10. Deviation in mobility patterns as an early indicator of lameness in dairy cows using sensor technology

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Fully blown lame cows can be identified, assessed, and treated on the basis of behavioural characteristics for detection, and progress of lameness. However, information collected on cows that are already showing full-blown lameness signs does not allow early detection of lameness. Prolonged and severe lameness cases increase the demand for antibiotics and their costs, delay the healing process, and increase culling rates. Although visual behavioural observations are inexpensive and simplistic, they are also time-consuming and subjective. Wearable sensors such as GPS and accelerometers have been widely used in recent years. However, these sensors are currently unable to achieve high accuracy to detect lameness in dairy cows. The objective of this research is to integrate data from accelerometers and GPS to improve lameness classification accuracy. During spring to early autumn, fieldwork was conducted in 6 dairy farms situated in the South of Wageningen. Approximately 94 cows that were either healthy, lame, or healthy and later became lame were equipped with sensors. Data on movement characteristics was obtained through a combination of a neck-mounted accelerometer and GPS sensors on each cow for a week. During the process, visual behavioural observations were also undertaken using smartphone software and an ethogram for behavioural classification. The dataset attained through the various sources was then used for statistical analyses. During these analyses, prediction models were developed using either single or integrated datasets through various machine learning techniques. Generally, healthy and unhealthy cows behaved differently, therefore, differences in behavioural patterns between the cow groups were expected, e.g., lame cows will be less active compared to healthy ones, and lie more and graze less. These behavioural changes were also expected to steadily de/increase in cows that were initially healthy and later became lame. The model integrating all different data sources was expected to show improved classification accuracy, especially in early stages of lameness. The potential of a single wearable sensors to replace visual observations has already been demonstrated in several studies. However, integrated data could further improve automated lameness classification, and reduce single sensor limitations.

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