Validating accelerometer technology to detect play behaviour in weaned dairy calves

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The Red Tractor's Role in the GB Calf Strategy

DAIRY PRODUCTION

Consumers Care About Calves

EFSA: house calves in small groups to improve welfare
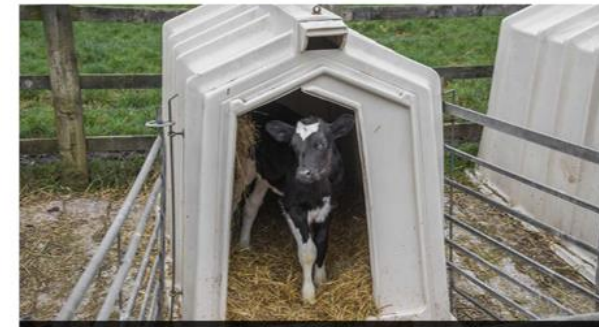
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- Drive to promote positive welfare states

- Play behaviour is commonly observed in young animals

- Play is recognised as an indicator of positive welfare

- Observational methods of recording animal behaviour are labour intensive and often impractical

- Accelerometers are being increasingly validated and used in the analysis of farm animal behaviour

- The **objective of this study** was to **determine the ability of a tri-axial accelerometer device to detect play behaviour in <u>weaned</u> dairy calves**

- Eight weaned female Holstein-Friesian calves (age 118 ± 16 d) recruited from one Scottish dairy farm

- Tri-axial accelerometers (IceTag®, Peacock Technology) attached to the lateral hindlimb of each calf for a 48-hour period

- Continuous video monitoring of the calves over the same 48-hour period

- Sensor data exported in 15-min intervals, with focus on "Motion Index (MI)" – an IceTag generated measure of overall animal activity

- Behavioural analysis of corresponding 15-min intervals conducted from video recording using one-zero sampling, where calf activity was scored as "No Play (0)" or "Play (1)"

- Visual observations and MI data combined in Excel and analysed using Minitab

- The MI threshold best correlated with visual observations established via 2x2 contingency tables to determine Sensitivity (Se), Specificity (Sp) and Balanced Accuracy ($\frac{Se+Sp}{2}$) at various MI thresholds

- Optimal MI threshold to detect play behaviour confirmed using Classification and Regression Tree (CART) analysis using 10-fold analysis to create a training and test dataset
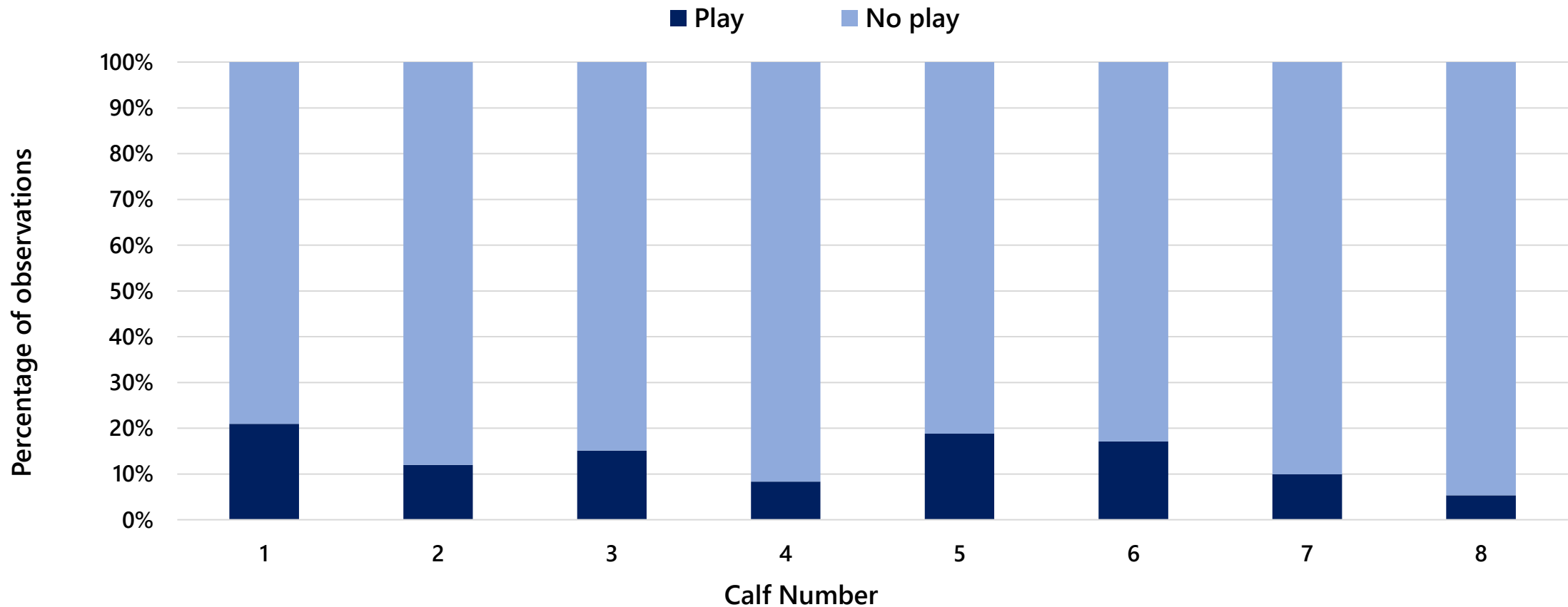
Figure 1. Stacked column chart demonstrating the percentage of 15-min intervals with recorded play events per calf in the 48-hour observation period. Any intervals in which the calves were not visible were excluded from analysis (mean 5%, range 0-12%).

MI threshold	Sensitivity	Specificity	Balanced accuracy
≥ 25	100.00%	28.75%	64.38%
≥ 60	95.43%	91.00%	93.21%
≥ 65	94.92%	92.58%	93.75%
≥ 66	94.92%	92.65%	93.79%
≥ 67	94.92%	92.73%	93.83%
≥ 68	94.42%	93.13%	93.77%
≥ 69	94.42%	93.60%	94.01%
≥ 70	93.40%	93.92%	93.66%
≥ 80	89.34%	96.37%	92.85%
≥ 281	14.21%	100.00%	57.11%

Table 1. Sensitivity and specificity calculations based on 2x2 contingency tables for various MI thresholds

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- CART defined MI threshold the same as that calculated using 2x2 contingency tables at > 68.5

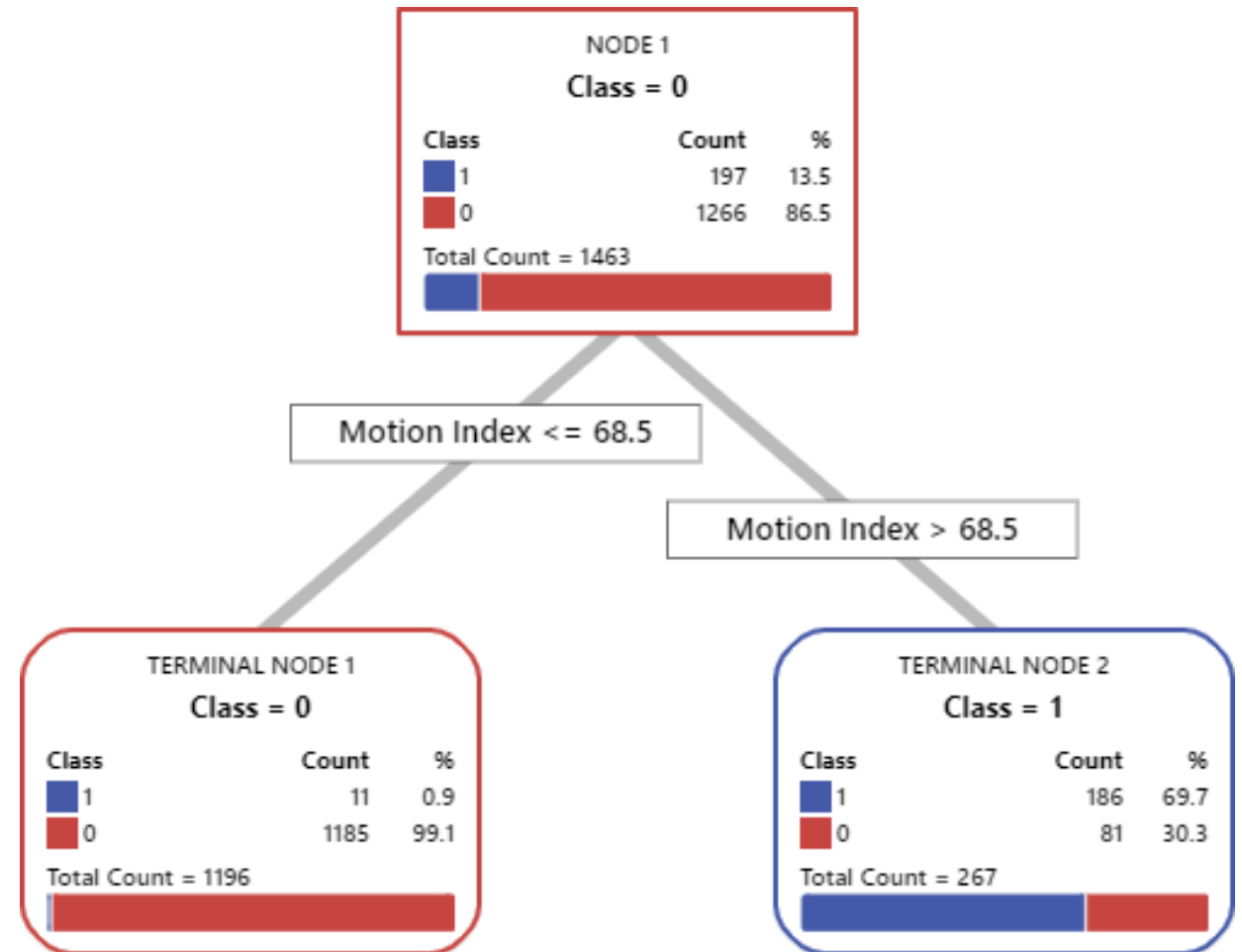- High sensitivity (93.9%) and specificity (91.7%) achieved in the test dataset

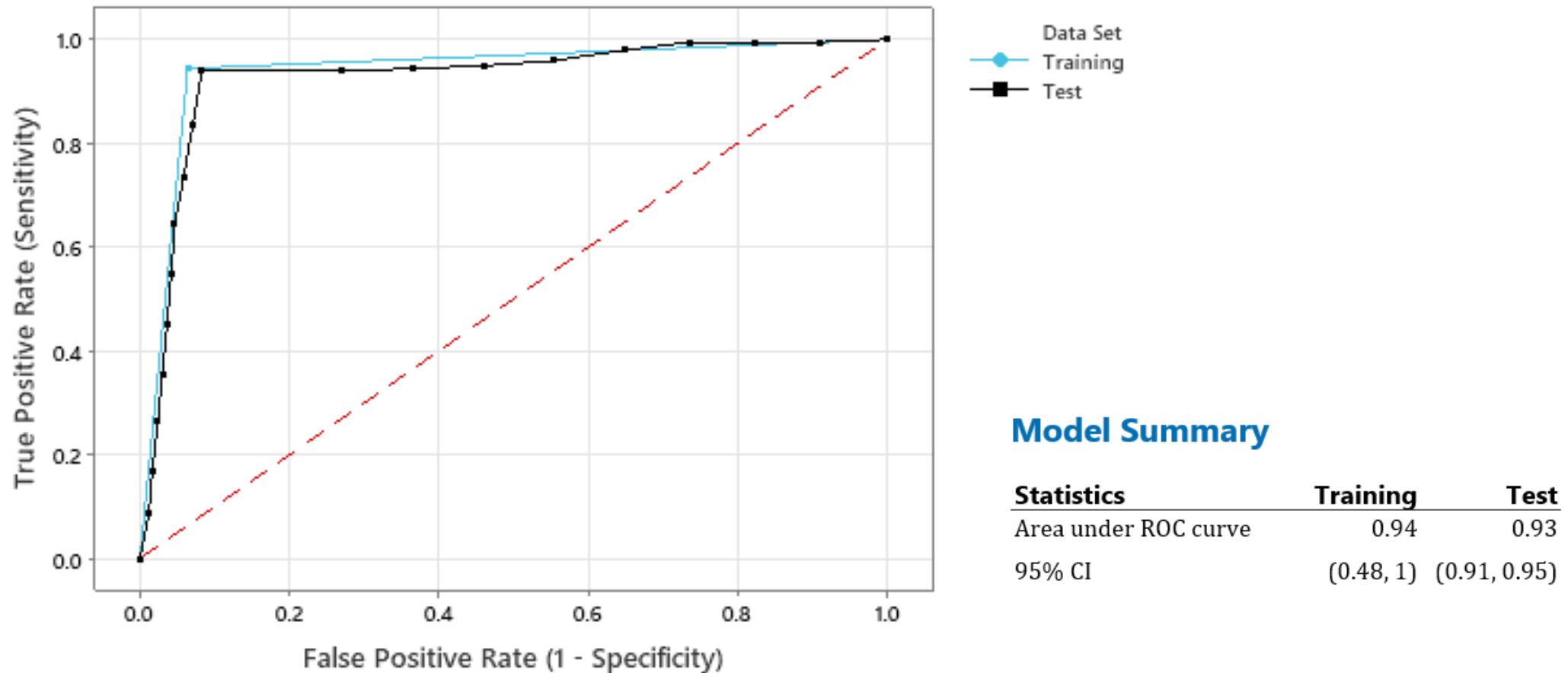**Figure 2. Two node optimal tree diagram for predicting play events using MI**

Figure 3. Receiver operating characteristic (ROC) curve demonstrating the sensitivity and specificity of MI ≥ 68.5 based on a training and test dataset

- IceTag accelerometers can detect play behaviour in weaned dairy calves

- Care must be taken if extrapolating results as validation can be limited to specific study design

- Further research work implementing this technology is ongoing

- Future value in on-farm welfare measurement
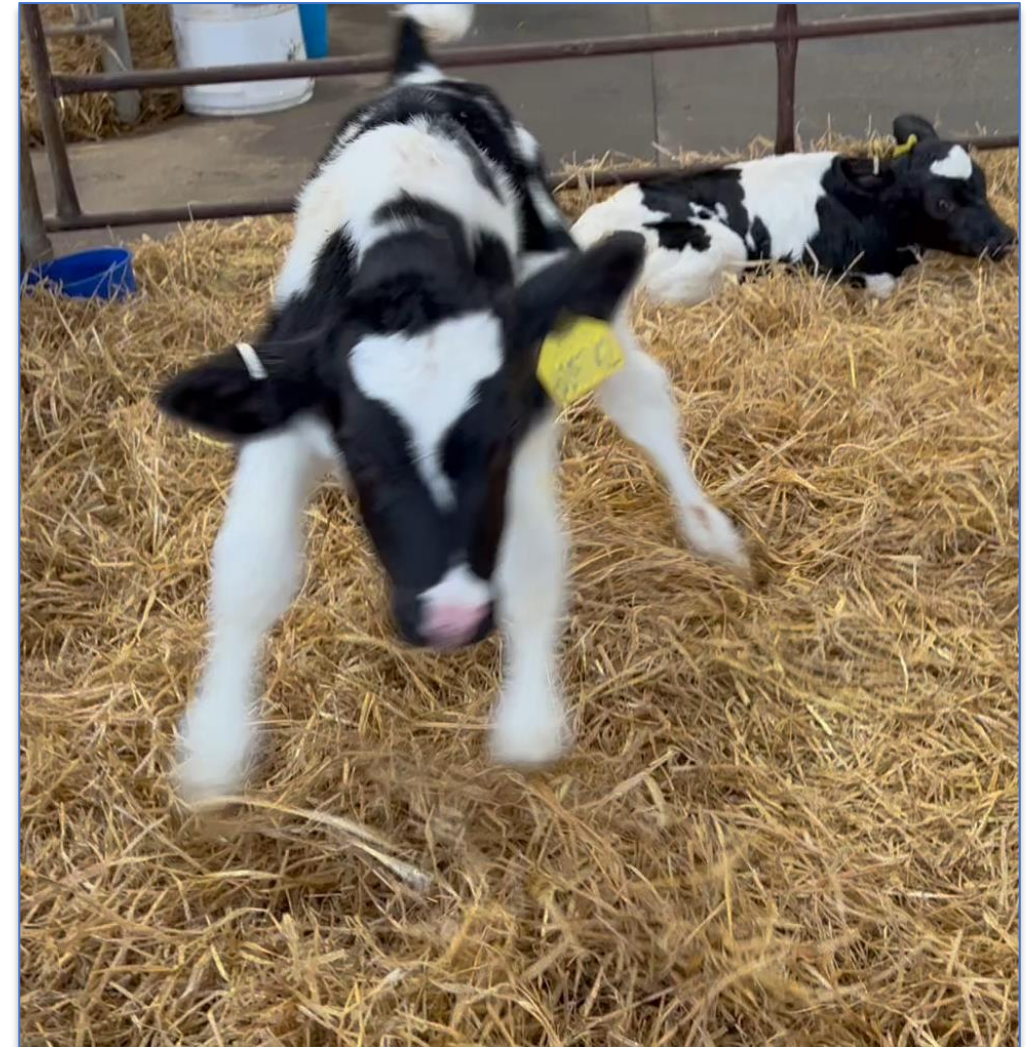
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Thank you for your attention! Questions?