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Tech Tools for Dairy Profitability: Making SMARTer Decisions

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54th Annual Dairy Practices Council Conference

What comes to mind when you hear "Precision Technology"?

Nobody has responded yet.

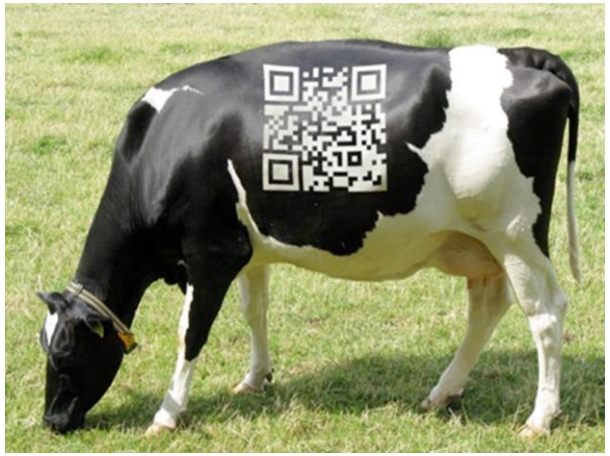
Hang tight! Responses are coming in.

Precision Technologies

- What do I mean?
  - Enhancing human:
    - Observation
    - Labor
  - Supplementing human:
    - Data collection
    - Decision-making

- Full replacement
  - Calf feeder
  - Robotic milking
  - CIP system
- Supplementation
  - Heat detection
  - Electroconductivity
  - Herd management software

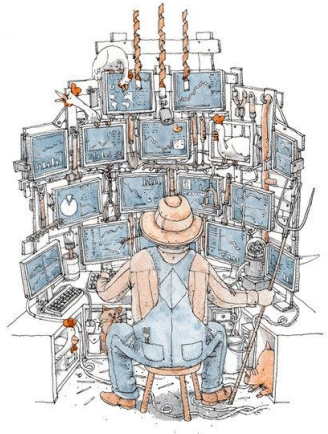
Precision Dairy Management



The use of automated, mechanized technologies toward refinement of dairy management processes, procedures, or information collection

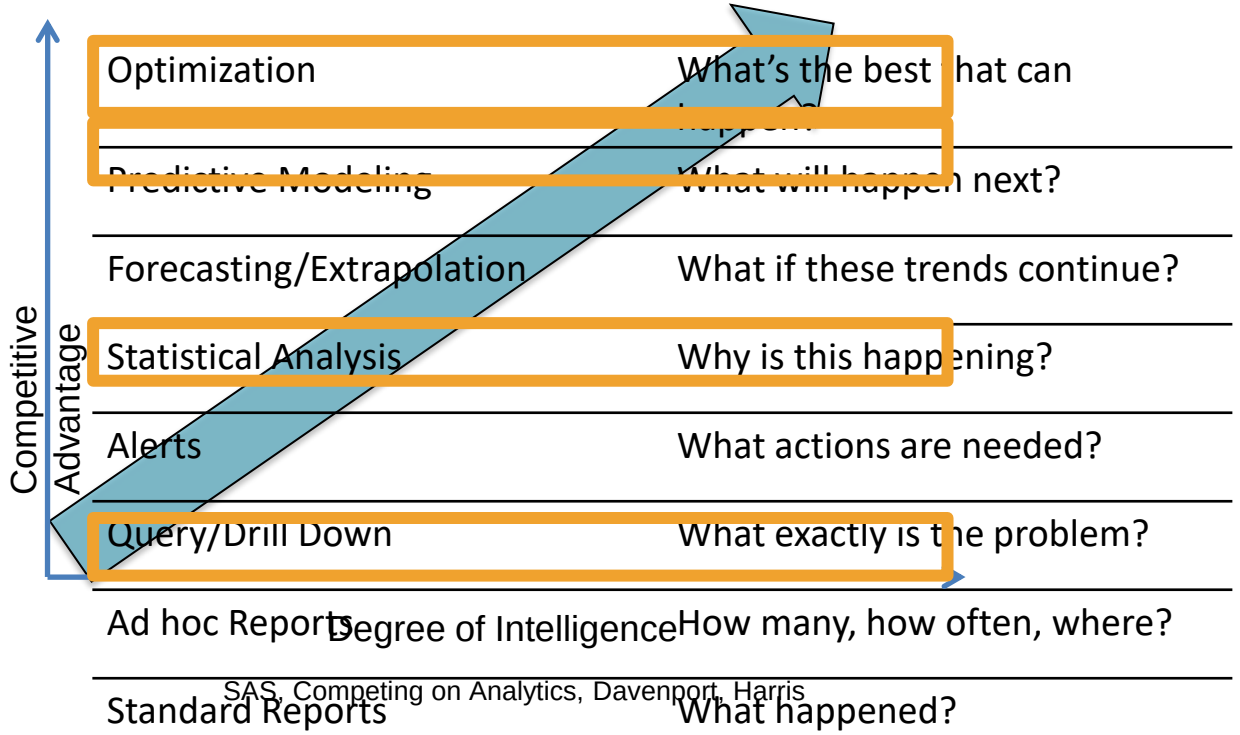
Something to keep in mind

- Farmer first, data second



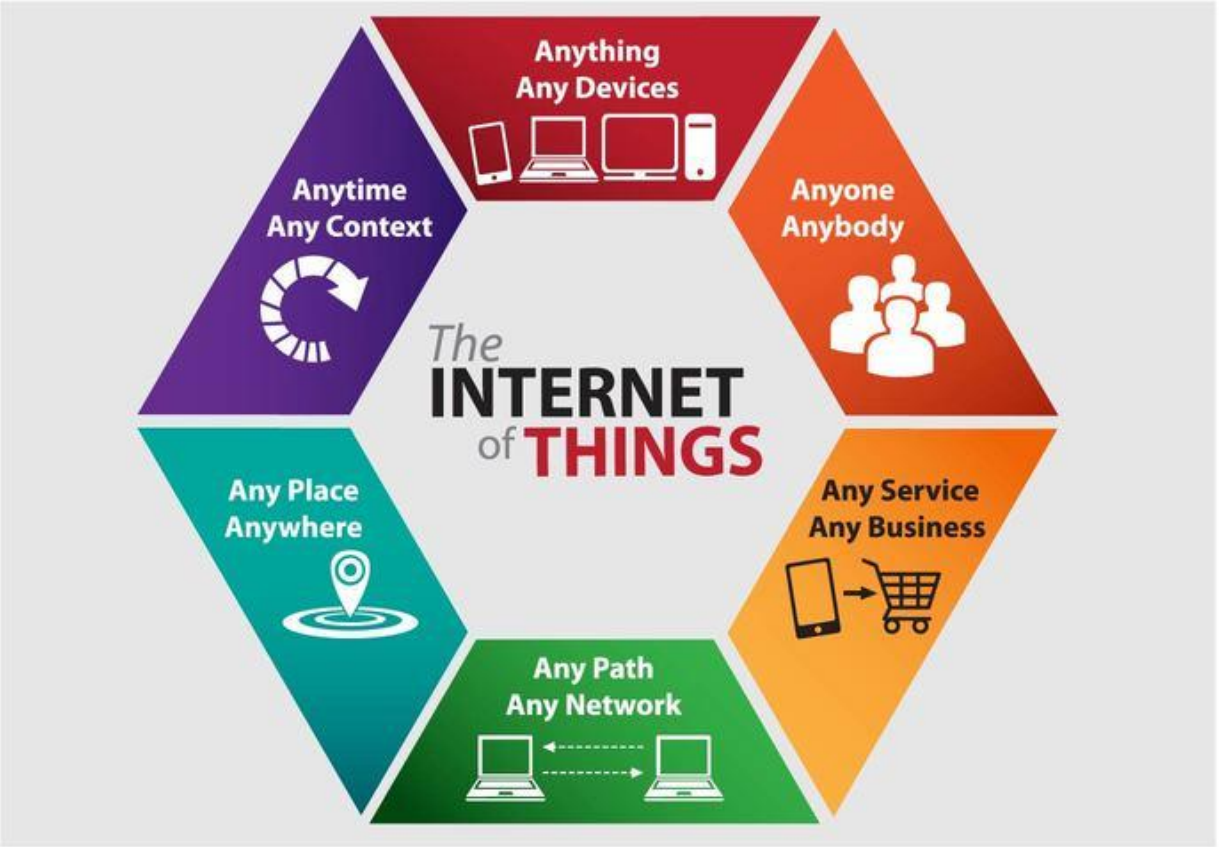
Using analytics to improve performance

Business Intelligence and Analytics



SAS, Competing on Analytics, Davenport, Harris

"In God We Trust; All Others Bring Data." – William Edward Deming


Anything
Any Devices
Anyone
Anybody
Any Service
Any Business
Any Path
Any Network
Any Place
Anywhere
Anytime
Any Context
The
INTERNET
of THINGS

What are your top two data security concerns related to technology you use?

Nobody has responded yet.

Hang tight! Responses are coming in.


TODAY:
INTERNET
OF COWS
COLLARS
BASE STATION
MOBILE
ALERTS
REMOTE
MANAGEMENT

Path to success

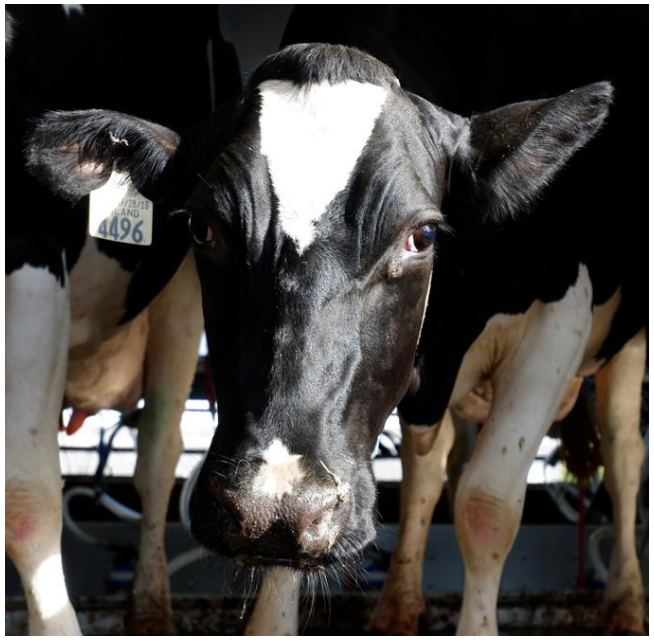
Integrate Analyze Visualize

What are you two greatest needs when engaging with members in your dairy community?

Nobody has responded yet.

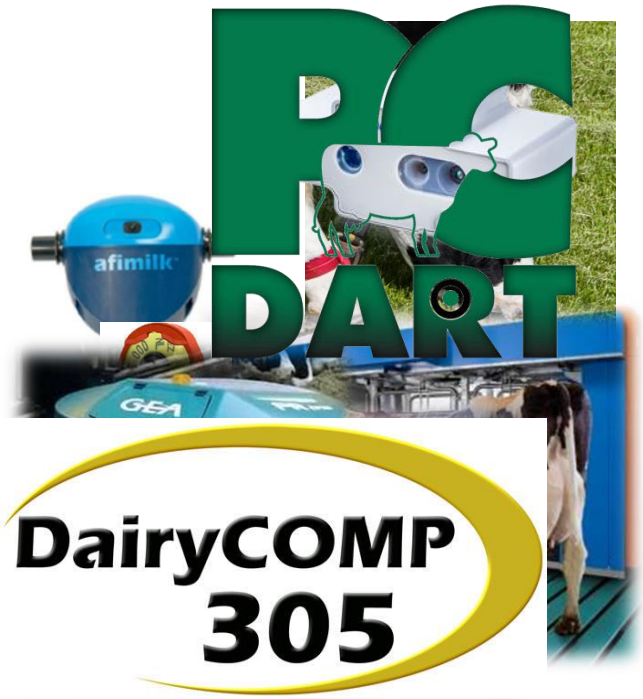
Hang tight! Responses are coming in.

How does this relate to:

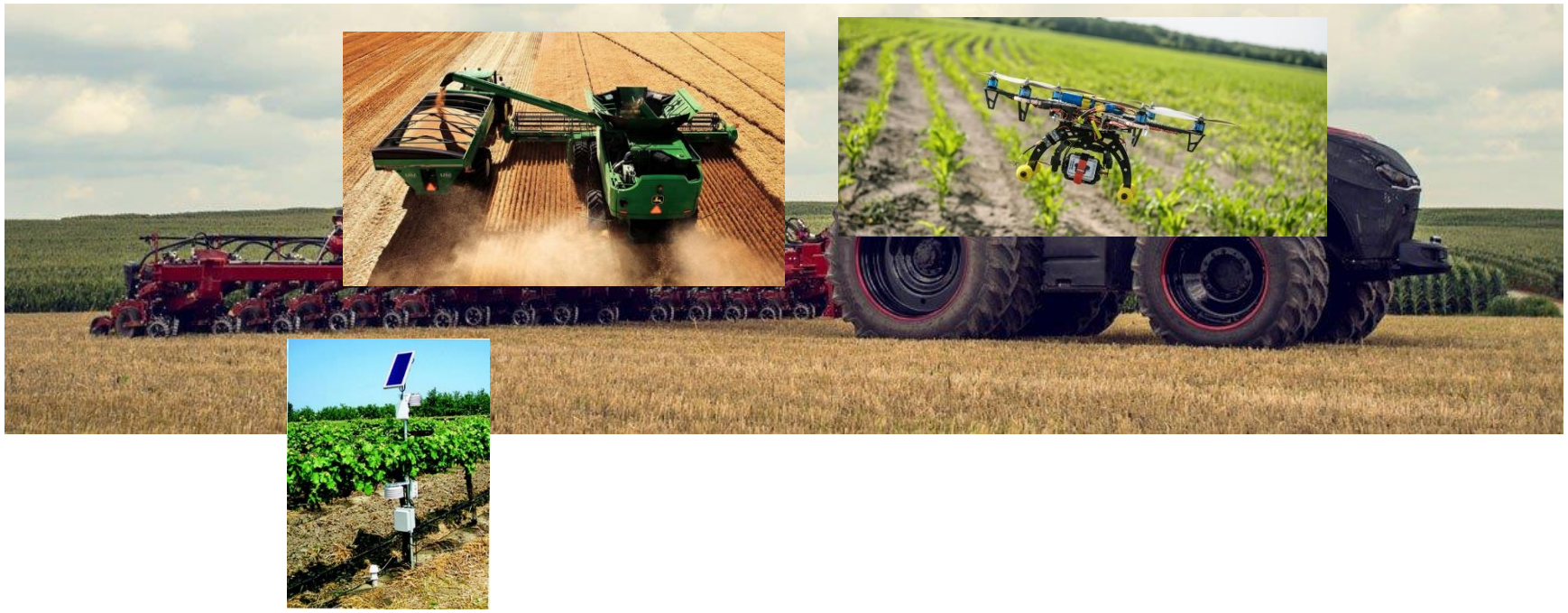


What counts as technology?

- Wearable
- Part of the milking system
- Stand-alone
- Management software



Precision Farming

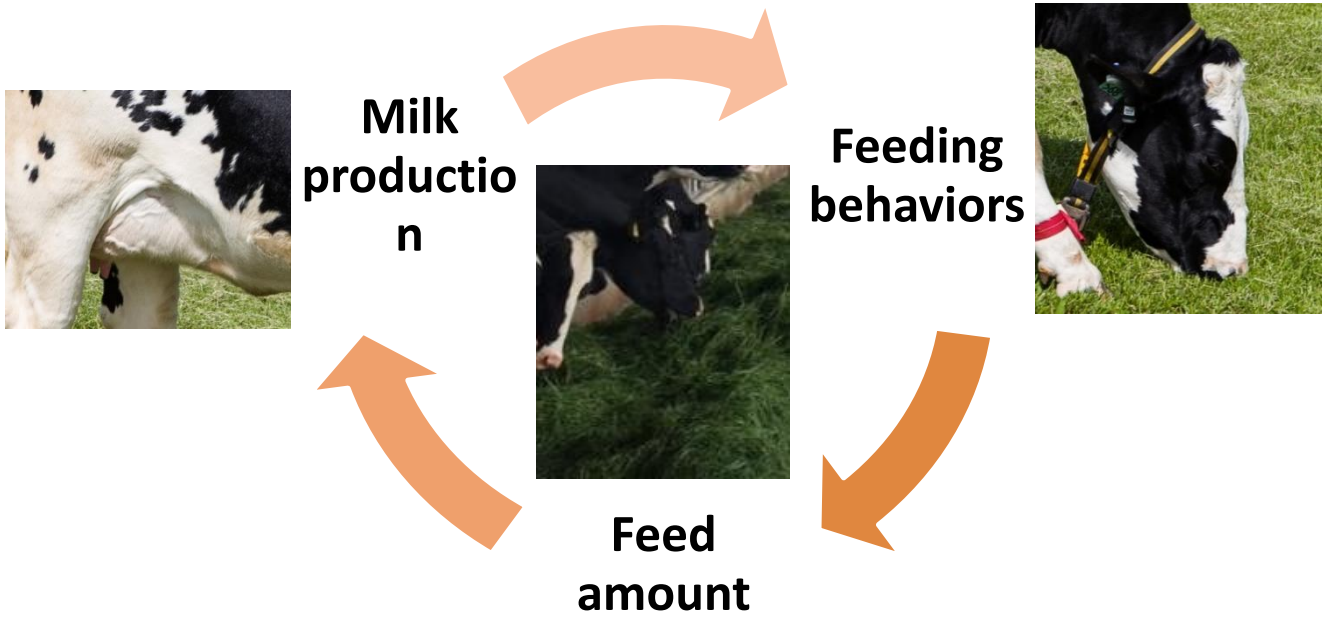


Feeding

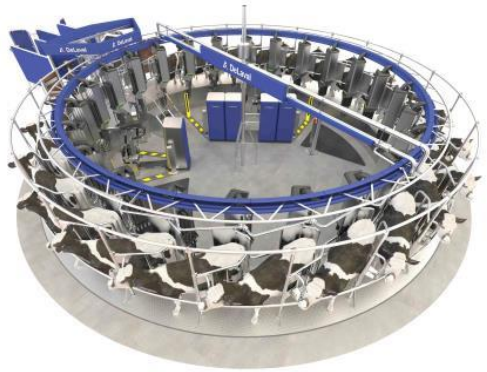
Automated TMR mixing

Precision feeding

- So why does it matter?
  - More than just replacement of labor

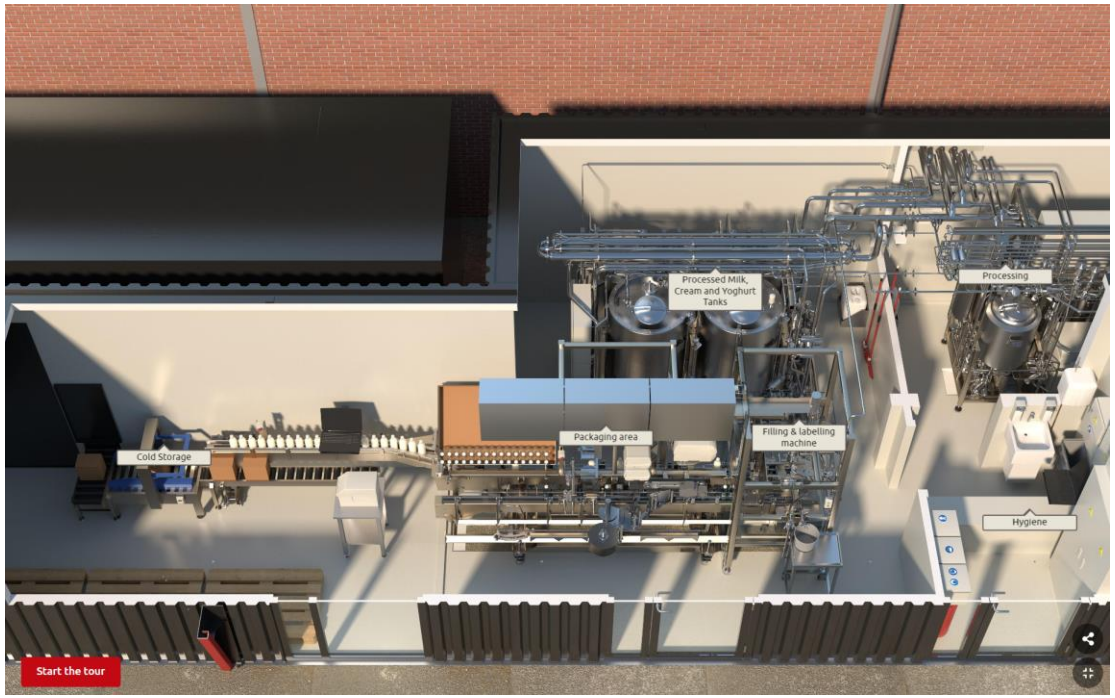


Automated Milking Systems



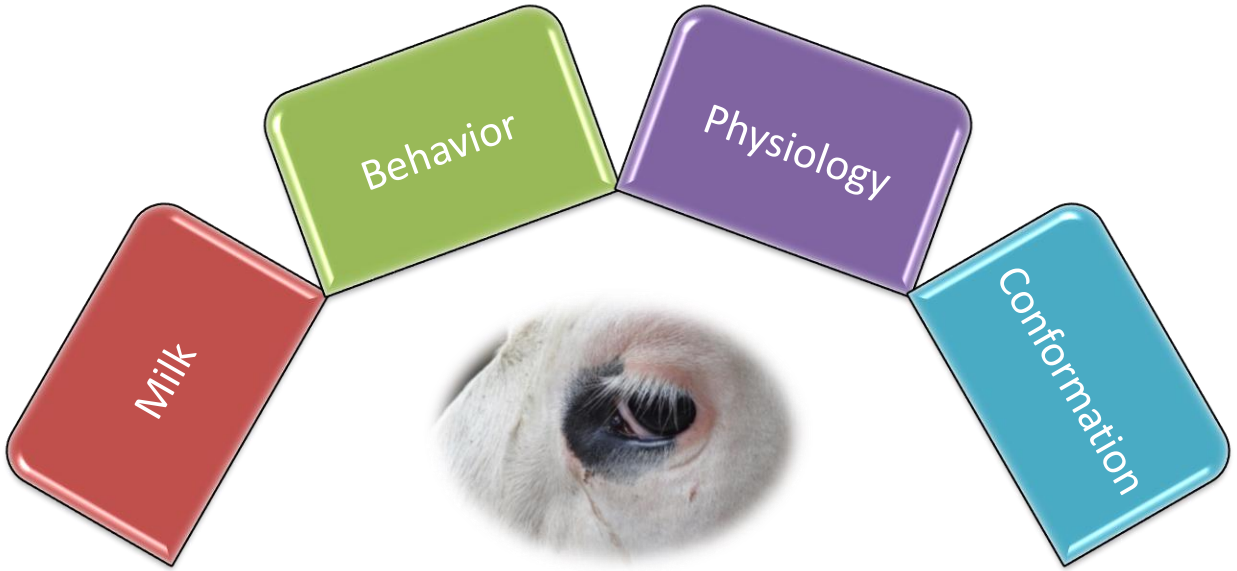
Automatic Processing?

- Lely Orbiter
  - Still in testing
  - Not FDA approved



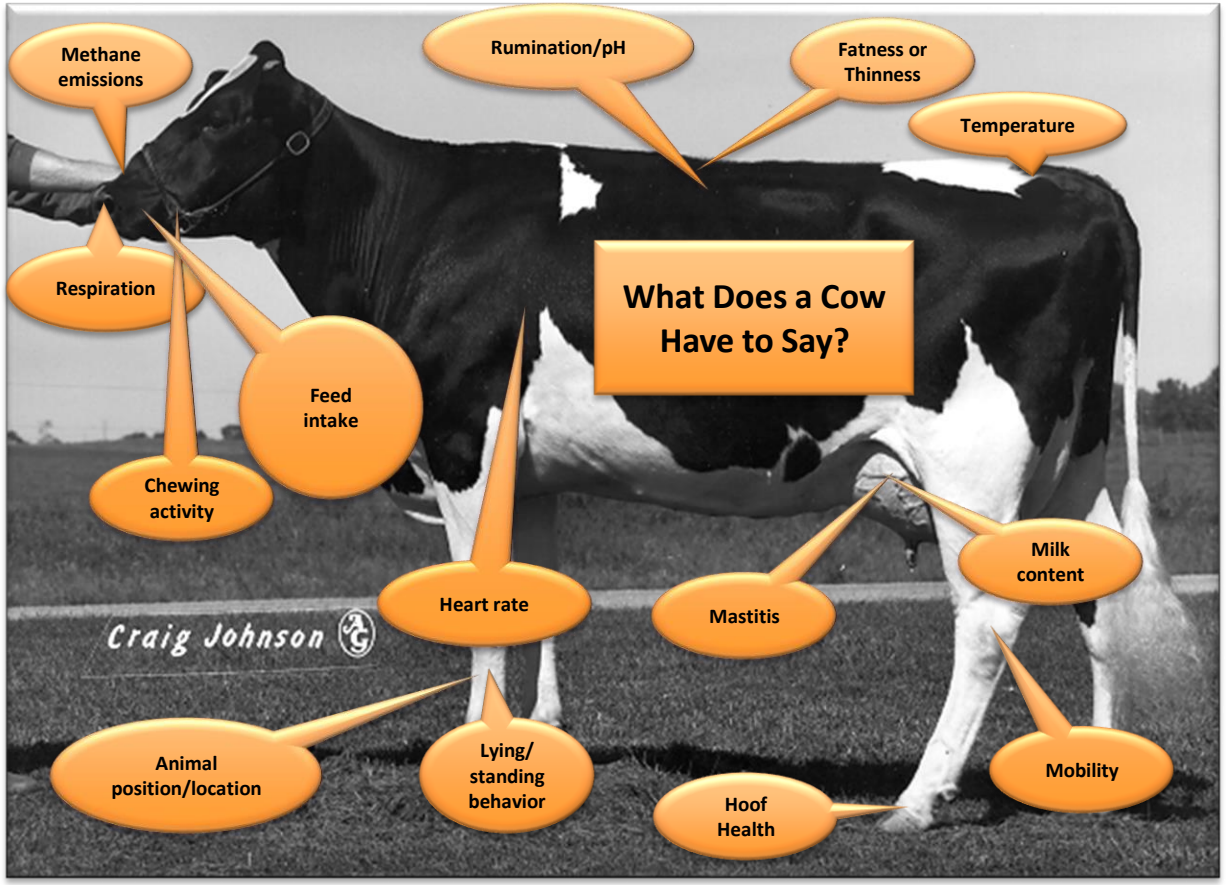
Data management solutions

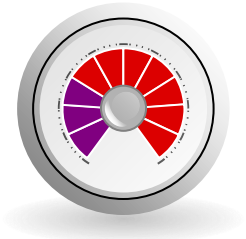
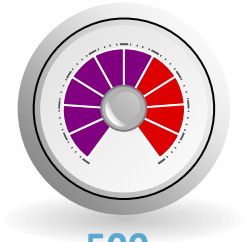
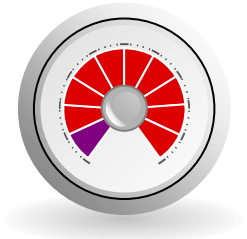
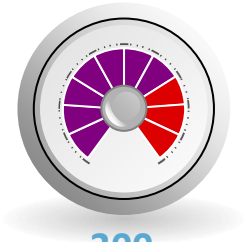
Precision dairy monitoring

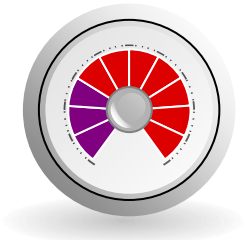
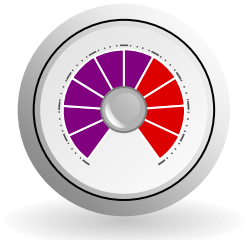
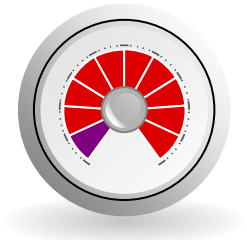
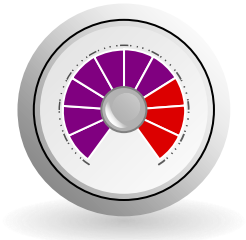


Precision dairy monitoring uses

- Estrus Detection
- Mastitis Detection
- Fresh Cow Disease Detection
- Lameness Detection
- Calving Detection
- Genetic Traits
- Management Monitoring


Methane emissions
Rumination/pH
Fatness or Thinness
Temperature
Respiration
What Does a Cow Have to Say?
Feed intake
Chewing activity
Heart rate
Mastitis
Milk content
Craig Johnson
Animal position/location
Lying/ standing behavior
Hoof Health
Mobility

Milk Yield	Rumination Time	Lying Time	Eating Time
			
43 pounds	500 minutes ✓	18 hours	300 minutes ✓

Somatic Cell Count	Body Condition Score	Temperature	Progesterone
			
682,000 cells/mL	3.0 ✓	104.0°F	10 ng/ml ✓

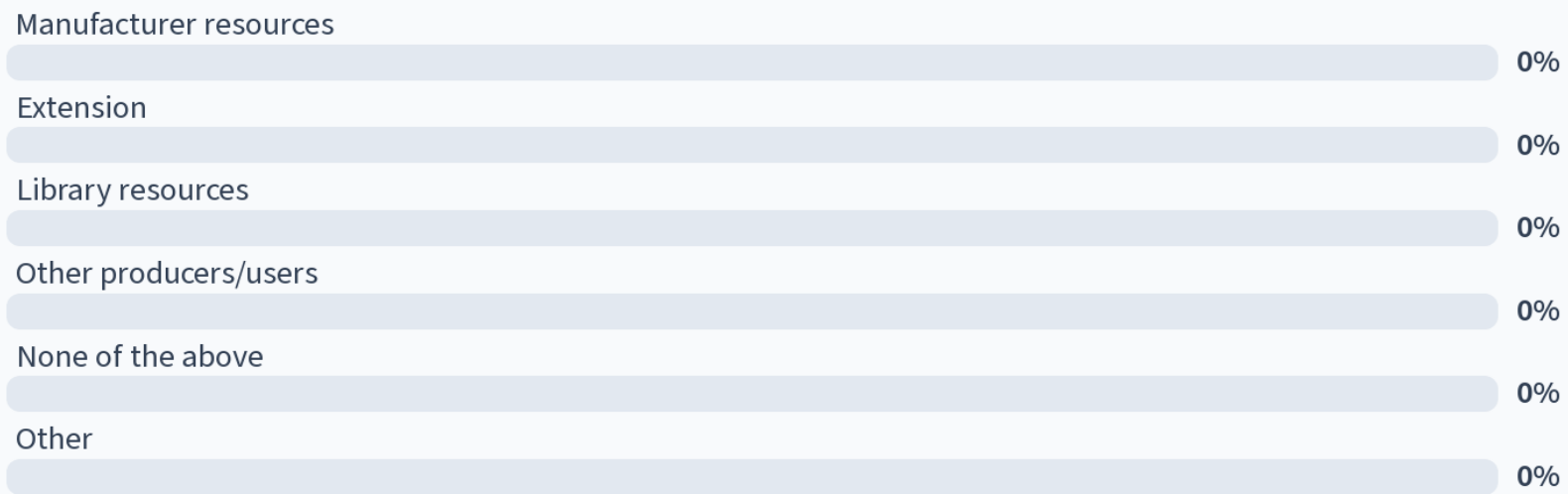
Precision dairy benefits

- Improved animal health and well-being
- Early detection
- Increased efficiency
- Improved product quality
- Minimized adverse environmental impacts
- More objective measures

Ideal technology

- Explains an underlying biological process
- Can be translated to a meaningful action
- Cost-effective
- Flexible, robust, reliable
- Simple and solution focused
- Readily available information

What resources do you use when looking for information about precision technologies?



The options are endless

Real. Life. Solutions.™

UT Dairy

UTIA INSTITUTE OF AGRICULTURE
THE UNIVERSITY OF TENNESSEE

Inline somatic cell count

Mastiline

Lely MQCC

DeLaval OCC

CellSense

DeLaval Herd Navigator™

- Milk measurements
- Progesterone
  - Heat detection
  - Pregnancy detection
- LDH enzyme
  - Early mastitis detection
- BHBA
  - Indicator of subclinical ketosis

Neck or Ear Based Behavior Monitoring

Physiology Monitoring

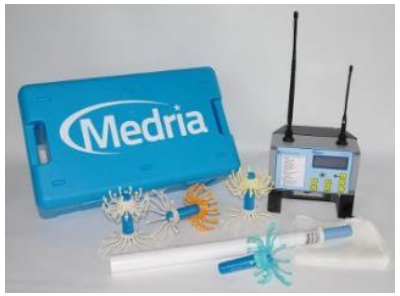
Vetcheq

Leg based behavior monitoring

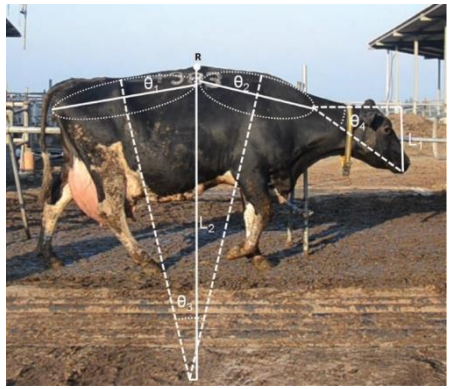
Real time location systems

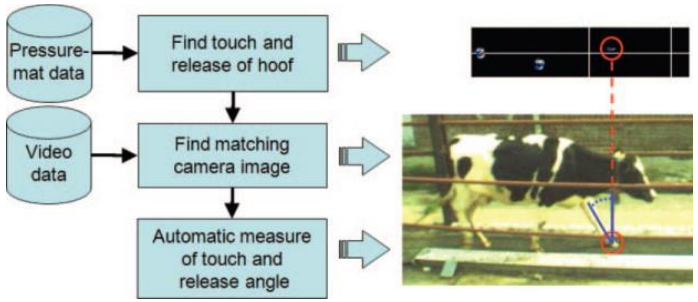
SMARTBOW
YOUR COWS. YOUR BUSINESS.

Calving detection

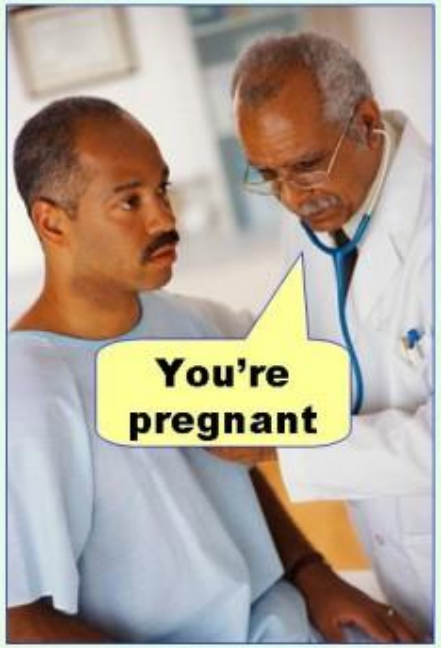


Objective Measurements

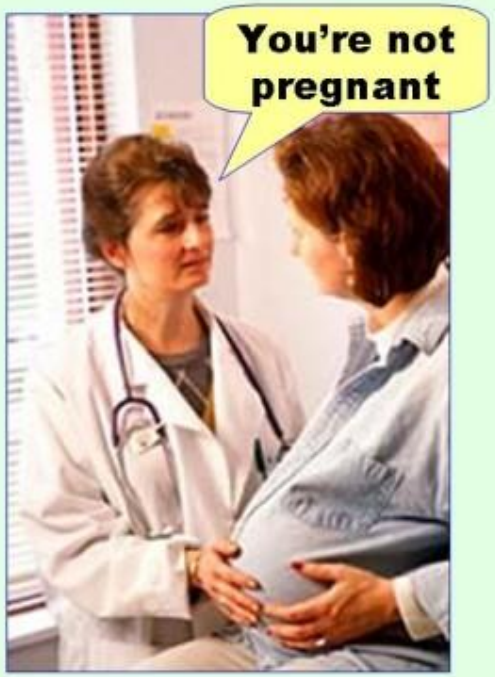




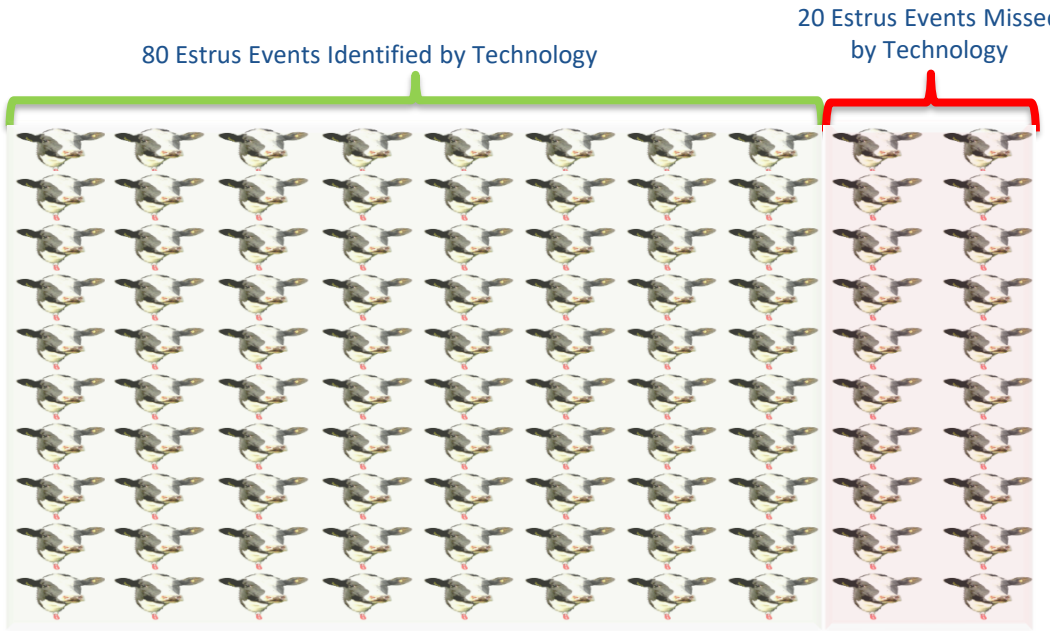
Type I error
(false positive)



Type II error
(false negative)

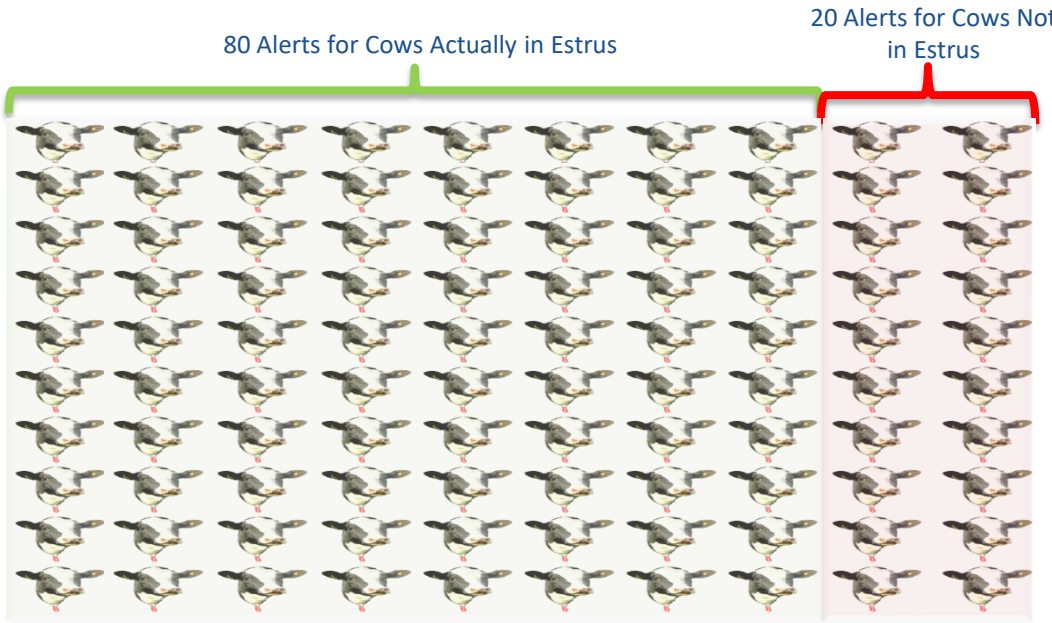


How many cows with a condition can we find?



Example: 100 estrus events

How many alerts coincide with an actual event?



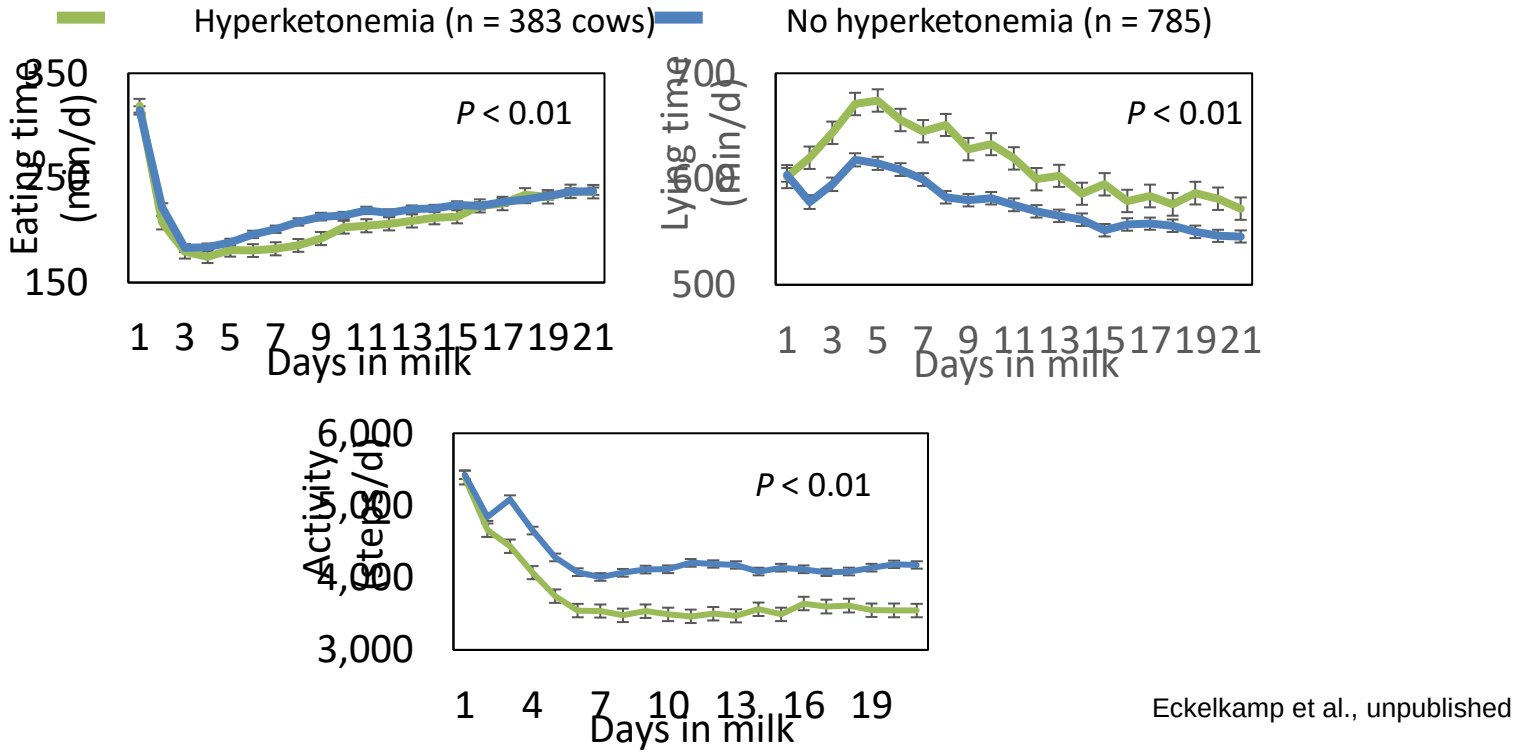
Example: 100 Estrus alerts

Assume we have 300 cows

		Alert + 100	Alert - 200
Estrus +	100	True positive (**TP**) 80	False negative (**FN**) 20
Estrus -	200	False positive (**FP**) 20	True negative (**TN**) 180

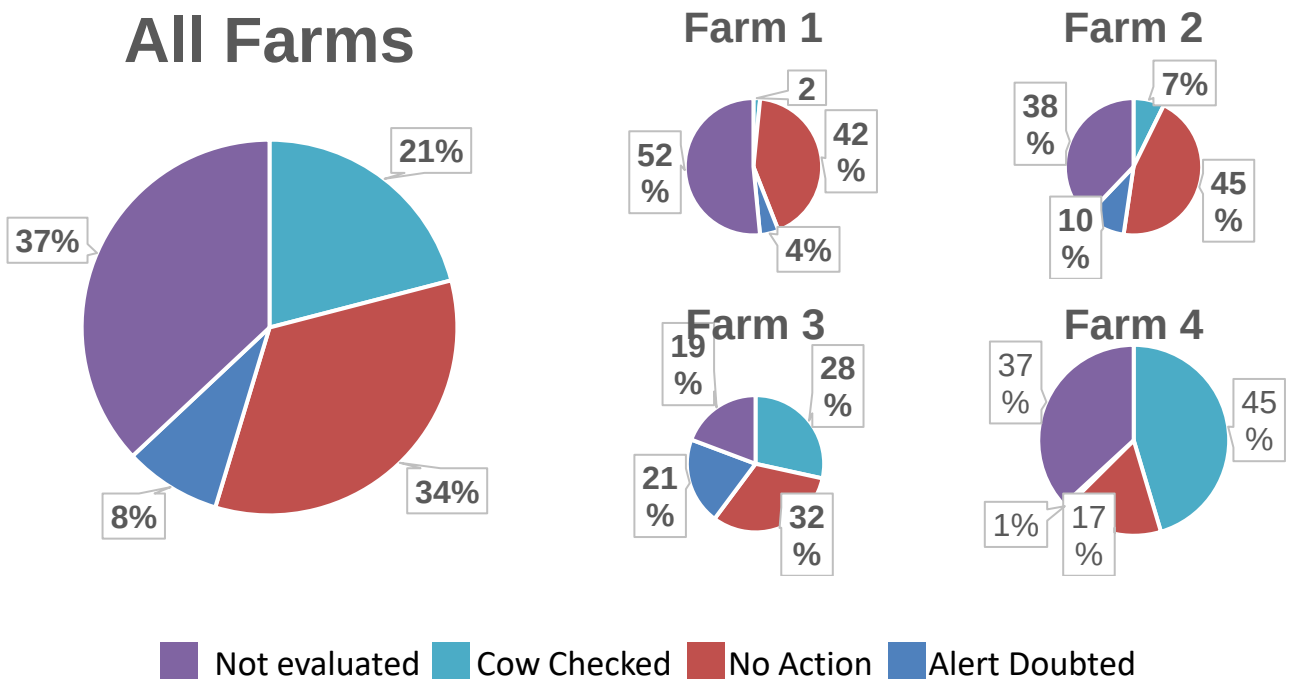
Specificity = 80%

Differences in observation



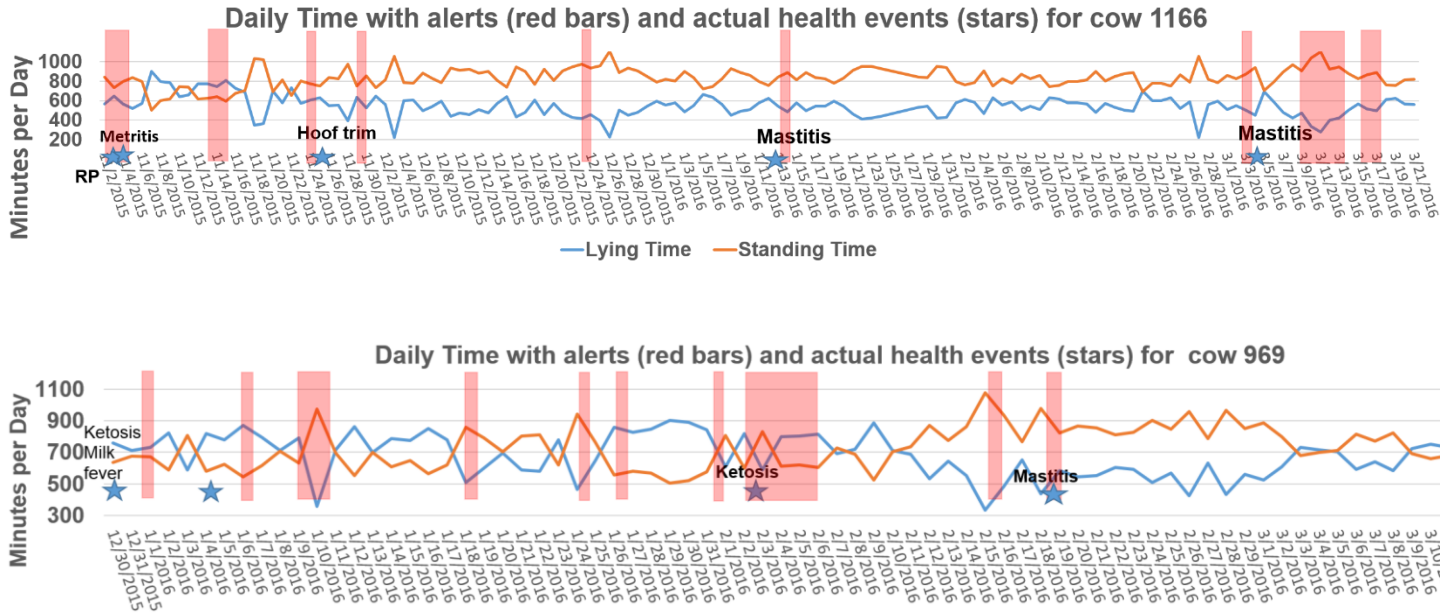
Eckelkamp et al., unpublished

Farmer use of real alerts



Eckelkamp et al., 2021

Why?



Eckelkamp et al., unpublished

So what now?

- Machine-learning?

Fresh cow disorders

Traditional analysis

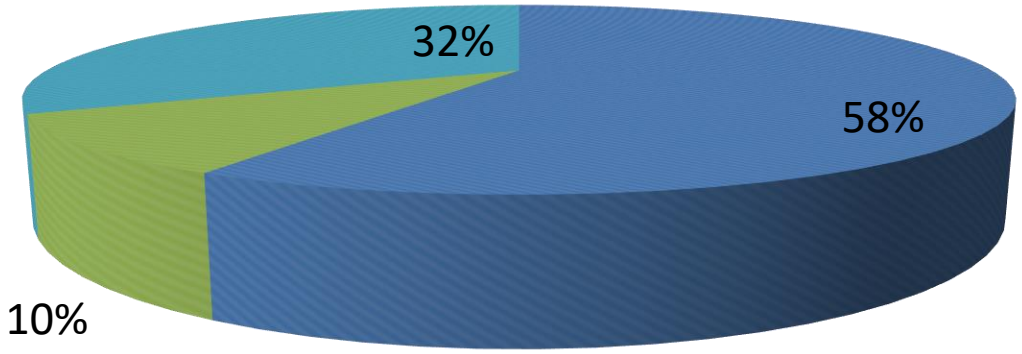
- Detecting any disease
  - 51 to 56% balanced accuracy
- Detecting a specific disease
  - 50 to 53% balanced accuracy

Machine-learning

- Detecting any disease
  - 73 to 75% balanced accuracy
- Detecting a specific disease
  - 76 to 78% balanced accuracy

Eckelkamp et al., unpublished

Calving detection



Hardy et al., 2015

Machine-learning

Technology	Sensitivity	Specificity
HR Tag	55.6%	91.8%
IceQube	88.9%	93.5%
Combination	100.0%	96.5%

Borchers et al., 2015

So what?

Practical considerations

- Technology
  - Must fill an on-farm need
  - Must have a practical outcome
  - Must enhance or replace labor or observation
  - Must have a good service team
  - Must provide good start-up guide

Practical considerations

- Farmer
  - Must be willing to use the technology
  - Must be a good manager
  - Must be able to incorporate technology into farm
  - Must have a good service team

What other considerations come to mind?

Nobody has responded yet.

Hang tight! Responses are coming in.

Questions?

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