Thursday, February 29, 2024

Abstract Submission Form

Title (Mr./Mrs/Dr./Prof.) Mr.

Presenting author Maxence BRUYAS

Institute

Institute/company: ELIANCE

Adress: 149 rue de Bercy

ZIP/Postal code: 75012 City: PARIS

Country: FRANCE

Insert all authors and institutions

Maxence Bruyas (1), Adrien Lebreton (3), Laurent Griffon (2), Corentine Gillé-Perrier (2), Laurent Delattre (4), Clément Allain (3)

(1) Eliance, 149 Rue de Bercy, F-75595 Paris, France
(2) Races de France, 149 Rue de Bercy, F-75595 Paris, France
(3) Institut de l'Elevage, 149 Rue de Bercy, F-75595 Paris, France
(4) 3D Ouest, 5 Rue Louis de Broglie, 22300 Lannion, France

Preferred presentation Oral

Preferred session Session 10: New approaches in the field of functional traits for management and breeding

Email of corresponding author maxence.bruyas@eliance.fr

Title of your paper Performance monitoring in the cattle sector innovates with 3D imagery

Insert ABSTRACT text

Performance recording and phenotyping of beef cattle are on the verge of a new era. Indeed, Bruyas et al. (2023) have recently shown that it is possible to collect three-dimensional images of beef calves at weaning using a 3D device suitable for high-throughput phenotyping and to automatically extract morphological parameters (heights, widths, volumes, surfaces, etc.). The aim of this new study, which is part of the PHENO3D project, was to develop models based on artificial intelligence to estimate Body Weight (BW) and morphological linear scores based on previously estimated body measurements. To achieve these objectives, 1194 Charolais calves aged 4 to 12 months and weighing from 90 to 620 kg were scanned on 14 commercial farms. Most of them were scanned twice, allowing a total of 2210 3D images to be acquired. Reference measurements were collected on these same animals: each calf was weighed on an electronic scale (BW) and scored by 3 experienced technicians. Scoring resulted in the estimation of 10 elementary scores, which then allowed for the calculation of 2 synthetic scores (ratings from 1 to 100) used ultimately for genetic selection: 1. the muscular conformation (MUS), relating to the

musculature of the animal and 2. the size (SKE) of the animal relating to skeletal development. To predict BW, MUS, and SKE, various Machine Learning (ML) algorithms such as Extreme Gradient Boosting, Random Forest, and Elastic Net Regression were trained using 70% of the images and tested on the remaining 30%. The models were evaluated using Mean Absolute Error (MAE) and Spearman's correlation (rs). The repeatability of predictions was also assessed by Spearman's correlation between estimates made for the 1st image and the 2nd (when available). For BW, 1462 images were used for the learning model and 356 images for testing. For the best model, BW was predicted with a rs of 0.97 and an MAE of 12.1 kg (4.2%). The repeatability rs was 0.98 between the two images. For MUS and SKE, 1267 images were used to train the model and 308 images for testing. For the best model, MUS and SKE were predicted with respective rs values of 0.78 and 0.75, and MAEs of 7.1 (14.5%) and 6.5 (11.9%). The repeatability rs for these predictions for MUS and SKE were respectively 0.81 and 0.87. The Spearman's correlation for prediction and repeatability of MUS and SKE were higher than the average results obtained by experienced scorers during annual certification sessions. These results show that automating the scoring process using a 3D scanner combined with ML models is possible and allows for more accurate and repeatable estimates than those obtained by long-term scorers. The performances achieved on the Charolaise breed allow us to consider multiplying our models on the 9 other beef cattle breeds scored today (Limousine, Blonde d'Aquitaine, Salers, Aubrac, Parthenaise, Rouge des Prés, Blanc Bleu, Gasconne des Pyrénées, and Bazadaise) and to project towards the industrialization of the PHENO3D solution.

Enter keywords Phenotyping, Calves, Weaning, 3D imaging, Artificial intelligence, PHENO3D