Heaven’s Light is Our Guide

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Computer Science And Engineering

THESIS TOPIC

Rice Leaf Diseases Classification Using CNN with Transfer Learning

Presented by

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Outline

Introduction

- Rice is an important economic crop in Bangladesh and is the main food source for over half of the world population . Recent problem of weather anomalies is one of the factors causing plant disease epidemics, which affect rice production. [1]

- Early detection and remedy of such diseases are beneficial to ensure high quantity and best quality but this is difficult due to the huge expanse of land under individual farmers and the huge variety for diseases as well as the occurrences of more than one disease in same plant. Agricultural expert known is not accessible in remote areas. Therefore the automated systems are required accuracy of plant disease detection, research work using various machine learning algorithms. [2]

Literature Review

SL No.	Author and Journal	Paper	Method	Dataset	Summarized Findings
1	Shreya Ghosal , Kamal Sarkar ieeexplore.ieee.org, Accessed: Oct. 02, 2021. [Online]. Available: https://ieeexplore.ieee.org/abstract/document/9106423/[1]	Rice Leaf Diseases Classification Using CNN With Transfer Learning	Transfer learning using fine-tuning the predefined VGGNet model	Dataset consists of 1649 images of diseased leaves of rice consisting most common three disease (blight, blast , brown spot)	Correctly classifies 92.46% of the test images and VGGNet has greatly improve the performance of the model
2	Kantip Kiratiratanapruk , Pitchayagan Temniranrat , Apichon Kitvimonrat , Wasin Sinthupinyo , and Sujin Patarapuwadol, Springer Nature Switzerland AG 2020 [2]	Using deep learning techniques to detect rice deseases from field images	Faster R-CNN, RetinaNet, YOLO v3, Mask R-CNN	Dataset consists of 6 classes(blast, blight, brown spot, narrow brown spot, leaf streak, RRSV) with 6630 images	Among these model YOLO v3 has highest precision of almost 80%. Faster R-CNN=70.96% Mask R-CNN=75.92% RetinaNet=36.11%.

Literature Review

Research lackings of base paper

1. The dataset used to train and evaluate the proposed method is relatively small.
2. The authors do not evaluate the performance of their method on images of rice fields that are affected by multiple diseases simultaneously.
3. The authors do not provide any information about the computational resources required to train and deploy their proposed method
4. Not so high accuracy.

Objectives

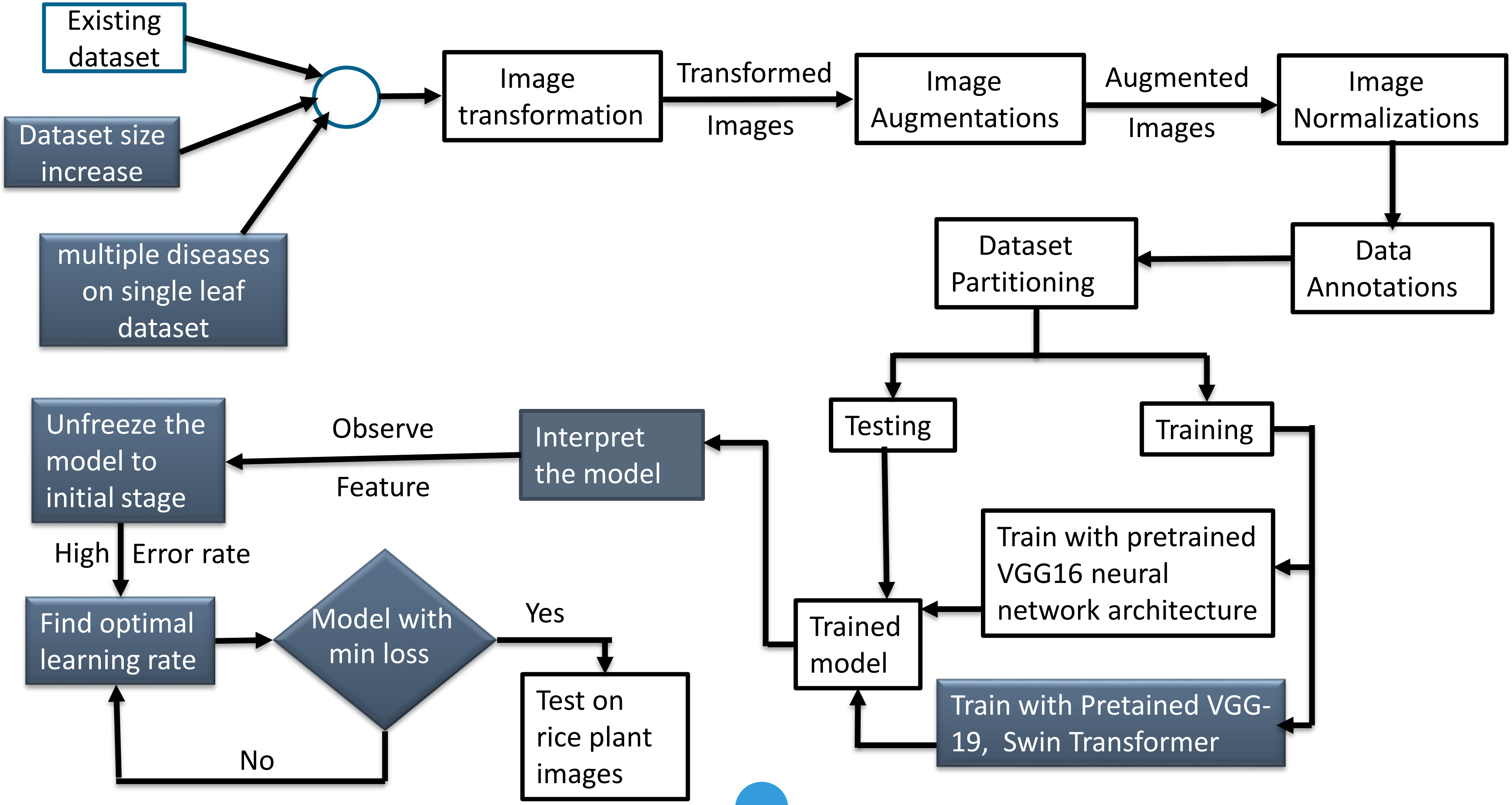
01 Develop and evaluate automated methods for identifying and classifying rice leaf diseases from field images.

02 Utilize deep learning techniques such as convolutional neural network (CNN) , to enhance detection accuracy and handle the variability of disease symptom.

03 To evaluate the performance of their method on images of rice fields that are affected by multiple diseases simultaneously.

03 Improve the efficiency and precision of base paper and reduce the computational parameters.

Proposed Methodology



Implementations

Dataset Collection:

I have collected Rice Leaves diseases dataset from internet of 10 types of leaves. Those are leaf blast, leaf blight, brown spot, dead heart, leaf downy, leaf false, leaf norm, leaf shea, leaf streak, tungro virus.

Source:https://www.kaggle.com/datasets/douaairaq/rice-disease-dataset-labelled-to-train-yolov5

Disease type	Train	Test	Validate	Total
Leaf blast	4115	758	1281	6154
Leaf blight	4169	585	682	5436
Brown spot	4180	617	202	4999
Dead heart	4292	688	204	5184
Leaf drowny	2170	402	100	2672
Leaf false	8016	427	924	9367
Leaf norm	2345	644	603	3592
Leaf shea	3901	583	612	5096
Leaf streak	4913	327	980	6220
Tungro virus	6752	360	916	8028
	44814	5391	6543	56748

Implementations

Existing paper architecture implementation with proposed dataset:

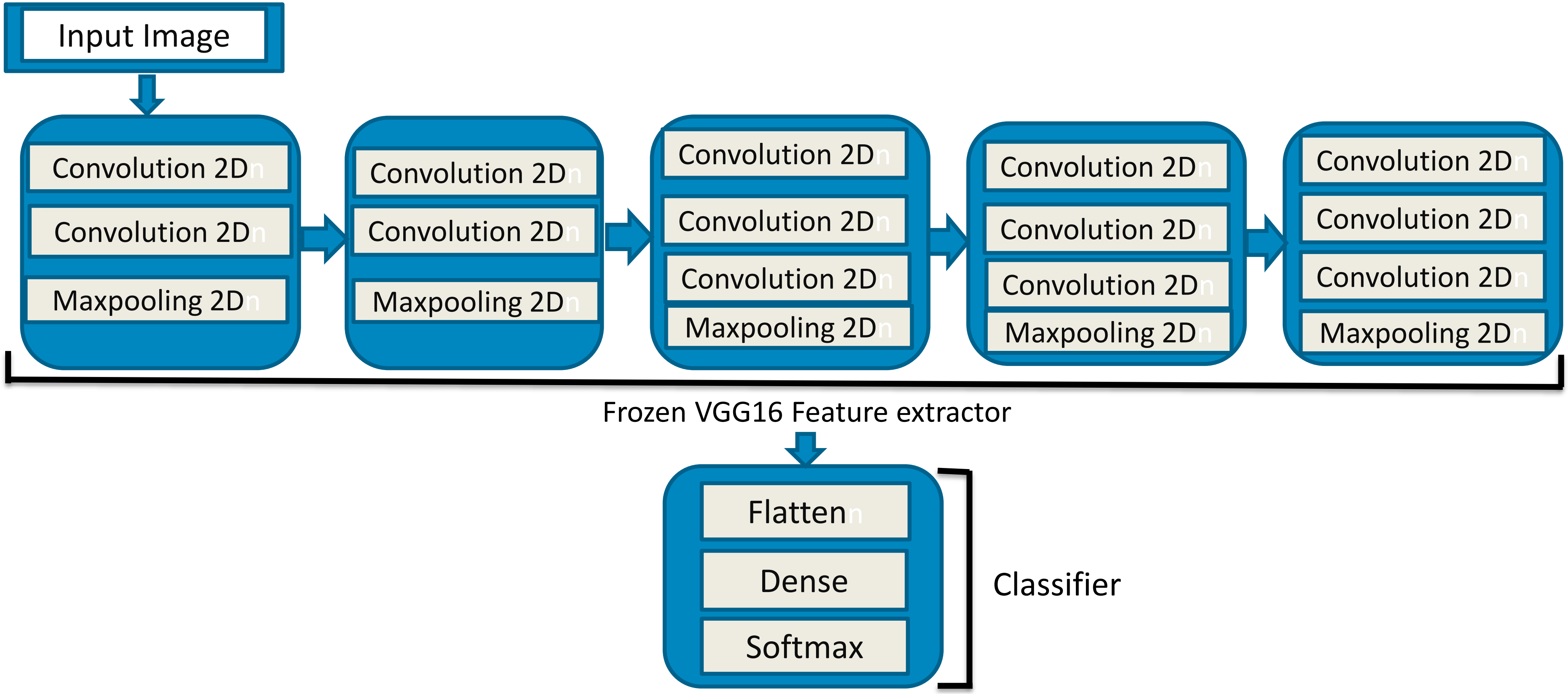
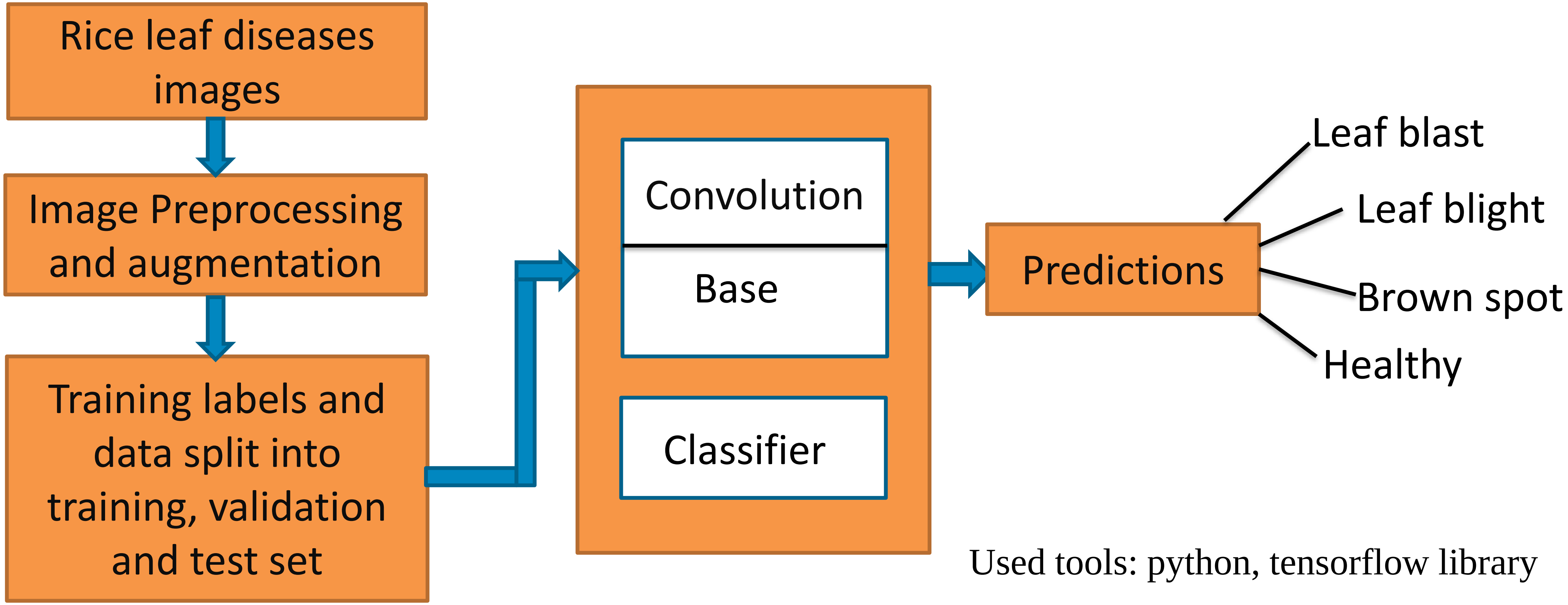


Fig-1: VGG-16 Architecture fine–tuned with the last two layers with 128 Dense FC Layer and 4 Dense Softmax Layer as the output

Implementations

Existing paper architecture implementation with proposed dataset:



Used tools: python, tensorflow library

Fig-2: Overall steps of implementing VGG16 architecture

Implementations

Rice leaf images dataset

Preprocessing

- Resize Image(224)
- Normalization
- Transformation
- Converting tensor

Feature extract using swin transformer pertained model

Fine tuning

Classification

Testing dataset

Results and analysis

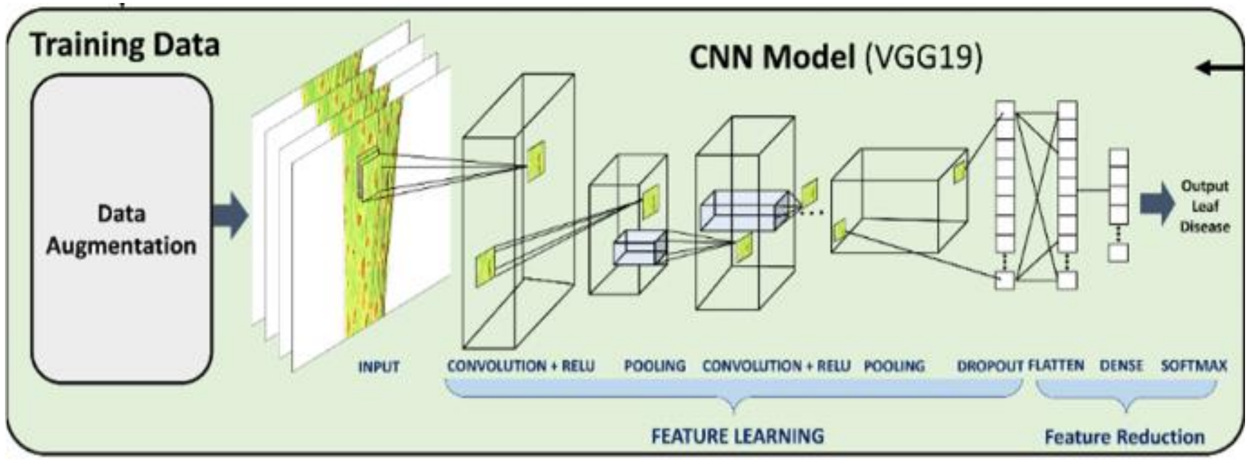


Fig-3: Pretrained VGG19 model

Used tools: python, tensorflow library

Implementations

Proposed Rice leaf images dataset

Preprocessing
- Resize Image(256)
- Augmentation
- Converting tensor
- Normalization

Feature extract using swin transformer pertained model

Fine tuning

Classification

Testing dataset

Results and analysis

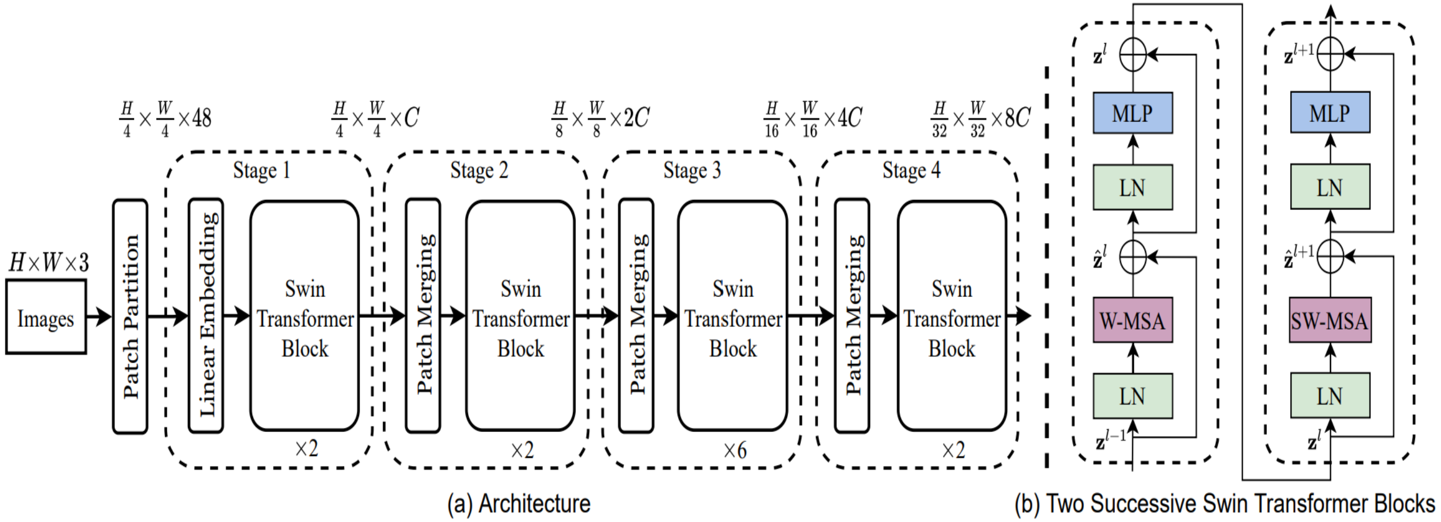


Fig-4: Swin transformer model

Used tools: python,pytorch library

Experimental Results and Analysis

Criteria	Existing paper	Proposed paper
Dataset	Contains 3 classes with 1649 images	Extending 10 classes with 56748 images
Model and Accuracy	Pretrained VGG16: Epoch: 25 Training Accuracy: 97% Validation Accuracy: 95% Testing Accuracy: 95.63%	Pretrained VGG19: Epoch:25 Training Accuracy: 99.28% Validation Accuracy:98.11% Testing Accuracy: 97% Swin transformer: Epoch:25 Training Accuracy: 99.37% Validation Accuracy: 99.92% Testing Accuracy: 99.6%
Training and Validation loss	Training Loss: 0.0856 Validation Loss: 0.1352	Pretrained VGG19: Training loss: 0.0247 Validation loss: 0.0713 Swin transformer: Training loss: 0.5723 Validation loss: 0.5012

Experimental Results and Analysis

Criteria	Existing paper	Proposed paper
Training time	Pretrained VGG16: Time: 5 hours 37 min	Pretrained VGG19: Time: 6 hours 25 min Swin transformer: Time: 1 hour 45 min 6s

Pretrained VGG16

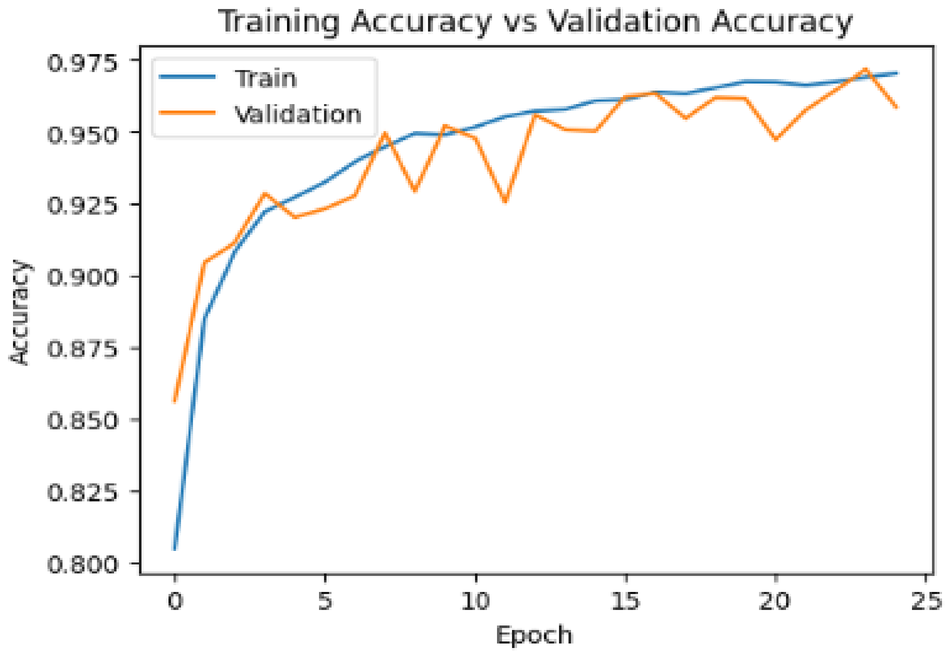


Fig-5: Training vs validation accuracy graph

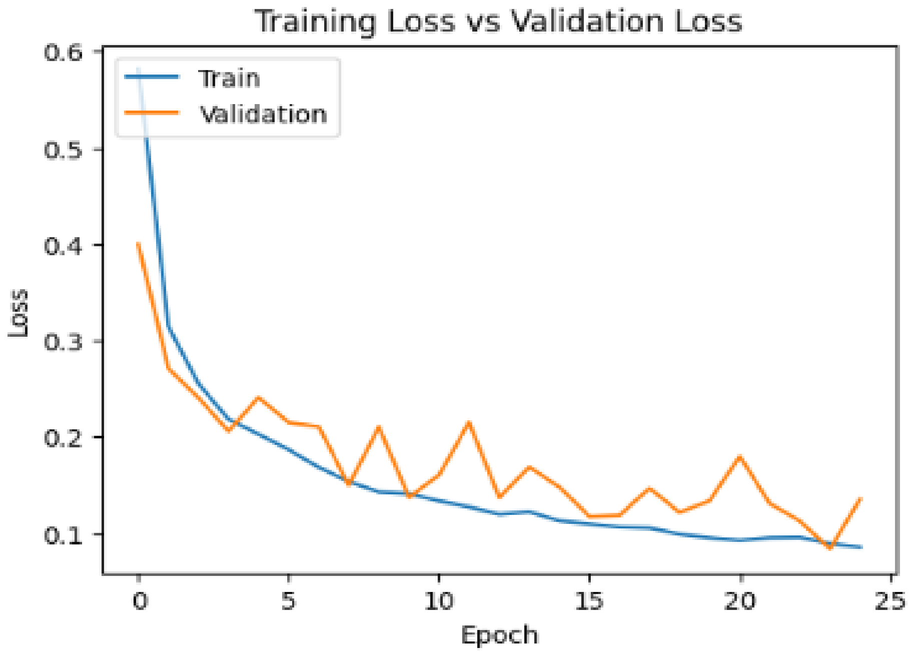


Fig-6: Training vs validation loss graph

Pretrained VGG-19

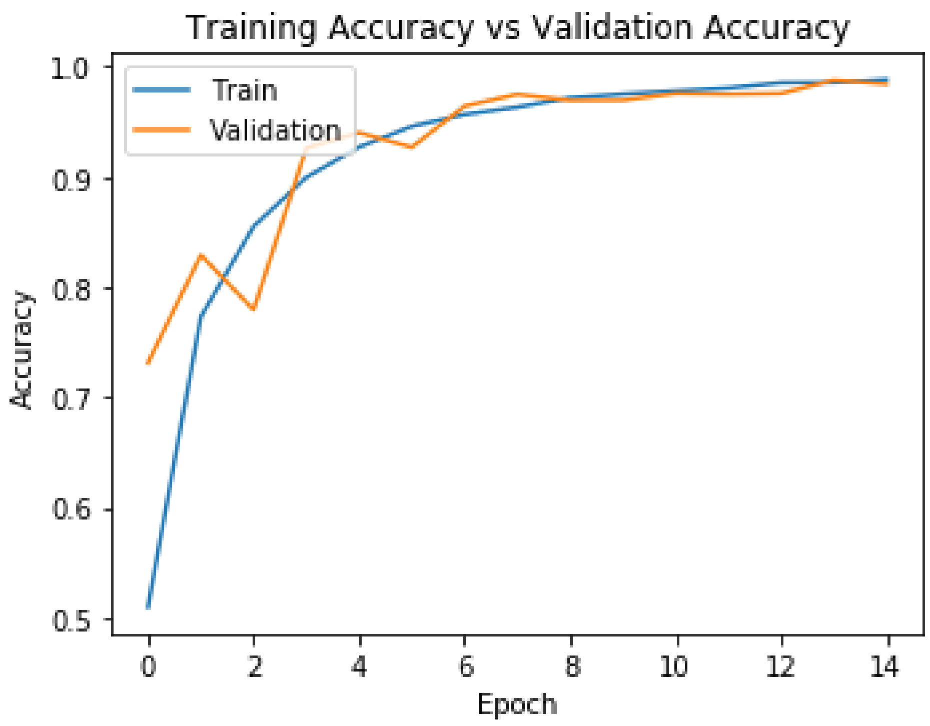


Fig-7: Training vs validation accuracy graph

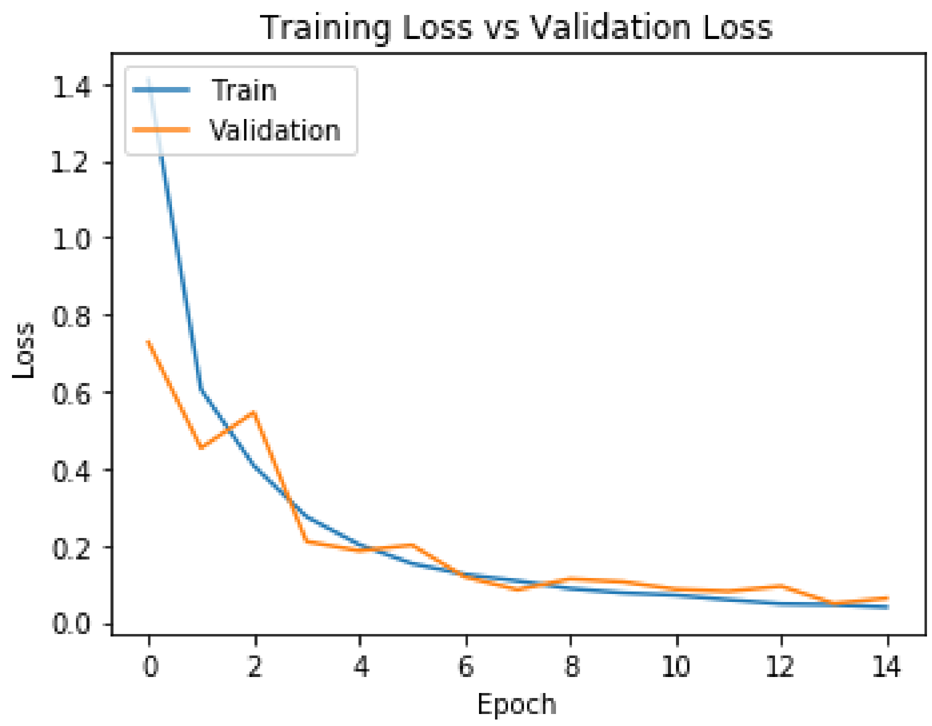


Fig-8: Training vs validation loss graph

Swin transformer

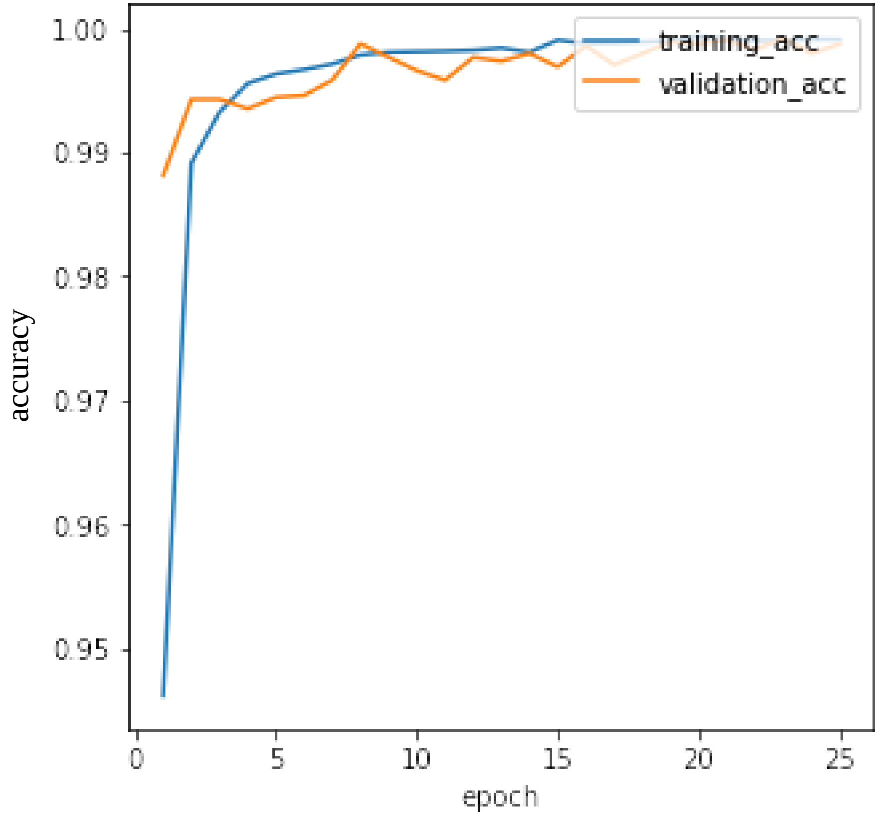


Fig-9: Training vs validation accuracy graph

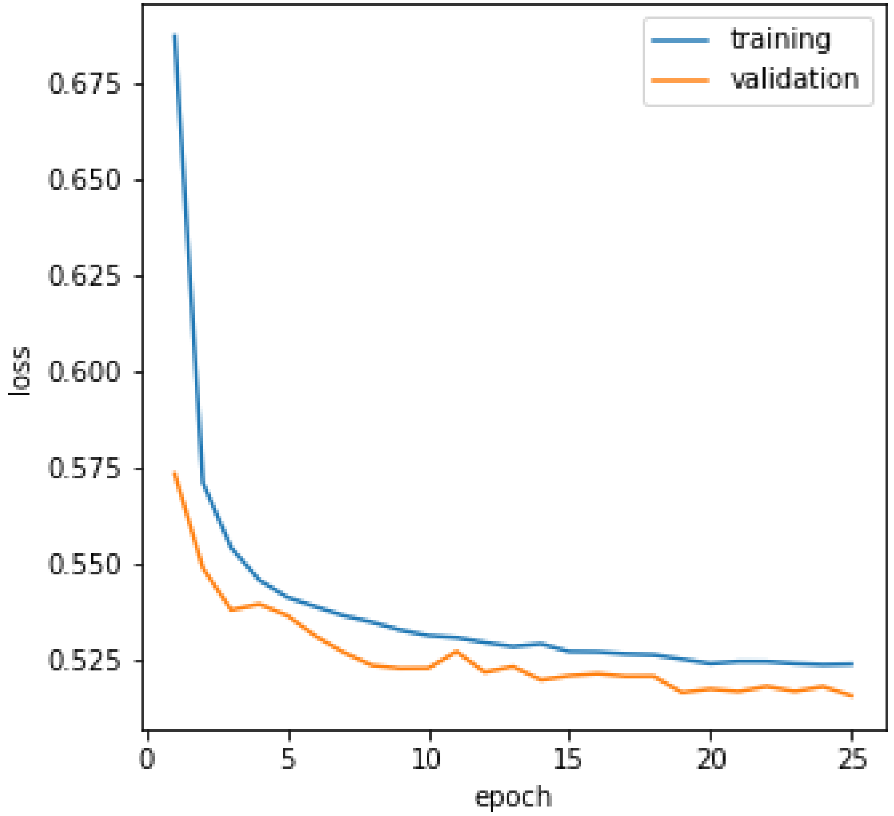


Fig-10: Training vs validation loss graph

Conclusions and Observations

- Implementing two architecture (VGG19, Swin transformer) Swin transformer is significantly more accurate than earlier techniques.

- Gives high training, testing accuracy , less training time and less computational cost though the dataset is large and complex background but this architecture utilizes the hierarchical feature of images and allows it to achieve high accuracy

Future Work

- Implementing proposed architecture by using dataset from rice field images with complex background.

- Assembling a dataset where individual images are afflicted by multiple diseases.

- Evaluating computational parameters for existing and proposed model.

References

[1] S. Ghosal, K. S.-2020 I. C. Conference, and undefined 2020, "Rice leaf diseases classification using CNN with transfer learning," ieeexplore.ieee.org, Accessed: Oct. 02, 2021. [Online]. Available: https://ieeexplore.ieee.org/abstract/document/9106423/

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[3] N. Krishnamoorthy, L. Prasad, . . . C. K.-E., and undefined 2021, "Rice leaf diseases prediction using deep neural networks with transfer learning," Elsevier, Accessed: Oct. 02, 2021. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0013935121005697

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THANK YOU

Any Question?