

VelKoTek (2024 – 2027)

Improving animal welfare and production in dairy cows through Computer Vision

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(1) The Aim Of The Project

- The aim is to improve animal welfare, production and sustainability in dairy cows through the development of new welfare indicators that help farmers to think and work preventively.
- A computer vision system will track individual cows throughout the day, monitoring welfare indicators like lying down, standing, and walking. This enables continuous, objective welfare assessment.

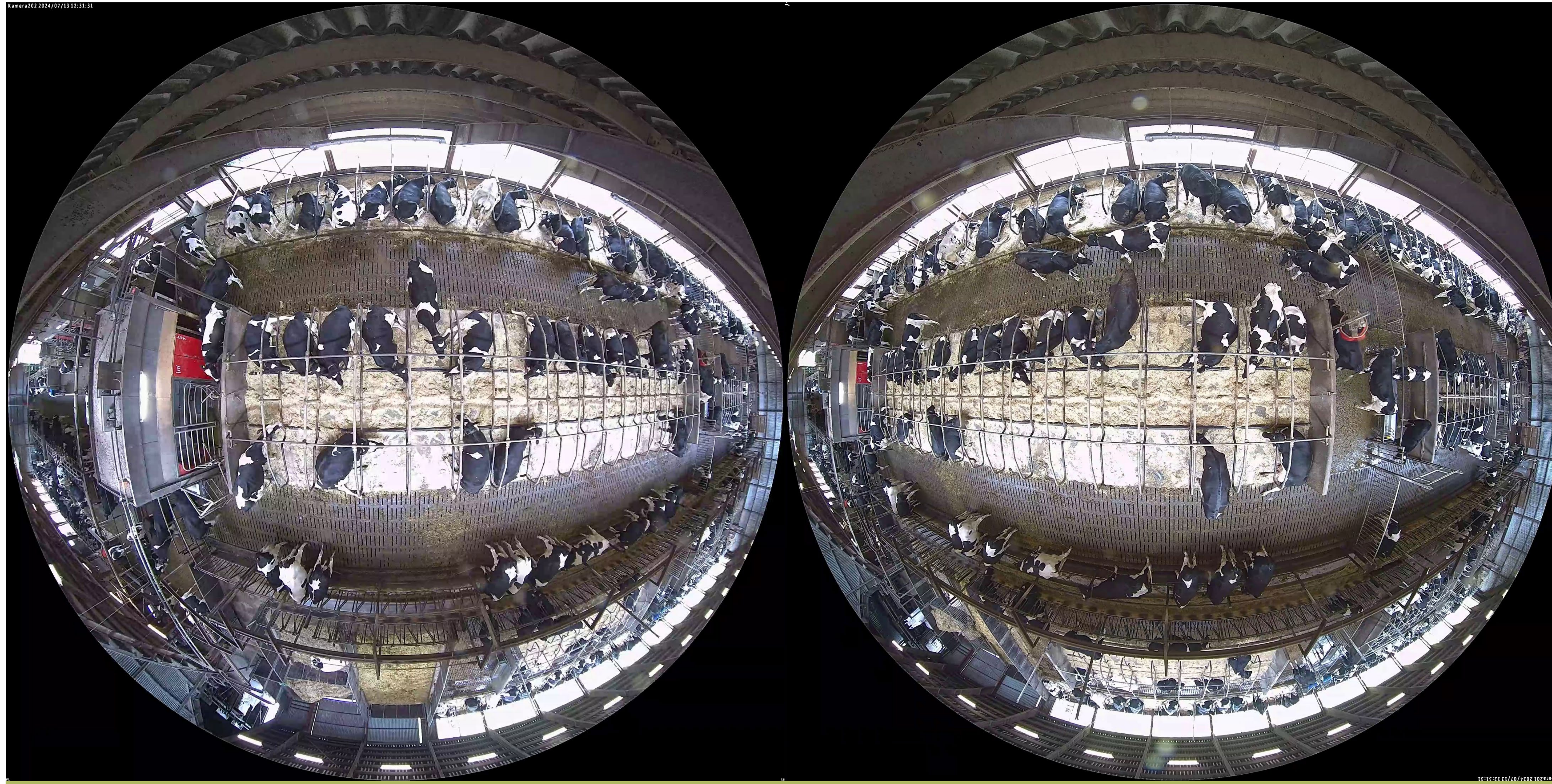


Fig 1: Shows the images produced by two of the camera placed in the same area in stable 2, approximately 12 meters apart and attached 6 meters above floor level. The cameras are identical and have a FOV of 180° and produce, an image of 2944 x 2944 px.

(2) Problem Formulation

- The task can be framed as a "Multi-Camera-Multi-Object Tracking (MCMOT)" problem.
- The challenge lies in accurately associating detections across all cameras over a 24-hour period.

(3) System Setups

- 4 different stable with 4 camera setup will be implemented.
- They vary in number of cameras (2-12) and number of cows (50-200+).
- Figure 1 shows the images produced by the selected surveillance cameras.

(4) Methodology

- Vision Pipeline & Data Acquisition

Install multiple overhead fisheye cameras for capturing the area of interest.

Installation of RFID-tag readers for re-ID of cows entering the area of interest.

Use deep-learning detection to locate cow instances.

Apply multi-object tracking to maintain continuous trajectories.

Apply multi-camera-multi-object tracking to maintain continuous trajectories across cameras

- Feature Extraction

Derive movement features, such as: distance covered, speed.

Derive time spent at key locations: Feeding area, cow beds, water, brush, hay area

Derive time spent laying vs standing

Potentially additional features that can help assess the wellbeing of a cow.

- Indicator Validation & Deployment

Correlate feature extractions with actual milk production and sickness to determine welfare-indicators.

Conduct pilot studies in commercial herds

Gather farmer feedback to refine alert thresholds and user interface design.

(5) Other Key Challenges

- The wide field of view of the cameras presents challenges in undistorting the images and selecting an appropriate projection method.
- Cows can move outside the camera's field of view, leaving the frame.
- Variations in stable layouts and the absence of markers further complicate the extraction of spatial information.
- Keeping the cameras clean from dust.

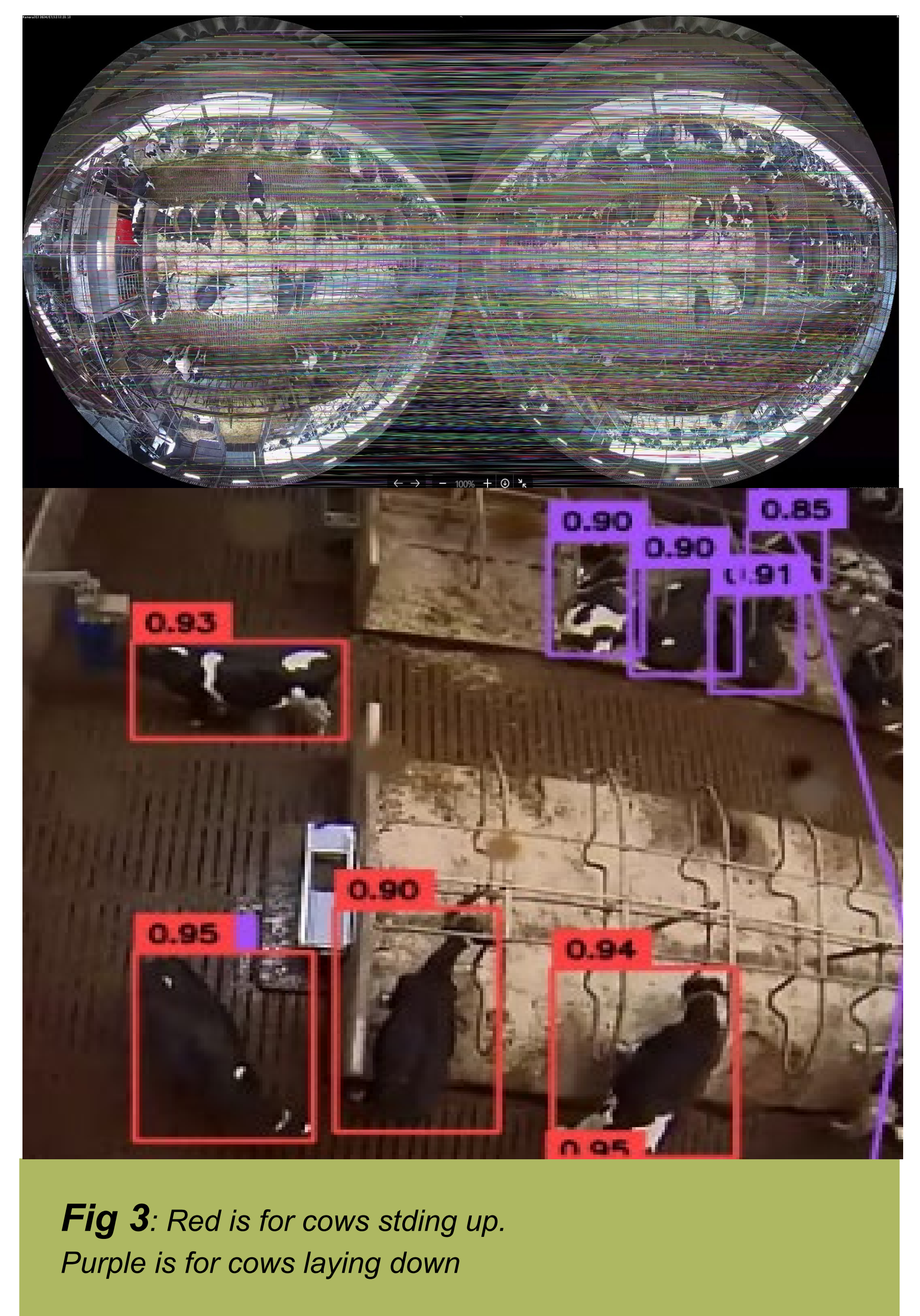


Fig 3: Red is for cows stnding up.
Purple is for cows laying down

Partners



Reference:

- [1] Multi-camera multi-object tracking: A review of current trends and future advances, Amosa m.fl., 2023
- [2] Hut, Peter Reit, (2024), Sense of Sensors: monitoring behavior of dairy cows, Universiteit Utrecht, DOI: 10.33540/1294
- [3] VelKoTek (2024-2027)
<https://www.sdu.dk/en/forskning/sdurobotics/researchprojects/velkotek>