Detecting irregular shaped feed bunk and computing feed quantity

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1 INTRODUCTION

- **What is the problem?**
- Estimating the amount of the feed in the bunk is a challenging task in feedlot management. Currently, the feed bunk managers score the bunk to estimate the amount of residual feed. These bunk scoring techniques contribute to feed loss through excess feed spoilage and reduction in the animal daily gain when there is not enough feed.

Why is it important?
Alternative methods are needed to ensure accurate feed estimation and minimize errors caused by the current feed scoring techniques.

What are the applications?
Feedlots can monitor their feed bunks using any RGB acquisition system (drones, robots, etc) and estimate the volumes and mass of the feed.

What approach are you planning to use?
We are planning to use different image processing techniques such as image segmentation to quantify the volume and use the different diets' respective bulk densities to estimate the mass of those diets in the bunk.

What will be your contributions?
Explore different image processing techniques [1] to quantify dimensions in an object and apply them to this study. This study will be the first step in understanding how to use the RGB images in quantifying the amount of feed in the bunk.

2 OBJECTIVES

The objectives are:

- Segmentation of the trough
- Computing the dimensions of the trough
- Computing the volume/mass of the feed

3 RELATED WORK

Similar works include, "Improving vision-based distance measurements using reference objects,"[1] by M. Jüngel, H. Mellmann, and M. Spranger. Their work looked at improving distance measurements based on reference objects.

In our case, we will use the same method of estimating depth but with less accuracy. This fits into the broad topic of computer vision of depth estimation , lidar, stereo vision, etc. The paper discusses methods used to mitigate this issue.

4 PROBLEM DEFINITION

Define the problem you are addressing precisely and completely. You should specify what the inputs are and what the outputs are using a formal approach. Describe why it is an interesting and important problem. It is perfectly acceptable to define the broad problem first and make some simplification for your specific project. Make sure that your assumptions are reasonable and non---trivial.

5 IMAGES

- Data collected at the Animal Science Complex (UNL) by the team members
- Data collected using Azure Kinect DK camera
- Collected for a study on quantifying residual feed using imaging technology

Give a tentative quality for each dataset. Give the size and scope of the datasets, in terms of number of images, contents, diversity, etc.

- RGB images of resolution 3072x4096
- 20 images of empty bunk
- 4000 images of bunk+feed
- Different feed weight level and different kind of feed

Fig. 1. Trough with feed

6 APPROACH

We will use Matlab as main software, and the following toolboxes:

- Image Processing Toolbox
- Deep Learning Toolbox

Image Processing Methods:

- Object Segmentation
- Feature Matching w/ Deep Learning
- Filters to extract features

Deep Learning Methods:

- Clustering.

7 EVALUATION

To evaluate the performance of the computer vision based feed estimation system, the results will be compared against the actual mass of the feed associated with each image. Based on the percent difference, we can adjust the algorithm to reduce the amount of errors.

8 IMPLEMENTATION PLAN AND TIMELINE

The objectives we have set can be seen as different steps to follow to achieve our global goal. The first thing we will try to complete is the segmentation of the through from the background. Then, we will compute the dimensions of the through and we will compute the volume.

The first week (week 9) we will meet to research what specific techniques , methods or programs we need for each objective.

The following week (week 10), we will work in the through segmentation from the background.

The two following weeks (weeks 11 and 12), we will work in the dimensions of the through.

The following week (week 13), we will finish the code by working on computing the volume of the feed.

To finish, the 15th week we will work on the project report and final project presentation.

REFERENCES

[1] M. Jüngel, H. Mellmann, and M. Spranger, "Improving vision-based distance measurements using reference objects," *SpringerLink*, 01-Jan-1970. [Online]. Available: https://link.springer.com/chapter/10.1007/978-3-540-68847-1_8. [Accessed: 10-Oct-2022].