Hoof lesion detection with manual and automatic locomotion scores in dairy cattle

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Hoof lesion importance

Prevalence
[> 60%]

Causes

Welfare

Cost

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Manual and automatic locomotion score

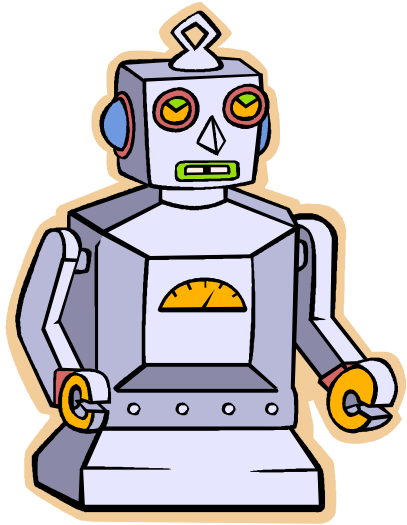
Alterations Gait and Posture

Locomotion score

Not Lame

Lame

Lesio



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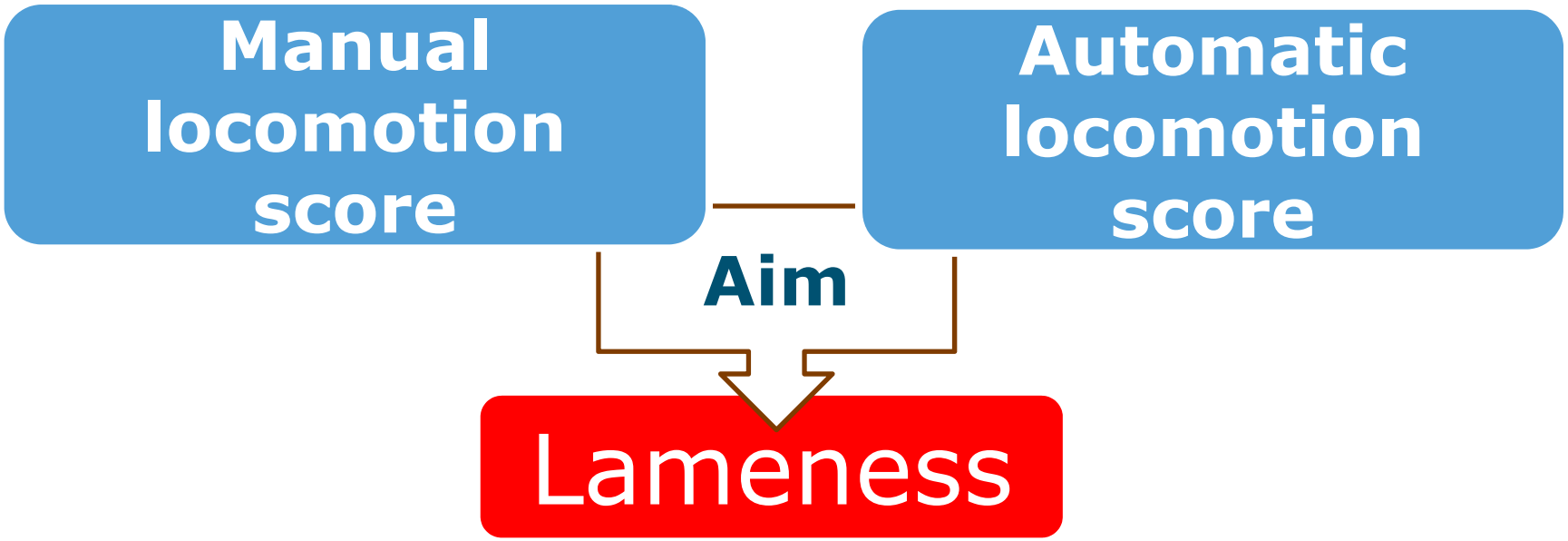
Lameness is an visual sign



Lameness is a sign
Not the problem
Problem = hoof lesions?

Objectives

consistency between **manual** and **automatic locomotion scoring systems** for scores assigned to a cow.

performance of **manual** and **automatic locomotion scoring system** for detecting hoof lesions in dairy cow.

Materials and Methods

Farm

Located in Belgium

210 – 240 Holstein cows in milk

Rotary milking systems
Twice a day

TMR and automatic concentrate supplier on barn

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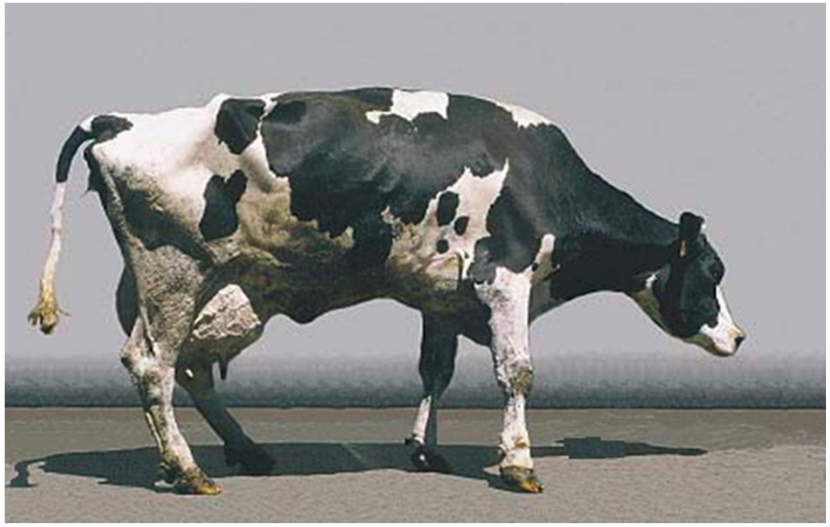
Manual locomotion score

1 experienced rater

5-level scale:

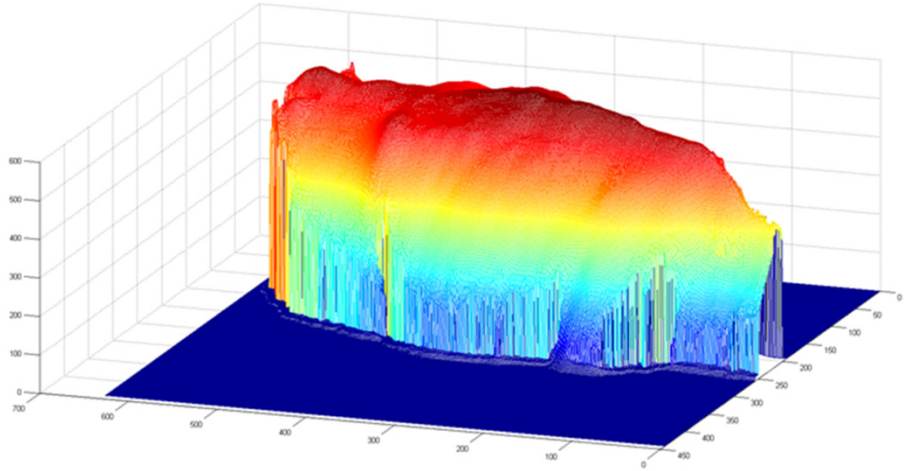
- **1: a smooth and fluid movement**
- **5: ability to move was severely restricted**

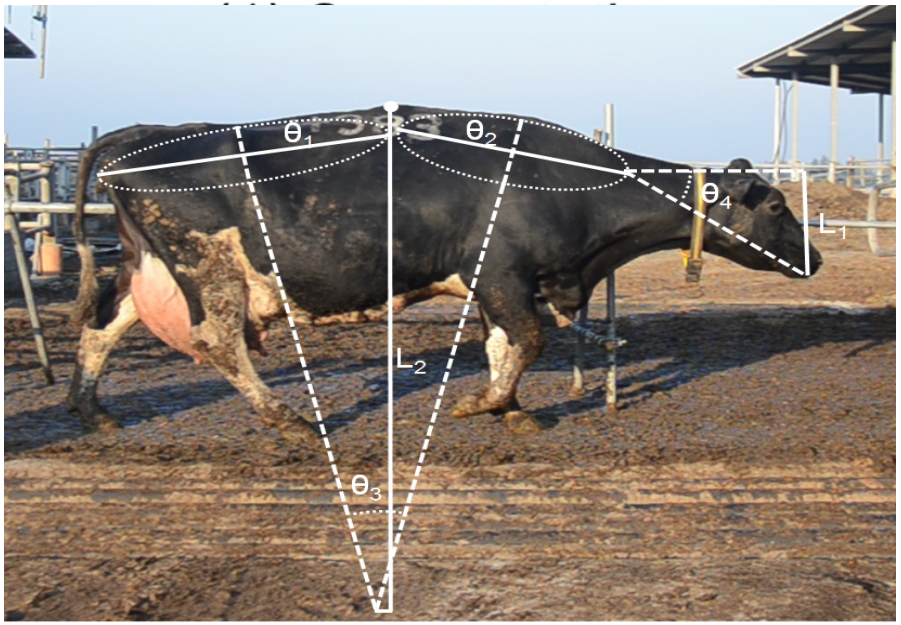
<u>Lame ≥ Score 3</u>



Credit: Zinpro

Automatic locomotion score





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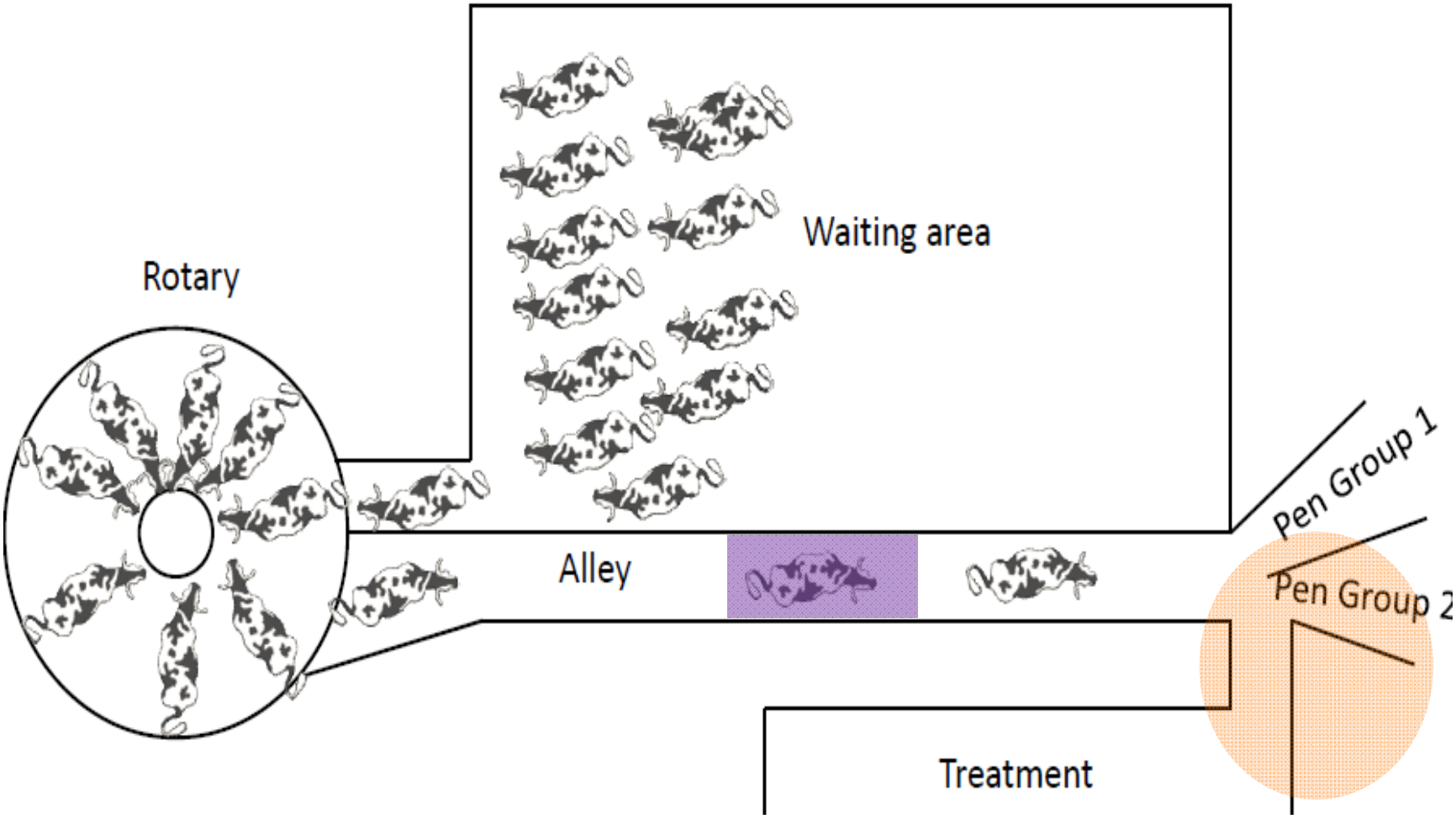
Manual and automatic locomotion scoring



Trimming and hoof lesion detection

Two professional trimmers (approx. half cows each)

Two observer recording lesions (not trimmers)

Lesion scored as:

0: no lesion
1: slight lesion
2: moderate lesion
3: severe lesion

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Consistency between manual and automatic locomotion score

Percentage of agreement (PA): Identical scores to a cow.

Weighted kappa (κw): Assign weight to the disagreements

5-level scale
Lame/not lame classification (Locomotion Score ≥ 3)

Performance for detecting hoof lesions

Sensitivity: Capability of a test for detecting cow with lesions

Specificity: Capability of a test for detecting cows without lesions

Locomotion score

Lame ≥ 3

Lesions score

Hoof lesion ≥ 1
Severe hoof lesion ≥ 2

Results and Discussion

Descriptive results

Cow locomotion scored

- Manual: **216**
- Automatic: **104**

Lameness Prevalence

- Manual: **32%**
- Automatic: **47%**

Hoof trimming

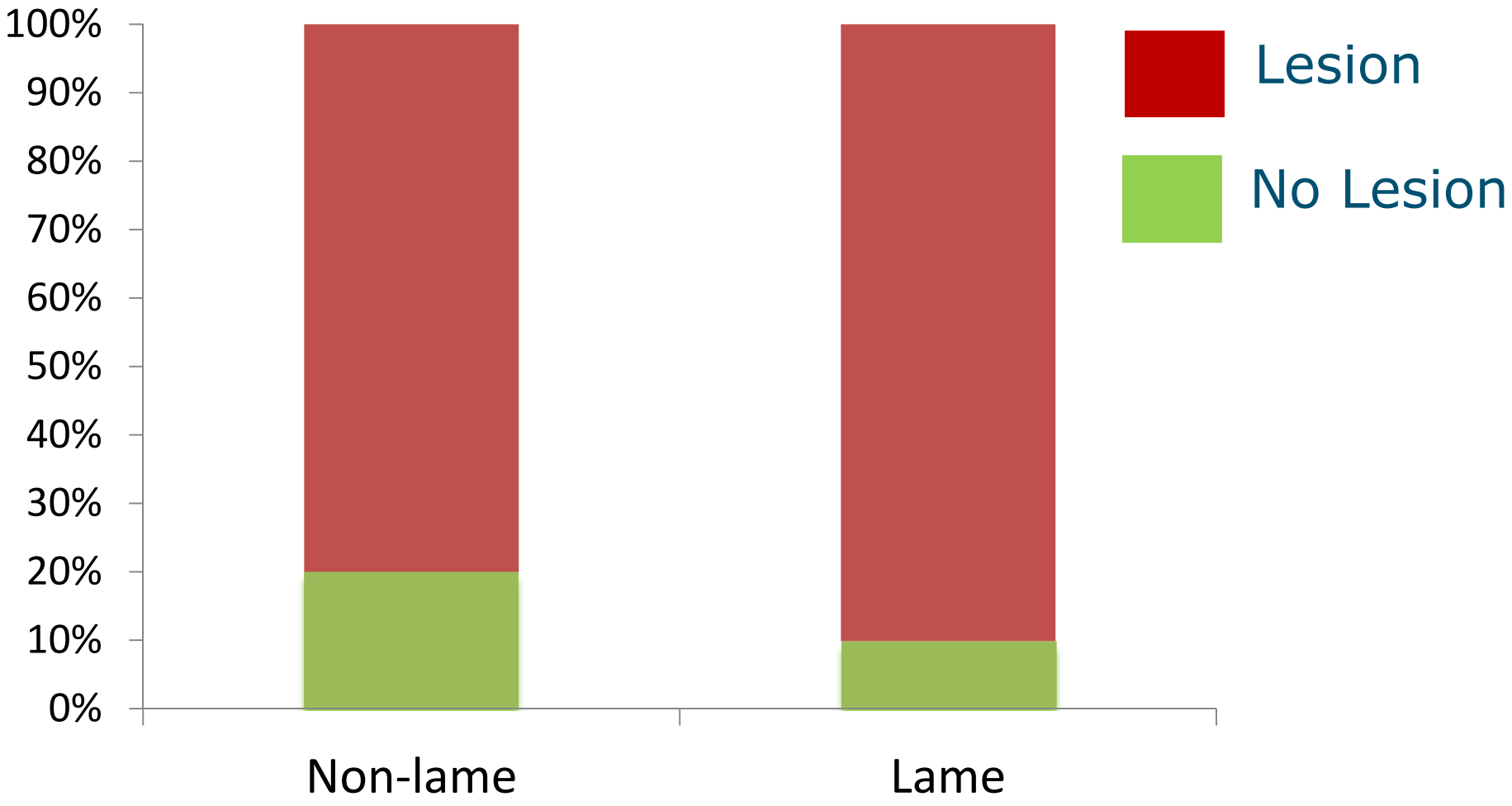
- Trimmed cows: **244**
- Hoof lesions Prevalence: **83%**
- Severe hoof lesions prevalence: **54%**

Consistency between manual and automatic locomotion scores

	Kw/K	PA
Five-levels	**0.29**	**33.9%**
Non-lame/lame	**0.33**	**67.2%**

Good
Kw ≥ 0.6
PA ≥ 75%

Cows with and without hoof lesions (manual locomotion score)



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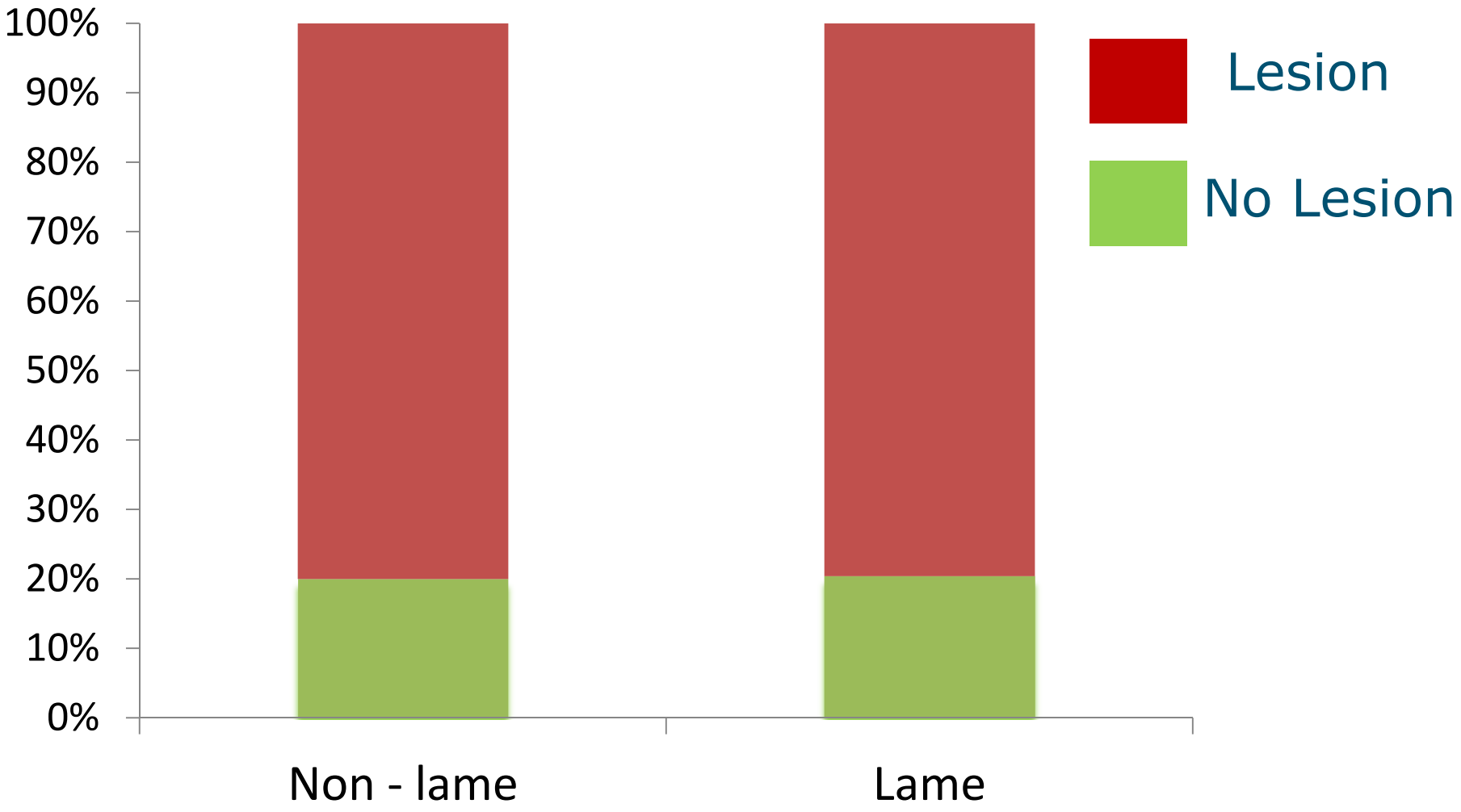
Cows with and without hoof lesions (Automatic locomotion score)



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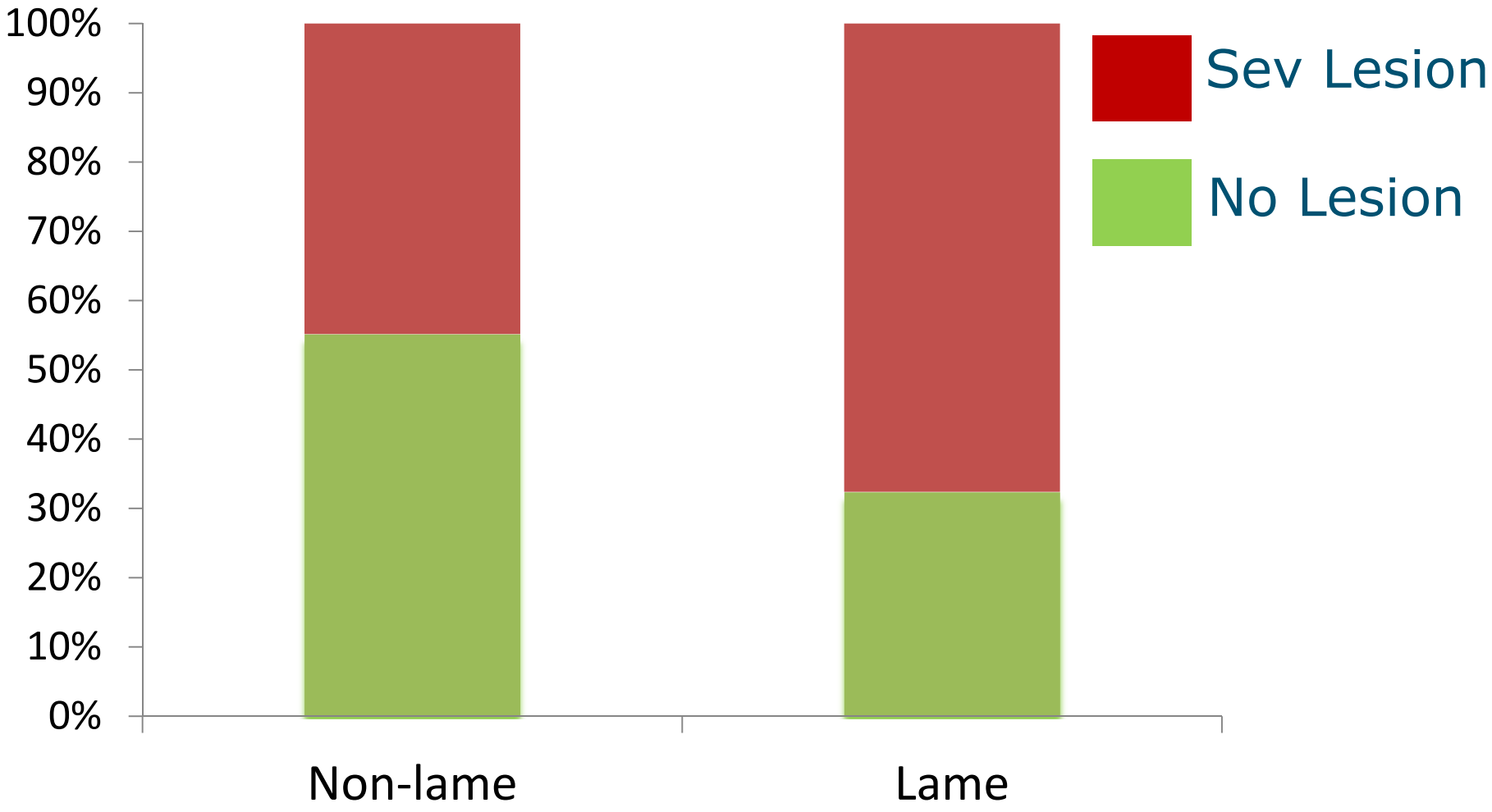
Cows with and without severe hoof lesions (Manual locomotion score)



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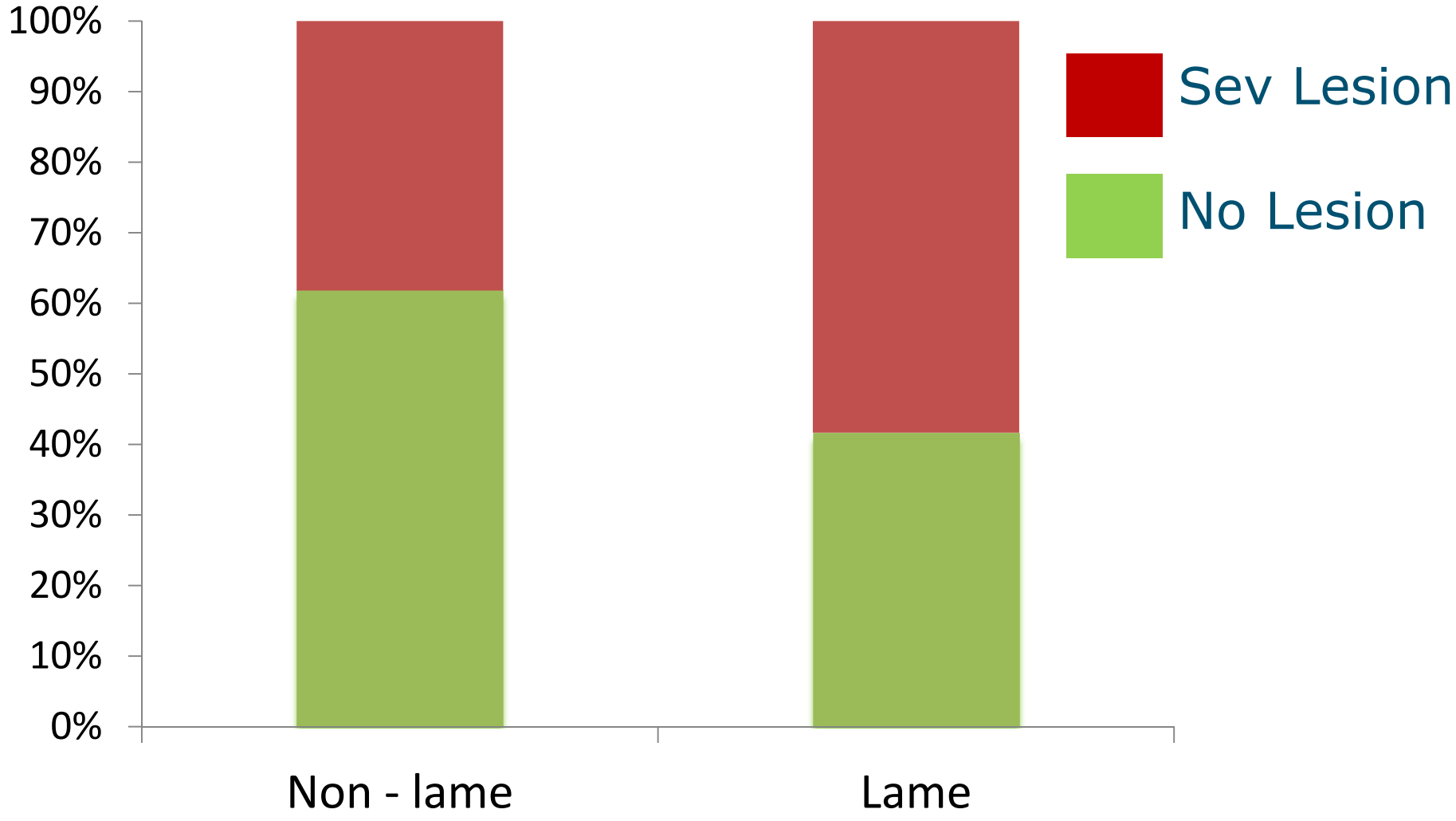
Cows with and without severe hoof lesions (Automatic locomotion score)



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Sensitivity and specificity of manual and automatic locomotion scores

	Sensitivity	Specificity
	Hoof lesions	
Manual	35.6%	80.6%
Automatic	46.9%	77.7%
	Severe hoof lesions	
Manual	42.5%	52.4%
Automatic	58.0%	62.9%

Sensitivity and specificity of manual and automatic locomotion scores in the literature

	Lesion	Sen	Spe	Reference
Manual	Sole ulcer	54%	70%	Chapinal et al (2009)
	Painful lesion	67%	84%	Bicalho et al (2007)
Automatic	Painful lesion	33%	90%	Bicalho et al (2007)
	Hoof lesions	74-78%	86-93%	Van Hertem et al (2013)

Locomotion is affected by many different factors:
Material of the walking surface, Anatomical conformation of cows, Parity, Breed, Hoof trimming, Degree of udder distension

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Conclusions

GOOD NEWS!
Automatic locomotion score perform similar as human raters for locomotion scoring (and lameness detection) and hoof lesions detection

BAD NEWS!
Manual and automatic locomotion scores have modest capability for detecting hoof lesions and severe hoof lesions

Are locomotion score useful?

- Trimming schedule:
  - **Pros** = Trim all cows, also preventive
  - **Cons** = require important organization skills, what is best? Every 2, 3, 6 months?
- Visual detection at milking
  - **Pros:** Save time, cheap (treat only cows with lesions)
  - **Cons:** Mostly useful for digital dermatitis, not preventive
- Manual locomotion scores
  - **Pros:** Cheap and easy to perform
  - **Cons:** Takes time, not preventive
- Automatic locomotion scores
  - **Pros:** Similar performance as manual locomotion scores, save time
  - **Cons:** Expensive, not preventive

THANKS

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BioBusiness Project

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