



Bayesian prediction of mastitis using sensor data routinely collected in dairy herds

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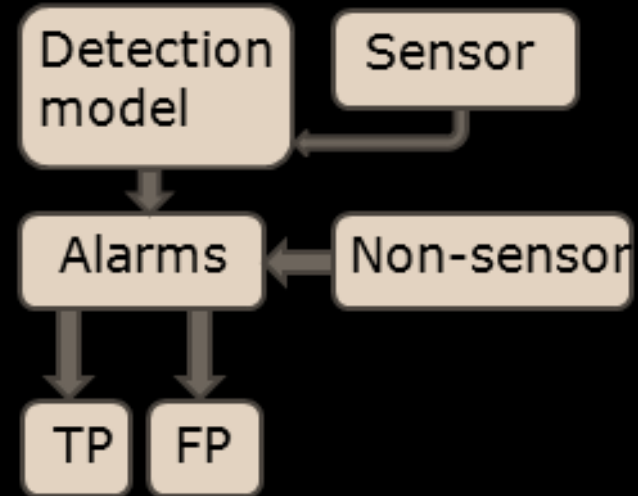
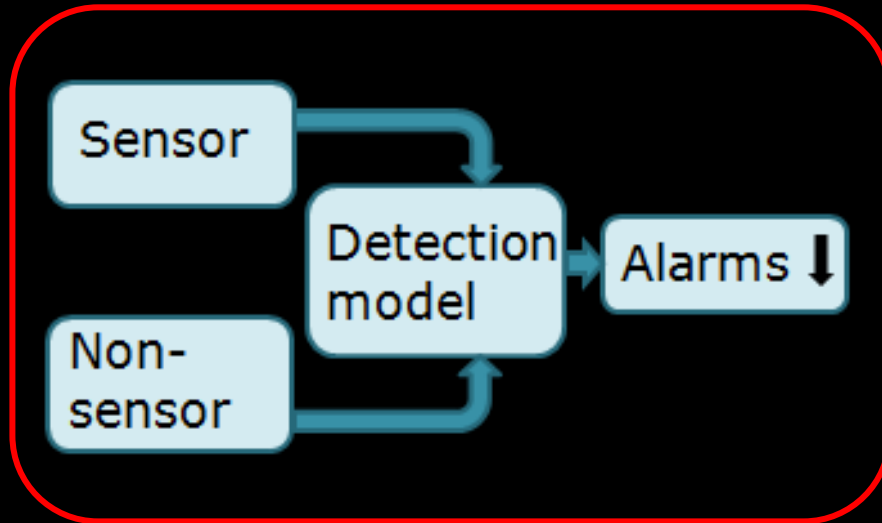
Albert De Vries

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Slide 1



Combination Method



Data Source

– University of Florida



Data Source



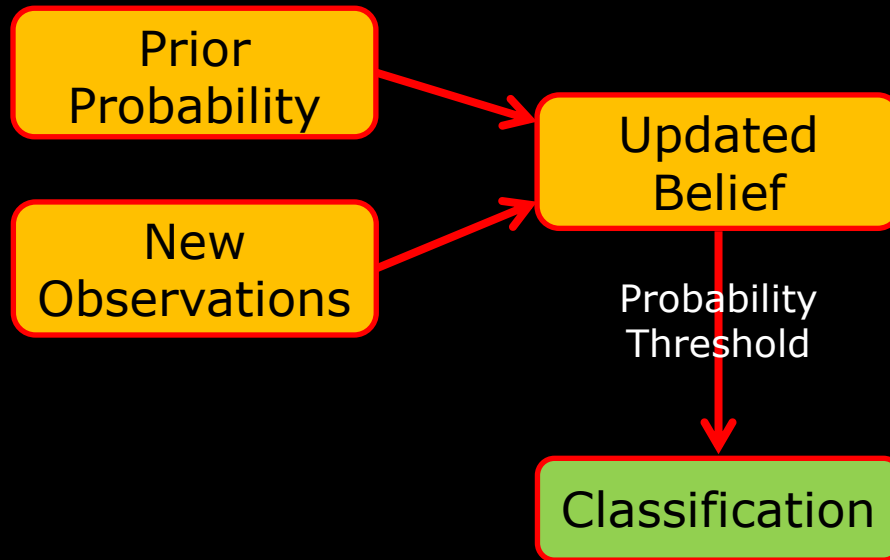
Data Source



- Non-sensor data
- Season of the year
 - Parity
 - Mastitis history

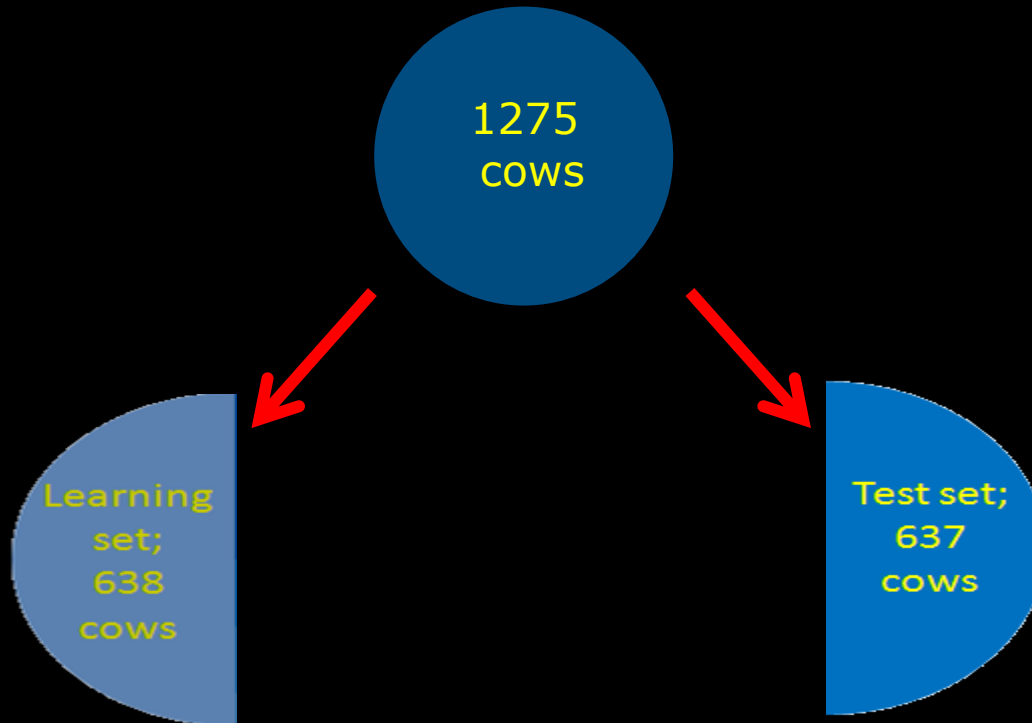
Predicting Mastitis

Naive Bayesian Classification:



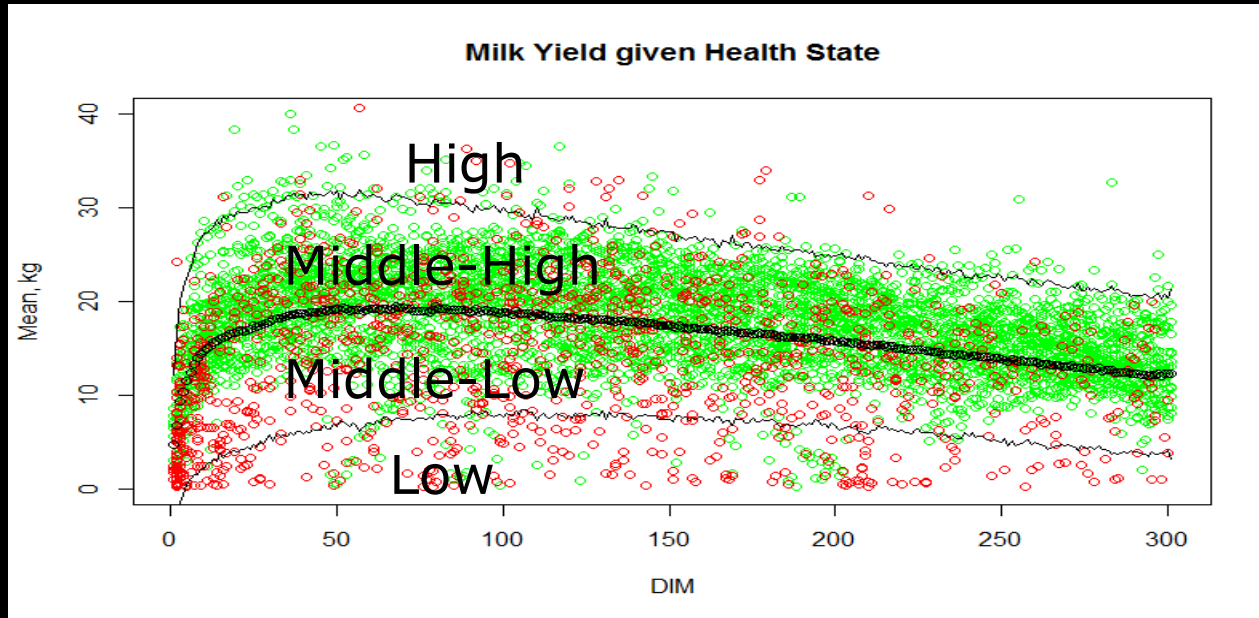
*Thomas Bayes,
1701-1761*

Learning and Testing the Model



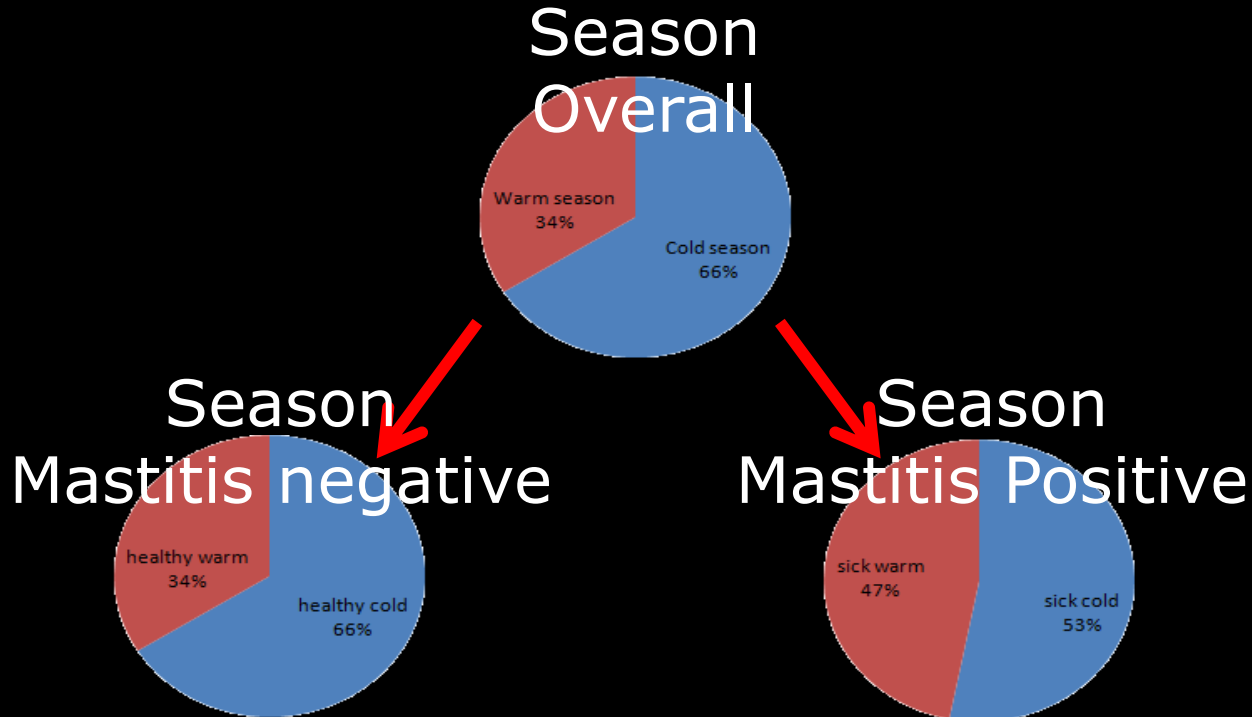
Learning the likelihoods -sensor example

Learning
set;
638
cows



Learning the likelihoods - non-sensor example

Learning
set;
638
cows



Predicting Mastitis

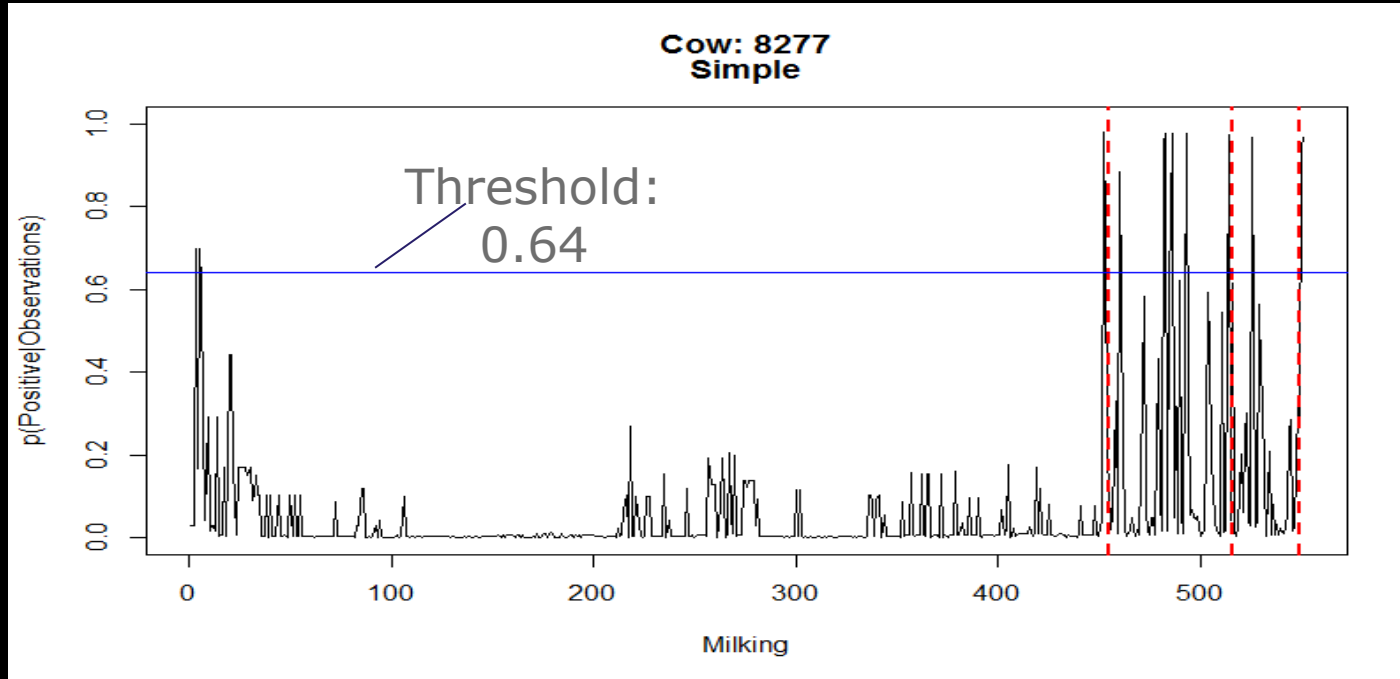
$$p(\text{Pos}|\text{Yield}, \text{Season}) = \frac{p(\text{Yield}|\text{Pos}) \cdot p(\text{Season}|\text{Pos}) \cdot \text{prior}(\text{Pos})}{p(\text{Yield}|\text{Pos}) \cdot p(\text{Season}|\text{Pos}) \cdot \text{prior}(\text{Pos}) + p(\text{Yield}|\text{Neg}) \cdot p(\text{Season}|\text{Neg}) \cdot \text{prior}(\text{Neg})}$$

Test set;
637
cows

Prior probability of Mastitis: 5 % \longrightarrow 16 %

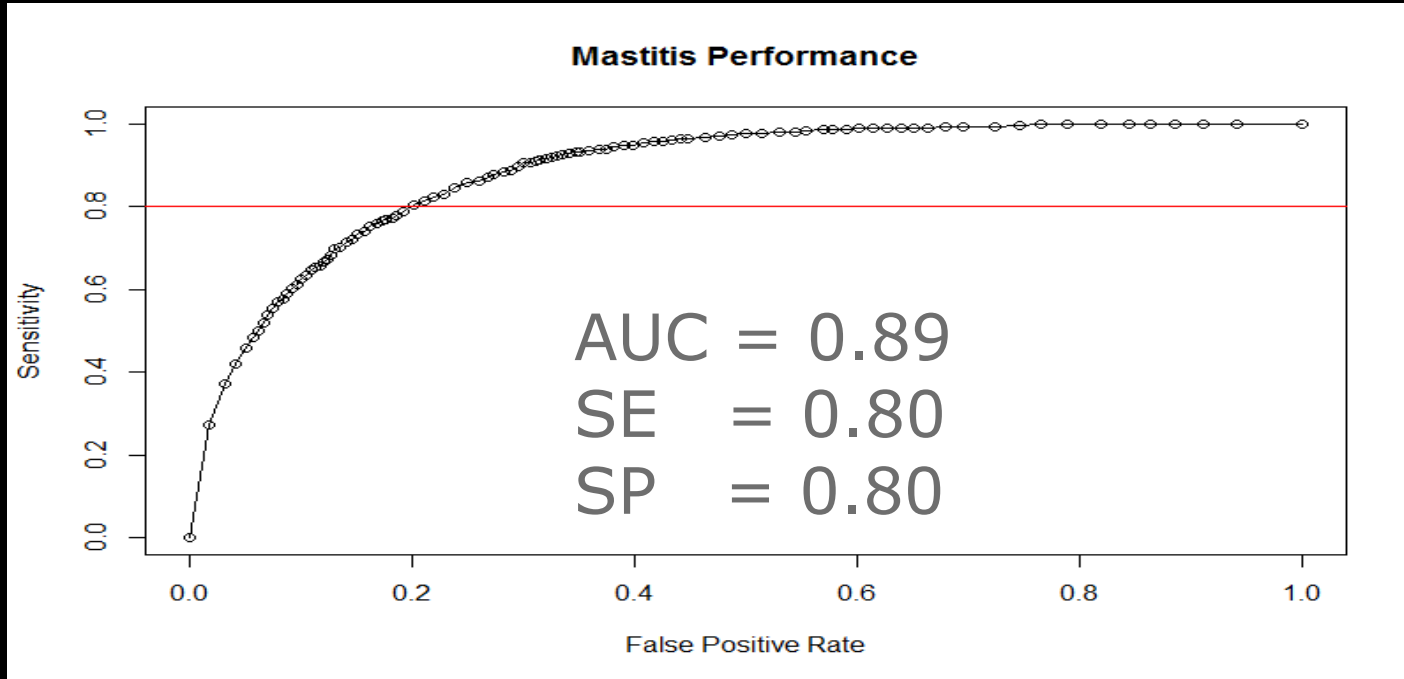
Categorical variable	Observed category	p(Observed Pos)	p(Observed Neg)
Milk Yield	Low	0.38	0.15
	Middle-Low	0.25	0.34
	Middle-High	0.23	0.36
	High	0.14	0.15
Season	Cold	0.53	0.66
	Warm	0.47	0.34

Predicting Mastitis



Test set;
637
cows

Predicting Mastitis



Test set;
637
cows

Perspectives

Individual cow expectations



AUC = 0.94

SE = 0.80

SP = 0.91

Detection/early warning of
other dairy cow conditions



Inter-herd transferability of
model



No threshold – prioritize based
on posterior probability



Take home messages

Bayesian combination of sensor
and non-sensor information

A probability threshold can be
set to define alarms

Perspectives for further studies

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