DETECTION AND CLASSIFICATION OF POULTRY DISEASES FROM CHICKEN FECAL IMAGES USING DEEP LEARNING TECHNIQUES

MACHINE LEARNING 2024-25M

PROBLEM STATEMENT:

This project aims to develop an **automated *system for the detection and classification of poultry diseases using chicken fecal images.*** Traditional diagnostic methods are slow, resource-intensive, and reliant on expert analysis, making them unsuitable for large-scale or real-time monitoring. By leveraging ***deep learning techniques***, this solution seeks to provide a fast, accurate, and cost-effective alternative for ***early disease detection, improving poultry health management*** and reducing economic losses.

PREVIOUS WORK

- Yadav and Jadhav (2019) combined PCR techniques with deep learning to improve the diagnostic accuracy of diseases like Coccidiosis and Salmonella
- Link

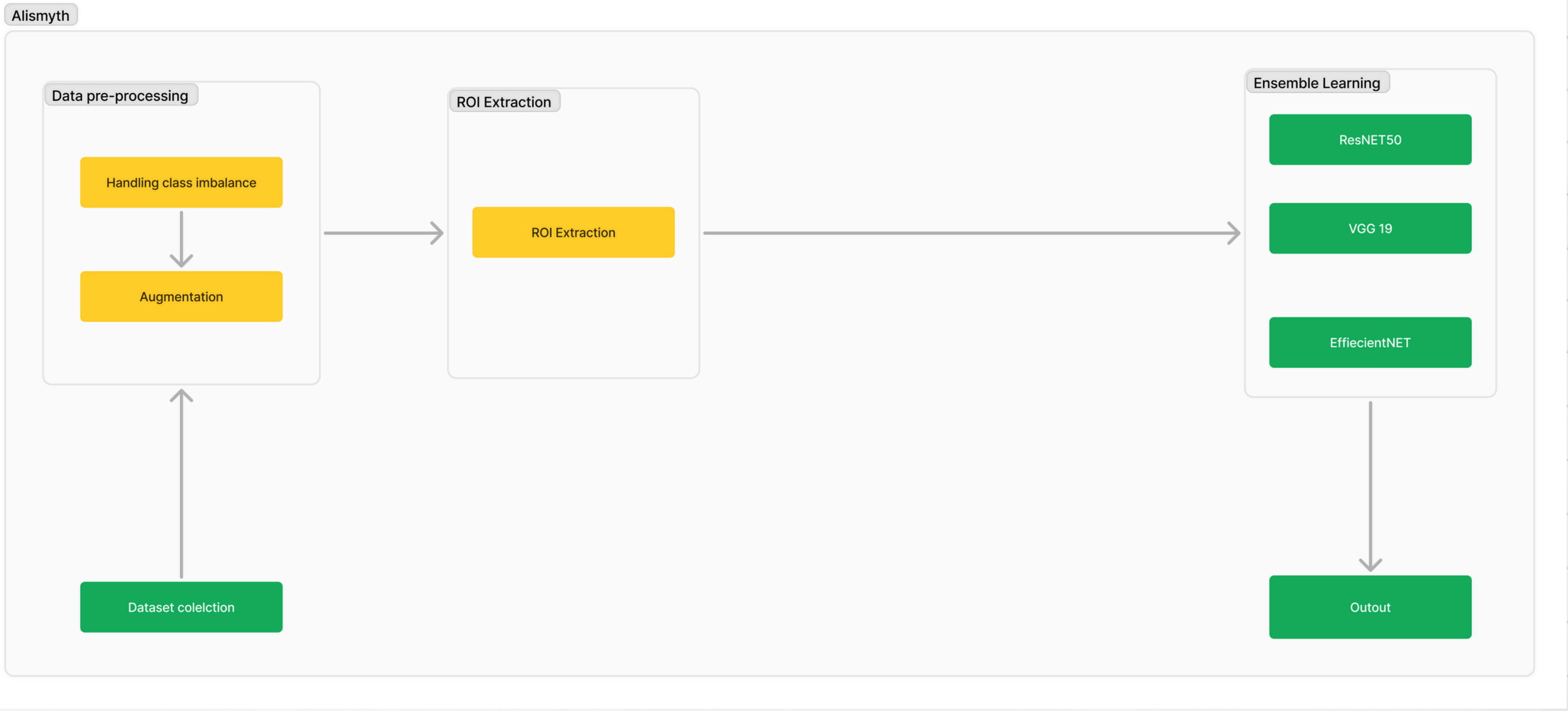
Current ongoing works inlcude Ensemble from which we took inspiration from

- Ensemble Learning: Combining multiple models to improve disease detection accuracy by addressing the limitations of single-model systems
- Link

NOVELITY

In this project, we introduce the application of ensemble learning, combining multiple models to improve the accuracy and robustness of poultry disease detection from fecal images. By using ensemble methods, we aim to address the limitations observed in individual model performance, achieving superior classification results compared to previous approaches that relied on single-model solutions. This approach has the potential to offer more reliable and scalable detection solutions for poultry farms.

METHODOLOGY:



EXPERIMENTAL SETTINGS AND RESULTS

Dataset and Preprocessing

- Dataset: Collected 10,000+ fecal images, categorized into four classes: cocci, healthy, NCD, salmo.
- Preprocessing: Applied ROI extraction and data augmentation (rotation, scaling) to improve model robustness.

Models Used

- VGG Model: Fine-tuned for classification.
- ResNet50: Optimized with frozen layers for feature retention.
- ImageNet Models: Adapted for real-time deployment

Experimental Setup

- Training-Validation-Test Split: 80:10:10.
- Optimizer: SGD with a learning rate of 0.001 and momentum of 0.9
- Metrics: Accuracy, Loss

Results

- Ensemble Learning resulted in a accuracy of 91.84%
- VGG: Achieved 90.11% accuracy on the test set.
- ResNet50: Achieved state-of-the-art accuracy of 91.10%.
- ImageNet: Demonstrated real-time prediction capabilities with 82.94% accuracy.

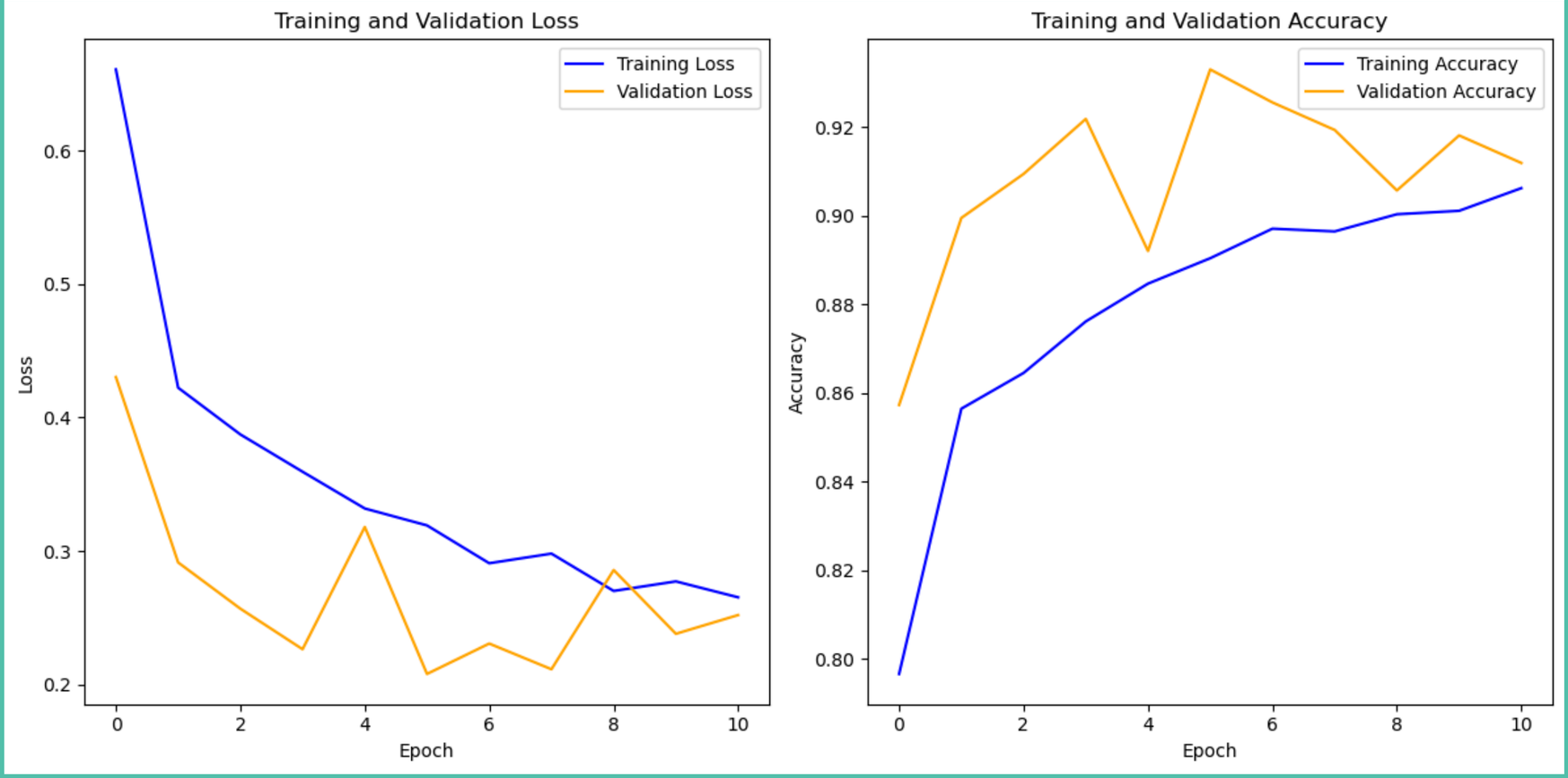
Comparison with SOTA

- Existing SOTA for similar tasks (MobileNetV2, Xception): ~92% accuracy
- Our Ensemble method nearly matched the performance.

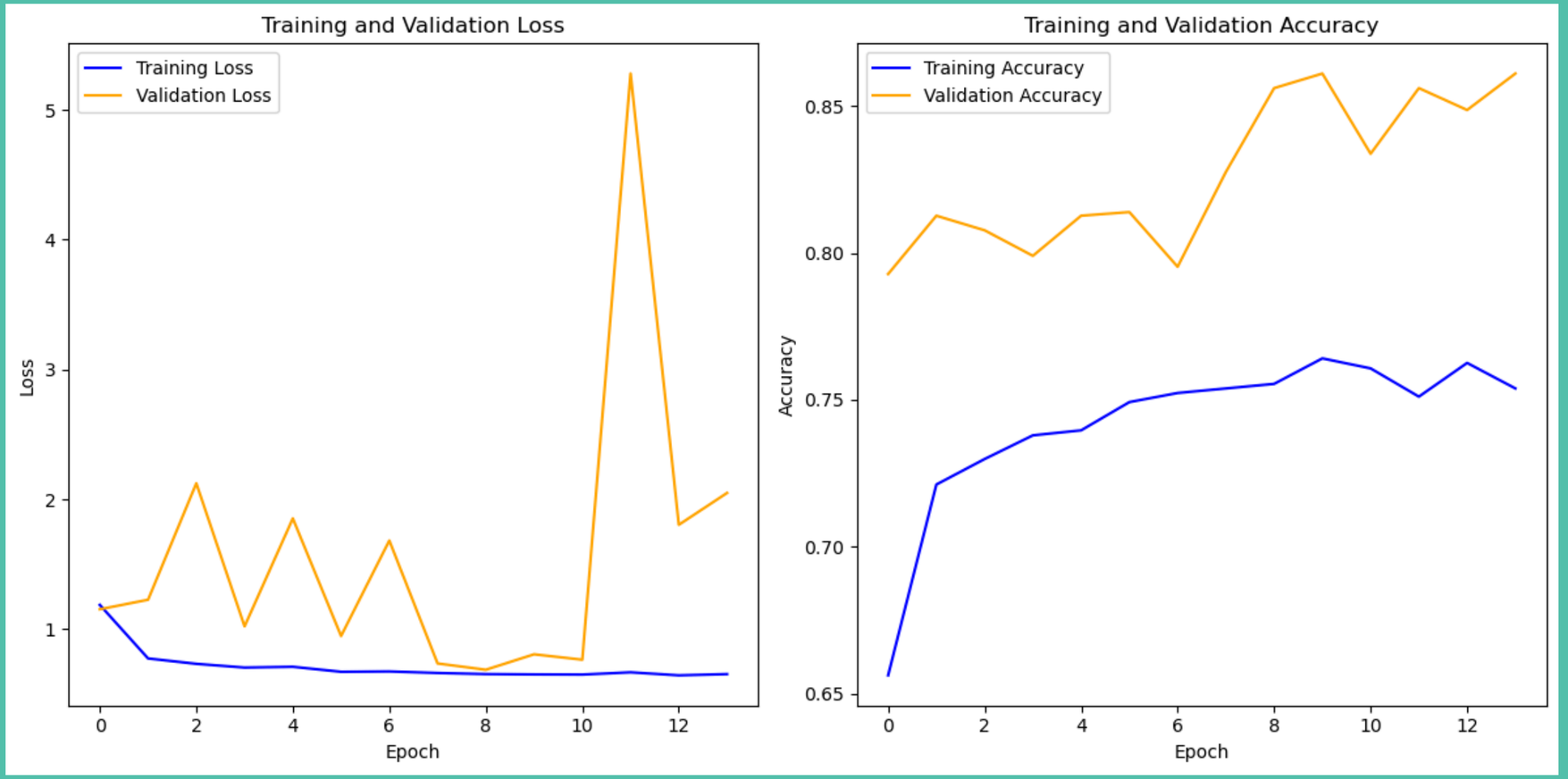
Key Insights

- ROI extraction significantly improved model performance.
- ResNet50 showed the best trade-off between accuracy and model complexity.

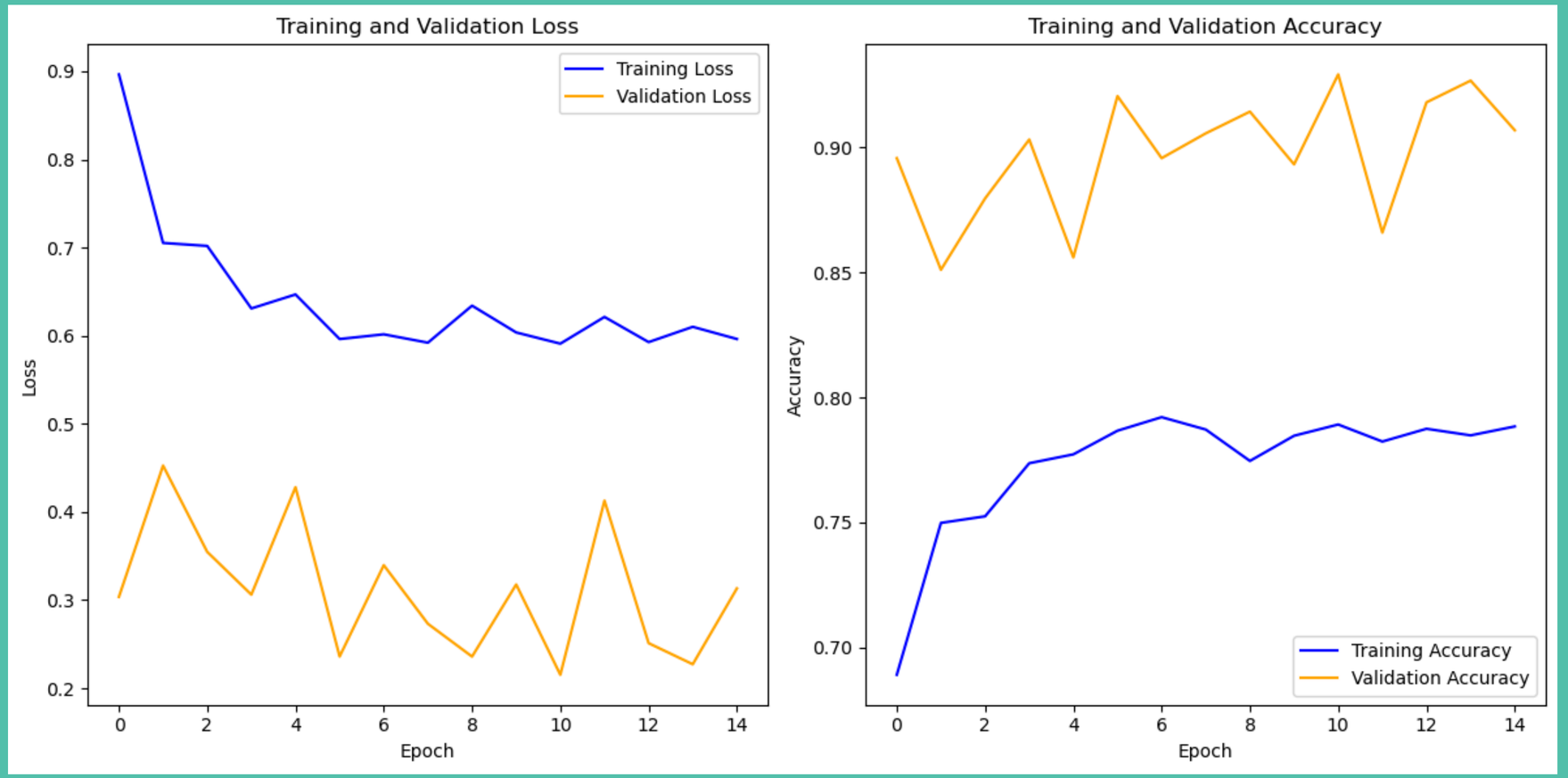
VGG


Training and Validation Loss
Training Loss
Validation Loss
Loss
Epoch
0.2
0.3
0.4
0.5
0.6
0
2
4
6
8
10
Training and Validation Accuracy
Training Accuracy
Validation Accuracy
Accuracy
Epoch
0.80
0.82
0.84
0.86
0.88
0.90
0.92
0
2
4
6
8
10

EFFICIENT NET



RESNET


Training and Validation Loss
Training Loss
Validation Loss
Loss
Epoch
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0
2
4
6
8
10
12
14
Training and Validation Accuracy
Training Accuracy
Validation Accuracy
Accuracy
Epoch
0.90
0.85
0.80
0.75
0.70

INDIVIDUAL CONTRIBUTIONS

Hemanth:

1. Collected and preprocessed fecal image datasets.
2. Implemented ROI extraction.
3. Trained and fine-tuned the VGG model for classification.

Pushan:

1. Fine-tuned and optimized the ResNet50 model.
2. Integrated ROI extraction into the preprocessing workflow.
3. Implemented ROI extraction along with Hemanth

Kaif:

1. Developed a utility function for real-world image classification.
2. Enhanced the pipeline for compatibility with ImageNet-pretrained models.
3. Ensemble with majority voting

THANK YOU