AI-Based Poultry Disease Detection Using Fecal Image Classification with EfficientNetV2

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Abstract- In this paper, an AI-based poultry disease detection system is presented using fecal image classification. Four poultry health conditions, such as Coccidiosis, Healthy, Newcastle Disease, and Salmonella, are classified using the transfer learning method with EfficientNetV2B0. In the experiment, the model achieved an approximate 98 percent accuracy with high precision and recall values for the classes. The proposed system is beneficial to the farming community as it is cost-effective and allows the detection of poultry diseases in their early stages. Farmers can use the proposed system to diagnose their poultry diseases by uploading the images of their feces into the proposed system.

Index Terms- Deep Learning, EfficientNetV2, Poultry Disease Detection, Transfer Learning, Image Classification

I. INTRODUCTION

Poultry farming is an important contributor to rural development and global food production. On the other hand, infectious diseases tend to spread rapidly among poultry, resulting in economic loss and lower productivity for the farms. Thus, in order to ensure the profitability of poultry farms, the health of the poultry, and prevent widespread diseases, it is important to detect diseases at an early stage.

The conventional method of detecting diseases is either by using laboratory tests or observation, which is time-consuming and requires expertise, and is mostly not available to small-scale farmers. Considering the availability of digital camera technology and computer power, computer vision and AI-based automatic detection of diseases have been identified as alternative solutions.

Deep learning models, specifically CNNs, have shown promising results in the classification of images based on the intricate features that they extract. Transfer learning was also utilized in agricultural and veterinary diagnostics in recent studies, where the models, after being trained on large datasets, could be fine-tuned for other uses.

In this study, an AI-based system for the detection of poultry diseases is presented, which classifies the images of feces into four conditions using the EfficientNetV2 model. In this system, the training of the model is carried out in two stages to increase the generalization capability of the model while maintaining the efficiency of the system. In addition to this, the system is also presented in the form of a web interface, which allows the farmer to upload the images to detect the poultry diseases.

The proposed system is beneficial in the detection of poultry diseases in an efficient manner.

II. LITERATURE SURVEY

Recent studies have focused on the use of deep learning methods for the detection of poultry diseases using image processing techniques. Yogi and Yadav (2024) employed the EfficientNet transfer learning method for the classification of fecal images, which yielded better accuracy. However, the model was computationally expensive. Zhou et al. (2023) employed an improved version of the Faster R-CNN method for the detection of abnormal chicken droppings, which yielded better accuracy but was computationally expensive.

Tasdelen and Arslan (2025) employed the ResNet transfer learning method for the detection of high-risk poultry diseases, which yielded better accuracy but was associated with the challenge of diversity in the dataset. Akbudak (2022) designed a lightweight CNN-

based system for mobile application, which had low accuracy compared to other models.

In the study that was conducted by Degu & Simegn in 2023, the researchers used the ResNet50 & YOLO-based method in the implementation of the diagnostic system using the smartphone, although the model showed that there was overfitting.

Machuve et al. in 2022 used various models in the detection of the disease, although the researchers experienced low F1-scores in the study, especially in the application of the dataset in the regions. In the study that was conducted by Li et al. in 2023, the researchers used the classifier system, although the limited dataset in the study limited the performance of the system.

III. RESEARCH GAP

The existing research works on poultry disease detection techniques mainly focus on improving the accuracy of classification using deep learning techniques. Some of the techniques require higher computational powers, while others use region-based data, which is a major limitation when it comes to deploying the system in a real-world scenario. Moreover, the mobile-based techniques face problems in terms of accuracy and generality. Additionally, the proposed techniques also lack the implementation of user interfaces to make use of the system for real-time prediction of poultry diseases. Therefore, it is essential to propose a system that can overcome the limitations of the existing techniques in terms of accuracy, computational powers, etc. This research aims at the implementation of the EfficientNetV2 model for optimized feature extraction, along with deploying the system using a web-based model.

IV. PROPOSED METHODOLOGY

A. Dataset Description

The dataset that has been utilized in this study contains images of poultry fecal samples belonging to different classes. These classes are Coccidiosis, Healthy, Newcastle Disease, and Salmonella, which make up the four different classes of the dataset. The images are divided into different sets in order to properly and correctly evaluate the model. All the images are of the size 224x224 pixels, which is the requirement of the EfficientNetV2 model. The class imbalance of the dataset is properly handled using the weighted training method, which ensures that no bias exists towards the majority class of the dataset.

B. Data Pre-processing and Augmentation

Before training the model, the images are normalized and preprocessed using the preprocessing method of the EfficientNetV2 model. Data augmentation techniques are utilized in this study in order to increase the diversity of the dataset, which in turn increases the generalization capabilities of the model. Techniques utilized in this study are the flipping, rotating, and zooming of the images.

C. Model Architecture

The transfer learning for the CNN model was achieved using the EfficientNetV2B0 model, which is pre-trained using the ImageNet dataset. The pre-trained CNN model is used for the extraction of the features, followed by the global average pooling layer for reducing the features, and finally, the dropout layer with a dropout rate of 0.3 is used for preventing overfitting, followed by the dense softmax layer with four neurons for achieving multi-class classification of the diseases.

D. Two-Stage Training Strategy

In order to achieve stability and accuracy in the learning process, the two-stage training process is utilized. In the first stage, the pre-trained EfficientNetV2 model is utilized, and the classification layer is fine-tuned. This is because, in the pre-trained model, the features are already learned, which makes the learning of the features of the dataset easier without changing the parameters of the pre-trained model. In the second stage, all the layers are fine-tuned using a low learning rate. This is done in order to achieve accuracy in the classification process by letting the deeper layers learn the features of the dataset.

E. System Implementation

To implement the above model, the efficient net V2 model is incorporated into the web-based system using the Gradio platform, and the user is allowed to upload the image of the faecal matter, and once the image is uploaded, the prediction of the class of the disease and the confidence level of the prediction is achieved, and the user is also allowed to see the probability distribution and the actions to be taken, and thus the model is able to run in real time in the farm environment.
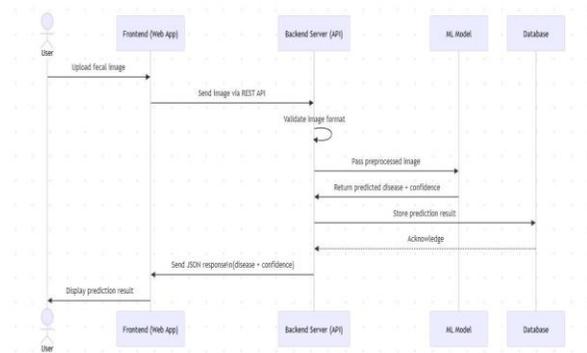

Figure 1: Proposed System Flow

F. User Interface and Deployment

The EfficientNetV2 model was deployed using the EfficientNetV2 model in the form of a web-based diagnostic application using the Gradio framework. The interface allows users to upload their poultry faecal images using the file selection option or drag-and-drop option. Once the image is uploaded, the image is preprocessed and passed to the EfficientNetV2 model for prediction.

The system displays the disease class along with the confidence score for the uploaded image. In addition, the probability distribution for the classes is also shown for the users. According to the disease type, the symptoms and actions to be taken are also shown to the users, which helps the users in taking preventive measures for the disease. The lightweight nature of the interface allows the model to be used in the farm environment.

V. RESULTS AND DISCUSSION

The proposed EfficientNetV2-based model was evaluated based on accuracy, precision, recall, and F1-score metrics. The model produced an accuracy of around 97.95% for the test dataset, which indicates the efficacy of the model for all the disease types.

Table 1 shows the class-wise performance metrics of the proposed model. As shown in the table, the model produced high precision and recall values, which confirms the efficacy of the model in classifying the healthy and disease samples.

Class	Precision	Recall	F1 Score	Support
Coccidiosis	0.99	0.98	0.98	248
Healthy	0.97	0.97	0.97	241
New Castle Disease	1.00	0.97	0.98	29
Salmonella	0.97	0.99	0.98	264

Table 1: Class-wise Performance Metrics

Confusion Matrix Analysis

Figure 2 shows the confusion matrix for the classification performance of the proposed model. As shown in the figure, the model produced low misclassification between the disease types, with most of the values along the diagonal, which confirms the efficacy of the model.
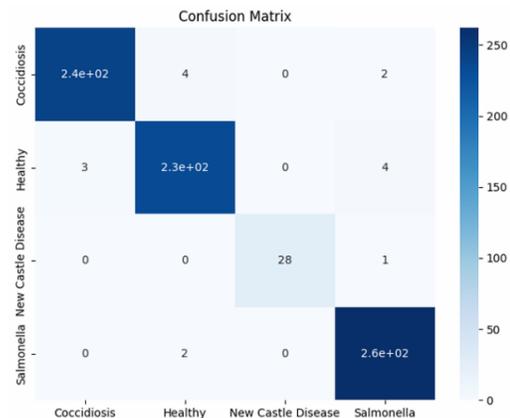

Figure 2: Confusion Matrix

ROC Curve Analysis

Figure 3 shows the Receiver Operating Characteristic curve for the classification performance of the proposed model for all the classes. As shown in the figure, the model produced high Area Under Curve values, which confirms the high separability between the disease types.
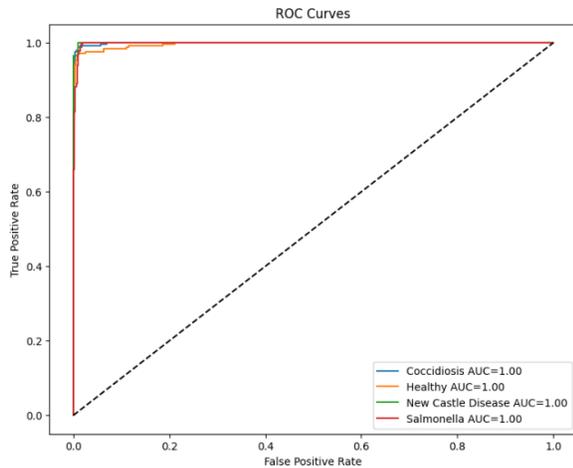

Figure 3: ROC Curves

Training Performance

The accuracy/loss validation and accuracy/loss training curves are presented in Figure 4. As shown, the accuracy/loss validation and accuracy/loss training curves converge stably, and there is little overfitting, indicating the validity of the two-stage training strategy.
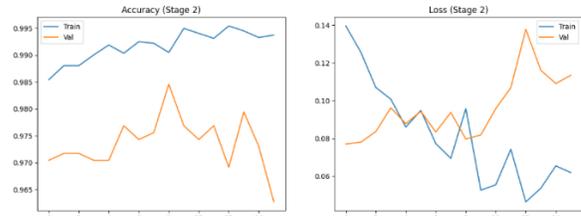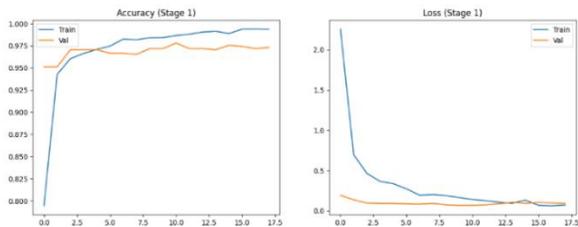

Figure 4: Training and Validation Curves

Web Interface Evaluation

To verify the applicability of the proposed system, the model was used in a user-friendly web interface. In this web interface, the model was able to provide real-time predictions of the disease, and the user could upload the images of the feces to obtain the diagnostic results, validating the applicability of the system.

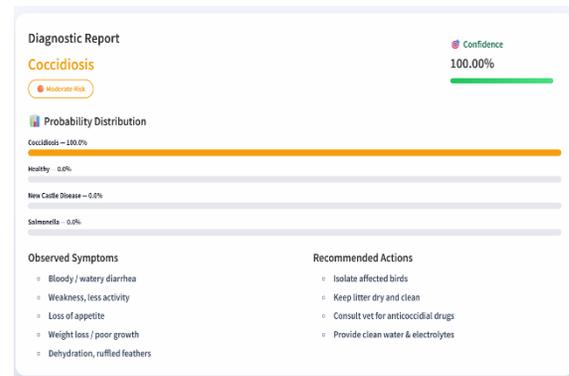Figure 5: Image upload interface of the poultry disease detection system.

Figure 6: Prediction output interface showing detected disease, confidence score, probability distribution, and recommended actions.

VI.   CONCLUSION

The research proposed an AI-based poultry disease detection system using fecal image classification and

transfer learning with EfficientNetV2. The proposed system shows that deep CNNs can efficiently classify poultry health conditions with high accuracy while ensuring computational efficiency. The proposed system also shows the efficacy of the proposed two-stage training strategy, ensuring the convergence of the model, resulting in reliable classification results for all disease classes.

The proposed system also shows the potential of the proposed system when the trained model is incorporated into a web-based disease prediction system, demonstrating the potential of the proposed system for real-world poultry farming environments. The proposed system also shows the efficacy of the proposed system through the results obtained, proving the potential of the proposed system for early disease prediction, efficient farm management, and reducing economic losses in poultry farming.

The proposed system shows that the proposed system is efficient in terms of the results obtained, proving the potential of the proposed system for poultry farming environments. The proposed system also shows the efficacy of the proposed system when the trained model is incorporated into a web-based disease prediction system, demonstrating the potential of the proposed system for real-world poultry farming environments.

ACKNOWLEDGMENT

REFERENCES

[1] D. Machuve, E. Nwankwo, N. Mduma, and J. Mbelwa, "Poultry diseases diagnostics models using deep learning," *Frontiers in Artificial Intelligence*, vol. 5, pp. 733345, 2022.

[2] K. K. Yogi and S. P. Yadav, "Chicken diseases detection and classification based on fecal images using EfficientNetB7 model," in *Proc. Conference Paper*, 2024.

[3] M. Zhou, J. Zhu, Z. Cui, H. Wang, and X. Sun, "Detection of abnormal chicken droppings based on improved Faster R-CNN," *International Journal of Agricultural and Biological Engineering*, vol. 16, no. 1, pp. 243–249, 2023.

[4] A. Tasdelen and Y. Arslan, "Detection of high-risk diseases in poultry feces through transfer learning," *Engineering Science and Technology, an International Journal*, vol. 64, p. 102002, 2025.

[5] B. S. Akbudak, "Disease detection from chicken feces on a mobile platform using deep learning methods," *Young Scientist Research*, vol. 6, no. 1, pp. 17–23, 2022.

[6] M. Z. Degu and G. L. Simegn, "Smartphone based detection and classification of poultry diseases from chicken fecal images using deep learning techniques," *Smart Agricultural Technology*, vol. 4, p. 100221, 2023.

[7] H. K. Joy, N. Sandhyana, and M. R. Kounte, "Advanced poultry disease detection with deep convolutional neural networks," in *Proc. ICTACS*, IEEE, 2024.

[8] G. Li, R. S. Gates, and B. C. Ramirez, "An on-site feces image classifier system for chicken health assessment: A proof of concept," *Applied Engineering in Agriculture*, vol. 39, no. 4, pp. 417–426, 2023.