Gait analysis of chickens: predicting expert scores using accelerometer data

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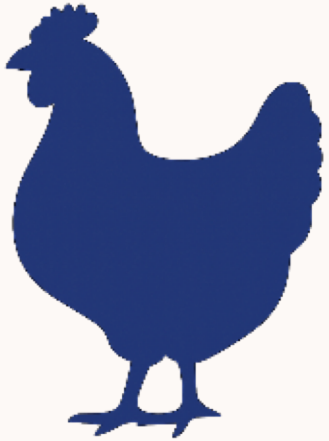
Poor gait in broilers: a welfare & production problem



Why it matters

- Impaired locomotion → pain & discomfort[1]
- Poorer gait → lower intake, slower growth[2]
- More lameness → higher morbidity & mortality[3]

Behavioral signs

- Reluctant to walk
- Unsteady, waddling gait
- Struggles to reach feed & water

Current limitations

- Manual observation = subjective
- Flocks are too dense
- Video = not always practical

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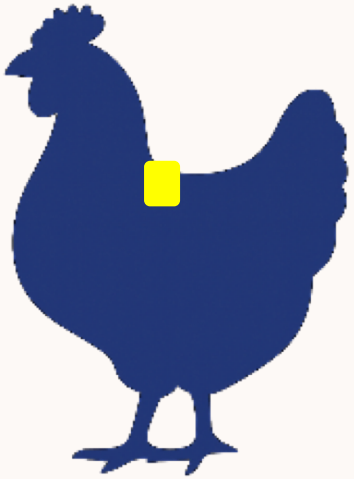
Data gathering and preprocessing



Accelerometer

16 broiler chickens

Accelerometer data

- 16 datasets
- 20 Hz sampling frequency
- Backpack on the bird's back

Gait scores

- Expert score: poor (1) → good (4)
- Scored at day 23 and day 38
- Grouped: Good, Fair, Poor

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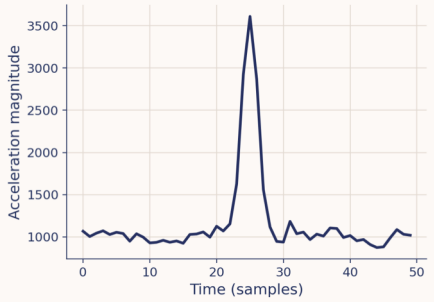
Detection pipeline

Raw signal

$$|a| = \sqrt{a_x^2 + a_y^2 + a_z^2}$$

Peak detection & Segmentation



Feature extraction

20 features per segment:

- 1st quartile
- Median
- Step duration
- Peak width
- …

Classification

Gradient Boosting Machine (GBM)

→ Good / Fair / Poor

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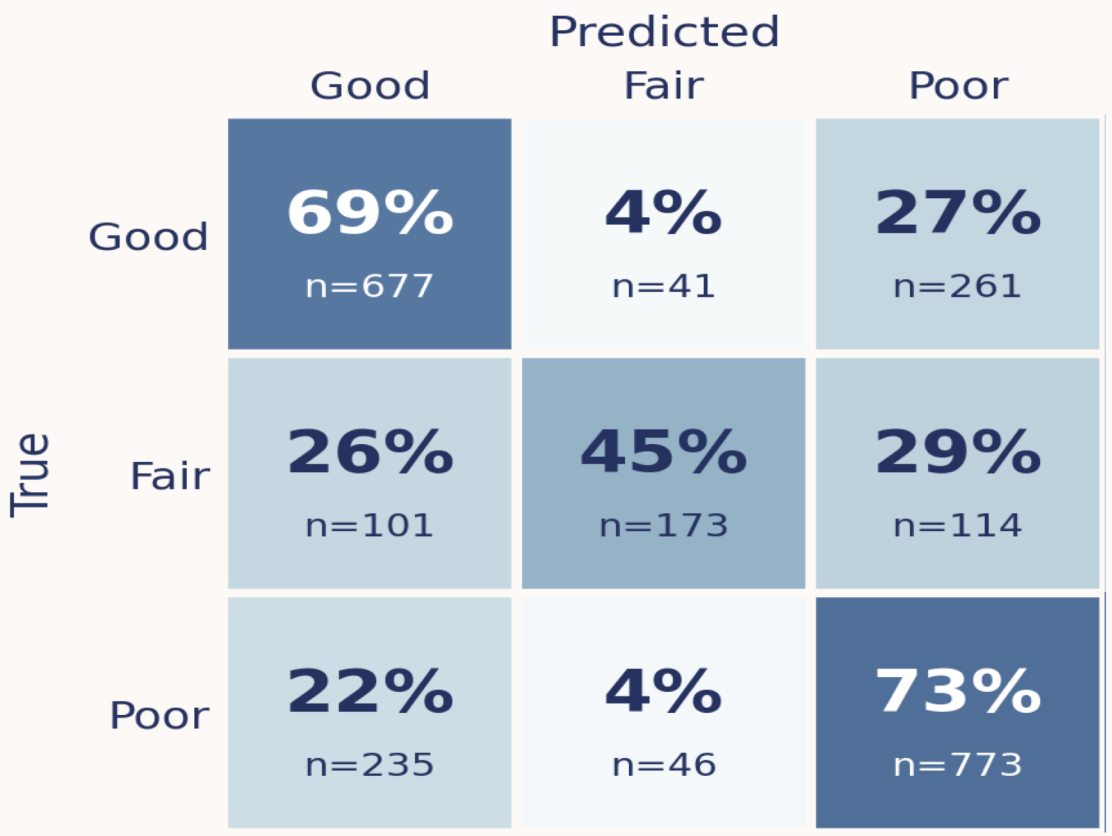
Results



- 16 birds, 4,931 segments
  - GBM classifier
  - 67% overall accuracy
- Good & Poor recovered well
- Fair is the hardest class

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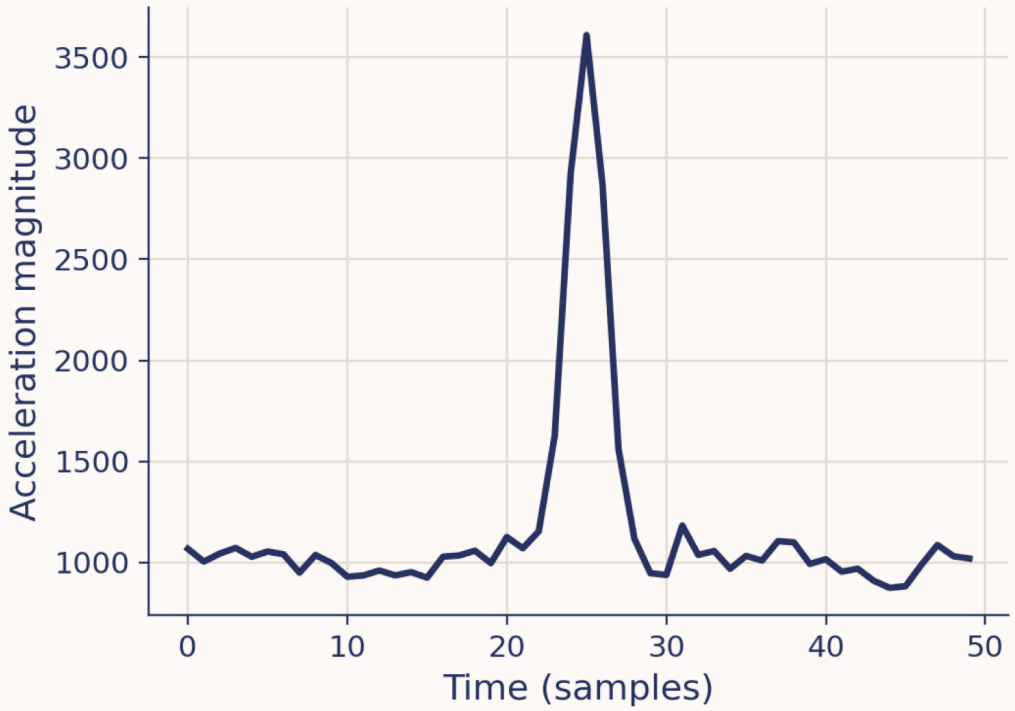
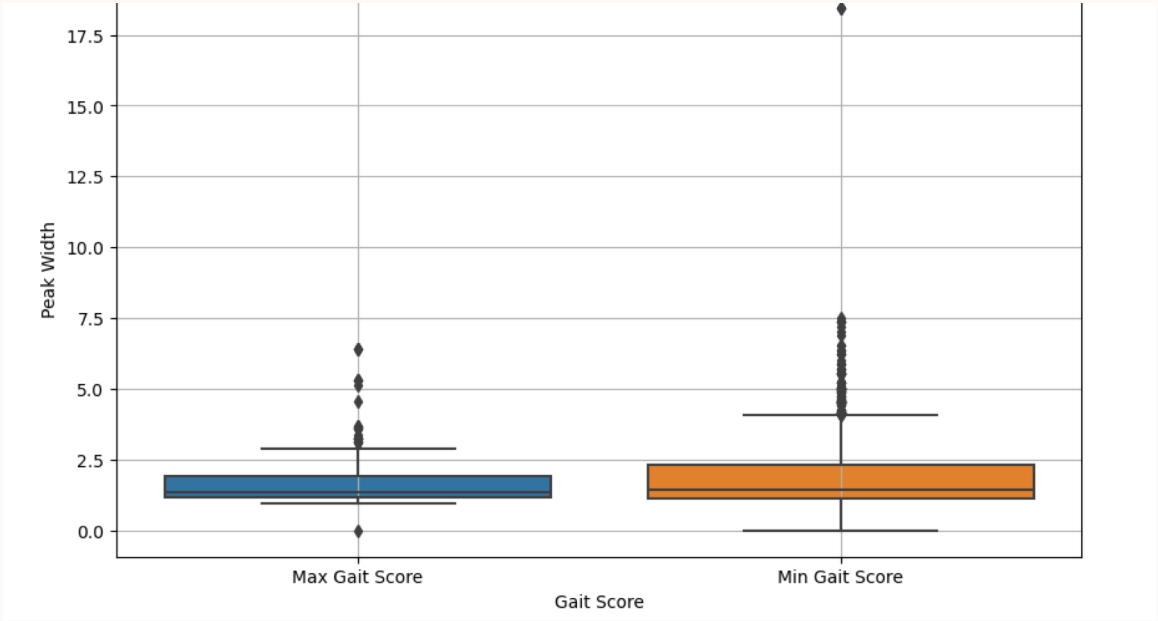
Key signal: peak width



A single stride: segmented walking peak



Peak width: poorest vs best gait scores

Widest peaks in the poorest-locomotion birds — significant, interpretable marker

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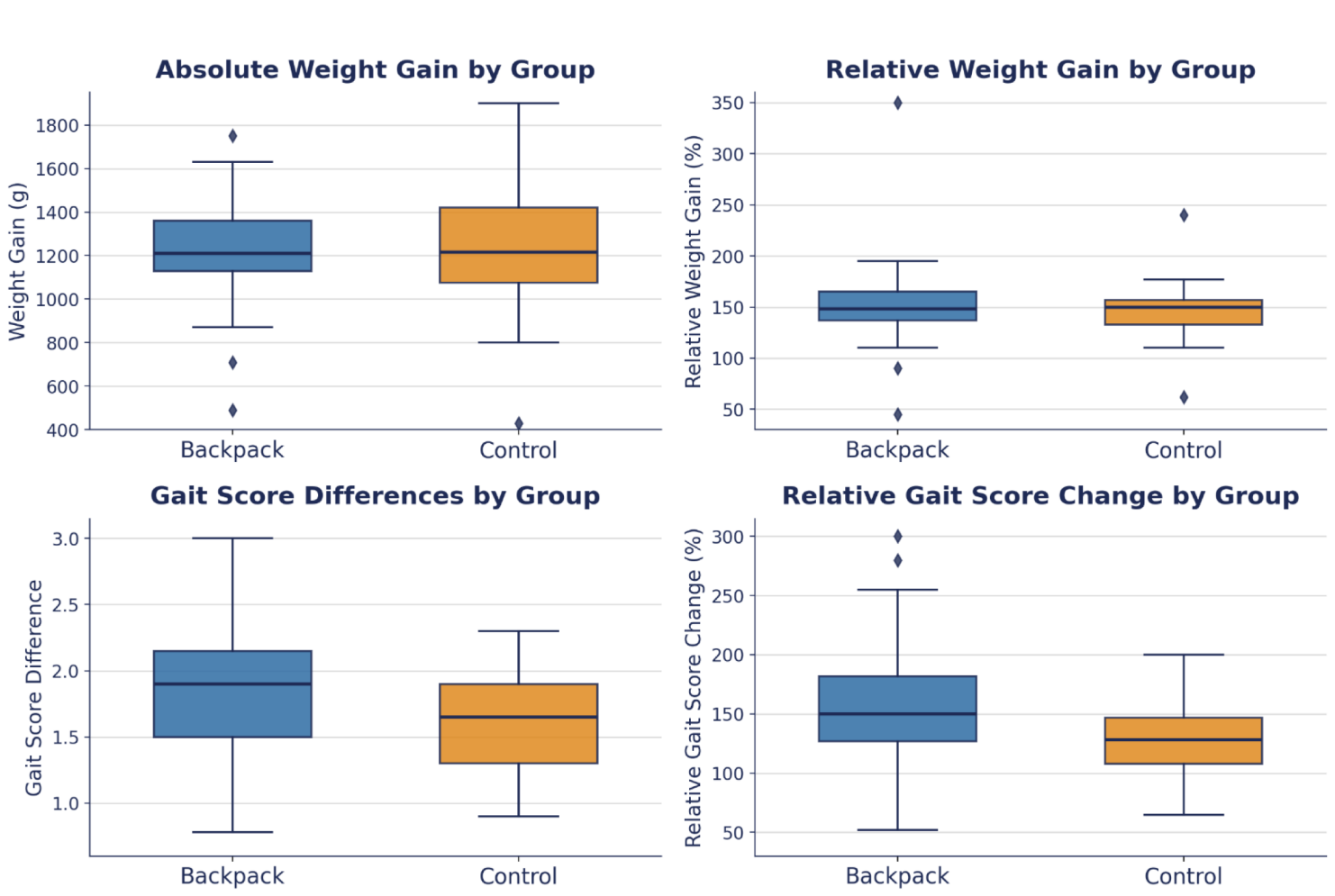
A caveat: the backpack changes gait



No impact on growth — but the backpack notably changes gait

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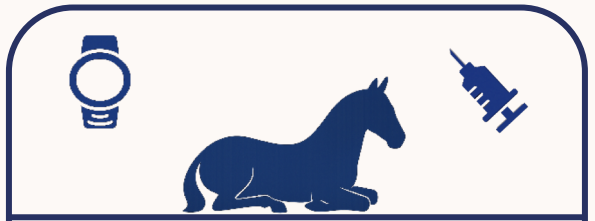
Take-home messages

- Accelerometer data can predict expert gait scores (67%, beats baseline)
- Peak width is a key, interpretable marker of poor locomotion
- Sensor attachment must be controlled because the backpack alters gait

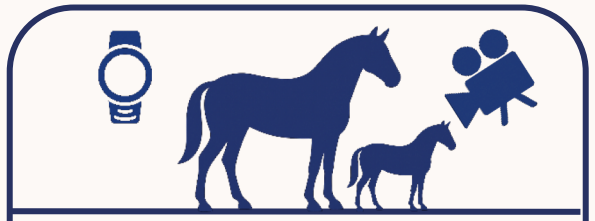
Next steps

- Extend and balance the dataset (more birds, Fair class)
- Improve the hardest class (Fair) and tune features
- Work towards real-time, on-bird scoring

Animal IoT at WAVES

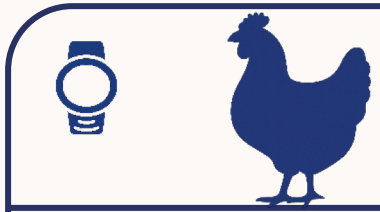


Colic detection
Wearables & implantables

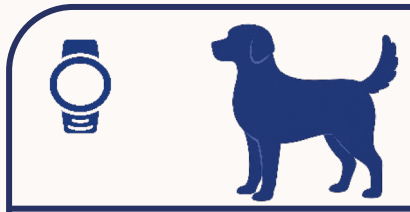


Foaling detection
Wearables & computer vision

Goat gut health
Ingestibles



Chicken health
Wearables



Dog behavior
Wearables

Thank you for listening! Any questions?

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Butterworth, A., & Haslam, S. M. A lameness control strategy for broiler fowls. Welfare Quality Reports, 13 (2009), 33-37.

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