Abstract Submission Form

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Title of your paper   Identifying mastitis earlier by combining test day data and AMS sensor data

Insert ABSTRACT text

Mastitis is one of the most important diseases in dairy cows, affecting both the welfare of cows and the economy. On farms with automatic milking systems (AMS), farmers do not check the udder and foremilk during the milking process at a daily basis. Therefore, it is necessary to provide alternatives for the detection of conspicuous cows or milk. AMS manufacturers rely on a combination of sensors such as milk quantity measurement, somatic cell count (SCC), electrical conductivity (EC), etc. To estimate a daily cell count status in order to identify cows at risk of mastitis, we developed a model using daily AMS milking data in combination with routinely collected data from milk performance recording.

Data preparation, model fitting, and evaluation were carried out with the software R including multiple packages. For developing models to estimate a daily cell count status, AMS sensor data from Lely milking robots (period: 2020-07-01 to 2022-03-31) and exact laboratory results for SCC from monthly milk testing were used. After outlier filtering, data from 113 dairy farms and 9,859 cows (mostly dual-pupose Simmental cattle) were available. The data set was divided into a training (93 dairy farms and 8,244 cows) and a test data set (20 dairy farms and 1,615 cows).

Model fitting was carried out with the glm command (stats package), and the final models were selected using the Akaike information criterion (AIC). The SCC determined in the laboratory was used as dependent variable, with the cows divided into two groups for each model:
- 1st model: status 0: SCC < 200,000 cells/ml, status 1: SCC ≥ 200,000 cells/ml
- 2nd model: status 0: SCC < 400,000 cells/ml, status 1: SCC ≥ 400,000 cells/ml

Initial analyses of AMS sensor data showed that both the SSC as well as the EC difference between the highest and lowest quarter in % (ECdiff) increases 2 to 3 days before a mastitis diagnosis and indicates an infection.

The correlation between AMS cell counts and laboratory cell counts was calculated, and remarkable differences between farms were observed (correlations between 0.12 and 0.98). The mean correlation was 0.72. Even within farms large fluctuations occurred between test days. Therefore, correlations should be checked regularly and the SCC sensor should be maintained, if necessary.

In total, we developed four models. Two each for AMS with integrated SCC sensor and for AMS without integrated SCC sensor or dairy farms with SCC correlations below 0.7. The variables in the final models were:
- from AMS: SCC from AMS-sensor (if available), ECdiff, and daily milk quantity (l/day)
- from milk recording database: SCC from the last test day, lactose content, and days in milk.

Variables tested but not used in the final models were lactation number, breed, fat content, protein content and changes of ECdiff between milking day and the day before. The threshold for all models was determined by the coords-function (pROC package) using the "best" argument. Model sensitivity and specificity ranged between 0.75 and 0.88.

A test phase is currently underway in which pilot farms receive weekly reports with the SCC status of their cows. The aim is to evaluate the practical benefits for farmers as a tool for early detection of mastitis.

Enter keywords   mastitis, early detection, AMS, milk recording

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