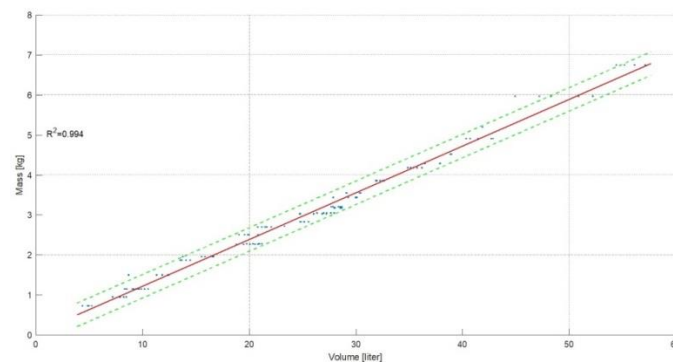


Evaluation of Cow Feed Mass by Photogrammetry

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Monitoring the individual cow feed intake is critical for detecting the inefficient and efficient cows, and then improving the cow genotype. A feed mass weighing system, which is a common method in research, requires multiple costly scales, making it inappropriate for commercial farms. However, feed mass can be estimated by its volume, which is measured by a small number of sensors, such as LIDAR or cameras with a light projector. In this research, the feed volume was achieved by the photogrammetry method. The method requires cameras along the feed-lane, photographing the feed before and after the cow visits the feed-lane, and calculating the feed volume. The installation of the cameras does not change existing infrastructure and routines of the cowshed, such as feed distribution and cleaning of the feed remnants. This study tested the precision evaluating feed mass by its volume. The following principal factors were examined in order to analyze the sensitivity and precision of this evaluation method: camera quality, lighting conditions, image resolution, number of images, and feed density. To design a commercializable feed measuring system, a designer has to find an optimal trade-off between these factors: minimal camera cost, worst lighting conditions, minimal image number and maximal feed density diversity. Based on the analysis of conducted experiments, the following camera type and installation method were chosen: a high-quality camera in the laboratory experiment; and medium quality cameras, installed above the feeding lane, for the experiment in a cowshed. Under laboratory conditions, the mass evaluation error was 0.293 kg, while in the cowshed, using the aforementioned cameras and simple installation system, the precision was 3.06 kg. A separate experiment was conducted to examine the effect of the feed compressibility.



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