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KEYNOTE

CattleAssess3D: 3D camera technology integrated with BeefSpecs drafting tool to assist 'meeting market specifications'

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Abstract: CattleAssess3D (https://www.youtube.com/watch?v=Dnv9Tiswg2U) integrates a 3-dimensional (3D) real-time assessment of *Bos tarus* and European breeds of cattle using off-the-shelf Red Green Blue-Depth (RGB-D) structured light cameras with the BeefSpecs drafting tool (Walmsley et al. 2014; http://beefspecs.agriculture.nsw.gov.au/drafting). CattleAssess3D is designed to assist producers manage risks associated with meeting carcass market specifications [P8 fat depth (P8 fat, mm) and hot standard carcass weight (HSCW, kg)]. Failure to meet carcass market specifications costs over AU$51 million/year to the southern Australian beef industry and even more when feeding costs to produce a non-compliant product are taken into consideration.

Data inputs, skills, and data requirements to develop CattleAsssess3D include:

- BeefSpecs inputs: Frame score, liveweight (LW), P8 fat, breed type, average daily gain (kg/day), days on feed (DOF), dressing percentage (%), feed type (grass or grain), and carcass specification inputs.
- Skills: ultrasound scanning P8 fat depth (mm) assessed by trained technicians, 3D perception, sensor fusing, machine learning, image processing, software systems modelling and optimization, skills by mechatronic engineers.
- Data requirements: P8 fat, measured hip height (HH, mm), and data collected from 16 3D cameras to create a 3D representation of the animal taken from the shoulder to the tail head covering the pin bones and stifle region.

Individual point cloud representations from the 16 RGB-D cameras, generated using a pinhole camera model, are converted to the final consolidated 3D representation (Figure 1a). A compact feature vector computes and encodes the surface curvature for each element of the point cloud. Supervised learning uses the feature vector to develop the relationship between the 3D images and P8 fat. Hip height is directly obtained from the 3D representation. The software is developed in C++ and exploits a multi-core processing unit to achieve the performance/output in real-time. The 3D technology has been installed at a research feedlot where cattle are assessed immediately before the weigh box. Stability of the 3D images of cattle is achieved within 10 seconds. Real-time assessments of HH and P8 fat followed by the radio-frequency identification number of the animal and LW are then loaded into a wi-fi data storage hub and reported on a computer screen. These real-time assessments are then uploaded into the BeefSpecs drafting tool where HH and age (default value of 18 months) determine frame score, final LW and HSCW are calculated, and P8 fat is predicted corresponding to the number of DOF (Walmsley et al. 2014). Carcass compliance is then displayed on a BeefSpecs drafting tool grid (Figure 1b). Days on feed or diet can then be varied to improve market compliance rates.

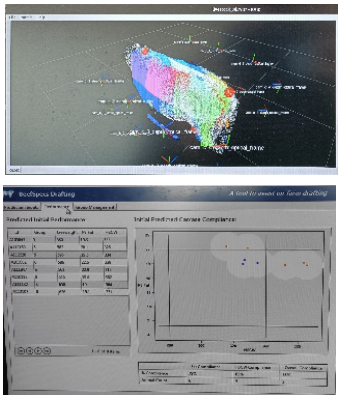

Figure 1. Real-time (a) 3D representation of an animal and (b) BeefSpecs drafting tool indicating market compliance: out (orange) and in (blue) specifications.

REFERENCES

Walmsley, B. J., McPhee, M. J., & Oddy, V. H. 2014. Development of the BeefSpecs fat calculator to assist decision making to increase compliance rates with beef carcass specifications. Animal Production Science, 54(11–12), 2003–2010. https://doi.org/10.1071/An14611

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