

SHORT TERM SCIENTIFIC MISSION (STSM) – SCIENTIFIC REPORT

The STSM applicant submits this report for approval to the STSM coordinator

Action number: FA1308

STSM title: Towards a validation protocol for sensor information

STSM start and end date: 15/01/2018 to 26/01/2018

Grantee name: Chris Knight

PURPOSE OF THE STSM/

A growing variety and number of sensor-based technologies are finding their way into modern cow barns, claiming to be helpful in dairy herd management. Although developed with the best of intentions, many technologies fail to fulfil the promises for some reasons. Those reasons range from technical breakdowns, short battery life, hardware failure over user-unfriendly interfaces to missing integration with other technologies. A protocol for testing devices on a range of performance indicators that jointly describe quality and reliability would be very helpful for users of the technology. That is what we call a validation protocol.

This work is based on the description of the quality and reliability of a Body Condition Score (BCS) camera, in order to establish a validation protocol. Data were obtained from 3D overhead camera system from DeLaval. As an animal passes under the camera, it collects an image and analyzes it using the company's proprietary algorithms to assign a score on the traditional 5-point BCS scale to 0,1 point increments.

The first objective of this work is to establish a validation protocol for testing the performance of Body Condition Score (BCS) Cameras (DeLaval) on performance indicators such as sensor drift, variability in BCS within and between measurement days and handling of missing observations or other technical alterations of the BCS readings.

The second objective is to use blood beta hydroxyl buturate (BHB) as gold standard for establishing a protocol for testing BCS changes (trends, time to nadir, total loss) as predictors of subclinical ketosis in dairy cows.

DESCRIPTION OF WORK CARRIED OUT DURING THE STSMS

In order to establish a validation protocol, we worked on the description of the quality and reliability of a Body Condition Score (BCS) camera by using a data obtained from 3D overhead camera system from DeLaval in Norway. As an animal passes under the camera, it collects an image and analyzes it using the company's proprietary algorithms to assign a score on the traditional 5-point BCS scale to 0,1 point increments.

After an analysis study of the data, we investigated, firstly, the performance of the BCS Cameras on performance indicators such as sensor drift, variability in BCS within and between measurement days and handling of missing observations, outliers, randomness and trend. Several errors were detected in the BCS camera data. These errors were illustrated not only in the instrumental side but also in the BCS profile at the cow level. Time series model was used to develop forecasts with instrumental errors before and after correction. Forecasting model showed the importance of instrumental error correction in describing and predicting the correct profile of BCS at cow level.

Secondly, we used blood beta hydroxyl buturate (BHB) as gold standard for establishing a protocol for testing BCS changes (trends, time to nadir, total loss) as predictors of subclinical ketosis in dairy cows. Data were collected from Norwegian research herd at the Norwegian University of Life Sciences. In this study, we focused on the first 6 weeks after calving for detecting subclinical ketosis. Quantitative forecasting models were used to develop forecasts by taking into account randomness, outliers and trend.

DESCRIPTION OF THE MAIN RESULTS OBTAINED

We worked on the analysis of the data in order to describe the quality and the reliability of the Body Condition Score (BCS) camera. The data were obtained from 3D overhead camera system from DeLaval for 64 Norwegian Red cows.

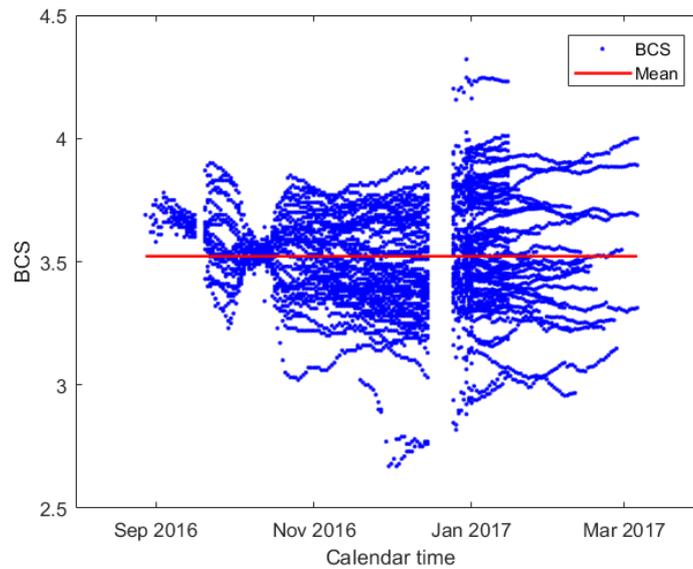


Figure 1. BCS measurement over calendar time. Mean value is 3,521. Standard deviation is 0,37413603.

Figure 1 shows the BCS measurement over calendar time. A missing observations periods were detected: first period between 16/09/2016 and 20/09/2016, second period between 15/12/2016 and 25/12/2016. The missing observation periods and other instrumental errors were illustrated by computing and plotting the average of the BCS as showed in Figure 2.

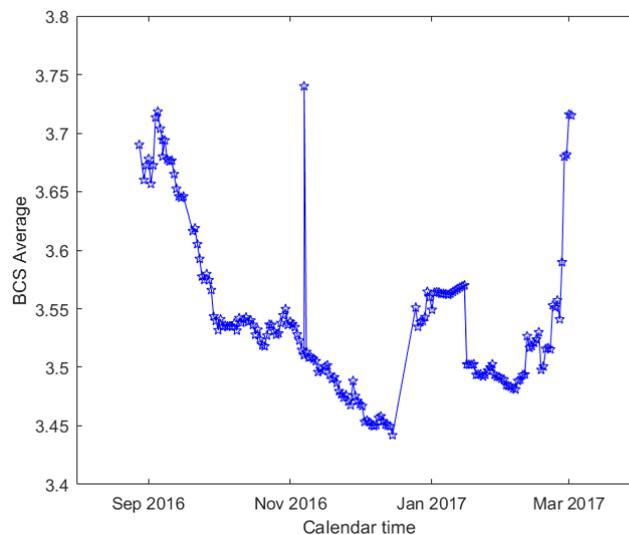


Figure 2. BCS average over calendar time before instrumental error correction.

The curve of the average of BCS over calendar time shows several errors that were detected in the BCS camera data: missing observations periods firstly between 16/09/2016 and 20/09/2016 and secondly between 15/12/2016 and 25/12/2016, outliers 07/11/2016 and on 01/03/2017, randomness and trend. These errors were illustrated not only in the instrumental side but also in the BCS profile at the cow level. We used Time series model to develop forecasts with instrumental errors before and after correction. Forecasting model showed the importance of instrumental error correction in describing and predicting the correct profile of BCS at cow level. We submitted and abstract for a poster in DairyCare conference [1].

Currently we are working on the correction of the instrumental errors detected.

In second part, we used blood beta hydroxyl buturate (BHB) as gold standard for establishing a protocol for testing BCS changes (trends, time to nadir, total loss) as predictors of subclinical ketosis in dairy cows. Data were collected from Norwegian research herd at the Norwegian University of Life Sciences. In this study, we focused on the first 6 weeks after calving for detecting subclinical ketosis. Quantitative forecasting models were used to develop forecasts by taking into account randomness, outliers and trend.

References:

1. Amira Rachah, Olav Reksen, Dan Christoffer Jansen, Peter Løvendahl. Towards a validation protocol for sensor information in dairy herd management.

FUTURE COLLABORATIONS (if applicable)

We intend to publish the results in a scientific journal dedicated to the dairy industry (e.g. J. Dairy Research or J. Dairy Science).

Further STSM's will help this process, and are welcomed by the host (Aarhus University).