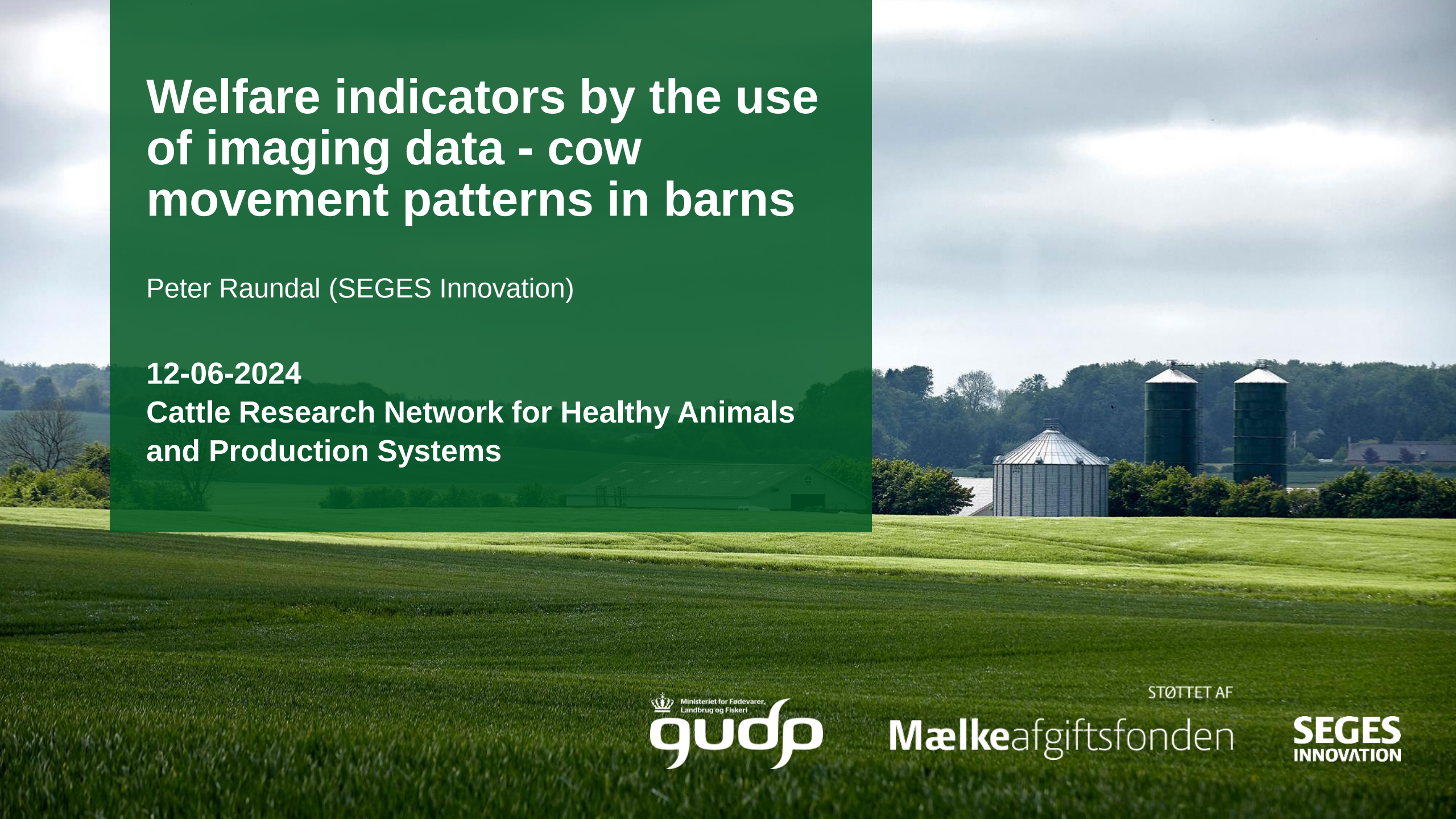
# Welfare indicators by the use of imaging data - cow movement patterns in barns

Peter Raundal (SEGES Innovation)

**12-06-2024**

**Cattle Research Network for Healthy Animals and Production Systems**



Ministeriet for Fødevarer, Landbrug og Fiskeri
gudp
STØTTET AF
Mælkeafgiftsfonden
SEGES INNOVATION

# VelkoTek = WelCoTech (Welfare Cow Technology)

**Developing welfare indicators based on data from milking parlours**

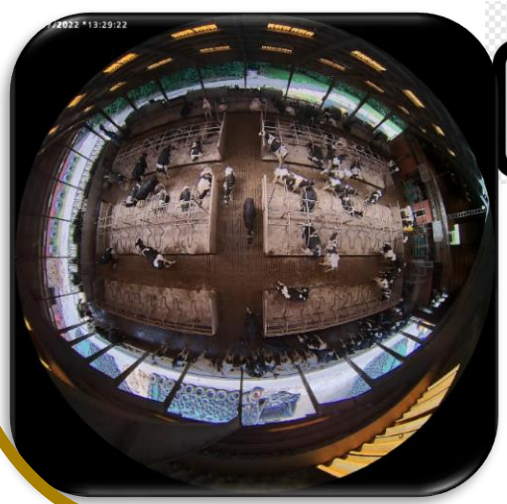
Cattle data base + activity

Milk volume

Algorithms measuring deviations:

Disease detection
Welfare indicator

**Developing indicators based on vision technology**



Annotation of images +
AI algorithms:
Movements, behaviour, tracking

Disease detection
Welfare indicator

**Developments of prototypes**

Prototype based on milk data

Common prototype

Prototype based on milk vision technology

**Knowledge dissemination**

# Developing indicators based on vision technology - scedule

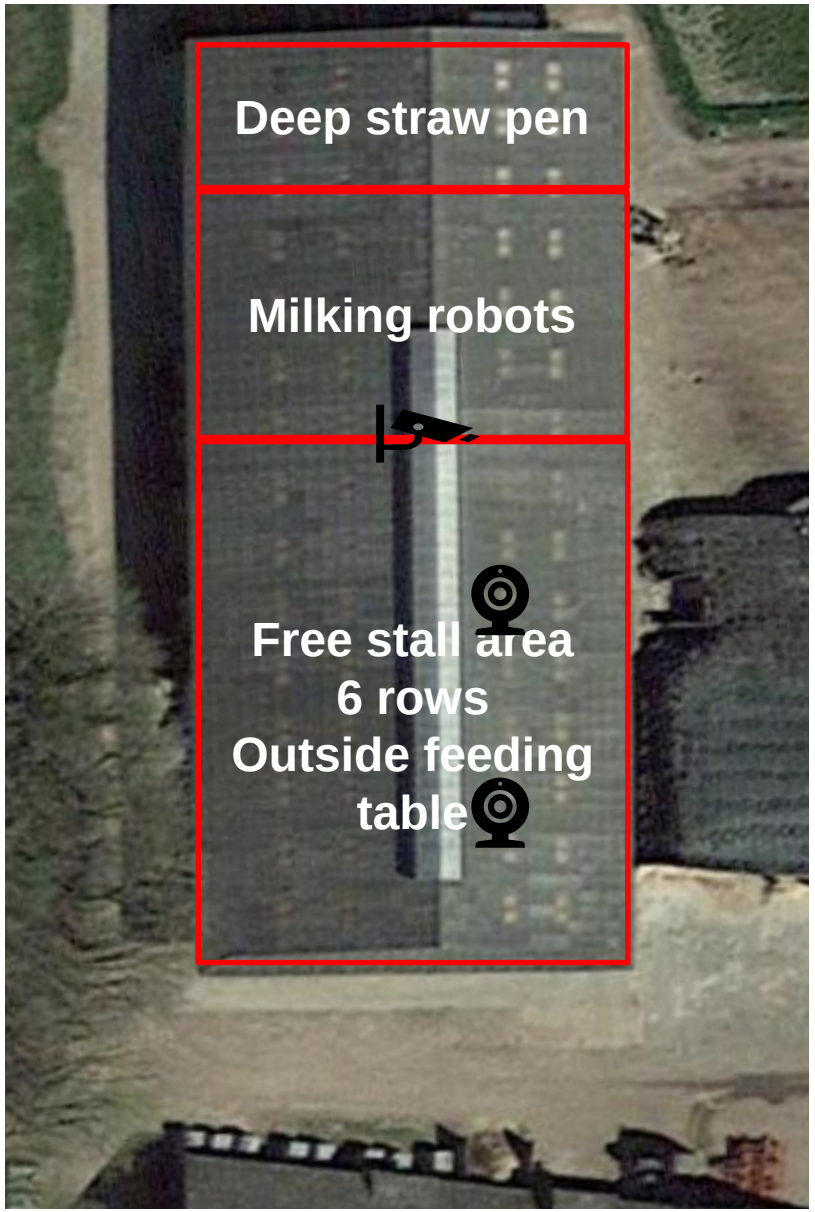
| Task | 2024 | | | | 2025 | | | | 2026 | | | | 2027 | | | | Participants |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | |
| Put up equipment in barns | | | | | | | | | | | | | | | | | SEGES |
| Annotation and test | | | | | | | | | | | | | | | | | SEGES/SDU |
| Development of detection models | | | | | | | | | | | | | | | | | SDU |
| Development of tracking models | | | | | | | | | | | | | | | | | SDU |

- 5 installations (barns)
- 2-3 cameras per 100 cows
- 2-D normal light sensitivity
- Fish eye lens
- Cameras covers lying area, feeding table and alleys

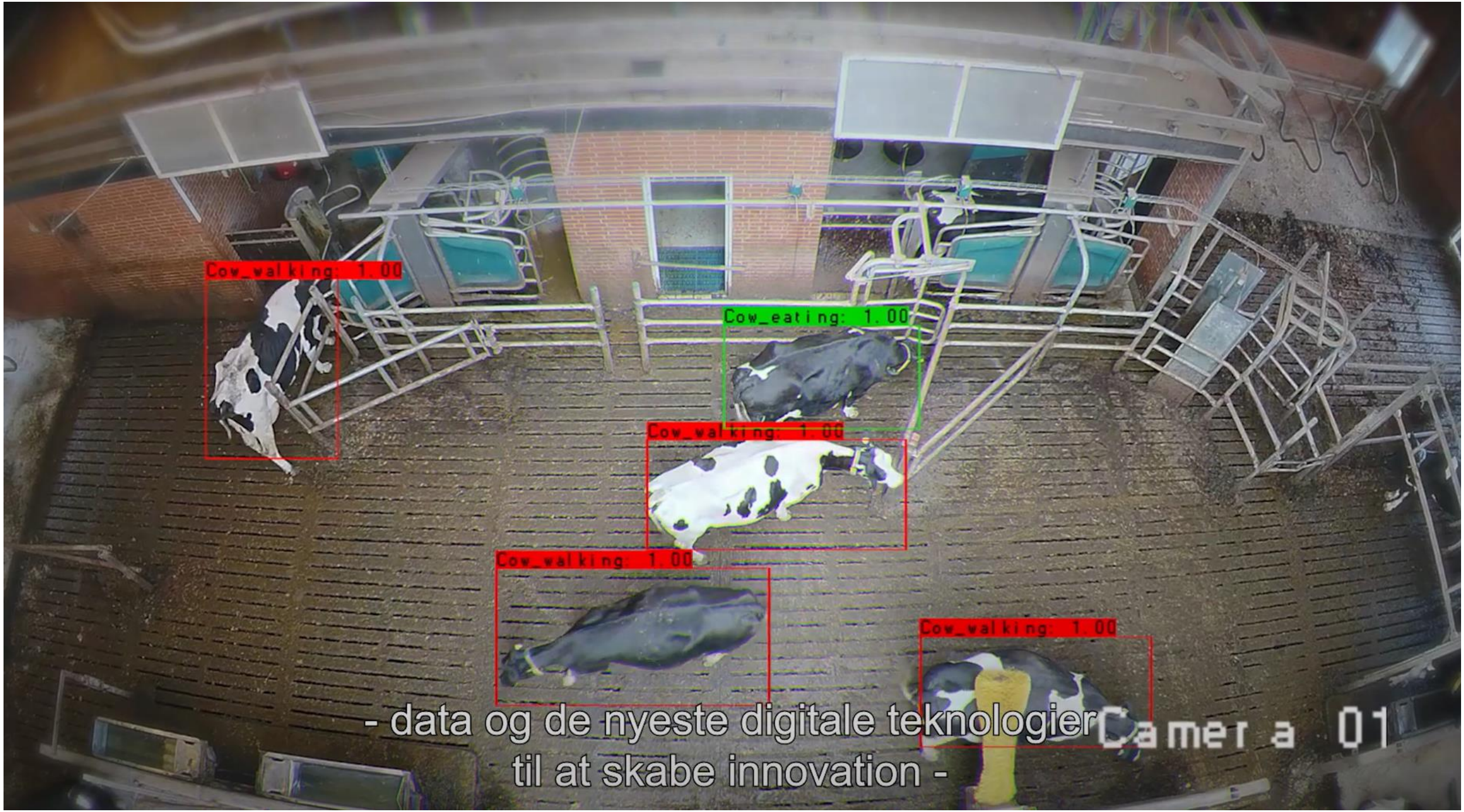
SEGES INNOVATION

Installation nr. 1
Monteret juli 2022

SEGES
INNOVATION


Deep straw pen
Milking robots
Free stall area
6 rows
Outside feeding
table

VelKoTek – AP2

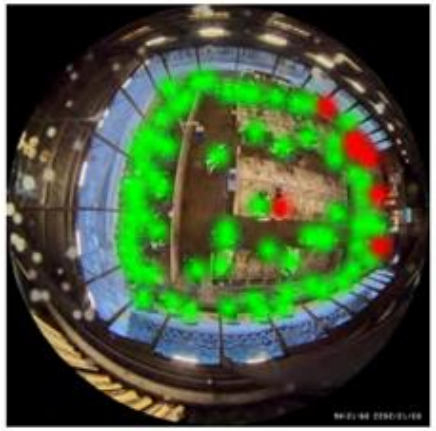

Cow_walking: 1.00
Cow_eating: 1.00
Cow_walking: 1.00
Cow_walking: 1.00
Cow_walking: 1.00
- data og de nyeste digitale teknologier
til at skabe innovation -
Camera 01

(a) Camera 1: Real footage

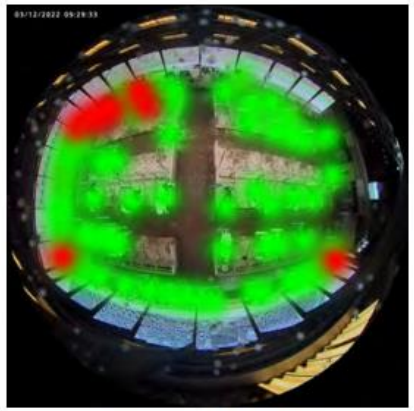
(c) Camera 2: Real footage

(e) Camera 3: Real footage

Patrick Bøgelund Dalage. 2023. Object Detection and Localization of Milking Cows, Projektopgave SDU

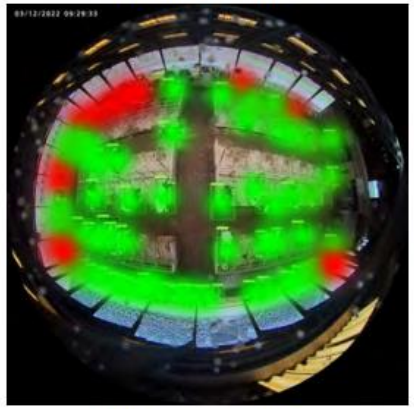


(a) Camera 1 at 60 %



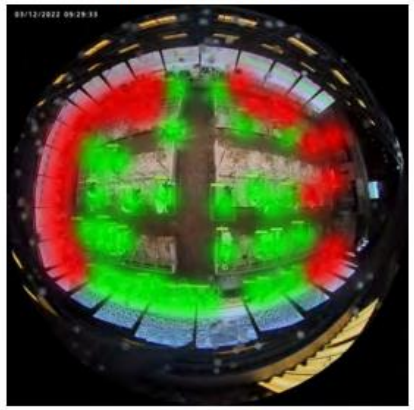
(b) Camera 2 at 60 %

(c) Camera 1 at 70 %



(d) Camera 2 at 70 %

(e) Camera 1 at 80 %



(f) Camera 2 at 80 %

Figure 13: Green indicates that the model has correctly predicted the cow.
Red indicates when the model is either predicting incorrectly or missing the object.

Patrick Bøgelund Dalage. 2023. Object Detection and Localization of Milking Cows, Projektopgave SDU

# Model development using Artificial Intelligence

Defining certain features from where welfare/disease indicators can be derived

Ground thruth – recognized by AI

a. Stalls
b. Alleys
c. Feeding table

Cow detection – recognized by AI

d. Cows position
e. Lying/standing

} Detection models

f. Cows position over time (24 h) – MultiObjectTracking models

SEGES INNOVATION

# Model development for measurements

| Derived measurements | a. Stalls | b. Alleys | c. Feeding table | d. Cows position | e. Lying/standing | f. position over time |
|---|---|---|---|---|---|---|
| Cow in stall +/- | X | | | X | | |
| Lying/standing bout duration | X | | | X | X | |
| Time at feeding table per cow | | | X | X | | X |
| Time in alleys per cow | | X | | X | | X |
| Displacements | X | | | X | X | X |
| # cows down in stalls over time | | | | X | X | |
| Cows are at feeding table or in alleys | | X | X | X | | |
| # cows at feeding table | | | X | X | | |

EGES
OVATION

# Models for disease detection and welfare indicators

- Use the measurements to
  - Develop indicators to detect initial sickness behaviour at cow level
    - Combined with milk deviations
    - Golden standart: Treatment recordings
  - Welfare indicators at group level
    - # cows having lay down/getting up difficulties
    - # cows with ‘long’ lying bouts
    - Golden standart: ‘traditionel’ welfare indicators – Welfare index at herd level

SEGES INNOVATION

# Development of prototype

**Developing welfare indicators based on data from milking parlours**

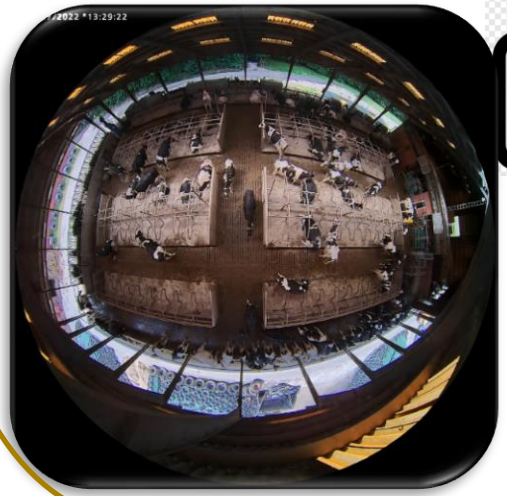
Cattle data base + activity

Milk volume

Algorithms measuring deviations:

Disease detection
Welfare indicator

**Developing indicators based on vision technology**



Annotation of images +
AI algorithms:
Movements, behaviour, tracking

Disease detection
Welfare indicator

**Developments of prototypes**

Prototype based on milk data

Common prototype

Prototype based on milk vision technology

**Knowledge dissemination**

# Questions

- Could there be other measurements valuable in
  - Disease detection?
  - Welfare indicators at group level?

- Could there be other welfare indicators at group level?

SEGES INNOVATION

# Thanks

Ministeriet for Fødevarer, Landbrug og Fiskeri
gudp
STØTTET AF
Mælkeafgiftsfonden
SEGES INNOVATION