

Thesis Title Image Processing and Deep Learning for Dairy Cow Monitoring
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ABSTRACT

Livestock farming is a large-scale industry, particularly for beef and dairy cows, which generate economic value as primary food sources worldwide. Behavioral recognition of beef and dairy cows has traditionally required continuous human observation, which is subject to recording accuracy limitations and human fatigue. YOLOv8n was therefore applied to assist in tasks requiring continuous monitoring for the behavioral recognition of beef and dairy cows. Datasets were collected over 24 hours for model training, and the model was subsequently deployed on-farm to monitor a herd of 16 dairy cows for behavioral data collection over an additional 15 days to derive statistical metrics. The target behaviors were categorized into five classes: Eating, Walking, Lying, Standing, and Drinking, then the model was also applied to analyze the behavior of individual dairy cows during milking 44 times on during morning and evening. The total dataset comprised 12,848 images, partitioned in a train:val:test ratio of 70:15:15. The mAP50-95 metric was compared across five YOLO-based models. YOLOv8n achieved the highest performance owing to its 3.2M parameters, which exceed those of the other versions, yielding Precision 74.85%, Recall 78.74%, mAP@0.5 78.37%, and mAP50-95 49.18%. The classes with relatively lower performance were Walking and Drinking, as their image counts were fewer than those of the other classes because the dairy cow within the farm had limited space for walking. The research primarily focused on the Eating class, as it is instrumental in predicting whether a herd of dairy cow in a farm is at risk of illness.

Keywords: Deep Learning, YOLO, CNNs, Livestock, Cattle Behavioral Recognition, Object Detection, Algorithm Comparison