Gaitwise, an automated detection system for lameness in dairy cattle

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To tackle the lameness problems on dairy herds, several research groups focus on the development of sensors that can measure lameness related variables from cows and the translation of this data into a warning system for lameness. Gaitwise, a walk-over device with an integrated pressure sensitive mat and specific software developed at ILVO is one of these systems and measures a total of 10 spatial (e.g. step length), temporal (e.g. stance time) and force related specific gait variables of claw-floor interactions when cows walk over the measurement zone. Assuming that these gait variables change when a cow develops lameness, Gaitwise could serve as a lameness detection system that alerts the farmer of cows that show abnormal changes in these variables that are related to lameness. In order for this system to be used in daily practice, measurements were fully automated and gait variables are available in real time. To select those variables that were most suited for a detection model, the 10 specific gait variables were compared to a reference method for lameness detection using observer locomotion scoring. All the tested variables were different between groups of non-lame, mildly lame and severely lame cows. The lameness detection model built based on these results, showed promising overall sensitivity and specificity, especially in detecting severely lame cows (Se 88%; Sp 100%). However, the results of the validation of the detection model revealed that detecting mildly lame cows is the most challenging as the differences with non-lame cows are much smaller (Se 76%). To improve the detection of mildly lame cases, the potential of gait inconsistency variables was investigated for early lameness detection in cows. In other words, will a cow that develops lameness first alter its gait by occasionally taking a shorter stride before altering its gait to shorter strides in general? The new model using the inconsistency variables outperformed the first model by far for the detection of the mildly lame cows (Se 88%; Sp 87%). It was therefore concluded that these new variables of inconsistent gait are promising for assessing lameness at an early stage. In addition, they might even aid in detecting the location of the lameness problem, i.e. which leg is lame. Whether these inconsistency variables are more promising in detecting lameness at an early stage compared to basic or specific gait variables should be investigated in future research using individual detection models.

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