

Development of 3D body condition score identification system for dairy cows ⁽¹⁾

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Abstract

The Body Condition Score (BCS) is an important indicator for assessing the health of dairy cows. This research adopts in-depth learning system, including information and communication technology, cloud computing, and artificial intelligence (AI), based on 3D image recognition technology, to construct the characteristic information of BCS and body shape, and to combine measured values with AI classification and assessment. The goal is to develop a system for identifying the body condition score of dairy cows. This system is divided into two parts: hardware equipment and software systems. The hardware equipment includes multi-view 2D and 3D imaging cameras, radio-frequency identification (RFID) sensor boards, image processing servers, protective electrical boxes, and workstation equipment...etc. The software part includes an AI identification program, an RFID value acquisition program, and an identification results and historical data browsing program...etc. The system includes two functions: (1) body shape measurement, which measures the body characteristics of dairy cows, including body length, body width, body height, and surface area of back; and (2) BCS scoring, which performs body condition scoring of dairy cows based on 2D and 3D image feature information for BCS classification, using a five-point scale from 2 to 5 (from very thin to obese) as the assessment mechanism. The system is installed in the cows' daily milking aisle, without interfering with the cows' physical condition and behavior, to collect cow body shape and BCS data twice a day (at 5:00 PM and 4:00 AM). Between July and the end of December 2023, the dairy cow body condition /BCS database collected 31,780 images and conducted AI system recognition training. The training accuracy was categorized into two types: perfect correction and tolerance of ± 0.25 in error value. The test results were 84.61% and 96.77%, respectively. The system improves 2D images due to the interference by images of pattern and body cleanliness of cows, as well as inconsistencies in human assessments of BCS.

Key words: Dairy cows, 3D image, Radio-frequency identification, Body condition score.

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