Zero-shot computer vision analysis of social behaviour in group-housed sows

Nusret Ipek – AI4AS 2026

Automated welfare assessment and evaluation of Pig Appeasing Pheromone (PAP) in group-housed sows

Regrouping unfamiliar sows can trigger aggression and stress

Aggression | Stress | Displacement

Pig Appeasing Pheromone (PAP) evaluated as a mitigation strategy

LONGITUDINAL MONITORING

DAYS → WEEKS → MONTHS

SOCIAL TENSION TREND

SCALABLE STORAGE & ANALYTICS

MULTI-CAMERA SYNCHRONIZATION → ZERO-SHOT SELF-SUPERVISED TRACKING → INSTANCE SEGMENTATION & RE-IDENTIFICATION → BEHAVIOUR DETECTION & WELFARE METRICS

96.63% TRACKING ACCURACY

90.7% COMPUTATIONAL REDUCTION

AUTOMATED DETECTION OF FIGHTING, FLEEING, AND DISPLACEMENT

GHENT UNIVERSITY | BIOVISM | KERMIT | ILVO Flanders Research Institute for Agriculture, Fisheries and Food

Background

Welfare Challenge

Gestating sows are regrouped after insemination → Mixing unfamiliar animals triggers social instability → Aggression leads to **stress**, **skin lesions**, and **welfare loss**

Pheromone-based Mitigation

Pig Appeasing Pheromone (PAP), synthetic analogue at 2% (SecurePig®; IRSEA Group)**,** mimics maternal chemical signals. Previous studies suggest reduced aggression and stress, mostly in smaller or less continuously monitored settings[1].

Research Gap

1. Limited evidence in larger sow groups.
2. No continuous longitudinal observations at scale.

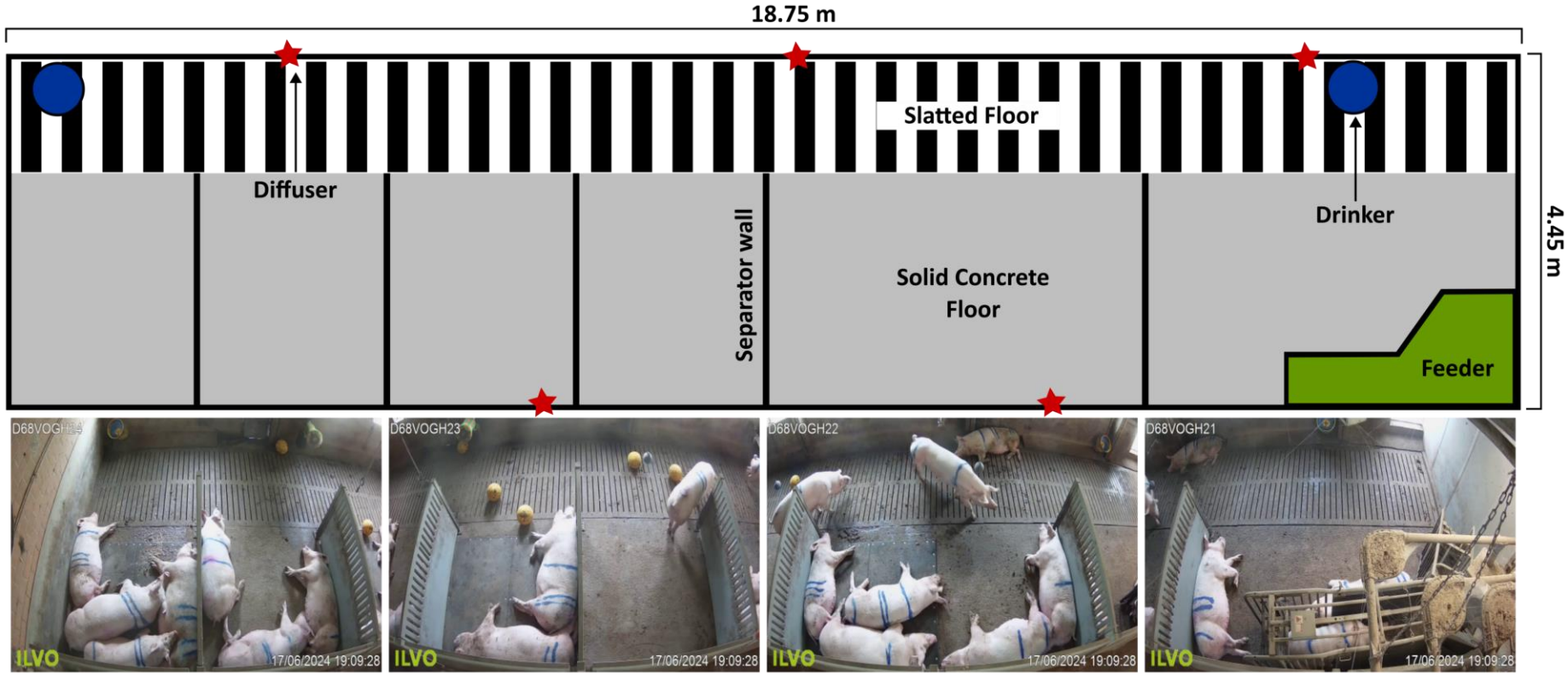
[1]Greenwood et al., 2016; Plush et al., 2016; Chasles et al., 2024

Experimental Design

8 groups (4 in treatment and 4 in control) of **16 to 20 gestating sows** were group-housed and monitored for **17 days**. Data were collected at ILVO to evaluate whether **Pig Appeasing Pheromone (PAP)** reduces **aggression, skin injuries**, **activity**, and stress after mixing.

D0 **D0–D2** **D2–D7** **D7** **D7–D9** **D9–D17**

Grouping → Early unrest → Hierarchy stabilisation → **Diffuser removal** → Immediate post-removal → Follow-up



Pairwise Interactions: Fighting - Fleeing – Displacement

Fighting

Sows engage in body contact while positioned in an **antiparallel stance, frequently circling one another**. May also involve behaviours such as biting and knocking.

Fleeing

A **sustained escape movement** by a receiving sow after approach or orientation by another sow.

Displacement

Resting sow **vacates a location after intervention**, which is then **occupied by the initiator**.

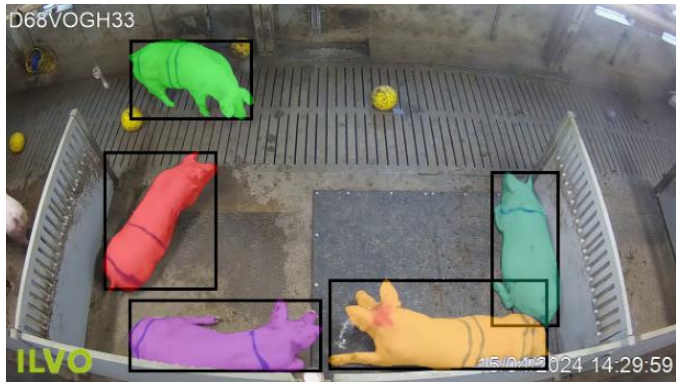
Self-supervised Zero-shot Learning Pipeline

Instead of relying on labelled data, novel models can **learn general visual representations** from large volumes of unannotated imagery, **reducing human labour**.

Self-Distillation with No Labels (DINO)

U-Net

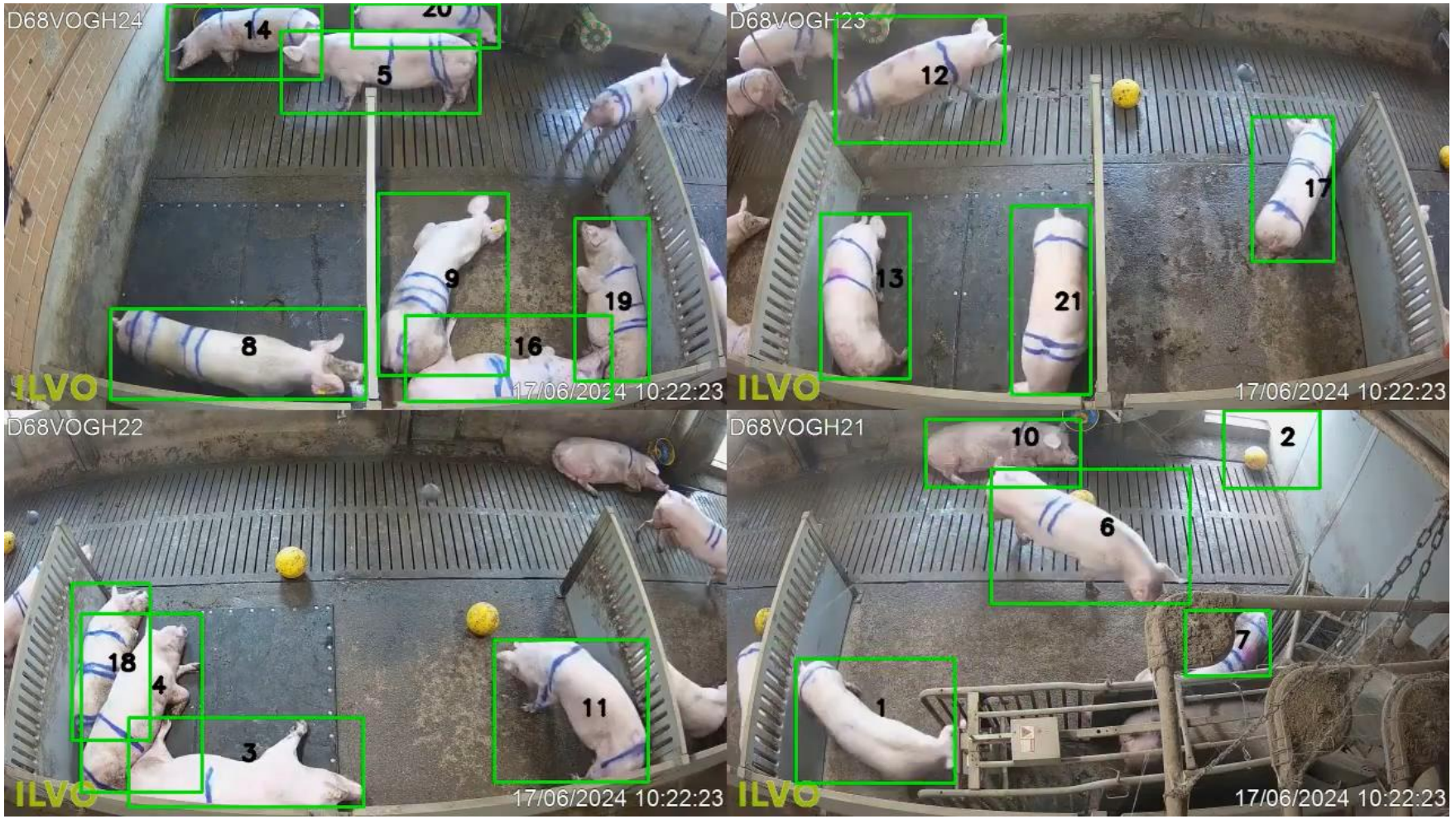
Segment Anything Model v2 (SAMv2)



Multiple camera tracking

Tracking animals across **four sections** is challenging due to **overlapping views, lens distortions** and **occlusions**.

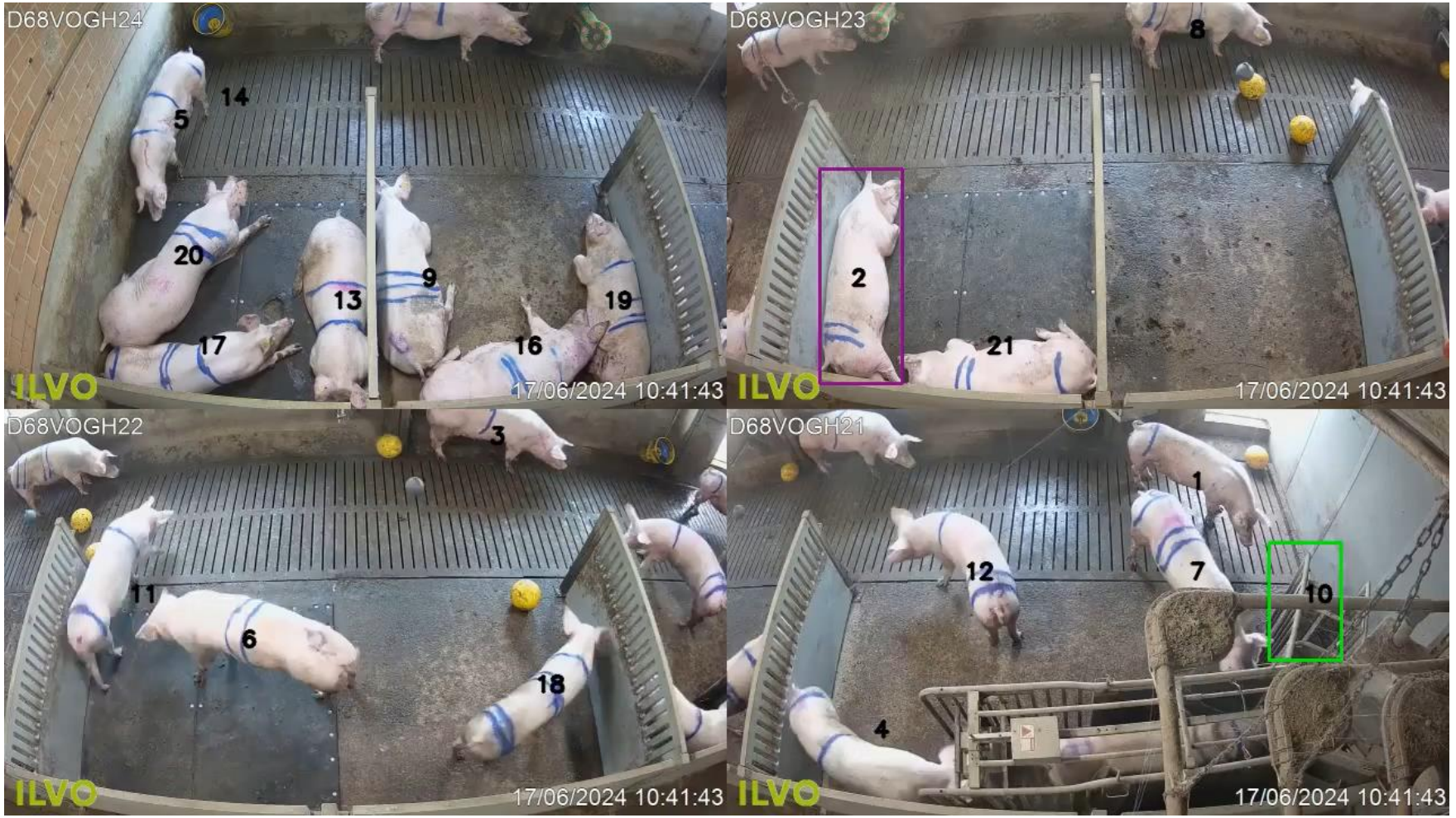
- **Tracking precision 96.63%** after validation.



Pairwise Interactions: Fighting

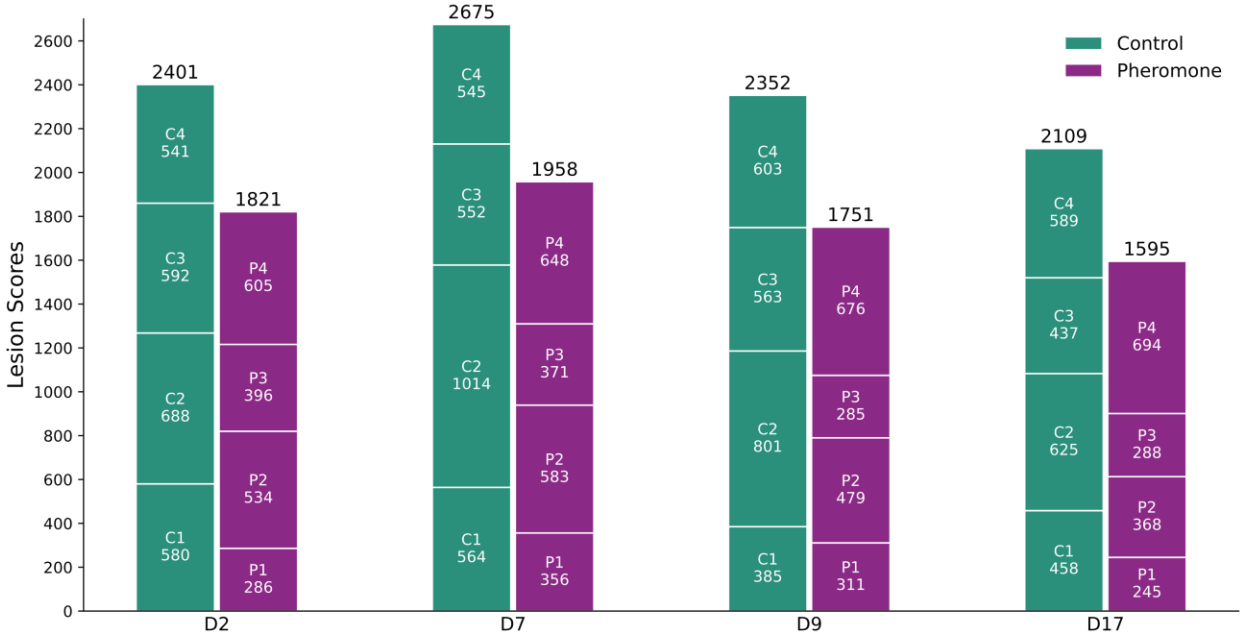
Pairwise Interactions: Fleeing

Pairwise Interactions: Displacement



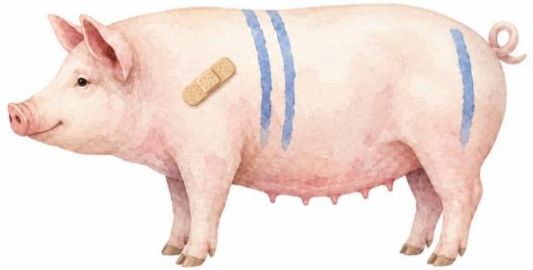
Results: Skin Injuries

Does PAP treatment reduce skin injuries compared to controls over time?



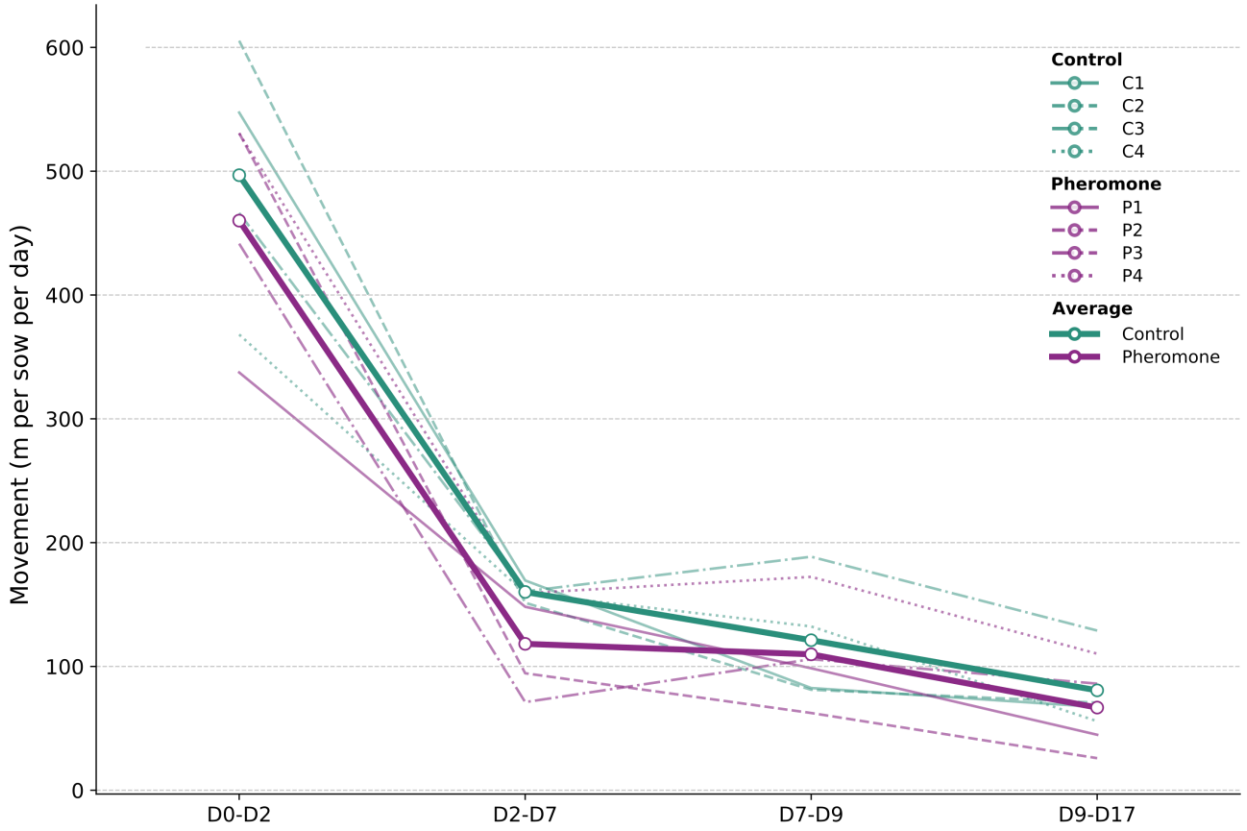
Skin lesions scored using the **Welfare Quality® Assessment** protocol for pigs.

- Across **D0–D17**, sows in the **pheromone group accumulated fewer skin lesions** than sows in the control group, with a **significant overall treatment effect (p = 0.046).**
- Lesion totals **peaked at D7**, when the treatment difference was strongest: approximately **8 fewer lesions per sow** under pheromone treatment (**p = 0.029**).
- After diffuser removal, lesion totals declined in both groups, and differences remained **lower under pheromone treatment**, but were **not statistically significant**.



Results: Sow Activity

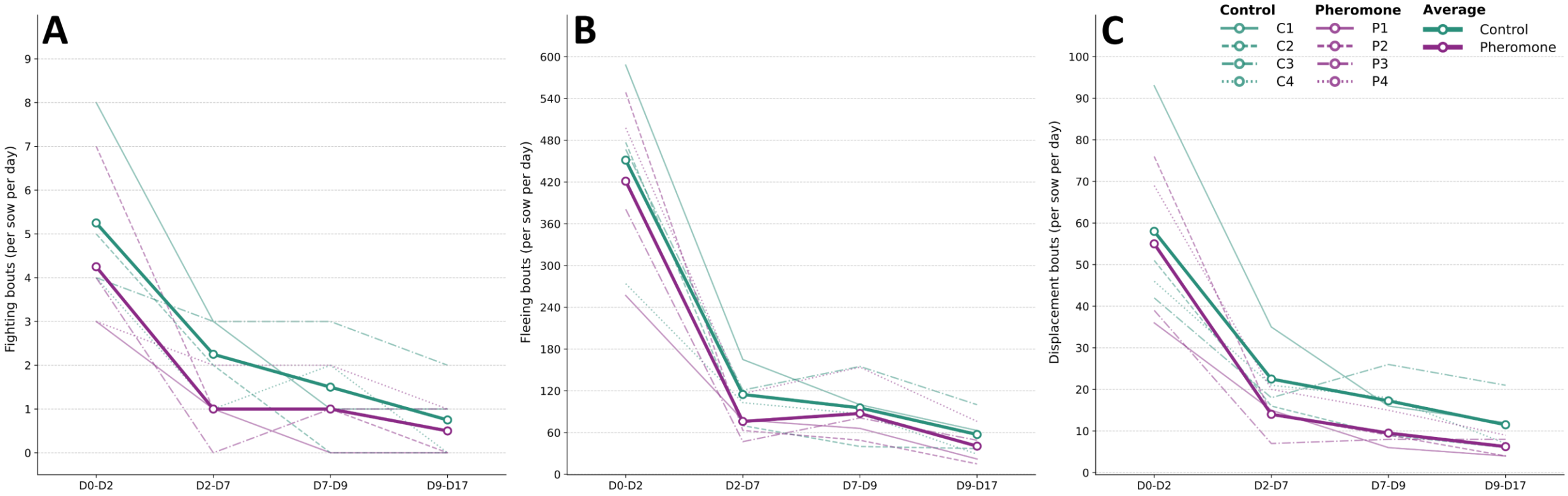
Does PAP treatment reduce sow activity compared to controls over time?



- Raw movement estimates showed an average **13.8% lower movement** under pheromone treatment.
- Pooled across **D0–D17**, the linear mixed model showed a **significant effect of pheromone treatment** on sow movement (**p = 0.002**).
- During **D2–D7**, movement decreased overall, with the **strongest treatment effect** observed under pheromone treatment (**p = 0.015**).

Results: Pairwise Interactions

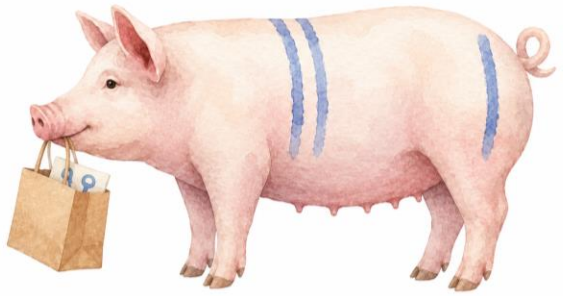
Does PAP treatment reduce agonistic pairwise interactions between sows compared to controls over time?



- Sows in the control group engaged in **16.45% more agonistic interactions** on average than sows in the pheromone group.
- These patterns were supported by the linear mixed model, which showed **significantly fewer agonistic interactions under pheromone treatment across D0–D17** for all three agonistic behaviours.

Key Takeaways

- **PAP treatment reduced social unrest** after grouping in gestating sows.
- Sows in the **pheromone group showed fewer skin lesions, lower movement, and fewer agonistic interactions** across D0–D17.
- The **strongest treatment effects occurred between D2 and D7**, suggesting improved group stability during the dominance settlement period.
- Benefits generally **persisted after diffuser removal**, with no clear spike in activity or aggression.
- Baseline information for studying dominance hierarchies.
- The automated **zero-shot** computer-vision pipeline enabled **continuous, observer-independent behavioural monitoring** over the study period.



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Zero-shot computer vision-based analysis of social behaviour among group-housed sows

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