A comparison between RumiWatch noseband and neck-mounted accelerometer for automated measurement of ingestive-related cow behaviors

Said Benaissa[1, 2, *], Frank Tuyttens [2, 3], David Plets[1], Luc Martens[1], Leen Vandaele[2], Hannes Cattrysse[2], Wout Joseph[1], Bart Sonck[2, 4]

[1]Department of Information Technology, Ghent University/imec, iGent-Technologiepark 15, 9052 Ghent, Belgium

[2]The Flanders Research Institute for Agriculture, Fisheries and Food (ILVO)-Animal Sciences Unit, Scheldeweg 68, 9090 Melle, Belgium

[3]Department of Nutrition, Genetics and Ethology, Faculty of Veterinary Medicine, Heidestraat 19, B-9820 Merelbeke, Belgium

[4]Department of Biosystems Engineering, Faculty of Bioscience Engineering, Ghent University, Coupure links 653, B-9000 Ghent, Belgium

*** Corresponding author: Said Benaissa, Tel: +32 09 331 48 99; E-mail address: said.benaissa@ugent.be**

Changes in ingestive-related behaviors (e.g., feeding and ruminating) are key indicators for assessing health and well-being in cattle. The aim of this study was to compare two different sensors for the measurement of feeding and ruminating behaviors of dairy cows. Collar-mounted accelerometers and RumiWatch noseband sensors were used to distinguish between three behavioral categories: feeding, ruminating and other activity (non-ingestive). Ten multiparous dairy cows were used in this study. The cows were housed in an area of 36x13m2 with individual cubicles and concrete slatted floor. The cows were fed roughage ad libitum. Drinking water was available ad libitum. A RumiWatch noseband sensor and a collar-mounted accelerometer were attached to each cow. Direct observations of the cows' behaviors were made from 9:00 AM to 03:00 PM. The observation data were used to validate the sensor data. The clocks of the observer, the RumiWatch noseband, and the accelerometers were synchronized at the start and at the end of the observation period. Both sensors were programmed to log data at 10 Hz. For the RumiWatch noseband sensor, the recording files contain already the classification of the behaviors at 10 Hz. However, for the accelerometer, a new decision-tree algorithm was developed to classify the raw data. The decision-tree algorithm was selected for its low computational costs, which make it implementable on the on-cow nodes. Thus, the sensor wirelessly sends only the classified behavior and not all the raw data. This considerably extends the lifetime of the monitoring system. Results show that the two sensors have similar classification performances for the three behavioral categories, with overall accuracy of 86 % for the accelerometer and 87 % for Rumiwatch noseband sensor. The precision, sensitivity, and specificity measures varied between 78 % and 92 % for the precision, 79 % and 92 % for the sensitivity, and 85 % and 93 % for the specificity. These preliminary findings illustrate the potential of the collar-mounted accelerometer to classify feeding and ruminating behaviors with performances comparable to the Rumiwatch noseband sensor. The use of a simple decision-tree algorithm would optimize the power consumption of the sensors by transmitting just the behavior of the cow instead of all the raw data to the backend system. Moreover, farmers may prefer to use collar-mounted sensors rather than noseband halters. Measurements are being continued in order to validate the reported results.

Keywords: Accelerometer, RumiWatch noseband sensor, dairy cows, machine learning, behaviors classification