Detection of mastitis and abnormal milk with automatic milking systems [1]

H. Mollenhorst and H. Hogeveen

Department of Farm Animal Health, Faculty of Veterinary Medicine, Utrecht University

Automatic milking (AM) has proven to be a viable alternative to traditional milking systems, providing dairy farmers with more flexible working hours without negatively affecting cow welfare. However, obstacles related to the detection of abnormal milk and clinical mastitis remain to be solved to improve adoption. While automated separation of visually abnormal milk with AM systems will be required by legislation in the near future, this has not yet been implemented. Separating abnormal milk automatically requires a reasonable detection rate combined with few false positives to limit the amount of milk that is discarded unnecessarily. Currently used AM systems are able to detect a reasonable proportion of clinical mastitis cases, but only at the expense of predicting many normal milkings as having mastitis, which requires much time and effort from the dairy farmer to separate false positives from real cases. Once a case of clinical mastitis has been detected, the dairy farmer needs support to determine a proper treatment, often involving antibiotics. Patterns in the milk quality data measured with AM systems are expected to help determine the type of pathogen causing the mastitis, although this has not yet been investigated extensively. The detection, diagnosis, and treatment of mastitis might be further enhanced through the use of additional, non-AM system, data such as somatic cell count, mastitis history, pathogen prevalence, and antibiotics effectiveness, which are available at many farms.

This project aims to enhance AM systems with new or improved data processing modules that deal with abnormal milk and clinical mastitis. Development of these modules can be grouped into two related areas of investigation. The first area covers the detection of abnormal milk, mastitis, and mastitis causing pathogens based on sensor data from the AM system. Data mining techniques will be used to develop detection models from large amounts of data acquired from commercial farms. Improved classification models for mastitis or abnormal milk may be created by combining data from multiple sensors (e.g., electrical conductivity (EC), colour, and milk flow) as well as through proper pre-processing of the sensor data patterns. Furthermore, assessing the value of additional sensors, like inline somatic cell count, is part of the project (see abstract Kamphuis et al.). The second area of investigation is intended to improve the detection of mastitis and mastitis pathogens and to develop mastitis treatment plans by taking into account non-AM system data. (For more information on the second part of the project see the abstract of Steeneveld et al.)

At this moment, 9 farms with a total of 12 AM systems (Lely Astronaut) are involved in the project. Sensor data are automatically logged and farmers are asked to record if there were clinical signs of mastitis or not for each cow on the daily mastitis attention list. For each treated case of mastitis, the farmer is asked to take a milk sample of the infected quarter for bacteriological culturing (BC). The quarter milking before the start of a mastitis treatment will be labelled as having mastitis. Quarter milkings from cows without clinical mastitis during their lactation and milkings labelled by the farmer as having no clinical signs will be used as negative cases for mastitis and pathogen detection.

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