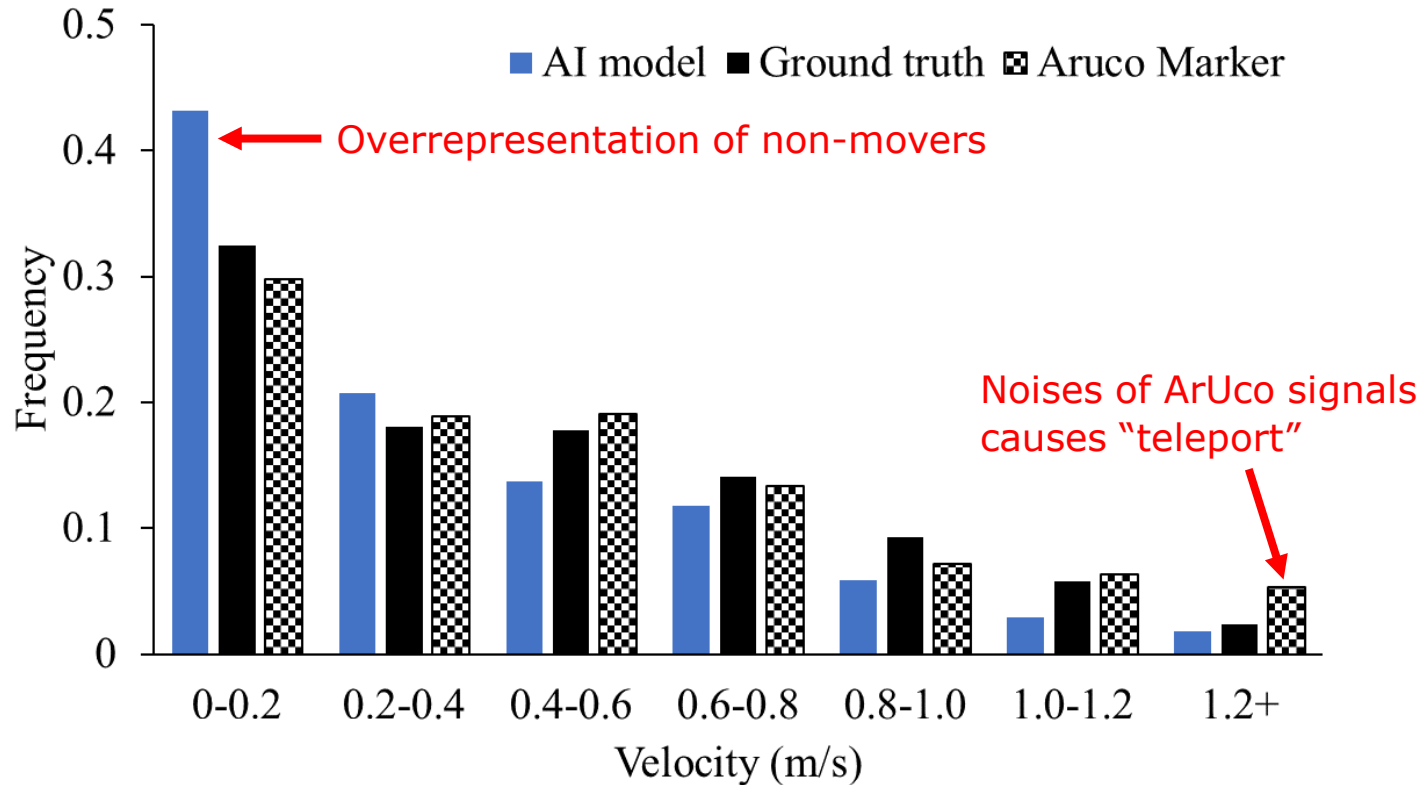


Animal tracking by ArUco Markers

(n=300)



Results: Velocity of animal



Conclusion

- We developed AI-based and marker-based multi-camera tracking algorithms for locomotion monitoring.
- AI-Based tracking:
 - effectively track turkeys over short time periods
 - challenges with identification, occlusion etc.
- Marker-Based tracking :
 - higher accuracy for long-term locomotion monitoring.
 - the markers have impact on animals' behavior

**Thank you
for your attention!**