Optimized System to Monitor Animal Behavior

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DAIRY INNOVATION HUB

Background

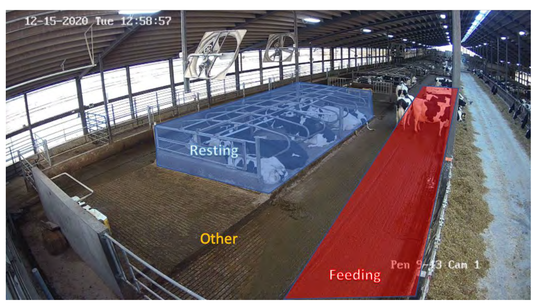
✓ Behavioral patterns are known to be associated with animal health, estrus event, and calving time.

✓ In large dairy operations, the daily monitoring of animal behavior is laborious, and the large number of animals becomes a limiting factor for such evaluation.

✓ Computer vision systems can be used for real-time monitoring of animal behavior

Objective

✓ The main objective of this project is to develop an automated computer vision system using RGB images and deep learning algorithms for animal recognition and behavior monitoring. Thus, three specific objectives will be developed as follow:



- Counting → **Preliminary results presented here**
- Identifying
- Classifying Behavior

→ ***Ongoing research***

Material and Methods

✓ A total of 2,200 images were randomly selected to train a counting algorithm

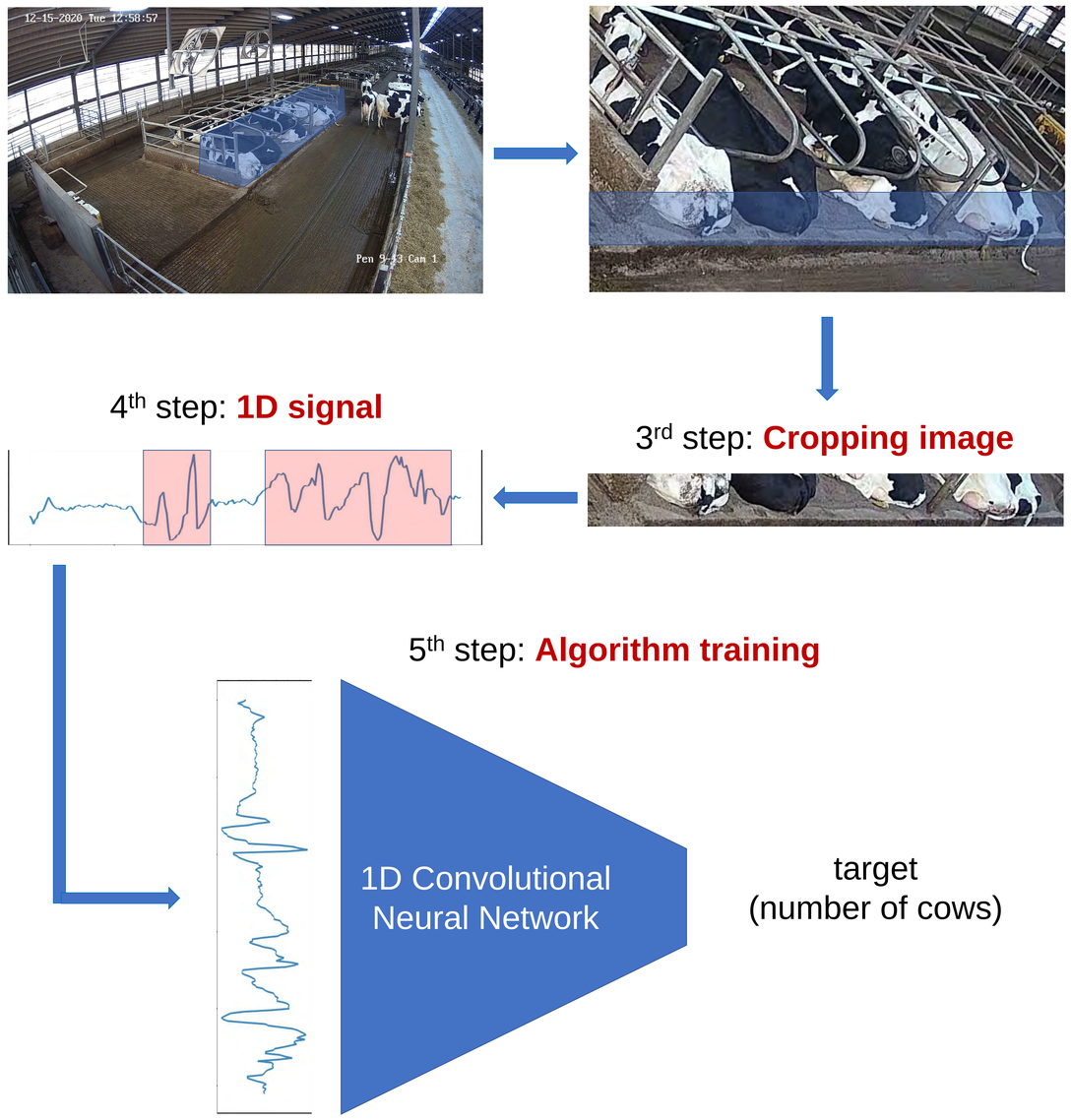
✓ All images were labeled when cows were in the resting area

✓ The algorithm was trained using 2,000 images and tested on 200 images

✓ The framework consists of five different steps:

1. **Pen area:** *from the entire image the resting area was selected to train an algorithm to count the number of cows;*
2. **Target loci:** *a target loci region of the resting area was selected to generate a 1D signal feature vector;*
3. **Cropping image:** *images were cropped in the target loci region to reduce data dimension;*
4. **1D signal:** *all pixels from the cropped region were sum up to generate the final feature vector;*
5. **Algorithm training**: *the signal feature vector was used to train a 1D Convolutional Neural Network, where the target was the number of cows in the resting area.*

Framework



Results

✓ From the total of images used in the testing set (200), on 169 the number of cows were corrected predicted

✓ The algorithm predicted the number of cows with an ***accuracy of 84.5%***

Predicted \ *Observed*	0	1	2	3	4	5	Total
0	***41***	0	0	1	2	0	44
1	1	***6***	0	0	0	0	7
2	1	1	***5***	1	0	0	8
3	1	0	0	***13***	3	1	18
4	0	0	1	2	***28***	10	41
5	0	0	1	1	4	***76***	82

Ongoing Research

✓ Predict eating, drinking, and other activities to have a complete temporal analysis for animal behavior.

✓ Perform individual cow identification to compute behavior activities at the animal-level

✓ Explore deep learning algorithms for object tracking to refine individual animal monitoring