Cattle Feed InTake CFIT

3D camera system for individual measures of dairy cattle feed intake and body weight on commercial farms
Vision with the CFIT system

- Identification of the individual cow
- Individual feed intake per cow per day
- Individual body weight per cow per day
- Used for breeding value estimation
- Used for management on farm
- Documentation (ESG and climate)
- Cow behaviour, health and reproduction
- Continued development
Diseases occur in early lactation

Lehmann et al., 2016
Genetic correlation through lactation

Manzanilla Pech et al., 2016 JDS

Li et al., 2018 JDS
Saved feed index

SAVED FEED = Maintenance + Metabolic efficiency
VG strategy is based on:

- Full lactations are necessary in all lactations
- Research farm data will not provide enough data
- The research farm approach is too expensive, time consuming and impractical in commercial farms
- Data from normal production herds are needed for documentation
CFIT – Cattle Feed InTake
Installations and agreements March 2023

- 7,5 herds RDC ~ 3500 cows
- 8 herds JER ~ 4000 cows
- 9,5 herds HOL ~ 5000 cows
Data flow and amount

- +1700 cameras
- + 90,000,000 images pr day
- +700,000 feed visits pr day
- +100,000 meals pr day
System setup

3D Camera – time of flight

4.5 m  4.2 m

Zero calibration of floor at each feeding
What are we doing?
Contour -> MASK-CNN

- ID accuracy with contour model 95-98% in Jersey
- Change of algorithm from contour to MASK-CNN
- Including colour, patterns, contours in model
- ID accuracy +99% in all three breeds
Example of feed intake

Blue is higher

Red is deeper

Removed 14.39 l
Added 10.75 l
Total 3.64 l

Total is difference between red and blue
Validation study at Aarhus University

• Scale measures together with cameras

• 4 diets: maize/grass silage and barley/drybeetroot

• 48 HOL cows in latin square design

• Challenge the camera system with different densities – especially with different silage types

Giagnoni et al.,2022
Results – comparing kg and volume

Giagnoni et al., 2022
Data

- 1329 measurement from 102 Jersey cows
- 460 average weight (350-650 kg)
- 400 contour variables pr visit
- PLS model
Pred vs obs
Example of a cow

<table>
<thead>
<tr>
<th>Lactation number</th>
<th>Current weight (kg)</th>
<th>Weight at calving (kg)</th>
<th>Weight 50 days after calving (kg)</th>
<th>Weight change 50 days after calving (kg)</th>
<th>Weight at dry off (kg)</th>
<th>Weight change dry period (kg)</th>
<th>Days from calving</th>
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</thead>
<tbody>
<tr>
<td>4</td>
<td></td>
<td></td>
<td>472</td>
<td>-2</td>
<td>469</td>
<td>-3</td>
<td>44</td>
</tr>
</tbody>
</table>

![Graph showing body weight over weeks from calving for different lactation numbers.](image-url)
Data for farmer

Total amount of feed

Amount of feed at start/end of day

Number of cows for the chosen day and average for the last 7 days

Average feed intake pr cow
Example of dif between cows at same yield level and lactation

<table>
<thead>
<tr>
<th>animal</th>
<th>Feed intake 0-305 days</th>
<th>ECM 0-305 days</th>
<th>CM</th>
<th>dif in CM</th>
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</table>
Weight development early lact
Weight development dry period
Days from calving at minimum weight
Weight change in late lactation
Recent improvements

- Improved head detection
- Automation of event handling
- Automated re-calibration
Sum up

- The CFIT system and scale measures of daily feed intake correspond with each other (r>0.90)

- CFIT data is both used for management and genetic analysis

- CFIT continues to be developed and improved for more installations