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EARLY WARNING SYSTEM BASED ON DEEP LEARNING FOR MULTI-TYPE ABNORMAL CHICKEN COMB DETECTION

Yun-I Chu[1]*, Ming-Wen Wu[1], Kuang-Wen Hsieh[1], Ming-Kun Hsieh[2] and Tsai Yao-Chuan[1]

[1]Dept. of Bio-Industrial Mechatronic Engineering, National Chung Hsing University, Taichung, Taiwan
[2]Graduate Institute of Microbiology and Public Health, National Chung Hsing University, Taichung, Taiwan

*Corresponding Author: chloechu970720@gmail.com

Abstract

With the rapid development of smart agriculture, environmental sensing technologies have been widely applied to enhance production efficiency and management in poultry farming. However, existing poultry house systems mainly focus on monitoring environmental parameters such as temperature, humidity, and gas concentrations, offering limited capabilities for real-time assessment of individual chicken health. Currently, flock health largely relies on manual inspections by farm personnel, which are time-consuming and prone to subjective judgment, lacking objective and consistent standards. According to farmers' experiences, abnormalities in chicken combs are often early signs of health problems, making them important indicators for early warning. This study developed a deep learning-based multi-class abnormal comb detection and warning system. High-resolution cameras were installed in commercial poultry houses to automatically capture chicken images and upload them to a cloud server. After annotation and preprocessing, a YOLOv7 model was trained to establish a recognition model for normal and abnormal combs, achieving a precision of 74.7% and a recall of 75.6%. Furthermore, a multi-class model was developed to identify different abnormal types, such as cyanosis, pallor, inverted comb, and scabbing, with a precision of 54.7% and a recall of 63.1%. The system has been deployed and validated over the long term in commercial poultry houses. By integrating the detection results of both models with farming records, it is possible to clarify the occurrence timing and potential causes of each abnormal type. Daily updates on the proportion of abnormalities are uploaded, assisting farmers in promptly understanding flock health trends and achieving the goal of early warning management in intelligent poultry houses.

Keywords: Deep Learning, Chicken Comb, Abnormal Detection, Image Recognition

INTRODUCTION

Taiwan raises various chickens, including red- and black-feather native chickens and broilers. Native chickens grow slower and face higher disease risks, with avian influenza causing mass culling in recent years. Farmers must inspect chicken health daily, which is time-consuming and risky. This study uses a controllable camera and deep learning to automatically detect abnormal combs, improving health monitoring, reducing labor, and lowering disease risk.

MATERIALS AND METHODS

Research structure

This study's system was installed in a commercial poultry house, using cameras with adjustable angles and zoom to capture images of chicken combs. The images were uploaded to a cloud server for annotation and deep learning model training. The model can identify both normal and abnormal comb types (as shown in Fig.1). The recognition results are instantly transmitted to the data platform.

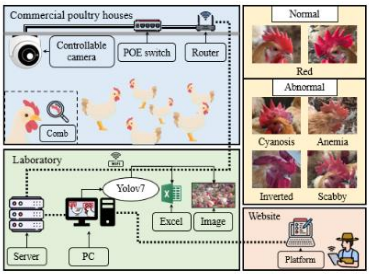

Fig.1 Research structure diagram.

Quantitative Model Accuracy

This study used YOLOv7 deep learning model for abnormal chicken comb detection and established two model architectures a binary classification model (normal vs. abnormal) and a multi-type classification model. For the binary classification model, a total of 800 images were used for training, with 100 images each for validation and testing. For the multi-type classification model, a total of 2,511 images were used for training, with 105 images each for validation and testing.

RESULTS & DISCUSSION

This study developed both a binary classification model and a multi-type classification model. The binary model achieved a precision of 74.7% and a recall of 75.6% on the test dataset, demonstrating stable overall performance and suitability for real-time abnormality screening in poultry houses. The multi-type model further identified specific abnormal comb types. Although its precision and recall were slightly lower, at 54.7% and 63.1%, respectively, it still exhibited basic recognition capability, which can support follow-up tracking and analysis of abnormal types. The performance of the multi-type model was limited by the high variability in comb appearance, significant differences across age stages and imaging conditions, and possible inconsistencies in annotation standards. Although data augmentation was applied to enhance sample diversity, the model still showed instability when dealing with highly variable samples. This indicates that there is room for further improvement in annotation quality and model optimization in future work.

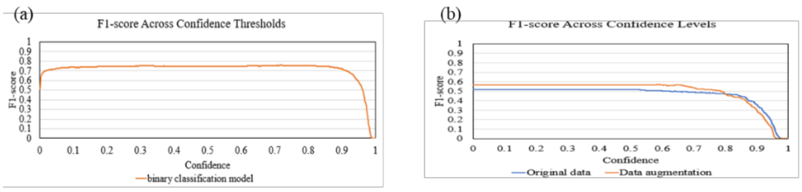

Fig.3. F1-score across confidence thresholds: (a) binary classification model; (b) multi-type classification model with data augmentation.

CONCLUSIONS

This study implemented a controllable camera system in a commercial poultry house to automatically collect chicken images. A comb abnormality detection model then analyzed the images to provide the total number of combs, abnormal combs, and the abnormality ratio.

REFERENCES

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