Session 5.1: PLF Technology development and data accessibility

S05.O-04

PREDICTION OF BODY CONDITION IN JERSEY DAIRY CATTLE FROM 3D IMAGES USING MACHINE LEARNING TECHNIQUES.

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The body condition (**BC**) of a dairy cow is one of the important indicators of the animal's welfare and health status. Maintaining optimal BC in dairy cows, is associated with more functional cows (healthy, fertile, etc.). Currently, the assessment of BC in dairy cows is performed through manual scoring by experts, which is labor intensive and routine application on farms is limited. The use of computer-vision shows great potential as a high-throughput method for predicting the BC of cows. However, despite its promise, no study has investigated the predictive ability of using 3D cameras to assess BC in Jersey dairy cattle. Data from three commercial farms with 808 individual cows and 2,253 BC observations was obtained from December 2021 to August 2022, every second month. Body conditions were scored by two trained classifiers from SEGES (Aarhus, Denmark). The feature data consisted of contours from top-down 3D images, generated when a cow leaves the milking area. The features represent the depth on specific points of the back. When a cow enters the image frame, the spine and circumference are identified, and a 3D cloud of the back is made within the circumference. The features used in this study, were the points on the back where there was a drop from the spine of 3, 5, 10, 15 cm each side. For each of these drops, 100 features were generated from the neck to the tail of the cow. Splitting the training and validation data was carried out as a random split of 7:3 clustered by cows and replicated 10 times. The clustering by cows ensured that cows could not appear in both the training and validation dataset. The H_2O AutoML algorithm was used to find the best performing classification and regression model. Furthermore, AutoML was used to tune input parameters for the machine learning model. Among classification and regression models, DeepLearning performed best. Additionally, a Partial Least Square (PLS) model was tested with the Proc PLS procedure in SAS. Validating the classification model, showed accuracies with a weighted mean of 48.1% (range: 45.9-50.7%) on the exact phenotype. The accuracy increased to a weighted mean of 93.5% (range: 92.7-95.3 %) by adjusting a 0.5-unit deviation. The results from the regression models showed r^2 and RMSE at 0.67 and 0.31 for PLS and 0.66 and 0.29 for DeepLearning. The validation accuracies were at the similar level as reported for Holstein cows. The results indicate that we can predict BC in Jersey cows with a 3D camera-based system. This can potentially improve management decisions and breeding values for feed efficiency in Jersey cattle.