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Sensor-based monitoring of post-calving cows in a robotic dairy farm

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Outline

- Aim
- Why post-calving diseases?
- Why in robotic dairy farm?
- Material & Methods
- Results
- Discussion
- Conclusion

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Aim

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- Apply a behaviour and performance based disease detection model for post-calving cows in a robotic dairy farm

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Why post-calving diseases?

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- Prevalence

  - 10 to 50 % of cows ketosis and/or metritis

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Why post-calving diseases?

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- What is:
  - Ketosis?
    - Metabolic disorder
  - Metritis?
    - Inflammation of the uterus

- Diagnosis
  - Veterinarian → routine check

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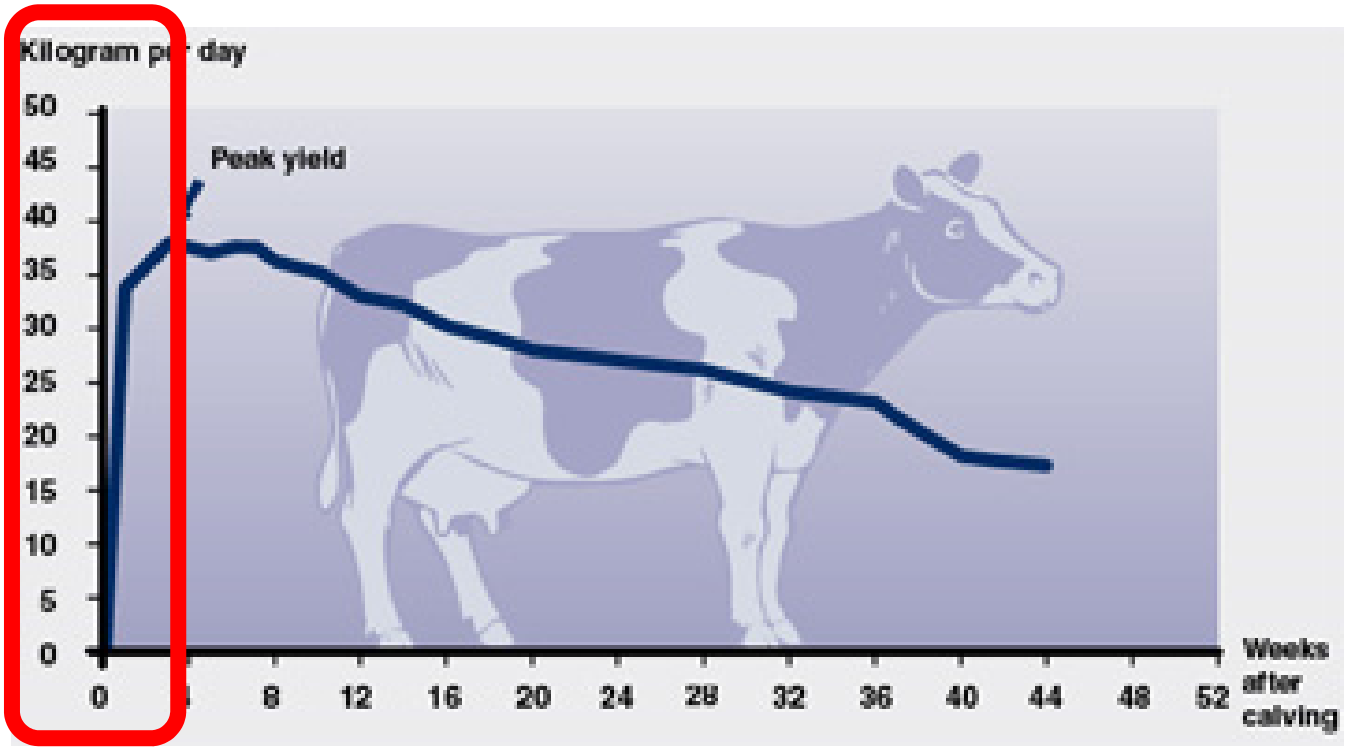
Why post-calving diseases?

- Early lactation: 3 weeks after calving
- Causes



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Why in robotic dairy farm?

- Cows ‘choose’ how to spend their time

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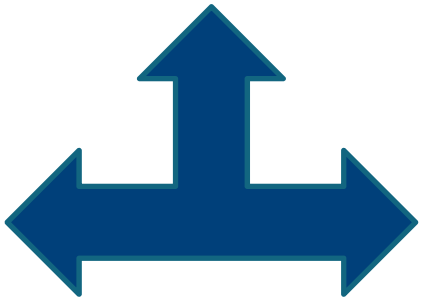

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Why in robotic dairy farm?

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- But: Fetching cows disturbs routine

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Why in robotic dairy farm?

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- Availability of sensors
  - Milk yield
  - Body weight
  - Visits to the robot
  - Rumination time
  - Activity
  - …

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Material and Methods

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- Commercial robotic dairy farm
  - 250 Israeli-Holstein cows

- 5 milking robots – behaviour and performance sensors TVH3

-Milk yield
-Body weight
-Visits to the robot

-Rumination time
-Activity

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Dias nummer 10

TVH3 DO you have pictures or give a description of the sensors. Which behaviour is being mesured? which performance?
Van Hertem, Tom, 23/08/2014

Model calibration

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- All post-calving diseases 5-21 DIM
- Variables: Milk yield, rumination time, activity, body weight relative to body weight at calving, number of milkings
- Model development with historical data (1 year)
- Tree Based Model – cut-off threshold 0,5

Calibration		Reference = Veterinarian		
Model	N = 111	Healthy	Sick	
	Healthy	72	5	0.94
	Sick	4	30	0.88
		0.95	0.86	0.91

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Model validation

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Cows divided into 2 groups – Two validations:

- Validation I:

Model is followed - cows only brought to veterinarian when model indicates disease

- Validation II:

All cows checked by veterinarian, data fed to model and compared to diagnosis of veterinarian

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Validation I

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- Every Sunday:
  - Model check of cows 5-21 days after calving
  - List of cows at risk for disease → to farmer
    - Cut-off threshold = 50% chance of being ill
  - Veterinarian check

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Validation I: Preliminary results

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- 34 cows

		Diagnosis of veterinarian		
		Healthy	Ill	
Model outcome	Healthy	17	1	0,85
	Ill	3	13	0,93
		0,85	0,93	0,88

- Veterinarian confirms model outcome

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Validation II: Preliminary results

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- Behaviour and performance data are fed to model and compared to the diagnosis of the veterinarian

- 31 cows

		Reference = veterinarian		
		Healthy	Ill	
Model outcome	Healthy	9	10	0,47
	Ill	4	8	0,67
		0,69	0,44	0,55

- Model ≠ reference (veterinarian)

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Discussion

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- Severe – moderate – light cases of ketosis / metritis
- Model = tool, farmer = decision (e.g. risk cows)
- Separating only part of the cows for the veterinary check
  - Time saving
  - Less disturbance for cows
- Model: daily ⟷ Vet: weekly
  - Now model is only compared with the day of the diagnosis of the veterinarian → too early or too late to detect problem?

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Discussion

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- Imbalance in parity
  - Disease prevalence is different in younger and older cows

- Future research:
  - Consequences
    - Fertility
    - Culling rate
    - Milk yield
    - Labour

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Conclusions

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Combine existing robotic milking farm data → develop and validate tree-based model → detect post-calving health problems

Thank you!

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