

➤ Evaluating standing and lying behaviors measured with collar-mounted accelerometers for lameness detection in dairy cows

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30/06/2026

Lameness

Second most frequent disease in dairy cows: 20 to 30% of the French cheptel.

Musculoskeletal disorders that result in changes in gait

- ➔ Detection and diagnosis through Mobility Scoring
- ➔ Need of continuous monitoring to detect changes/cases and limit the worsening

Mobility score

Category of score				Score
Good mobility				
				0
Imperfect mobility				
				1
Impaired mobility				
				2
Severely impaired				
				3

Sjöström et al. 2018. Lameness prevalence and risk factors in organic dairy herds in four European countries.

<https://ahdb.org.uk/knowledge-library/mobility-scoring-how-to-score-your-cows>

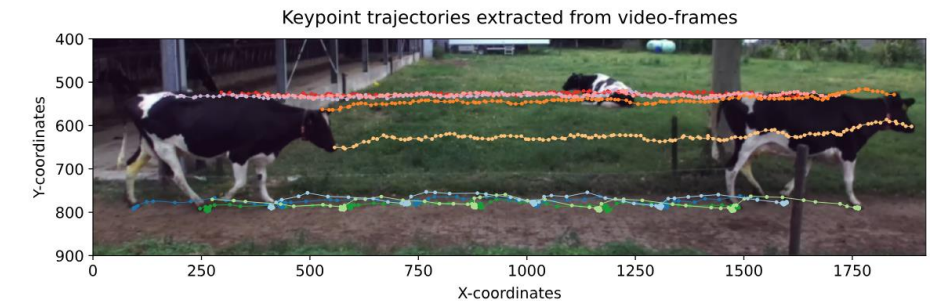
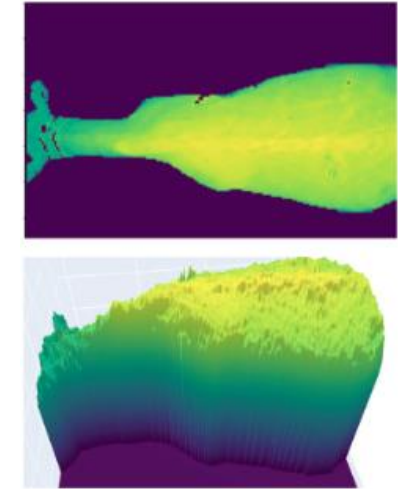
Weigle et al. 2018. Moderate lameness leads to marked behavioral changes in dairy cows.

Whay & Shearer, 2017. The Impact of Lameness on Welfare of the Dairy Cow.

Towards Automatic Lameness Detection Systems

Need continuous monitoring to detect **early** cases and limit the worsening

➔ In dairy cows : pasture grazing !



Alsaad et al. 2019. Automatic lameness detection in cattle.

O'Leary et al. 2020. Invited review: Cattle lameness detection with accelerometers.

Tun et al. 2026. Cattle lameness detection using depth image and deep learning.

Russello et al. 2026. Lameness detection in dairy cows using pose estimation and bidirectional LSTMs..

Towards Automatic Lameness Detection Systems

Need continuous monitoring to detect **early** cases and limit the worsening

➔ In dairy cows : pasture grazing !



➔ Neck mounted 3D-accelerometers!



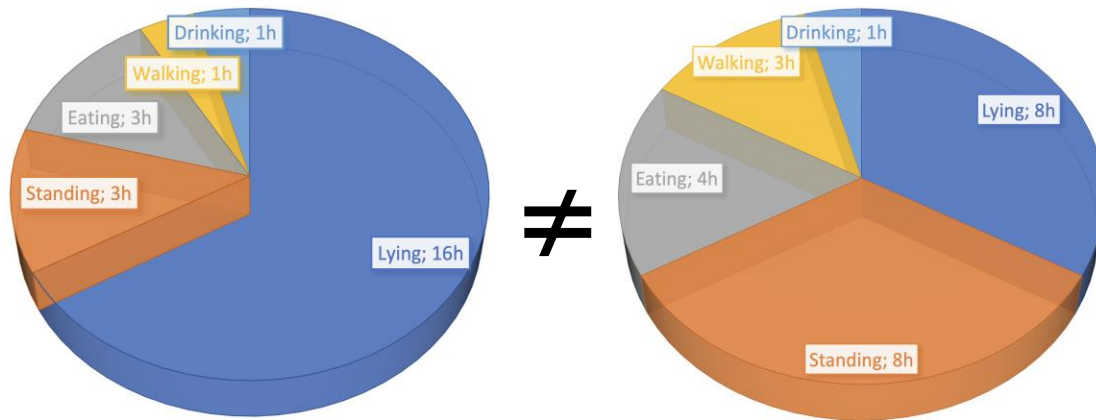
Alsaad et al. 2019. Automatic lameness detection in cattle.

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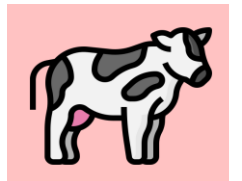
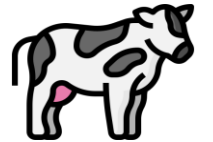
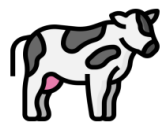
Using behaviors for ALDS ?



Lame

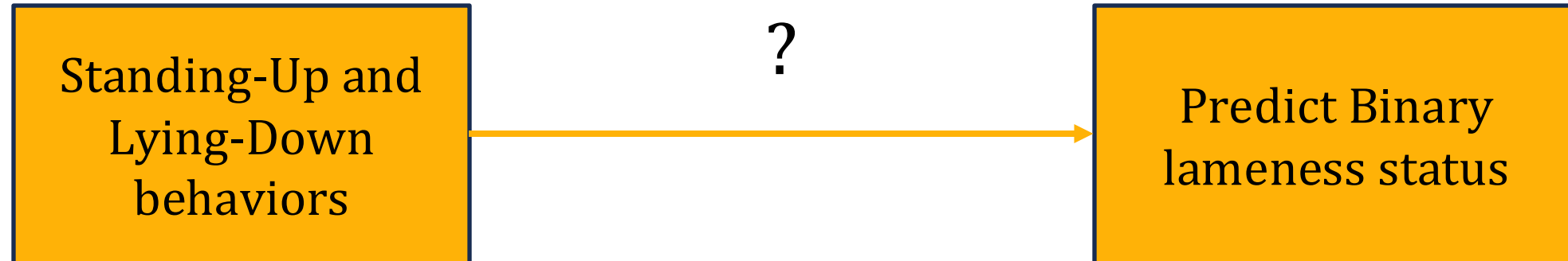


Non-lame

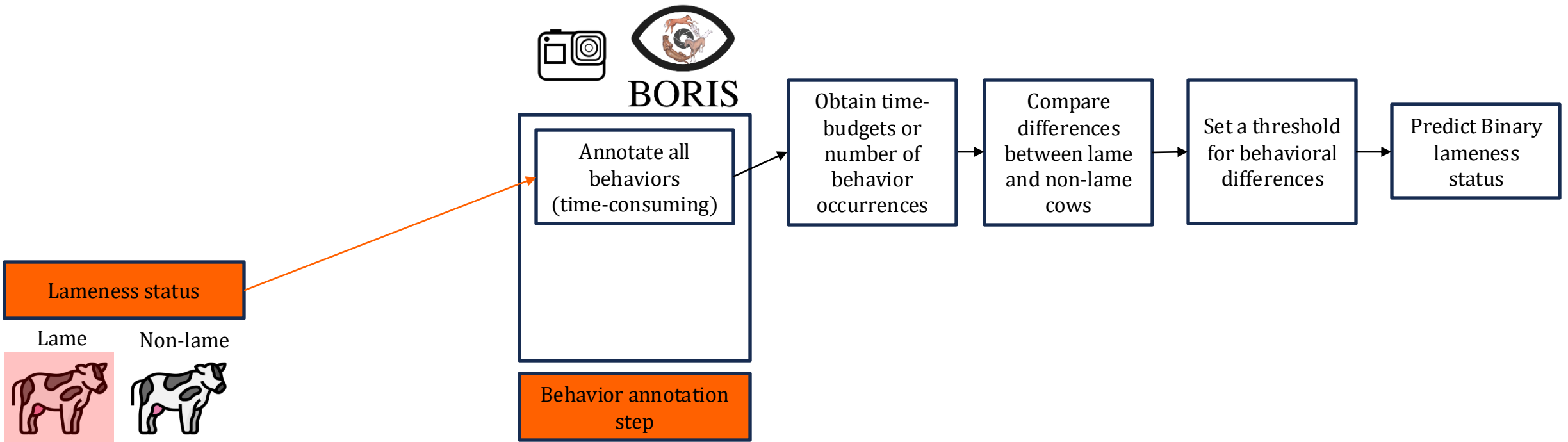


Tucker et al. 2021. Invited review: Lying time and the welfare of dairy cows.

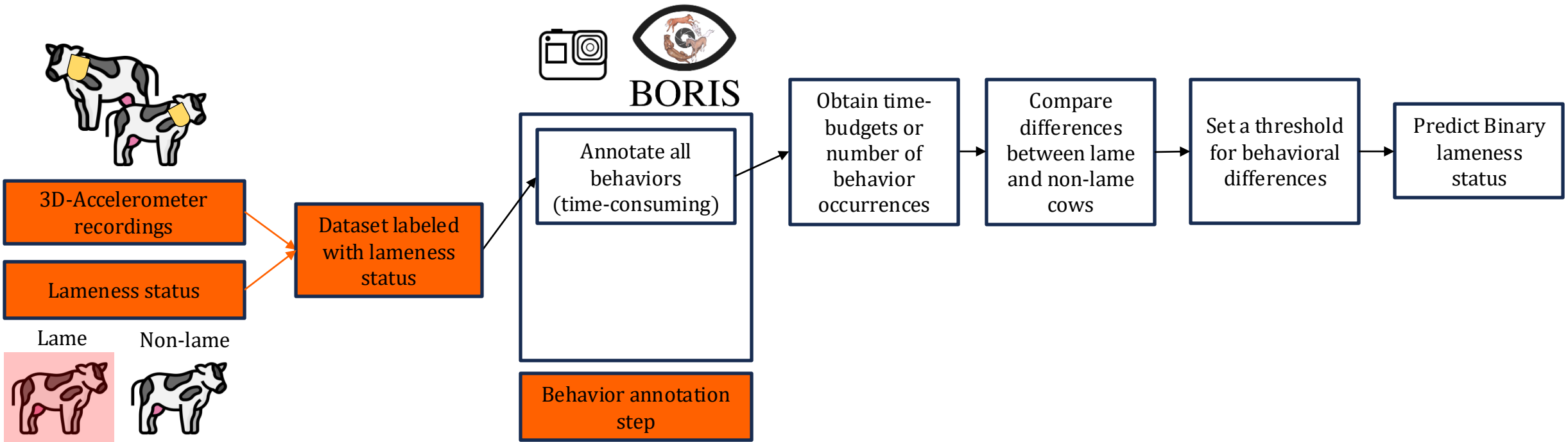
Study Goal



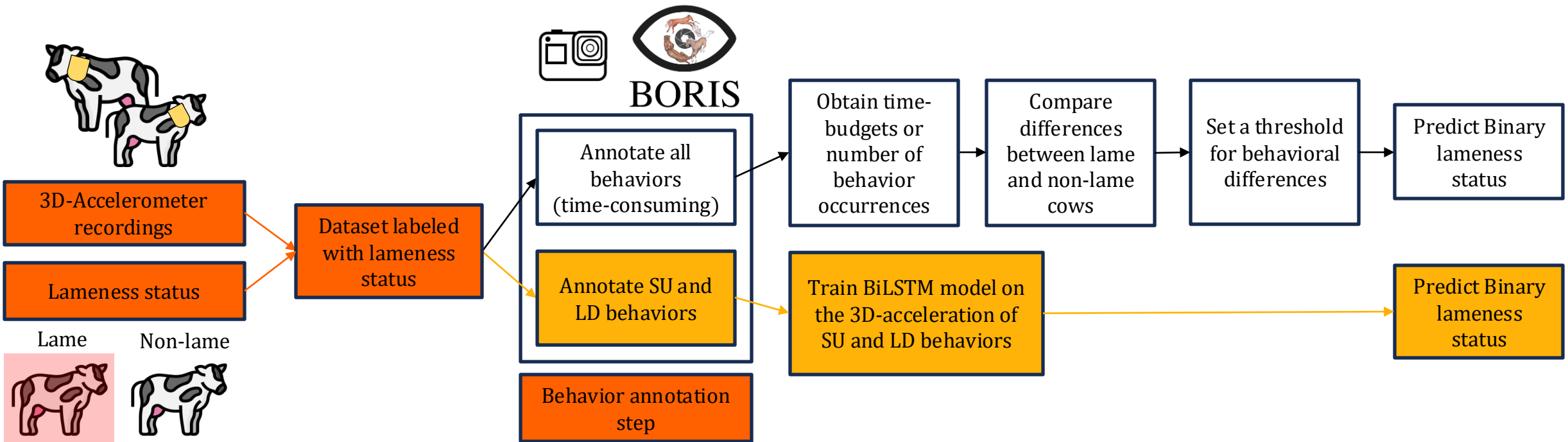
Study Goal



Study Goal



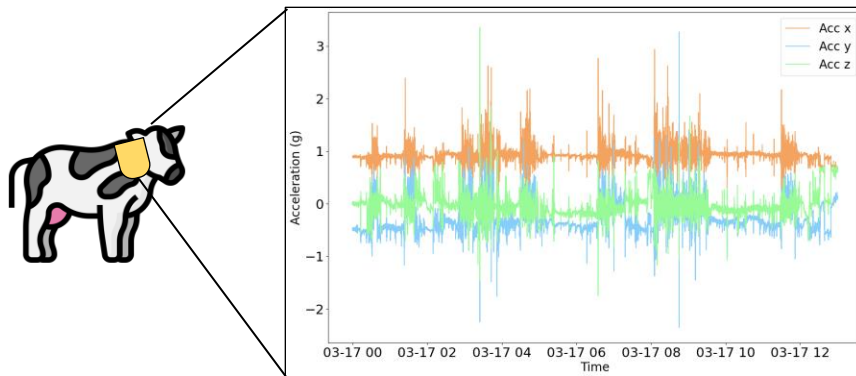
Study Goal



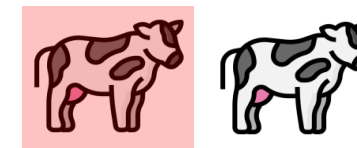
Data presentation



x 3 dairy farms
(15 to 22 days)



x 42



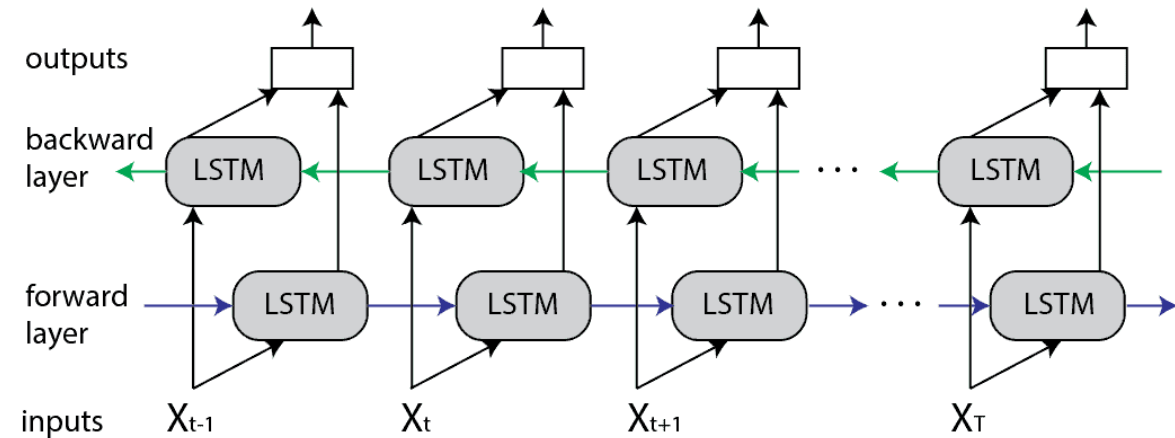
Lame / Non-lame

x 3 locomotion
scores

Model presentation



Baseline : MiniRocket + Ridge Classifier



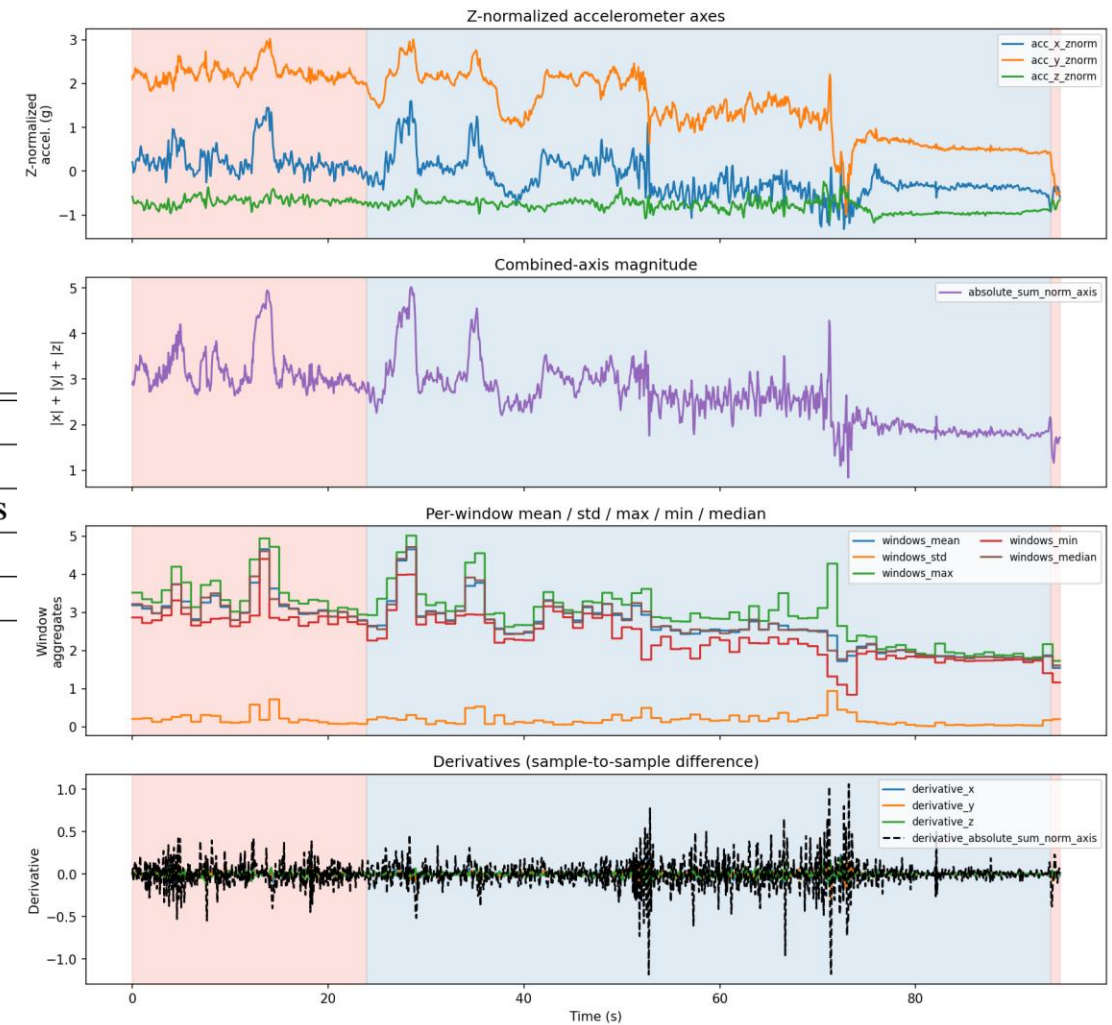
Bi-LSTM model

<https://dagshub.com/blog/rnn-lstm-bidirectional-lstm/>

Features presentation

	Feature	Description
1 – 3	X, Y, Z	Z-normalized raw acceleration
4	$S_t = X + Y + Z $	Sum of the absolute values of the accelerations
5 – 9	$\mu_S, \sigma_S, \max_S, \min_S, \text{med}_S$	Rolling statistics over non-overlapping windows
10 – 12	$\Delta a_k, k \in \{X, Y, Z\}$	First-order temporal derivatives of raw axes
13	ΔS_t	First-order temporal derivative of S_t

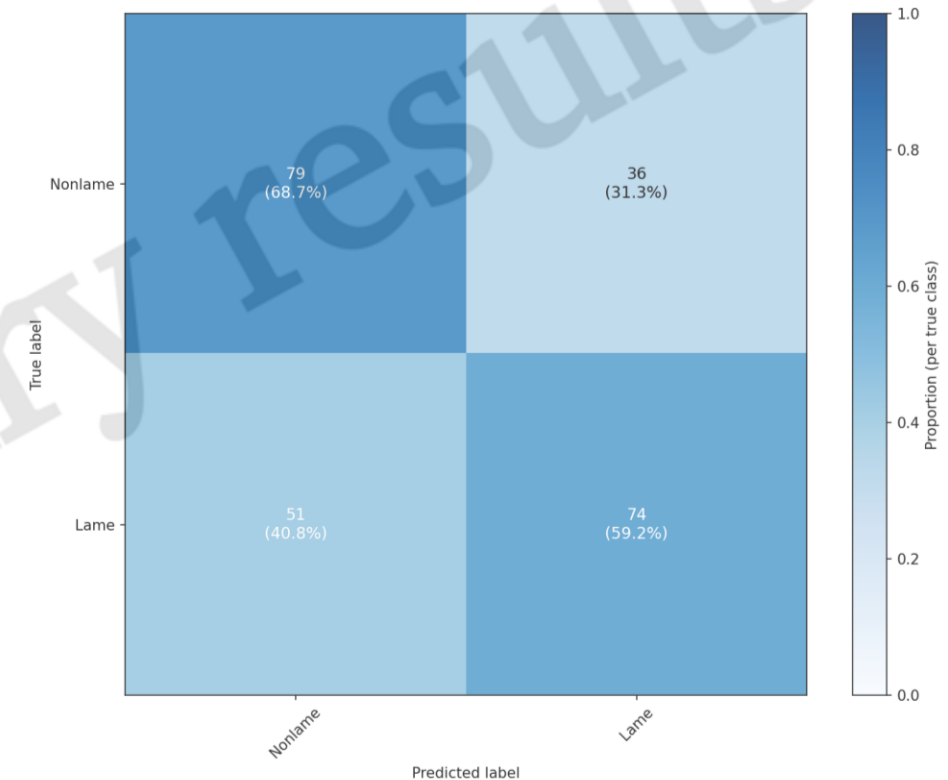
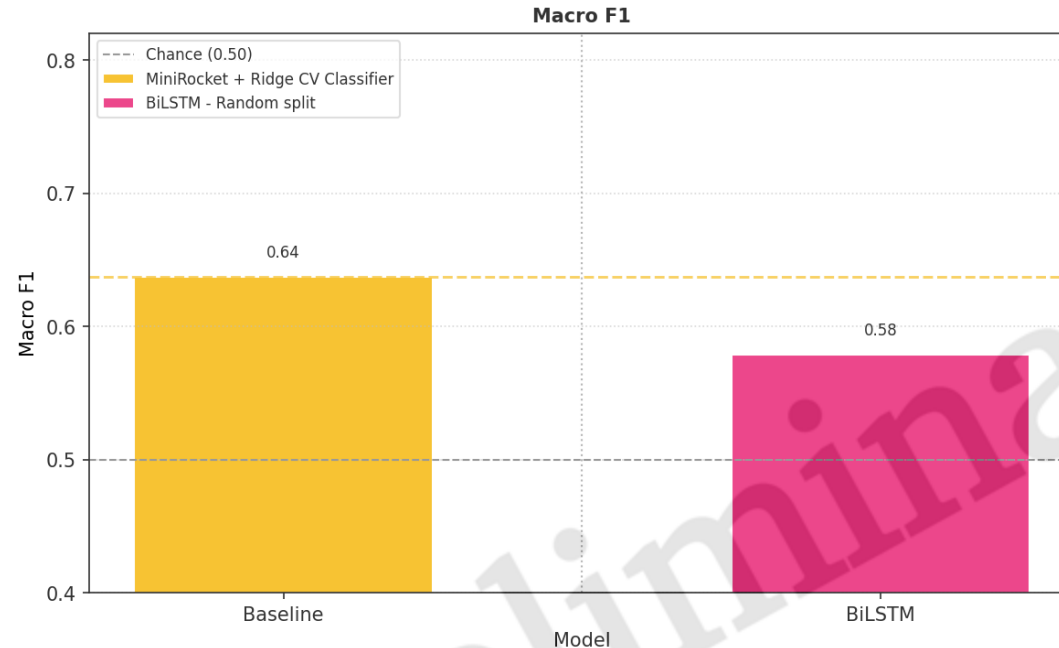
Table 3: Description of the features used as input of the *BiLSTM* model



Bonneau et al. 2025. Hierarchical long short term memory recurrent neural network for goats behaviour prediction from accelerometer data.

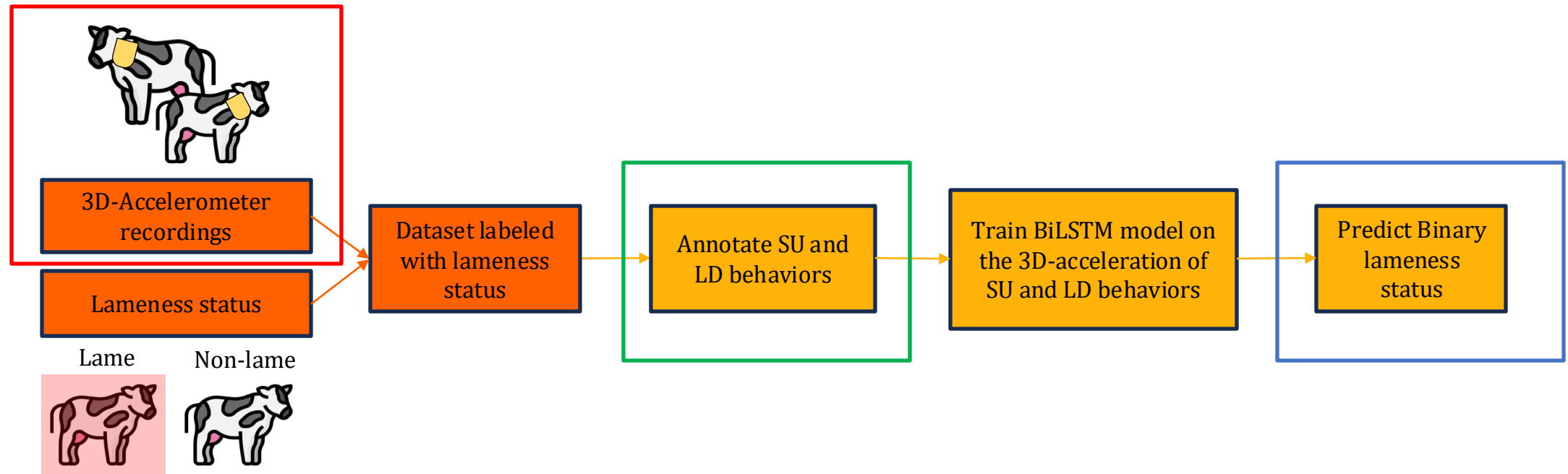
Results

Predict Binary
lameness status



- ➔ Low overall performance of the classifier
- ➔ MiniRocket is still hard to beat for Time Series Classification

Take home message



- ➔ The neck movement is not representative of the movement during SD and LD
 - ➔ The SU and LD behaviors are not good indicators for lameness
- ➔ Predicting Health Status from neck-mounted 3D-acceleration alone is HARD

Acknowledgements

This work was supported by a state grant managed by the French National Research Agency under the France 2030 program, reference ANR-22-PEAE-0008.

The authors would like to especially thanks the farmers that allowed data collection on their farms and the veterinary students that helped conducting the study and scoring of the cows.

Another talk I have given yesterday (Session 1) : “ViT-Cow: Self-Supervised Video Pretraining for Few-Shot Dairy Cow Behavior Recognition”



Research page



INRAE

2nd EAAP Conference on Artificial Intelligence 4 Animal Science Ghent - Belgium
20260630 – SU and LD for lameness detection – Presented by Joseph Allyndrée

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p. 15