

Application of machine learning for the validation of behaviours of spring calving dairy cows as indicative of insufficient grass allocation

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Abstract

Precision dairy farming uses sensor technologies to measure grazing and ruminating behaviours, as well as physical activities of individual cows. These data can be used to support farmers in a decision making process. One of the key decisions in pasture-based milk production involves the correct grass allocation so that the grass utilization per cow can be maximized while optimizing the cow performance. In this study, we aim to assess how indicative the RumiWatchSystem [1] recorded cow behaviour and activities are in practical deployment of a support system for correct grass allocation, i.e., identify cows having insufficient or sufficient grass. This study thus addresses the validation of the indicators, captured by the RumiWatchSystem, as a classification problem and applies a number of machine-learning (ML) algorithms that identify the best set of indicators. The overall experiment had 105 spring calving dairy cows divided in the control group offered 100% of their intake capacity as herbage allowance throughout a 10-week experimental period and in 6 treatment groups, offered 60% of their intake capacity for a 2-week or 6-week period [2]. For each ML algorithm, the performance of candidate sets was measured for the 1000 test data for repeated cross-validations. The results demonstrated that the SVM [3] and random forest [4] algorithms achieved higher accuracy, sensitivity and specificity in most cases. It was further revealed that the rumination time (min/day), bite frequency (n/min), rumination chews per bolus (n/bolus), grazing bouts (n/day), ruminate chews (n/day), rumination bout length (min/bout), frequency of standing or laying (n/day) and head activity (n/day) comprise the best indicators for further development of a decision support system.

Key Words: *Binary Classification; Machine Learning; Feeding Behaviour and Activities; Grass Allocation; Precision Dairy Farming.*

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