**Predicting daily eating activity of dairy cows from 3D accelerometer data and RFID signals by use of a random forests model**

Leslie Foldager [1,2], Lene Munksgaard [1], Philipp Trénel [3], Peter T Thomsen [1]

*[1] Department of Animal Science, Faculty of Science and Technology, Aarhus University, Blichers Allé 20, DK8830 Tjele, Denmark; [2] Bioinformatics Research Centre, Department of Computer Science, Faculty of Science and Technology, Aarhus University, C.F. Møllers Allé 8, DK8000 Aarhus C, Denmark; [3] AgroTech A/S, Agro Food Park 15, DK8200 Aarhus N, Denmark*

leslie@anis.au.dk

Feed intake is very important for dairy cows and deviation from normal eating behaviour may predict a cow that needs treatment. Therefore we investigated whether a device from Lyngsoe Systems (Aars, Denmark) could be used to estimate eating behaviour.

Data were collected from 23 cow/logger combinations and synchronised with video recordings at the Danish Cattle Research Centre (DKC). The sensor recorded 3D accelerometer data and radio frequency identification (RFID) signals for positioning of the cow at the feed bunk. Video observations from 21 to 48 hours per cow/logger combination were classified per second by a trained technician into the states: ears behind feed bunk, ears above feed bunk, eating, other, or view blocked. Logger data was reduced to per second level by averaging the original 12-14 hertz signals.

In the current stage of the study we are developing a prediction model to be used for monitoring eating behaviour of dairy cows. Our results show that daily eating time is predicted reasonably well by a random forests algorithm using sensor observations at present time and a number of seconds back in time (lag window). Performance was measured by "leave one cow/logger out" cross-validation, i.e. in turns preserving data from one cow/logger combination as test set and using data from the other 22 for training of a random forests model.

Results were only slightly affected by the number of trees and 50 trees seemed to suffice. Larger size of the lag window reduced the bias and increased the accuracy, see Figure 1. We varied the window size from 8 to 128 seconds and while accuracy stabilises from around 80 seconds the bias decreases through the whole range.

The results suggest that the device can be used to estimate eating behaviour of dairy cows with large accuracy. However, the equipment needs to be validated on commercial farms.

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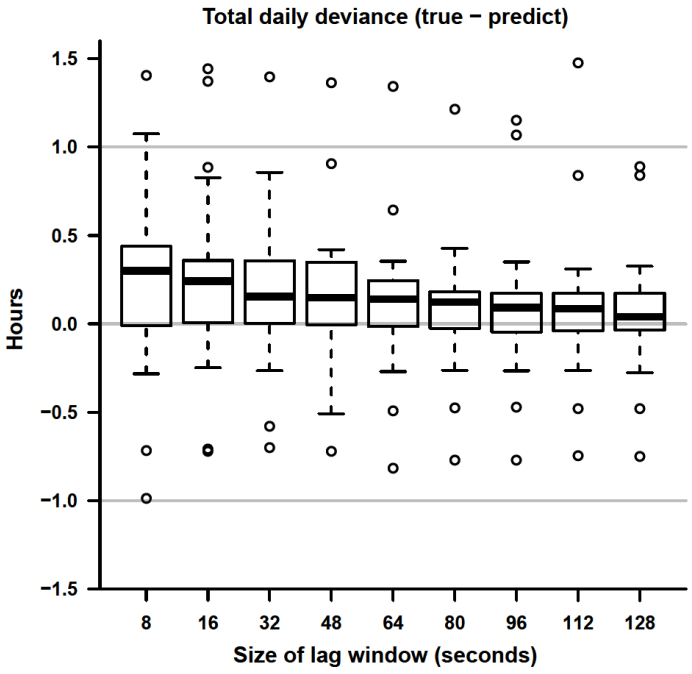

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