Measuring feeding time of dairy cows using an indoor positioning system

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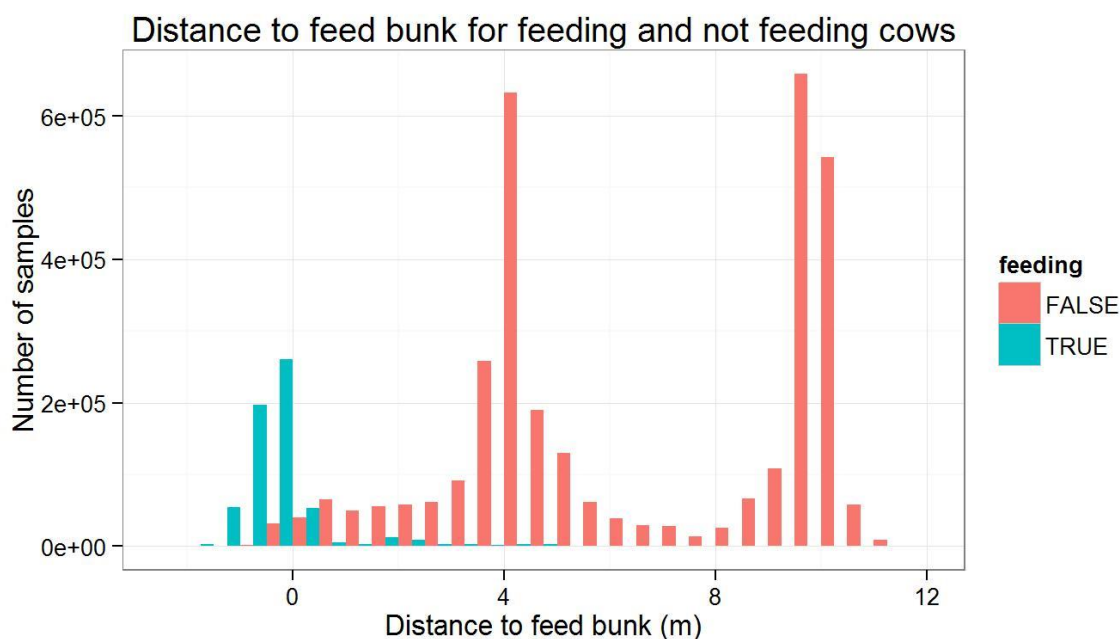lilli.frondelius@luke.fi

Automated measurement of feeding behaviour can be used for surveillance of production, health and welfare of dairy cattle. Feeding behaviour can be measured with stationary feeding systems, however, these systems often require high investments and structural changes in a barn. Thus, new low-cost, automatic measurement methods could be useful when measuring feeding behaviour. The aim of this study was to investigate how accurately we can measure the feeding time of dairy cows using an indoor positioning system.

We collected feeding time data of 39 dairy cows for 48 hours in a freestall barn using Insentec RIC feed intake measurement system. The position of the cows in the barn was simultaneously recorded using Ubisense UWB-based indoor positioning system at 1.2Hz. We filtered the positioning data to remove large jumps returning to original position with a custom algorithm and interpolated missing samples using piecewise interpolation.

We calculated the distance of each location sample to the feed bunk. Samples on the side of the feed bunk were defined as negative and on the side of the cows positive. We fitted a linear discriminant model (LDA) using the distance to feed bunk in order to classify feeding from position data to the first 24 hours of the sample and evaluated the classification performance of the model on the second 24 hour period.

The model predicted that data points closer than 97cm (0.5 cut-off for LDA) to feeding troughs come from feeding cows. The classification accuracy of the model (mean ± sd) was 94.6 ± 6.2% with sensitivity 94.1 ± 6.8% and specifity 95.0 ± 7.2%. The area under the ROC curve with model cut-offs from 0 to 1 for the LDA model was 0.98. High AUC indicates that the model is not very sensitive to used cut-off.

The results indicate that the used positioning system provides very accurate estimates of feeding time for dairy cows, and thus it may provide an inexpensive tool for feeding behaviour measurements at the feed bunk.