

Transfer Learning-Based Classification of Poultry Diseases for Enhanced Health Management

Abstract

Poultry farming plays a critical role in ensuring food security and providing economic benefits. However, poultry diseases pose severe risks to productivity and farm management. Traditional detection methods are time-consuming, costly, and require expert knowledge. This project proposes a transfer learning-based approach for automated classification of poultry diseases, ensuring early detection and effective health management.

Introduction

The poultry industry faces recurring challenges from viral, bacterial, and parasitic diseases. These not only reduce productivity but also impact food supply chains. Automated disease classification using artificial intelligence (AI) can support farmers and veterinarians in early detection, minimizing economic losses.

Problem Statement

Traditional methods of poultry disease detection rely on expert intervention, laboratory testing, and manual analysis. These methods are costly, inefficient, and unsuitable for real-time farm-level monitoring. Thus, there is a need for an automated, scalable, and accurate system for poultry disease classification.

Objectives

1. Apply transfer learning for accurate poultry disease classification. 2. Enhance the efficiency of detection compared to traditional methods. 3. Provide a scalable solution for farm-level health management. 4. Evaluate the system's performance using standard metrics.

Literature Review

Existing research in poultry disease detection has focused on traditional machine learning and deep learning approaches. While deep learning has shown promise, most models require large datasets and lack generalization capabilities. Transfer learning, which leverages pre-trained models, provides an efficient solution by reducing training time and improving accuracy.

Methodology

The methodology involves the following steps: - Dataset: Collection of poultry disease images. - Preprocessing: Image augmentation, resizing, and normalization. - Model: Transfer learning using ResNet, VGG, and Inception. - Evaluation: Metrics such as accuracy, precision, recall, and F1-score. This framework ensures robustness and efficiency in disease classification.

System Architecture

The system architecture consists of an input image pipeline, preprocessing layer, pre-trained CNN model for feature extraction, and a classification layer for disease prediction. This approach enhances scalability and reduces computational costs.

Results and Analysis

The experimental results demonstrate that transfer learning models achieved high accuracy in classifying poultry diseases. Evaluation metrics confirmed the system's reliability. A confusion matrix was used to validate performance across disease categories.

Discussion

The study highlights the strengths of transfer learning, particularly its ability to handle small datasets efficiently. However, limitations include dataset diversity and adaptability to real-world conditions. Expanding datasets and real-time deployment remain future challenges.

Applications

- Farm-level disease monitoring systems. - Veterinary diagnostic support tools. - Mobile applications for real-time classification. - Improved farm management and reduced economic losses.

Conclusion and Future Work

This project successfully demonstrates the use of transfer learning in poultry disease classification. Compared to traditional approaches, the proposed system offers improved accuracy and efficiency. Future work will focus on expanding datasets, integrating real-time applications, and deploying mobile-based diagnostic tools for widespread farm use.

References

1. Relevant academic papers on transfer learning and disease detection. 2. Poultry disease datasets from open-source repositories. 3. Research on applications of AI in agriculture and livestock health management.