

# Computer Vision Systems for Real-Time Poultry Behavior Analysis and Anomaly Detection

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**Abstract** — Poultry farming is an important part of the agricultural industry, and maintaining the health and safety of birds is necessary for better production. In traditional poultry farms, farmers usually observe birds manually to identify changes in their behavior. However, checking a large number of birds every day is difficult and time-consuming. Sometimes, unusual behavior or early signs of illness may go unnoticed, which can affect bird health and farm productivity. This paper focuses on using computer vision technology to monitor poultry behavior in real time. A camera is used to capture images and videos of birds, which can be analyzed by a computer system to identify their activities and detect unusual behavior. The system can help observe activities such as feeding, drinking, walking, resting, and movement patterns. If it notices changes such as reduced movement, unusual grouping, or abnormal activity, it can alert the farmer to check the birds. This may help farmers identify possible health or environmental problems at an early stage. The main aim of this system is to reduce the need for continuous manual observation and make poultry farm management easier and more efficient. It can also help farmers save time, improve bird welfare, and take action before a small problem becomes serious. Although the system may face challenges due to poor lighting, camera quality, and crowded conditions, computer vision can be a useful tool for modern poultry farming.

**Keywords**— Computer Vision, Poultry Farming, Behavior Analysis, Anomaly Detection, Real-Time Monitoring, Bird Health.

## I. INTRODUCTION

### 1. Background

Poultry farming is one of the important parts of the agricultural industry. It provides eggs and meat and creates employment opportunities for many people. To maintain a healthy poultry farm, farmers need to observe the birds regularly and understand their behavior. Changes in feeding habits, drinking water consumption, movement, resting patterns, and group activities can sometimes indicate health problems or unsuitable conditions in the poultry house.

The main purpose of Computer Vision Systems for Real-Time Poultry Behavior Analysis and Anomaly Detection is to make poultry monitoring easier, faster, and more reliable. The system can continuously analyze camera footage and notify farmers when it detects behavior that requires attention. Farmers can then inspect the birds and take appropriate action. However, the system does not replace veterinary diagnosis or the farmer's judgment; it acts as a supporting tool for early observation and better farm management.

### 2. Problem Statement

In traditional poultry farming, farmers mainly depend on manual observation to monitor the behavior and health of birds. When a large number of birds are kept in a poultry house, it becomes difficult and time-consuming to observe every bird

continuously. Changes in feeding habits, movement, resting patterns, and group behavior may go unnoticed, which can delay the identification of possible health problems or abnormal conditions. This may lead to increased bird mortality, reduced productivity, and financial losses for farmers.

Therefore, there is a need for a computer vision system that can monitor poultry behavior in real time using cameras and identify unusual activities automatically. The proposed system aims to analyze bird movements and behavior, detect abnormal patterns, and alert farmers when further inspection may be required. This can reduce dependence on continuous manual observation and support early action, better bird welfare, and efficient poultry farm management.

### 3. Motivation for an AI-Based Approach

The main motivation for using an AI-based approach in poultry farming is to make bird monitoring easier, faster, and more effective. In traditional poultry farms, farmers observe birds manually to understand their health and behavior. However, monitoring thousands of birds continuously is difficult and requires a lot of time and effort. Small changes in bird movement, feeding habits, or group behavior may be missed during manual observation.

Artificial Intelligence (AI) and computer vision can help solve these problems by analyzing images and videos captured by cameras. The system can learn to recognize normal bird

activities and identify unusual patterns that may require attention. For example, if birds show reduced movement, unusual grouping, or changes in their regular activities, the system can notify the farmer for further inspection. Another motivation is to reduce the workload of farmers and improve poultry farm management. An AI-based system can support continuous monitoring and help farmers respond more quickly to possible problems. It may also help reduce losses, improve bird welfare, and increase farm productivity. Therefore, using AI for real-time poultry behavior analysis and anomaly detection is a useful step toward smart poultry farming. The goal is not to replace farmers but to provide them with a helpful tool for making better and faster decisions.

#### 4. Scope and Objectives of This Paper

This paper focuses on the use of computer vision systems for real-time poultry behavior analysis and anomaly detection. The system uses cameras to capture images and videos of birds and analyzes their activities to understand their normal behavior. It focuses on observing activities such as feeding, drinking, walking, resting, and movement patterns.

- To monitor poultry behavior: Use camera footage to observe bird activities continuously.
- To analyze normal activities: Identify common behaviors such as feeding, drinking, walking, and resting.
- To detect unusual behavior: Identify changes in movement, grouping, or activity that may require attention.
- To provide timely alerts: Notify farmers when unusual patterns are detected so they can inspect the birds.

## II. RELATED WORK / LITERATURE REVIEW

### 1. Foundational AI Concepts in Poultry farming

Artificial Intelligence (AI) is a technology that enables computers to perform tasks that usually require human intelligence. In poultry farming, AI can be used to monitor bird activities, analyze their behavior, and identify unusual changes. Computer vision is an important part of this system because it allows computers to process images and videos captured by cameras. Machine learning helps the system learn patterns from poultry behavior data, while deep learning can analyze complex images and recognize birds and their activities. Object detection helps identify the location of birds in camera footage, and behavior recognition helps observe activities such as feeding, drinking, walking, resting, and grouping. Anomaly detection is used to identify changes from normal behavior, such as reduced movement, unusual grouping, or changes in activity levels. These changes may indicate that the birds need

further inspection. The system can also provide alerts to farmers when unusual patterns are detected. By combining these AI techniques, poultry farms can reduce the need for continuous manual observation, identify possible problems earlier, improve bird welfare, and support more efficient farm management. However, AI-based monitoring supports farmers in decision-making and does not replace proper veterinary examination.

### 2. AI for Poultry Behavior Detection and Monitoring

Artificial Intelligence (AI) is becoming a useful technology in modern poultry farming because it helps farmers monitor birds more efficiently and identify unusual behavior. In traditional poultry farms, farmers observe birds manually to check their health, feeding habits, movement, and daily activities. However, when thousands of birds are kept in a single poultry house, it is difficult to observe every bird continuously. Small changes in behavior may go unnoticed, which can delay the identification of possible health problems. AI-based monitoring systems can help overcome these difficulties by analyzing images and videos captured by cameras installed inside the poultry house.

Computer vision is one of the main technologies used in AI-based poultry monitoring. It allows a computer to process images and videos and obtain useful information about the birds. The system can identify birds, observe their positions, and analyze their movement over time. For example, it can monitor whether birds are walking normally, gathering around feeders, drinking water, resting, or moving together in groups. By observing these activities, the system can help farmers understand the general behavior of their flock and notice changes that may require attention.

### 3. AI for Poultry Stress, Abnormal Behavior, and Welfare Detection

Artificial Intelligence (AI) can help farmers identify signs of stress, discomfort, and unusual behavior in poultry by analyzing images and videos captured by cameras. In poultry farming, birds may experience stress because of high temperatures, poor ventilation, overcrowding, insufficient access to feed or water, and other environmental conditions. These factors can affect bird health, behavior, and productivity. Traditionally, farmers identify such problems through manual observation, but it can be difficult to monitor a large flock continuously. AI-based systems can support this process by observing bird movement, distribution, and activity patterns in real time.

Computer vision techniques allow a computer to analyze the behavior of birds and identify changes from their normal activities. For example, reduced movement, unusual gathering in one area, increased agitation, or changes in feeding and resting patterns may indicate that the birds require attention. A trained AI model can analyze these patterns and flag unusual behavior for further inspection. However, these behaviors do not always indicate stress or illness, so they should be considered along with environmental conditions and other farm observations.

AI-based monitoring can also help farmers understand how birds respond to changes in their surroundings. When combined with temperature and humidity sensors, the system can help identify situations in which environmental conditions may be affecting poultry behavior. For example, unusual bird distribution combined with high temperatures may indicate a need to check ventilation, cooling, and water availability. The system can notify the farmer when such patterns are detected, allowing the farmer to inspect the poultry house and take appropriate action.

Another important application is long-term behavior analysis. By collecting information about bird activity over time, AI systems can help farmers compare current behavior with normal daily patterns. This may help identify gradual changes that are difficult to notice through occasional manual checks. The collected information can also support better decisions about housing conditions, feeding arrangements, and flock management.

Despite these benefits, AI cannot directly determine a bird's emotional state from camera footage alone. Its predictions depend on the quality of the video, the training data, and the accuracy of the model. Changes in behavior may have several causes, so automated alerts should not be treated as a confirmed diagnosis. Overall, AI-based stress and welfare monitoring can support poultry farmers by highlighting unusual activity, improving observation, and helping them maintain suitable conditions for healthier birds.

#### 4. Comparative Summary of Reviewed Sources

Research on computer vision and artificial intelligence in poultry farming shows that these technologies can help farmers monitor bird behavior, identify unusual activities, and improve farm management. Different studies have explored image processing, machine learning, deep learning, and video analysis to observe poultry and detect changes in their normal behavior. Some approaches focus on detecting and tracking individual birds, while others analyze the activities of the entire flock.

Object detection models, such as YOLO, can locate birds in images and videos, whereas behavior recognition methods can help identify activities such as feeding, walking, resting, and grouping. Anomaly detection techniques focus on identifying behavior that differs from established patterns and may require further investigation.

The reviewed approaches have different advantages and limitations. Image-based systems are useful for identifying birds and their positions, but they may provide limited information about behavior over time. Video-based systems can analyze movement and activity patterns, although they require sufficient processing power and good-quality footage. Deep learning methods can recognize complex visual patterns, but their performance depends on the quality and diversity of training data. Environmental monitoring systems can provide additional information about temperature, humidity, and ventilation, helping farmers interpret changes in bird behavior more effectively.

Another important finding is that unusual poultry behavior can have several possible causes, including environmental discomfort, changes in feeding, stress, injury, or illness. Therefore, a system that identifies an anomaly should not automatically classify it as a disease. Instead, it should alert the farmer so that the situation can be checked. Factors such as poor lighting, overcrowding, camera obstruction, and overlapping birds can also affect detection accuracy.

Overall, the reviewed research suggests that combining computer vision, deep learning, behavior analysis, and environmental monitoring could provide a more useful solution for real-time poultry management. However, further work is needed to develop systems that operate reliably under actual farm conditions, detect changes early, and minimize false alerts. The proposed approach aims to address these challenges by analyzing poultry behavior continuously and identifying unusual patterns that may require the farmer's attention. This could reduce manual monitoring efforts, support better bird welfare, and contribute to more efficient poultry farming.

#### 5. Synthesis: Literature Gaps

The review of existing research on computer vision and artificial intelligence in poultry farming shows that several techniques have been developed to detect birds, monitor their movement, and recognize their activities. However, some limitations remain that need further improvement. Many existing approaches focus on specific tasks, such as bird detection, counting, or identifying individual activities, rather than combining continuous behavior monitoring with anomaly

detection in a single system. As a result, changes in overall flock behavior may not always be identified effectively.

Another important gap is the difficulty of applying these systems in real poultry farm environments. Factors such as poor lighting, dust, overcrowding, overlapping birds, and camera obstruction can reduce detection accuracy. Some AI models also require large amounts of labeled training data and powerful computing resources, which may increase the cost of implementation. In addition, a model trained under one set of farm conditions may not perform equally well in another environment.

### III. PROPOSED FRAMEWORK

The proposed framework for Computer Vision Systems for Real-Time Poultry Behavior Analysis and Anomaly Detection aims to monitor poultry activities continuously and identify unusual behavior using cameras and artificial intelligence. The system is designed to reduce the effort required for manual observation and help farmers notice potential problems at an early stage. It consists of several stages, including video acquisition, image processing, bird detection, behavior analysis, anomaly detection, and alert generation.

#### 1. System Overview

The proposed system uses computer vision and Artificial Intelligence (AI) to monitor poultry birds in real time. Its main purpose is to observe bird activities, identify unusual behavior, and help farmers recognize potential problems earlier. In traditional poultry farming, farmers must observe birds manually, which can be difficult when thousands of birds are kept in one poultry house. The proposed system uses cameras and an AI model to reduce this workload and provide continuous monitoring.

The system begins by capturing live video from cameras installed inside the poultry house. The video is processed into frames, which are analyzed by a computer vision model such as YOLO (You Only Look Once) to detect birds. The system then examines bird movement and activity patterns, including walking, feeding, resting, and grouping. These observations are compared with normal behavior patterns to identify unusual activities.

#### 2. Module A — Imaging-Based Poultry Bird Detection

Imaging-based poultry bird detection is the first module of the proposed system. Its main purpose is to identify birds from images and video footage captured by cameras installed inside a poultry house. In traditional poultry farming, farmers observe

birds manually, which can be difficult when a large number of birds are present. This module uses computer vision and artificial intelligence to detect birds automatically and provide useful information for further behavior analysis. The system receives video footage from CCTV cameras or other suitable cameras.

The video is divided into individual frames, and image-processing techniques prepare these frames for analysis. A trained object detection model, such as YOLO (You Only Look Once), can then identify birds and mark their locations using bounding boxes. The model may also assign a confidence score to each detection, indicating how confident it is that the detected object is a bird.

#### 3. Module B — Camera-Based Poultry Behavior Analysis and Anomaly Detection

Module B focuses on analyzing poultry behavior using camera footage and artificial intelligence. After birds are detected in Module A, this module examines their movements and activity patterns to identify normal and unusual behavior. Unlike wearable-sensor systems designed for humans, this approach uses cameras to monitor birds without attaching any devices to them. This makes it suitable for observing large poultry flocks with less manual effort.

The system processes video frames and studies visible activities such as walking, feeding, drinking, resting, and grouping. Computer vision and machine learning techniques can be used to identify these activities and compare them with normal behavior patterns.

For example, if birds suddenly become less active, gather unusually in one area, or show a noticeable change in movement, the system may mark the behavior as an anomaly. These changes could be associated with environmental discomfort, stress, injury, or possible illness, but they require further investigation before a cause can be determined.

#### 4. Integration and Alerting Layer

The Integration and Alerting Layer is an important part of the proposed Computer Vision Systems for Real-Time Poultry Behavior Analysis and Anomaly Detection.

Its main purpose is to combine the information received from bird detection and behavior analysis modules, identify possible abnormal activities, and inform the farmer when further inspection may be required. This layer connects the different parts of the system and helps convert the results of AI analysis into useful information for poultry farm management.

The layer receives data from the bird detection module and the behavior analysis module. It processes information such as bird movement, activity levels, feeding behavior, resting patterns, and group distribution. The system compares these observations with established normal behavior patterns to identify unusual changes. For example, a sudden decrease in movement, unexpected gathering in one area, or a noticeable change in flock activity may trigger an alert. The system can also be extended to include temperature and humidity readings to help farmers understand whether environmental conditions may be contributing to the observed changes.

## IV. METHODOLOGY

### 1. Data Requirements

The proposed system, Computer Vision Systems for Real-Time Poultry Behavior Analysis and Anomaly Detection, requires suitable images, videos, and behavior-related information to detect birds and identify unusual activities accurately.

The quality and variety of the collected data directly affect the performance of the AI model. Therefore, the data should represent real poultry farm conditions, including different lighting levels, camera angles, bird densities, and normal daily activities.

### 2. Preprocessing Pipeline

The preprocessing pipeline is an important stage in the proposed Computer Vision Systems for Real-Time Poultry Behavior Analysis and Anomaly Detection.

It prepares images and videos captured by cameras before they are passed to the AI model for bird detection and behavior analysis. Raw video footage may contain noise, poor lighting, blurry frames, dust, or unnecessary information that can affect detection accuracy. Preprocessing helps organize the video data and makes it suitable for further analysis.

### 3. Model Selection and Training

Model selection and training are important stages in the proposed Computer Vision Systems for Real-Time Poultry Behavior Analysis and Anomaly Detection.

The main purpose of this stage is to select a suitable artificial intelligence model that can detect poultry birds, analyze their activities, and identify unusual behavior from camera footage. The selected model should provide reliable results while processing video quickly enough for real-time monitoring.

## 4. Architecture

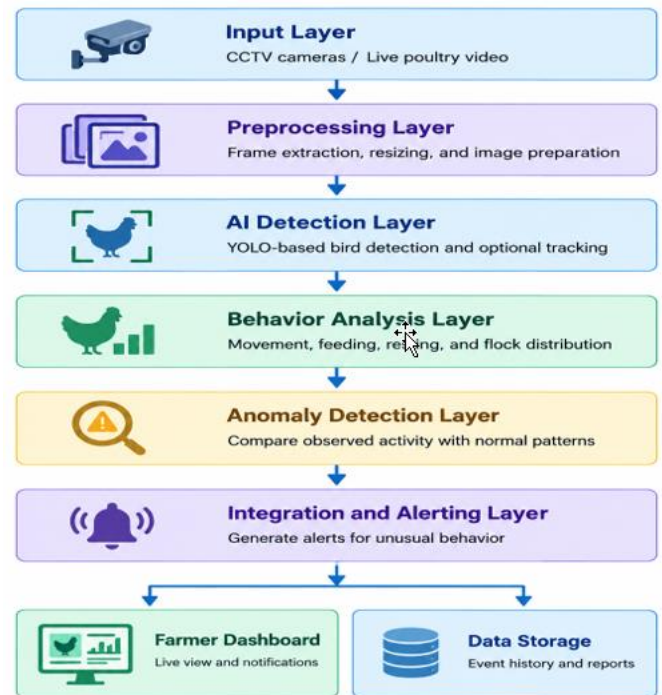


Figure 1: Proposed architecture of the poultry behavior monitoring system.

## 5. Evaluation Metrics

Evaluation metrics are used to measure the performance and accuracy of the proposed Computer Vision System for Real-Time Poultry Behavior Analysis and Anomaly Detection. These metrics help determine how effectively the system detects poultry birds, identifies their behavior, and recognizes unusual activities. The following metrics can be used to evaluate the proposed system. Accuracy measures the percentage of correct predictions made by the system out of all predictions. It helps evaluate how correctly the system classifies normal and abnormal poultry behavior.

## V. EXPECTED RESULTS AND DISCUSSION

### 1. Expected Outcomes

The proposed Computer Vision Systems for Real-Time Poultry Behavior Analysis and Anomaly Detection is expected to improve poultry farm monitoring by using artificial intelligence and camera-based observation. The system aims to detect poultry birds from live CCTV footage and analyze their common behaviors, such as feeding, resting, walking, and movement within the flock. It is expected to identify unusual behavior patterns, including reduced movement, abnormal flock distribution, and unexpected changes in normal activities.

When such patterns are detected, the system can generate automatic alerts to inform the poultry farmer so that the situation can be checked quickly. This approach may reduce the need for continuous manual monitoring, save time, and support better poultry farm management.

## 2. Discussion of Feasibility

The proposed Computer Vision Systems for Real-Time Poultry Behavior Analysis and Anomaly Detection is feasible because it can be developed using commonly available technologies such as CCTV cameras, Python, OpenCV, and deep learning models such as YOLO. Existing cameras installed in poultry farms can be used to capture video footage, reducing the need for additional monitoring equipment. The system can process video frames to detect birds, analyze their movement, and identify unusual behavior patterns. From a technical point of view, the system can be implemented on a computer with suitable processing capabilities, while more powerful hardware may be required for monitoring large poultry farms in real time. From an economic point of view, using existing CCTV infrastructure and open-source software can help reduce development costs. The system is also practical because it can provide automatic alerts and store monitoring data for future analysis. However, some challenges may occur due to poor lighting, overlapping birds, camera placement, and changes in poultry behavior.

## 3. Ethical and Regulatory Considerations

The proposed Computer Vision Systems for Real-Time Poultry Behavior Analysis and Anomaly Detection should be developed and used responsibly, considering animal welfare, data privacy, system reliability, and applicable regulations. The system should support the health and welfare of poultry birds by identifying unusual behavior without causing unnecessary stress or disturbing their normal activities. Cameras should be installed in suitable positions to monitor birds effectively while avoiding unnecessary interference with farm operations. The video recordings and monitoring data should be stored securely, and access should be limited to authorized users to protect the privacy of farm owners and workers. The system should provide reliable alerts, but its predictions should not be treated as a final diagnosis of poultry diseases. Any suspected health problem should be examined by a qualified veterinarian before treatment decisions are made. Developers should also ensure that the system is tested under different farm conditions and that its limitations are clearly explained to users. Applicable animal welfare requirements, data protection laws, and other relevant regulations should be followed when collecting, storing, and processing video data. Overall, ethical and regulatory considerations are important for ensuring that the proposed

system is safe, transparent, reliable, and useful for poultry farmers.

## 4. Limitations of This Study

The proposed Computer Vision Systems for Real-Time Poultry Behavior Analysis and Anomaly Detection has some limitations that may affect its performance in practical poultry farming. The accuracy of the system depends on the quality and quantity of video data used for training and testing. Poor lighting, dust, camera movement, overlapping birds, and obstructions may reduce the system's ability to detect birds and analyze their behavior correctly. Different poultry breeds, flock sizes, ages, and farm environments may also affect the performance of the trained model. Another limitation is that continuous video processing requires suitable computing power and may increase hardware and electricity costs. The system may sometimes generate false alerts or fail to detect certain abnormal activities, especially when the behavior is difficult to distinguish from normal activity. In addition, unusual behavior does not always indicate a specific disease, so the system cannot replace veterinary examination or laboratory testing. The proposed approach also requires further testing on real poultry farms to evaluate its accuracy, processing speed, and reliability over long periods.

## VI. CONCLUSION AND FUTURE WORK

The proposed Computer Vision Systems for Real-Time Poultry Behavior Analysis and Anomaly Detection provides an AI-based approach to monitoring poultry birds using cameras, image processing, and deep learning techniques. The system aims to detect birds, analyze their normal activities, such as feeding, resting, and walking, and identify unusual behavior patterns in real time. It can help poultry farmers monitor flock activities, receive alerts about potential problems, reduce manual monitoring, and improve poultry farm management and bird welfare. However, the performance of the system depends on video quality, lighting conditions, training data, and the farm environment. In the future, the system can be improved by using larger poultry video datasets, advanced AI models, individual bird tracking, and IoT sensors to monitor environmental conditions such as temperature and humidity. A mobile application could also be developed to provide real-time notifications and display monitoring reports. Further testing with poultry farmers and veterinary experts will be necessary to improve the system's accuracy and reliability under real farm conditions. Overall, this technology has the potential to support smarter poultry farming by providing continuous behavior monitoring and early identification of unusual activities, but it

cannot replace veterinary examination or professional disease diagnosis.

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