

An Algebraic Geometric Imaging Approach for Automatic Dairy Cow Body Condition Scoring System

Authors : Thi Thi Zin, Pyke Tin, Ikuo Kobayashi, Yoichiro Horii

Abstract : Today dairy farm experts and farmers have well recognized the importance of dairy cow Body Condition Score (BCS) since these scores can be used to optimize milk production, managing feeding system and as an indicator for abnormality in health even can be utilized to manage for having healthy calving times and process. In tradition, BCS measures are done by animal experts or trained technicians based on visual observations focusing on pin bones, pin, thurl and hook area, tail heads shapes, hook angles and short and long ribs. Since the traditional technique is very manual and subjective, the results can lead to different scores as well as not cost effective. Thus this paper proposes an algebraic geometric imaging approach for an automatic dairy cow BCS system. The proposed system consists of three functional modules. In the first module, significant landmarks or anatomical points from the cow image region are automatically extracted by using image processing techniques. To be specific, there are 23 anatomical points in the regions of ribs, hook bones, pin bone, thurl and tail head. These points are extracted by using block region based vertical and horizontal histogram methods. According to animal experts, the body condition scores depend mainly on the shape structure these regions. Therefore the second module will investigate some algebraic and geometric properties of the extracted anatomical points. Specifically, the second order polynomial regression is employed to a subset of anatomical points to produce the regression coefficients which are to be utilized as a part of feature vector in scoring process. In addition, the angles at thurl, pin, tail head and hook bone area are computed to extend the feature vector. Finally, in the third module, the extracted feature vectors are trained by using Markov Classification process to assign BCS for individual cows. Then the assigned BCS are revised by using multiple regression method to produce the final BCS score for dairy cows. In order to confirm the validity of proposed method, a monitoring video camera is set up at the milk rotary parlor to take top view images of cows. The proposed method extracts the key anatomical points and the corresponding feature vectors for each individual cows. Then the multiple regression calculator and Markov Chain Classification process are utilized to produce the estimated body condition score for each cow. The experimental results tested on 100 dairy cows from self-collected dataset and public bench mark dataset show very promising with accuracy of 98%.

Keywords : algebraic geometric imaging approach, body condition score, Markov classification, polynomial regression

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