PRACTICE ABSTRACT

Possibility to predict mid-term resilience in dairy cows using raw sensor data recorded during the first lactation

Cow's survival up to the third calving could be predicted based on first lactation sensor data

Problem

Economic, environmental, and ethical reasons suggest that a sustainably profitable cow should stay in the herd until at least the third lactation. Unfortunately, cows' productive lifespan in most developed dairy industries is lower than 2.5 lactations. Increasing cows' longevity would have a positive impact on farm profits and decrease the environmental footprint of the dairy sector through a reduction in the number of youngstock to be raised for replacement.

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Dairy cows, Resilience, Sensor data, Survival analysis

Solution

To improve herds' longevity, farmers should be able to early identify the most resilient cows, i.e., those that better cope with their specific environmental and managerial farm conditions. The great amount of information coming from sensor systems, that provide a constant flow of individual cow productive and behavioral measures, can provide valuable support to achieve this goal. This study aimed at developing an algorithm able to predict the probability for a cow to reach the third calving (i.e., mid-term resilience) using raw data collected by farm sensors in the early stage of cows' first lactation.

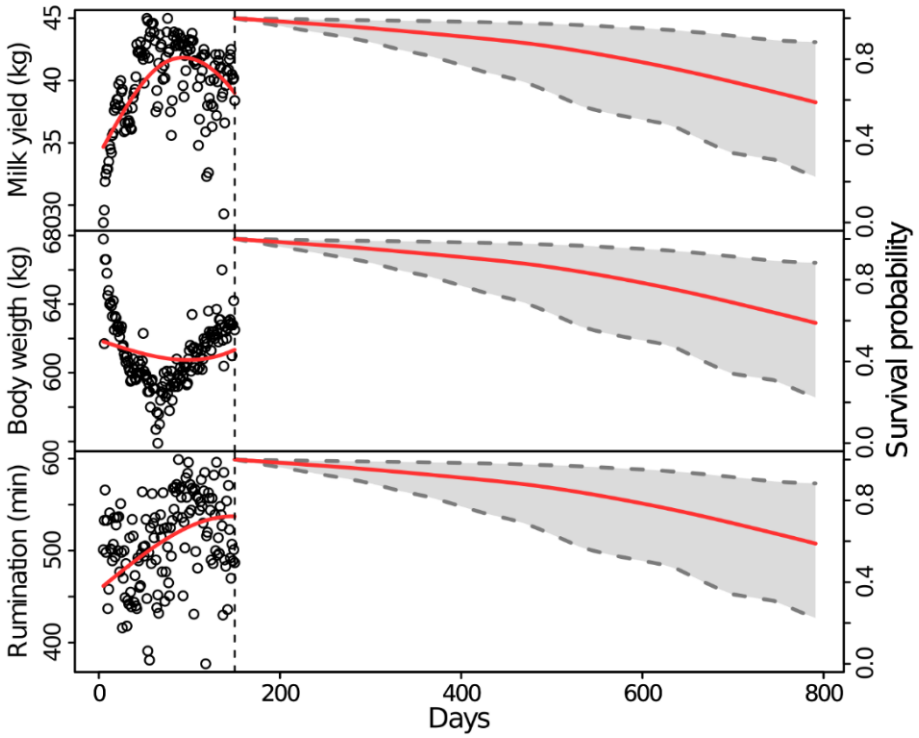

Figure 1 Predicted survival curve up to the third calving for one example cow, based on raw sensor data of the first 150 days of her first lactation.

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Outcome

Using data from 9 different farms (3 Belgian, 5 British, and 1 Italian) equipped with automated milking systems, a joint model for longitudinal and time-to-event data was applied to predict cows' survival up to the third calving. Starting from raw daily sensor data (milk yield, body weight, and rumination time) recorded during the first 150 days of the first lactation, the algorithm gives the farmer a survival probability for each cow with an average accuracy of 52% and a prediction error of 24%. An associated tool allows visualizing the individual cow's estimated survival probability based on daily milk yield, body weight, and rumination minutes during the first 150 days of the first lactation (Figure 1).

Practical recommendations

In order to use the algorithm, cows must have complete data of the first 150 days of the first lactation, which is considered as the maximum time period useful for taking breeding and management decisions in the dairy practice.

On-farm application

The algorithm informs the farmers about the future prospects of their cows in their specific farming environment, being very useful for making early adjustments to breeding and management decisions. It is very flexible and open to being further implemented with additional sensor measures possibly available on farms. However, further research is needed to improve the prediction performance.

*"**GEN**omic management **T**ools to **O**ptimize **R**esilience and **E**fficiency - GenTORE"* is an H2020 project which aims to develop innovative genome-enabled selection and management tools to empower farmers to optimize cattle resilience and efficiency in different and changing environments.
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