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AUTOMATIC COUNTING OF CHICKENS AROUND FEEDERS USING CONVOLUTIONAL NEURAL NETWORKS

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ABSTRACT

n 2023, Taiwan’s chicken industry generated about NTD 93.6 billion, or 43.5% of the livestock production value, underscoring its central role in the sector. Nonetheless, monitoring flock health and housing remains labor-intensive, and adjustments to feeding regimes frequently depend on subjective judgment, limiting standardization and scalability. Because feeding behavior is a key indicator of health and welfare, we present a vision-based system that continuously detects feeders and counts chickens around them to provide an objective measure of feeding activity. The framework employs two independent YOLOv11 detectors—a feeder model with a average precision (AP) of 0.975 and a chicken model with a AP of 0.916—and a custom thresholding scheme integrated with one-dimensional (1D) K-Means clustering on feeder positions to estimate per-feeder counts from 1080p/5 fps video. Experimental results show accurate detection of feeders and chickens and reliable quantification of chicken numbers near each feeder across commercial poultry-house footage. These capabilities establish a practical foundation for subsequent analysis of feeding behavior and represent a critical step toward standardized feeding indicators and data-driven poultry management, with the potential to reduce labor demands and improve decision-making in large-scale operations.

Keywords: Chicken detection, Chicken house monitoring, Feeding activity estimation

INTRODUCTION

According to the Council of Agriculture, Executive Yuan, Taiwan (2023), domestic chicken meat production in 2023 exceeded 650,000 metric tons, representing nearly 48% of the nation’s total meat output and ranking second only to pork. This underscores its role as a major protein source and a key pillar of the poultry industry in maintaining national food security. In recent years, many studies have applied image processing and deep learning to recognize animal positions. By defining feeding areas and applying decision rules, these methods have successfully quantified feeding behaviors, thereby improving the automation and accuracy of animal behavior monitoring. For example, Li et al. defined the bird number at feedersand the bird number at drinkers as quantitative indicators of chicken feeding behavior (Li et al., 2020). Similarly, Nasiri et al. annotated feeding areas and tracked chicken head positions to estimate feeding durations, reporting high accuracy at both the individual and flock levels (Nasiri et al., 2023). Therefore, this study proposes a vision-based system to continuously detect feeders and count the number of chickens around them, providing an objective basis for quantifying feeding-related behavior. This system is expected to facilitate standardized monitoring of feeding activity and support the development of data-driven poultry management strategies.

OBJECTIVES

This study aims to: (1) develop a YOLOv11-based pipeline to detect feeders and chickens in commercial poultry houses; (2) estimate per-feeder chicken counts using a thresholding approach with one-dimensional clustering; and (3) assess feasibility for continuous, automated quantification of feeding activity under production conditions.

MATERIALS AND METHODS

DATA COLLECTION

Images and videos of chicken houses were collected using an overhead side-view imaging system. The system consisted of a Raspberry Pi 4B connected to a 130° FOV distortion-free camera, capturing video frames at a resolution of 1920 × 1080 pixels and a frame rate of 5 fps. The data were obtained from a wet-pad cooled chicken house.

MODEL TRAINING

For model training, 100 images were extracted from video, each containing approximately 650–750 chickens distributed around 11 feeders. Feeding areas and chicken positions were manually annotated. These annotated images were used to train two YOLOv11-based object detection models: one for feeder detection and one for chicken detection.

FEEDING BEHAVIOR IDENTIFICATION

To identify which chickens were feeding, feeder positions were first grouped using a clustering approach to establish feeder regions. Manually annotated feeding chickens were used as reference samples. For each annotated feeding chicken, the distance to its nearest feeder was calculated, and the median of these distances was defined as the threshold for feeding behavior. Based on this criterion, the system automatically determined whether chickens detected around feeders were engaged in feeding activity.

RESULTS & DISCUSSION

The feeder detection model achieved an AP of 97.5%, and the chicken detection model achieved an AP of 91.6%, indicating robust performance under commercial farm conditions. The system successfully quantified chicken numbers around feeders in each frame, providing an objective indicator of feeding activity. However, this approach still has certain limitations. First, when feeders appear near the edge of the image, some chickens that are actually feeding may lie partially outside the predefined feeder zone, making their feeding activity difficult to capture. Second, chickens that are merely resting or lying close to feeders can be interpreted as feeding. These issues are primarily caused by perspective distortion and the difficulty of distinguishing closely related behaviors in crowded environments.

CONCLUSION

This study developed a vision-based system to monitor feeding behavior in commercial broiler houses. By integrating two YOLOv11-based detection models with a clustering approach, the system accurately detected feeders and chickens and quantified the number of chickens around feeders. The results demonstrate that the method provides an effective and objective indicator of feeding activity, offering practical support for automated flock monitoring. Although challenges remain in differentiating feeding from non-feeding behaviors in crowded scenes, the framework shows strong potential as a foundation for standardized feeding indicators and data-driven poultry management. Future work will refine behavioral classification and extend the system to continuous, long-term monitoring across diverse farm conditions.

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