Identification of cows and individual feed intake records using a 3D camera system in commercial farms

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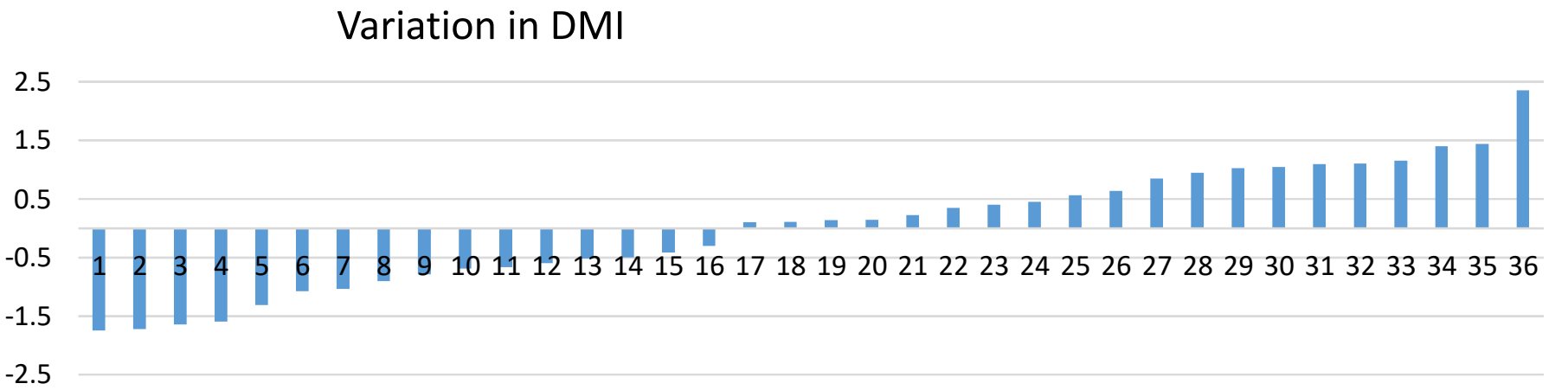
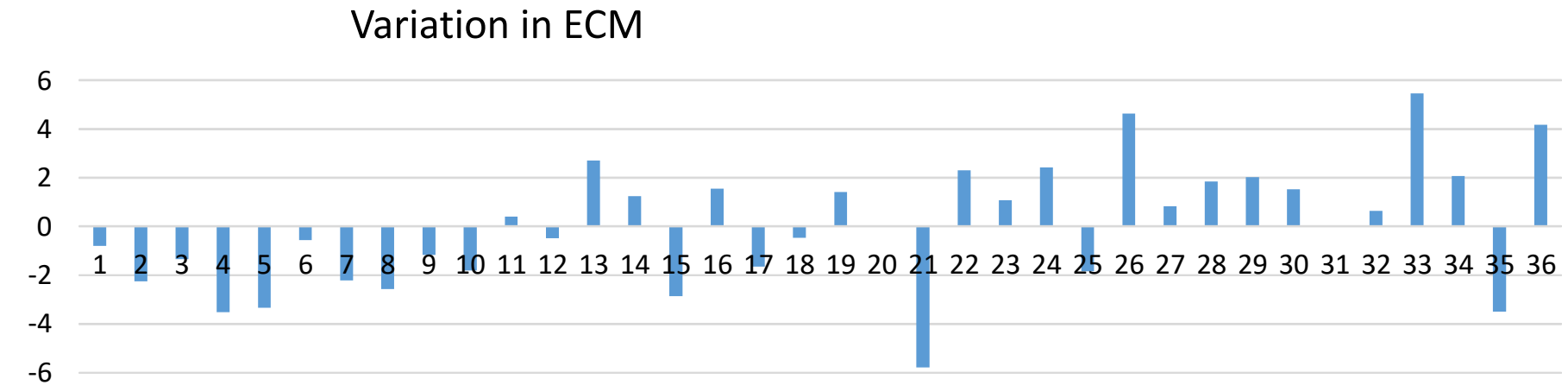




Yield alone cannot explain variation in DMI!

Johansen et al. JDS, 2017, 100, 8861

Aim and purpose

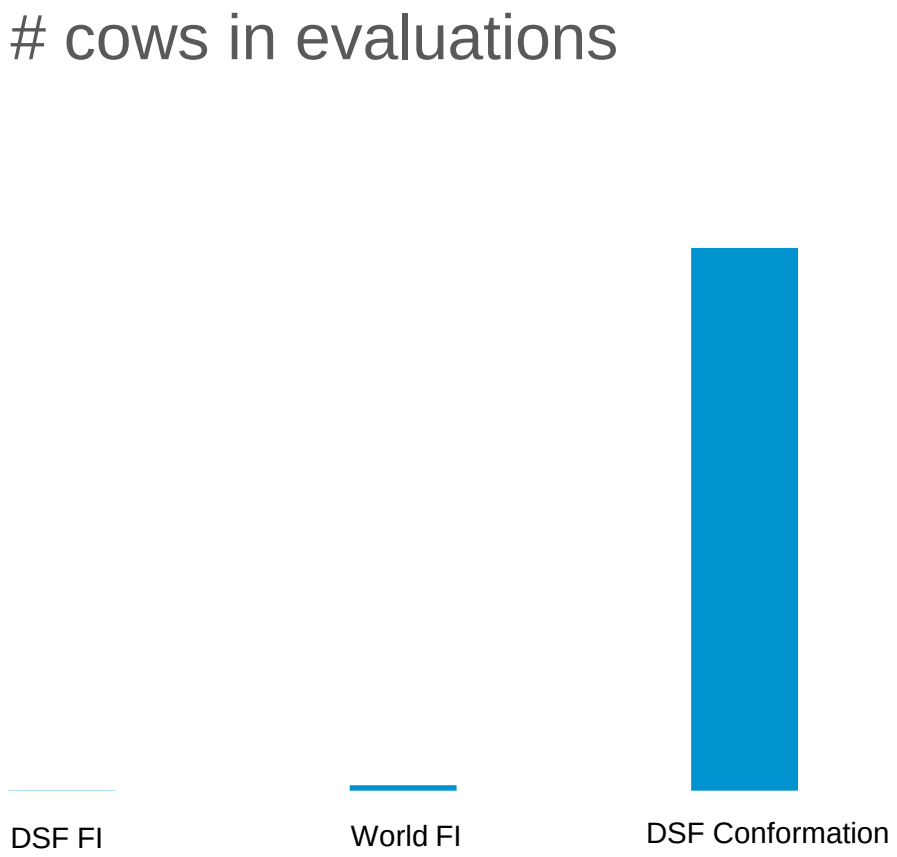
- To develope a 3D camera system that can measure feed intake at individual cow level at each visit

- May not:
  - Disturb daily routines on farm
  - Disturb cow behaviour

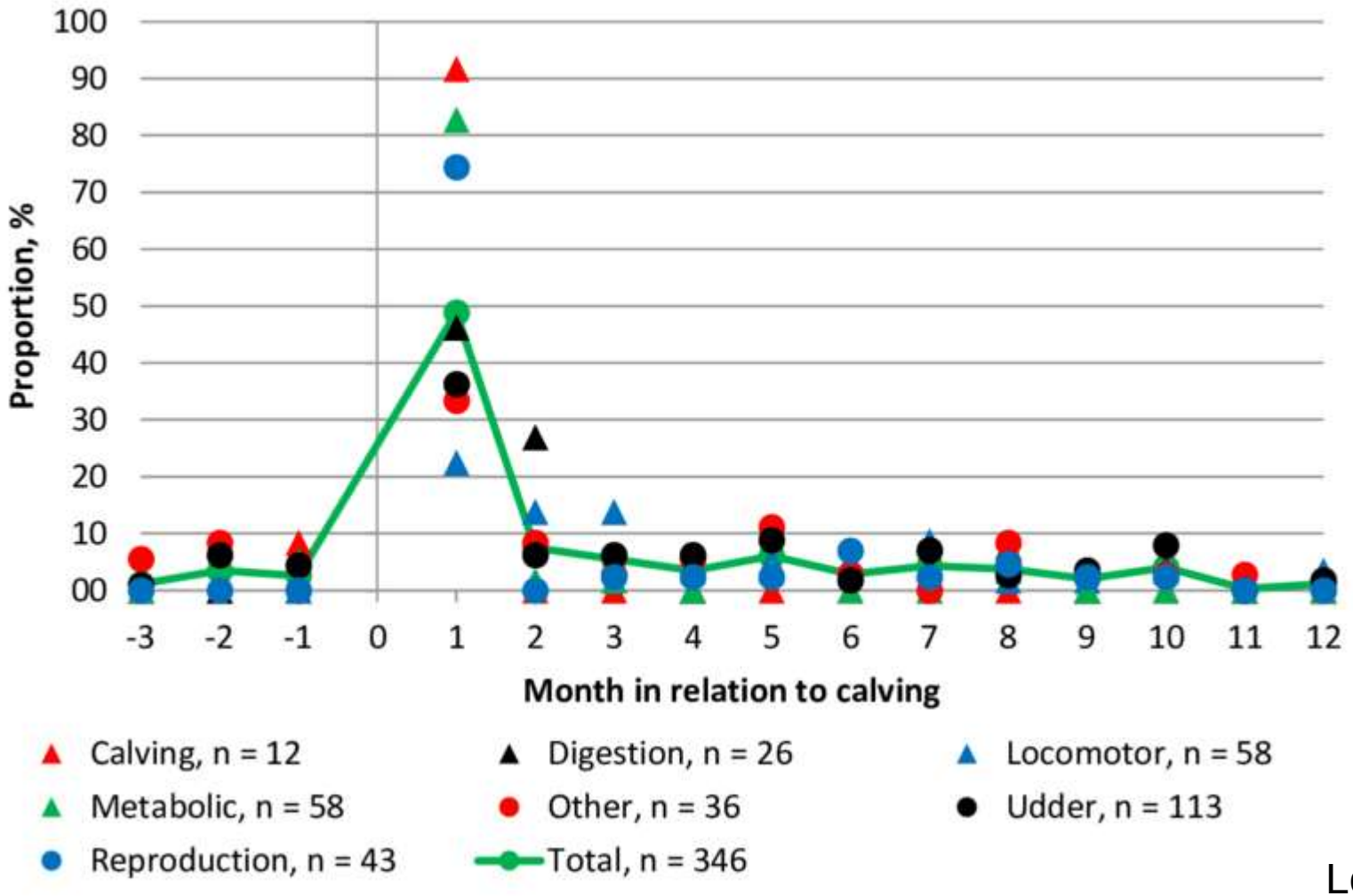
- Should be same system as for identification

The genomics revolution

”With genomic selection we will be able to select for scarsely measured traits such as efficiency.”



Disease incidence during lactation



Lehmann et al .,2018

Genetic parameters during lactation

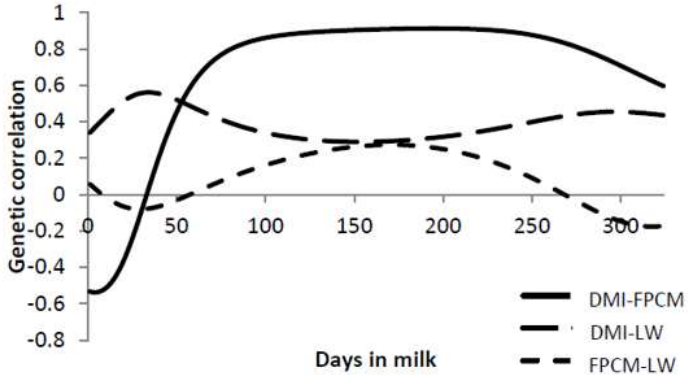
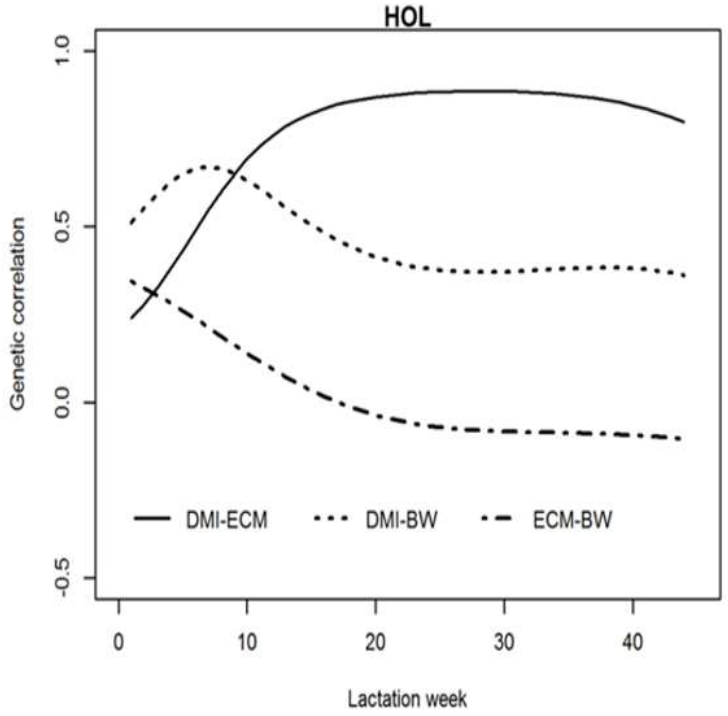


Figure 2.6 Pairwise genetic correlations when two traits are measured on the same day from 1 to 324 days in milk (DIM) between 1. dry matter intake and fat and protein corrected milk (DMI-FPCM, SE of median=0.06, of 3rd quartile=0.09), 2. dry matter intake and live weight (DMI-LW, SE of median=0.11, of 3rd quartile=0.10), and 3. fat and protein corrected milk and live weight (FPCM-LW, SE of median=0.12, of 3rd quartile=0.13).

Manzanilla Pech et al., 2016 JDS



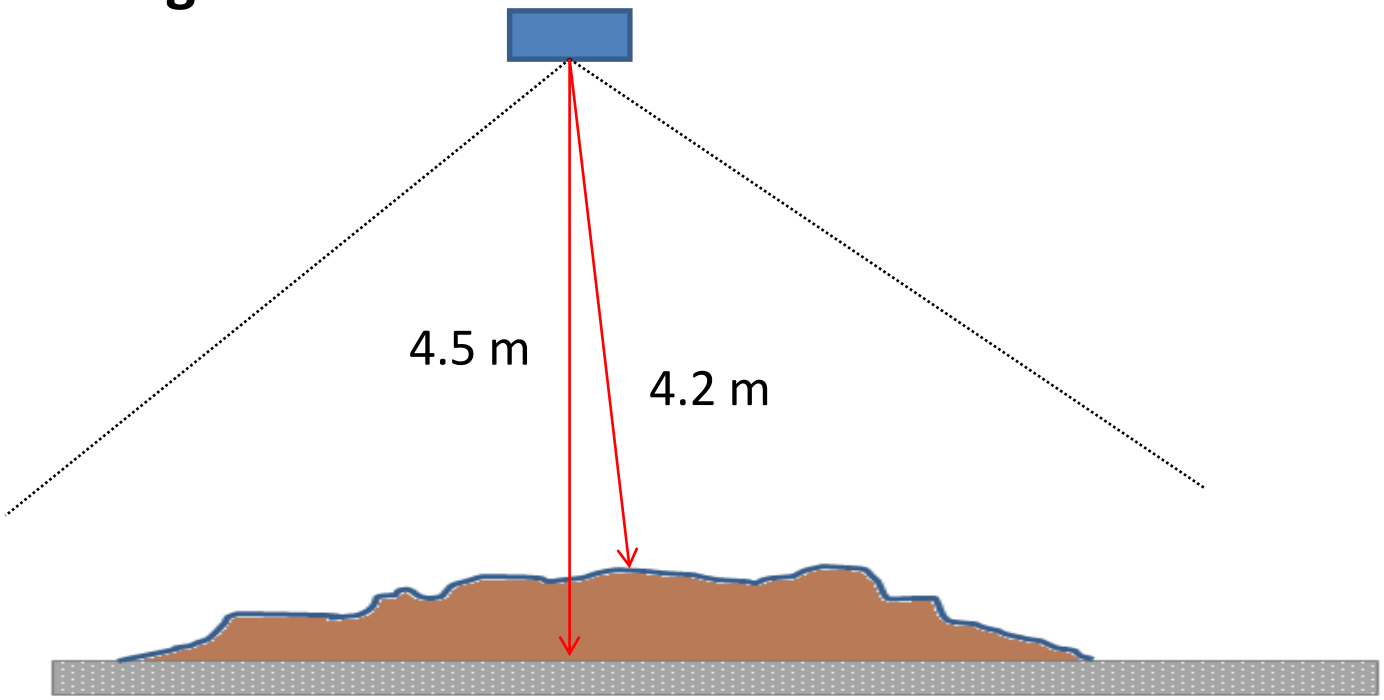
Li et al., 2018 JDS

So VG believes:

- Research farm data will not provide enough data
- Full lactations are necessary
- Feed boxes disturb animal behaviour, are time consuming and impractical in commercial farms
- We can build a system that identifies cows and allocate feed intake

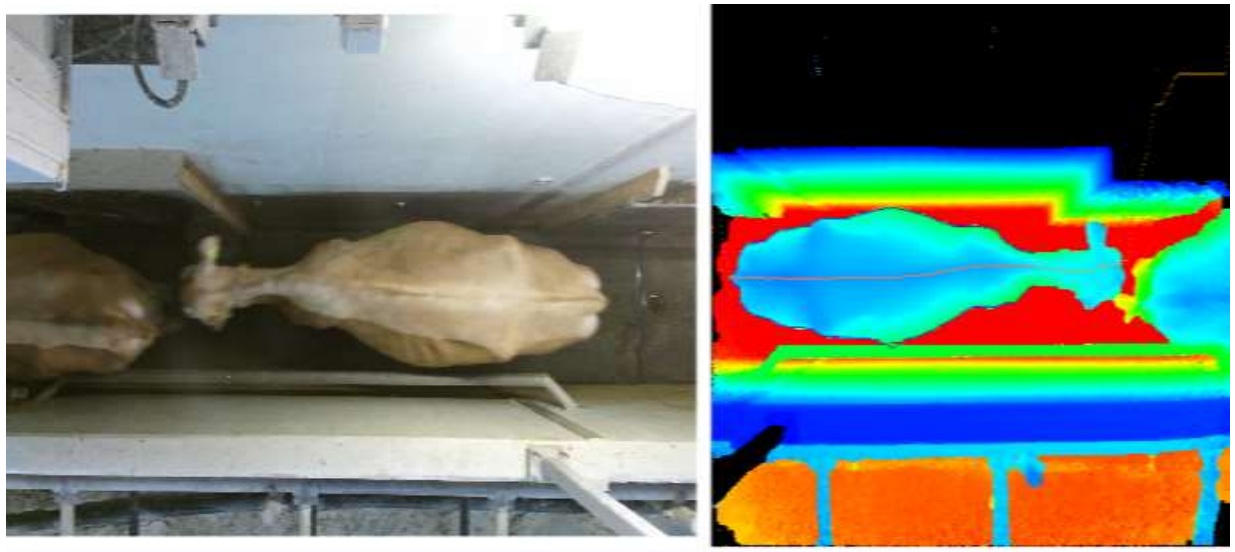
System setup

3D Camera – time of flight



Reference for identification

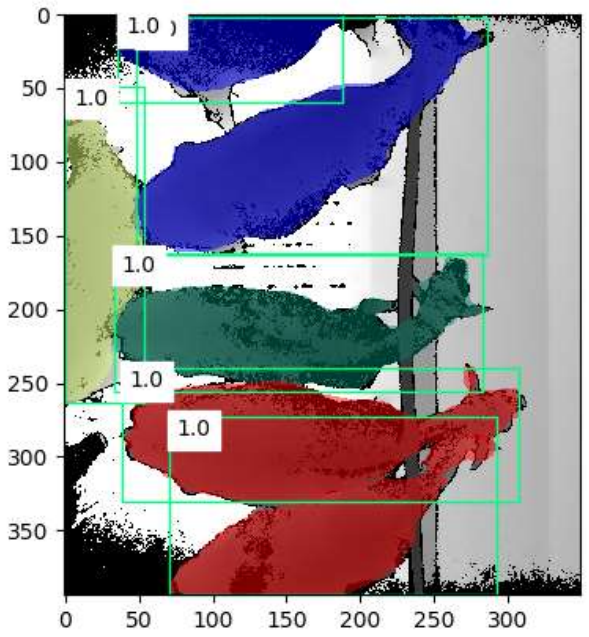
- After every milking
- Eartag is read
- 5 images a second



MASK-CNN for identification

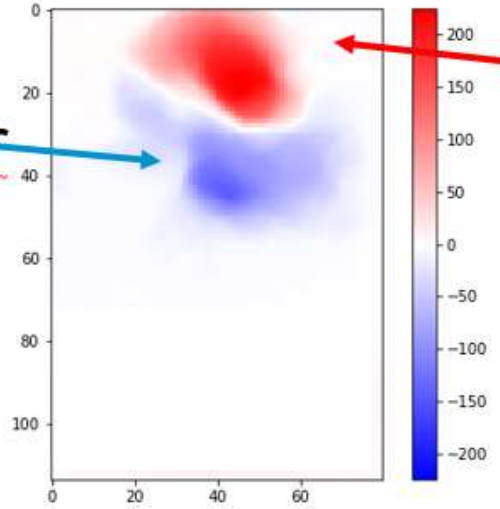
- MASK-CNN AI algortihm used for identification
- Including colour, patterns, contours in model
- ID accuracy +99% in all three breeds

He et al., 2018



Example of feed intake from a visit

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

Data description

- Data collected since february 2019 in 7 herds
- 5 JER, 1 RDC and 1 HOL
- Liters of feed transfered to kg by multiplying with density
- Feed intake summed over each day
- Phenotype analysed is weekly mean of daily intake

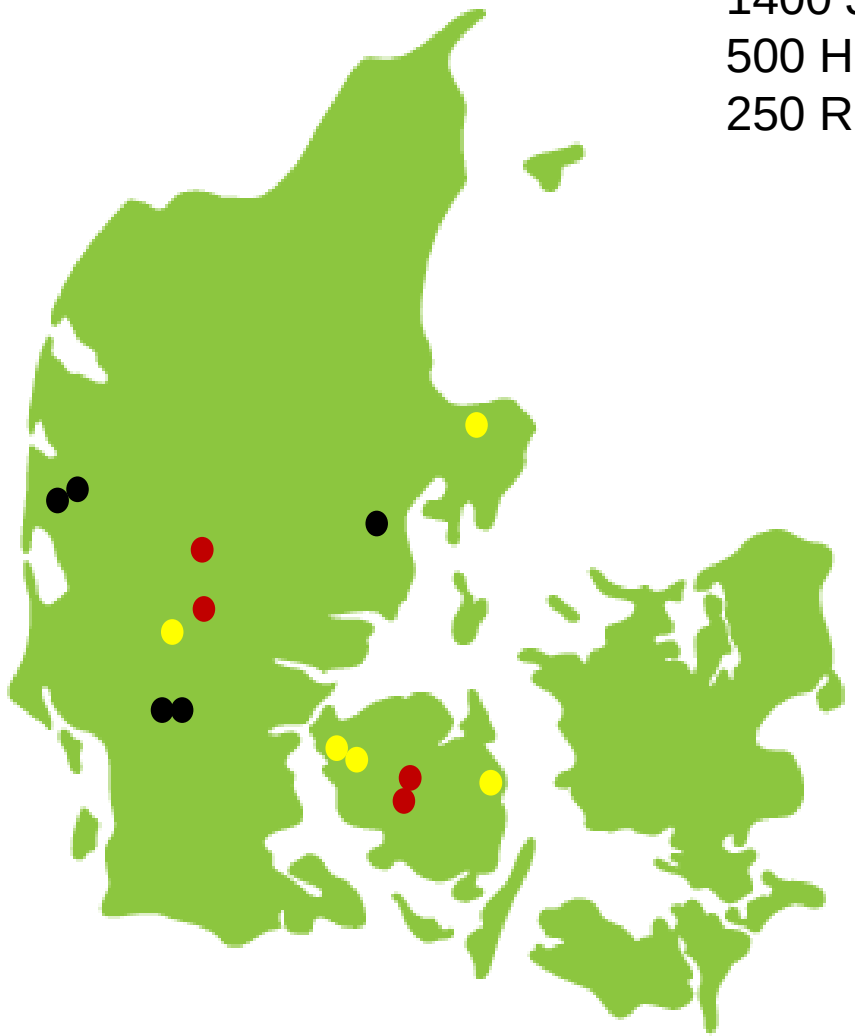
Within breed model

Feed intake = μ	+ Herd + week + year	class
	+ parity	class
	+ $wil^{(\beta 1\ dim)}$ + β_2 dim	fixed reg
	+ animal	random
	+ res	random

Results

Breed	Number of cows	Mean kg feed	Standard deviation	Repeatability
Jersey	1292	54.74	8.53	0.56
Red Dairy Cattle	222	59.72	9.53	0.61
Holstein	536	60.59	11.20	0.60

Current herds



1/4-21
1400 JER
500 HOL
250 RDC

1/7-21
1500 JER
1500 HOL
1500 RDC

1/1-22
2000 JER
3000 HOL
2000 RDC

Current status

- CFIT data used in saved feed index for Jersey and RDC
- HOL data will be part of May evaluation 2021
- Installation in herds to have 7000 cows with registrations during 2021

Sum up

- 3D camera technology can be used to identify cows and measure feed intake of individual dairy cows
- Data can be used for breeding value estimation (Stephansen et al. INTERBULL, 2021)
- CFIT continues to be developed and improved for more installations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innovative breeding
Thank you