Predicting the fertility of dairy cows using milk mid-infrared spectroscopy

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DataGene Solutions for Herd Development

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Dairy Australia Your Levy at Work

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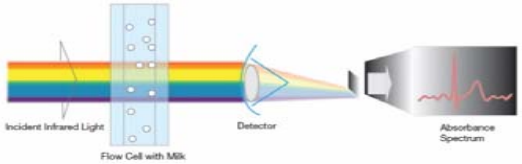

Herd-testing is the way to gain comprehensive production in[illegible]vidual cows

- Milk production
- Fat, protein, lactose concentration
- Somatic cell count

Which cows to dry-off

Which cows should be sold

Which cows should be treated

Feeding management

What else can we get out of a herd-test?

Why is fertility important?

- Fertility is a key driver of profit in dairy farming as it ensures appropriate culling rate, milk sales and number of replacements
- Multiple factc **Benefits of improved fertility** genetic, nutrition, man
- Few studies Improved fertility gives you flexibility to better manage your dairy farm and your herd. You can choose your calving pattern and the best time to calve. As fertility declines you lose this ability. can be used to make informed breeding decisions

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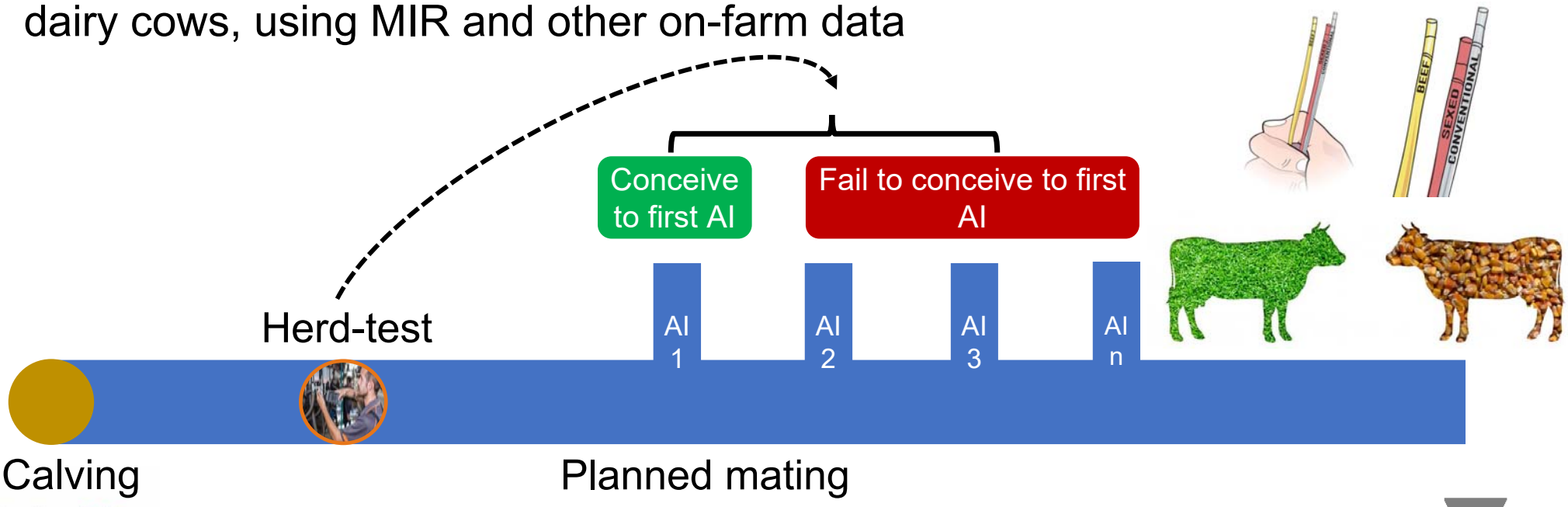
Objective

Develop a model to predict the likelihood of conception to first insemination of dairy cows, using MIR and other on-farm data



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Classifying the fertility of dairy cows using milk mid-infrared spectroscopy

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Predicting the likelihood of conception to first insemination of dairy cows using milk mid-infrared spectroscopy

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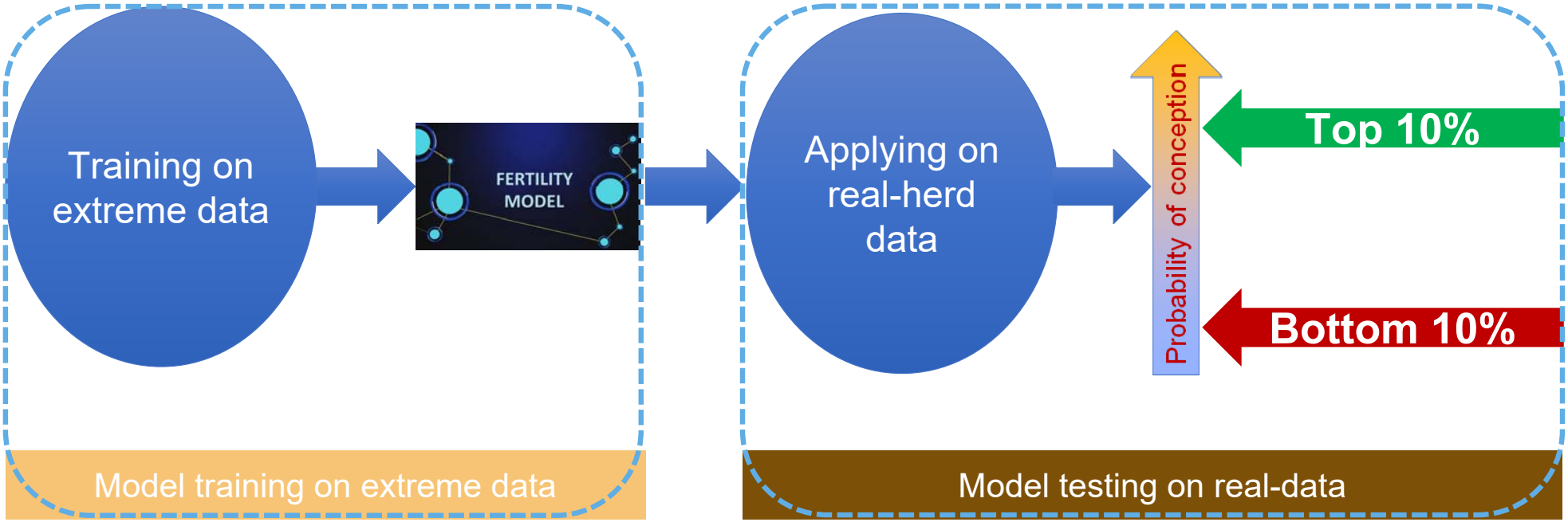

STEP 1

STEP 2

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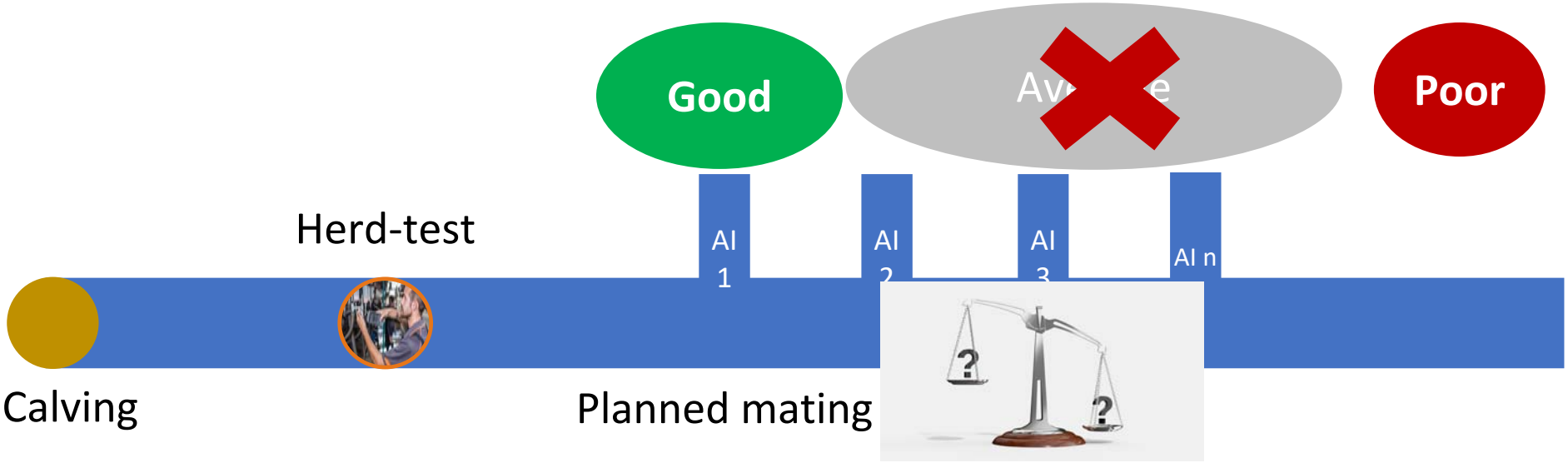
Model concept: Extreme data approach



Good and poor cows might have significantly different metabolic conditions, and consequently likelihood to conceive, while the metabolic conditions of average cows could be similar to that of good and poor cows

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Prediction models

Model	MIR	DIM	Calving age	DAI	MY	Fat	Protein	Lactose	SCC	Fert GEBV	GRM
1				x	x	x	x	x	x		
2		x	x	x	x	x	x	x	x		
3	x	x	x	x	x				x		
4	x	x	x	x	x				x	x	
5	x	x	x	x	x				x	x	x
6		x	x	x	x					x	

Data: 29,341 spectral and other on-farm records of 13,806 cows from 55 commercial dairy herds (63 herd-years [2016 – 2019])

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Accuracy of classifying good vs. poor cows on extreme data

Accuracy 1st AI (bottom 10%)	Accuracy 1st AI (top 10%)	Accuracy 2nd AI (top 10%)
0.74 ± 0.15	0.67 ± 0.18	0.74 ± 0.12

Accuracy of predicting likelihood of conception to first and second AI on real-herd data

Accuracy 1st AI (bottom 10%)	Accuracy 1st AI (top 10%)	Accuracy 2nd AI (top 10%)
0.72 ± 0.16	0.51 ± 0.17	0.73 ± 0.16

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Conclusions

- Prediction accuracy of the models for predicting likelihood of conception to first insemination was improved by focusing on extreme data
- MIR of milk samples and other milk recording data collected in early lactation can be used to identify top and bottom 10% cows that are most and least likely to get pregnant in early joining period with accuracy of around 70-76%

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