



Addressing purpose and subjective data labelling challenges in automated lameness detection for cattle with machine learning and micro-Doppler radar

Konstantina Linardopoulou, Lorenzo Viora, Julien Le Kernec, Nicholas Jonsson

Introduction

Lameness → a clinical sign but also a crucial welfare issue that can result in high costs.

Detection

Individual full clinical examination

+

Gait assessment



AHDB mobility scoring system



- ✓ Even weight bearing
- ✓ Flat back



- ✓ Uneven steps
- ✓ Shortened strides
- ✓ Affected limb/s not immediately identifiable



- ✓ Uneven weight-bearing
- ✓ Limb immediately identifiable
- ✓ Usually arched back

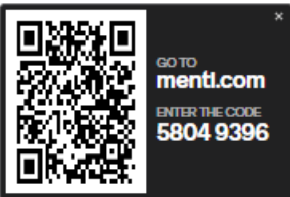


- ✓ Very lame
- ✓ Back arched
- ✓ Affected limb/s easy to identify

Challenges in Labelling - Quiz

Join at menti.com use code 5804 9396

Cow A



0 0 0
score 1 score 2 score 3



Challenges in Labelling - Quiz

Join at [menti.com](https://www.menti.com) use code 5804 9396

Cow B

▶ Start Mentimeter



0 0 0
score 1 score 2 score 3



Challenges in Labelling - Quiz

Join at [menti.com](https://www.menti.com) use code 5804 9396

Cow C



0 0 0
score 1 score 2 score 3



Challenges in Labelling - Quiz

Join at [menti.com](https://www.menti.com) use code 5804 9396

Cow D



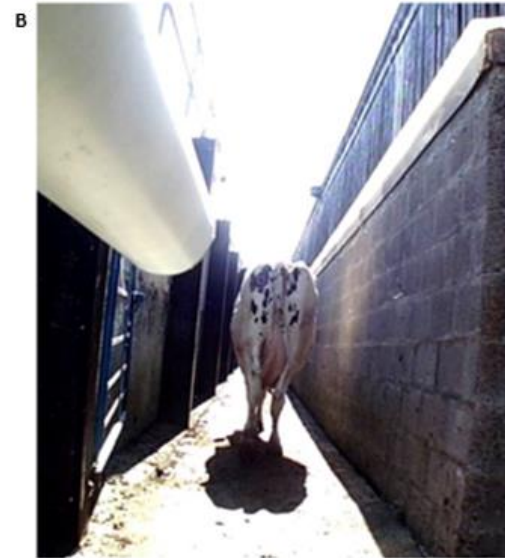
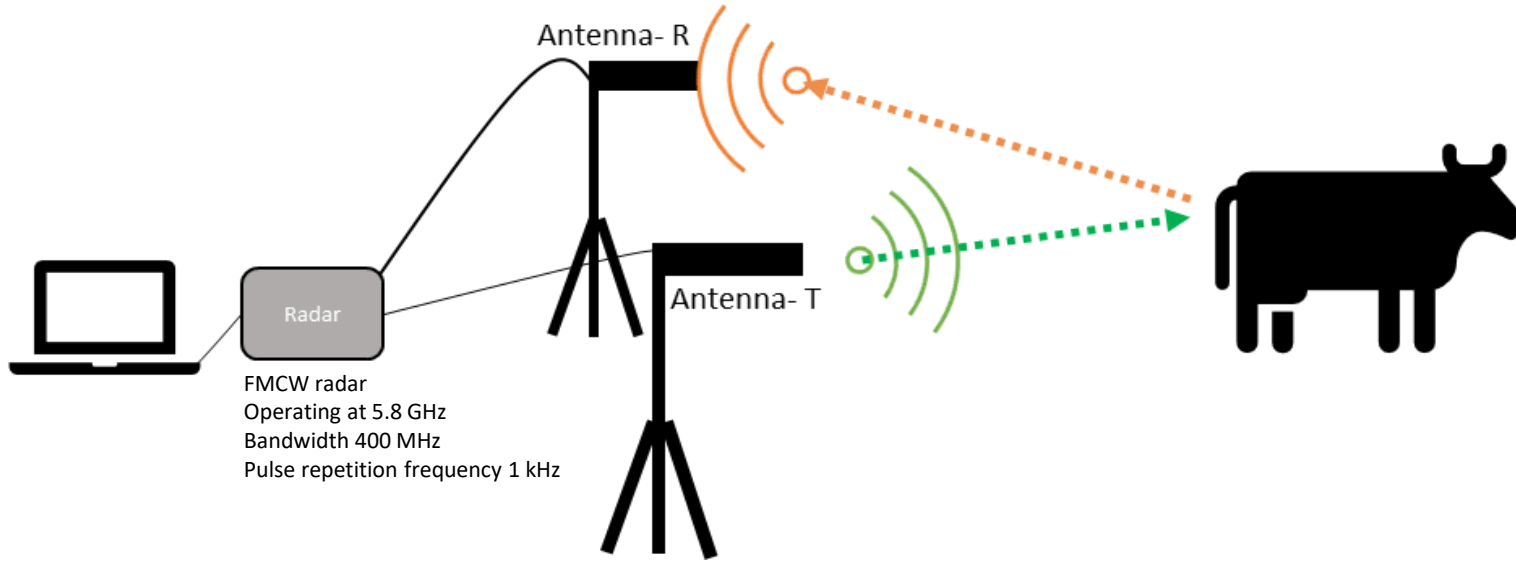
0
score 1

0
score 2

0
score 3



Micro-Doppler Radar Technology



- ✓ contactless
- ✓ not affected by environmental conditions
- ✓ single unit per herd

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Animal Lameness Detection With Radar Sensing

Aman Shrestha, Charalampos Loukas, *Student Member, IEEE*, Julien Le Kerrec¹, *Senior Member, IEEE*,
 Francesco Fioranelli², *Member, IEEE*, Valentina Busin, Nicholas Jonsson, George King,
 Martin Tomlinson, Lorenzo Viora, and Lance Voute

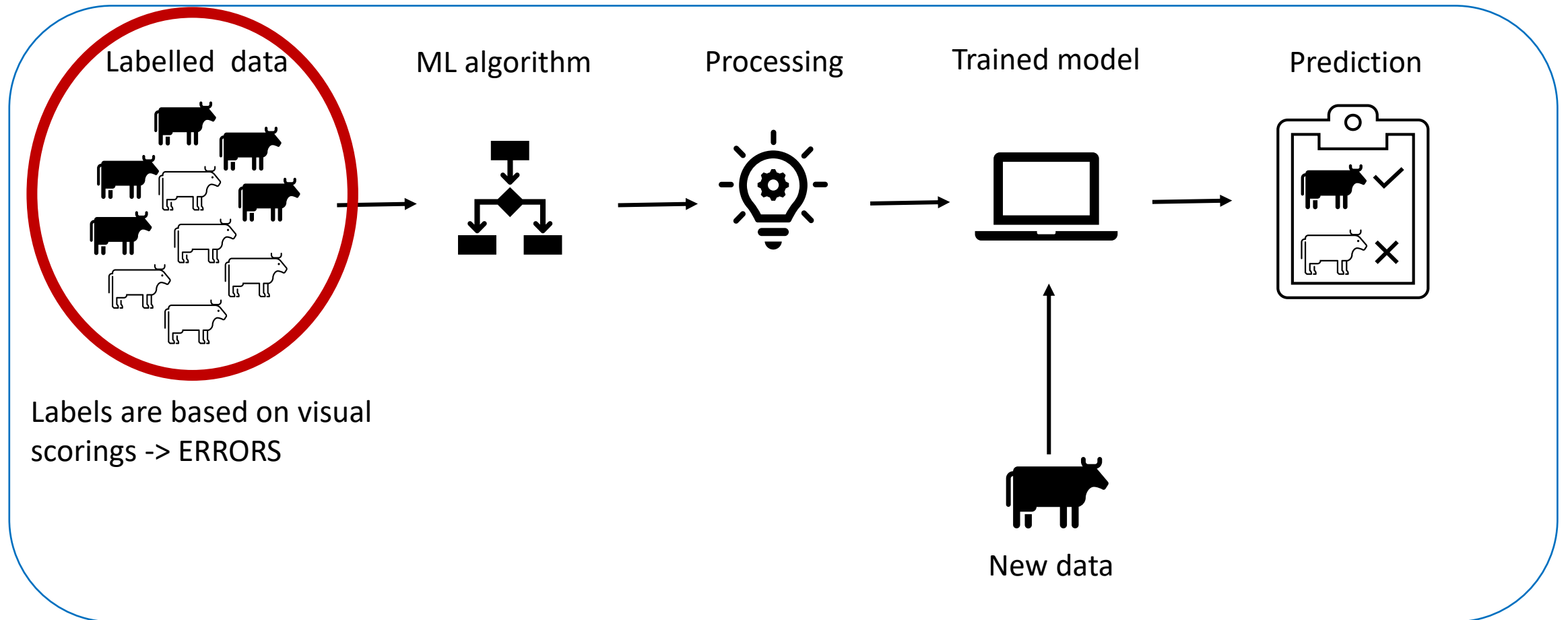
Acc >0.83
 SP=0.81
 SE=0.85

Evaluation of lameness detection using radar sensing in ruminants

Valentina Busin,¹ Lorenzo Viora,² George King,² Martin Tomlinson,² Julien LeKerrec,³ Nicholas Jonsson,⁴ Francesco Fioranelli³

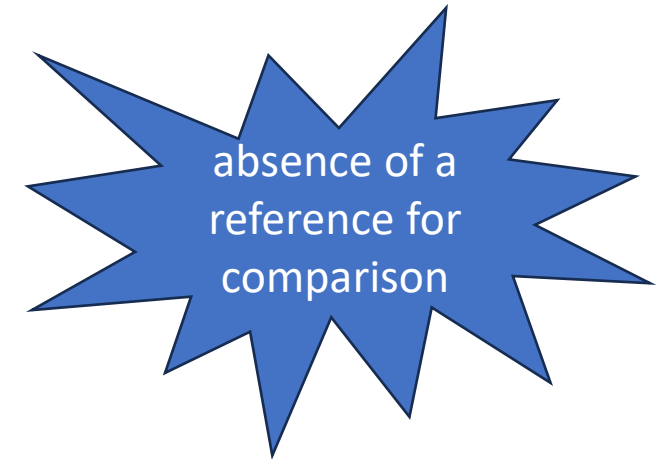
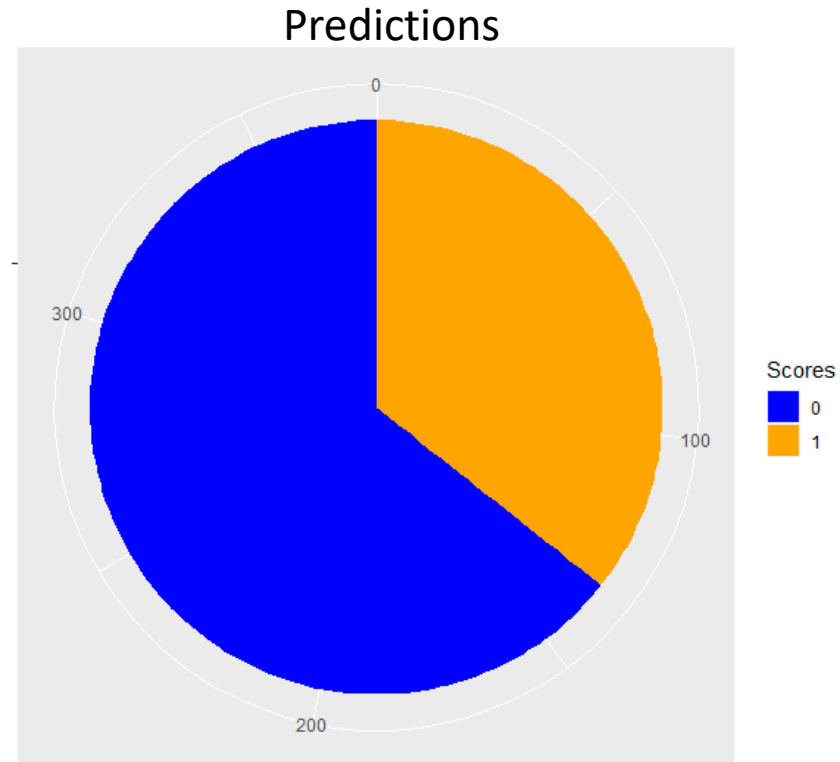
Supervised Machine Learning (ML)

How does supervised ML work?



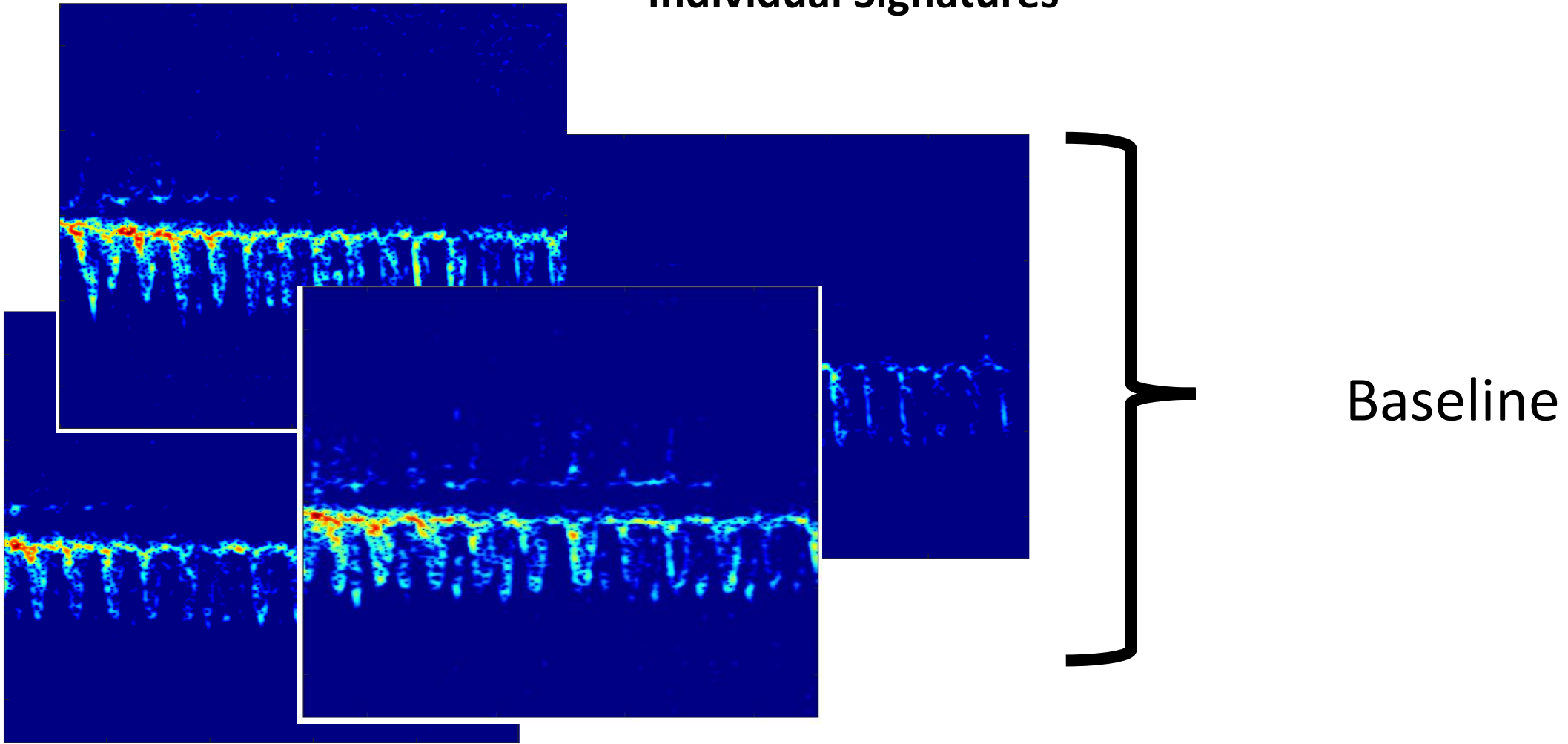
Alternative Approaches

Unsupervised Machine Learning



Alternative Approaches

Individual Signatures



Take home message

- Automation → promising...
- Current visual lameness assessment methods, which involve scoring cows from the side using a multi-level system, lack consistency and we should be cautious when using them as a gold standard in automation
- Defining the automated system's purpose can help with the expectations

Acknowledgement

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