RICE LEAF DISEASE DETECTION USING CONVOLUTIONAL NEURAL NETWORKS.

BY

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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APPROVAL

This Project titled "Rice leaf disease detection using convolutional neural networks", submitted by Md. Sabbir Hossain to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 16/06/2024.

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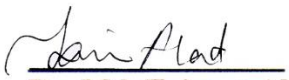

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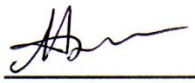

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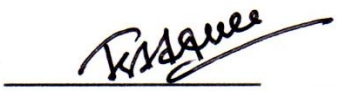

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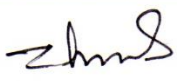

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DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Saiful Islam, Assistant Professor, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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I would like to express our heartiest gratitude to **Dr. Sheak Rashed Haider Noori** and **Head,** Department of CSE, for his kind help to finish my thesis and also to other faculty member and the staff of CSE department of Daffodil International University.

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Finally, we must acknowledge with due respect the constant support and patients of our parents.

ABSTRACT

Rice is one of the major developed crops in Bangladesh which is influenced by different infections at different stages of its cultivation. It is exceptionally troublesome for the farmers to manually identify these infections precisely with their constrained knowledge. Recent improvements in Profound Learning appear that Automatic Image Acknowledgment frameworks utilizing Convolutional Neural Network (CNN) models can be exceptionally advantageous in such issues. Since rice leaf malady picture dataset is not effortlessly accessible, we have created our possess dataset which is little in measure subsequently we have used Transfer Learning to create our profound learning show. I use primary data which are collected from different cultivation field in Tangail. The proposed CNN engineering is based on InceptionResnetV2 and is trained and tried on the dataset collected from rice areas. The exactness of the proposed demonstrate is 93.12%.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

Rice has traditionally been the staple food in Bangladesh and about 135 million people of the country depend on rice. About 2/3 of the calories, half of the protein consumed by the average individual in the nation, and 48% of rural employment are derived from it. Half of Bangladesh's agricultural GDP and one-sixth of the country's total income come from the rice industry.

As is globally recognized Bangladesh being predominantly agricultural population. Agriculture is the main source of livelihood for majority of people. Increasing the productivity of our fruits and grains is crucial in the current situation. Despite Bangladesh's harsh and shifting environment, the people and farmers their struggle to cultivate their crops in a necessary way. Numerous diseases can harm rice leaves. The three rice diseases that are the subject of this work are leaf smut, brown spot, and bacterial leaf blight. It is critical to accurately detect and identify illnesses in order to apply the appropriate nutrients.

Among the most prevalent diseases affecting paddy leaves is brown spot. The emergence of tiny, dark brown spots on the leaves is the most distinctive brown spot sign of this illness. These lesions frequently begin as little dots and get larger over time.
Actually, rice sufferers of leaf smut are afflicted with a fungal disease called Trichometasphaeria turcica. Initially, rice leaves have little, unevenly shaped dots on their top surface. As the illness worsens, these originally white patches eventually turn gray.

The bacterium Xanthomonas oryzae pv. oryzae is the cause of the widespread and deadly rice disease known as bacterial leaf blight. The early indications of the illness are tiny, water-soaked lesions on the leaves. These lesions can appear anywhere on the leaf blade and are frequently transparent. Water-soaked lesions quickly enlarge and take on a brown or dark gray hue as the condition worsens. Necrotic patches with uneven shapes may form on the leaf surface as a result of lesions that merge together. This work's primary goal is to create a system that uses image processing methods to categorize illnesses affecting papaya plants.

1.2 Motivation

Bangladesh's economy is essentially affected by the agribusiness industry. In any case, this industry still employments generally small data innovation, and our agriculturists are still trailing behind in receiving cutting-edge rural innovation. In the current computerized period, ranchers must utilize modern innovations to oversee their crops successfully. Agriculturists are presently utilizing smartphones more regularly to get data, which has significantly expanded their efficiency. In any case, since it is troublesome to educate agriculturists on a wide scale in things like illness distinguishing proof and control, there is a shortage of information sharing between ranchers and agrarian experts when it comes to the point of ideal trim administration. Subsequently.

1.3 Rationale of the study

There are without a doubt thousand of ponders in the areas of protest classification and picture preparing. Be that as it may, there are as it were a modest bunch of completed works on “Paddy Leaf disease Discovery Utilizing Machine Learning Procedure. So, our investigate is working with diverse approaches to calculations and classifications. Moreover, machine learning classifications and calculations are able to recognize them.

1.4 Research Question

- How is the above dataset created?
- Categorizing the Rice leaf dataset.
- How many classes are in this set?
- How the working of this helps the agriculture industry?
- In what ways does this work & approached benefit farmers?

1.5 Expected Outcome

In rural division of my nation, our ranchers are not however able to identify rice leaf maladies legitimately. Utilizing this program, ranchers can effortlessly distinguish Rice leaf illness. And appropriately distinguishing the sickness can offer assistance them to take the right step. As the result rancher will be profited. Subsequently, the taking after is a list of these anticipated result:

- Detecting the disease in early stage can help the farmer to take necessary steps to do early remedy of Rice leaf disease.
- Farming will be easier than before to farmers which will put a strong impact on economic growth of the country.

1.6 Project management and finance

This huge expedition was successfully managed by our rightful supervisor Mr. Saiful Islam. He guided us from start to end of the whole process. However, we had a few expenses, not a big issue for us. There is main problem to collection data. I collected the data from my village in Tangail and is expensive to collect information about the current situation of rice plant and take the images data. Also, there is main problem for run the program in my computer that is can't handle execution and that's why I need to replace RAM. I calculate the total cost around 6000/= including RAM and transport cost.

1.7 Report Layout

Our thesis report is organized as follows:

- Chapter One will contain an introduction to the project, the motivation behind the project, the research questions, and the expected results of the project.
- Introduction part of Chapter Two covers Background, related works, research summary and challenges.
- Chapter Three is Research Methodology.
- Chapter Four comprises Experimental Results and Discussion.
- Chapter five focuses on the Summary and Conclusion The chapter covers the experiment result and discussion.
- Chapter six includes

CHAPTER 2
BACKGROUND STUDY

2.1 Preliminaries

In this paper, I used in particular the Convolutional Neural community which is shortened as CNN. Here, the procedural programming of choice was Python. For the purpose of calibrating the model, we had to employ TensorFlow. I have collected data from the cultivation field in Tangail. Farmers permitted me to take photos in various field. From there, we collected more than 500 genuine photos. For the preprocessing part, there are some open-source equipment that we employed for labeling, noise removal, scaling and some few effects. For resize the data I use a free windows software which named 'FastStone Photo Resizer'. All image data are categorized by a farmer who have 40 years experienced.

2.2 Related Work

Image processing using CNN, is quite powerful for detecting visual diseases. Researchers are trying to identify pests and diseases using image processing and various algorithms where few researchers have found success in such tasks. We found some research.

Shreya Ghosal and Kamal Sarkar completed "Automatic Rice Leaf Disease Segmentation Using Image Processing Techniques" [1]. Rice Leaf Diseases Classification Using CNN With Transfer Learning. They propose framework to classify rice infections utilizing Convolutional Neural Organize (CNN) engineering is based on VGG-16 and prepared and tried on datasets collected from rice areas and the Web. They are collected information from the development areas of Madarat town (Locale: South 24 Parganas) in Baruipur, Dharinda town (Area: Purba Medinipur) in Tamluk and Basirhat (Locale North 24 Parganas), having a place to the state of West Bengal, India as well as from the Web. The precision of the proposed show is 92.46%.

K.S. Archana and Arun Sahaydhas completed "Automatic Rice Leaf Disease Segmentation Using Image Processing Techniques"[2]. They are centered on programmed location

strategies for picture division of rice takes off beneath a wide extend of natural conditions for advance examination. They utilized diverse half breed methods for picture division and classification calculations and proposed a programmed discovery strategy to identify particular maladies in rice clears out beneath distinctive natural conditions.

Gugan Kathiresan, Anirudh M, Nagharjun M and Karthik R "Disease detection in rice leaves using transfer learning techniques" [3]. They propose a tall precision, exchange learned demonstrate that can give a versatile arrangement for agriculturists. Proposes a tall exactness, exchange learned demonstrate that can give a portable arrangement for farmers.

Yang Lu, Shujuan Yi, Nianyin Zeng, Yurong Liu and Yong Zhang completed "Identification of rice diseases using deep convolutional neural networks" [4]. They are Propose a novel rice illness discovery strategy based on Profound Convolutional Neural Arrange (CNN) strategy. Utilizing a dataset of 500 common pictures of ailing and sound rice clears out and stems gotten from an exploratory rice field, CNNs are prepared to distinguish 10 common rice maladies. Beneath the 10-fold cross approval procedure, the proposed CNN-based demonstrate accomplished an precision of 95.48%. This exactness is much higher than that of conventional machine learning models.

Panuwat Mekha and Nutnicha Teeyasuksaet completed "Image Classification of Rice Leaf Diseases Using Random Forest Algorithm" [5]. They are worked with Picture preparing methods in the classification of rice leaf maladies, such as; Irregular Timberland Classification Calculation, Choice Tree Classification Calculation, Angle Boosting Classification Calculation, and Nai've-Bay Classification Calculation, which are measured by the precision, accuracy, and review of each calculation. The best result of execution in picture classification of rice leaf malady is Irregular Timberland calculation with break even with to 69.44 percent.

Minu Eliz Pothen and Dr. Maya L Pai completed "Detection of Rice Leaf Diseases Using Image Processing" [6]. They were using 70% information is utilized for preparing and 30%

information is utilized for testing. The test information is once more isolated into 15% for confirmation. They utilize distinctive highlights utilizing "Neighborhood Double Designs (LBP)" and "Histogram of Arranged Angles (Hoard)". At that point the highlights are classified with the offer assistance of S back Vector Machine (S VM) and 94.6% done by polynomial part SVM and HOG.

2.3 Comparative Analysis and Summary

Lots of algorithm and method are used for classification the disease of rice leaves. I studied journal and gather easiest disease detection technique for rice leaves.

Following Table 2.1 is showing a summary of related works.

Table 2.1: Research Summary

SL	Author	Methodology	Description	Outcome
1.	Shreya Ghosal and Kamal Sarkar[1]	deep learning model	CNN architecture is based on VGG-16	The accuracy of the proposed model is 92.46%.
2.	K.S. Archana and Arun Sahaydhas[2]	k-means clustering algorithm	Those colors were extracted by color models HSV (Hue, Saturation and value)	The algorithm separates leaf color, sign color and illumination from different color channel.
3.	Gugan Kathiresan, Anirudh M, Nagharjun M and Karthik R[3]	CNN based deep learning techniques.	utilizing a GAN architecture to generate more samples for specific classes.	The model performance of 98.38% average accuracy.
4.	Yang Lu, Shujuan Yi,	Deep Convolutional	Using a dataset of 500 natural images	Under the 10-fold cross validation

	Nianyin Zeng, Yurong Liu and Yong Zhang[4]	Neural Network (CNN).	of diseased and healthy rice leaves.	technique, the proposed CNN-based model achieved an accuracy of 95.48%.
5.	Panuwat Mekha and Nutnicha Teeyasuksaet[5]	Image processing techniques	Random Forest Classification Algorithm, Nai've-Bay Classification Algorithm	The best result of execution in picture classification is 69.44%
6.	Minu Eliz Pothen and Dr. Maya L Pai[6]	"Local Binary Patterns (LBP)" and "Histogram of Oriented Gradients (HOG)"	the features are classified with the help of S support Vector Machine (S VM)	94.6% done by polynomial kernel SVM and HOG.

2.4 Scope of the problem

An essential component of our endeavors is to create a framework that can rapidly recognize between harmed takes off or sound conditions. We found through our inquire about how well convolutional neural systems picture classification perform exceptionally well than the other calculation or strategy. We will be able to utilize such innovation in different places counting noteworthy agrarian ventures in the future.

In presently days, maximus rancher are worked with their encounter. Most of the agriculturist don’t know the real issue of their crops, they depict the side effects to get pharmaceutical or treatment for crops. But they can’t depict indications precisely, so they don’t offer assistance their nourishment legitimately. The great news is that, it all can be unraveled by utilizing a smartphone. I’ll make my source open for available to everybody

and attempt to make it straightforward for all. It makes a difference our rancher, enormous ranches, too Argo organized to guarantee sound food.

2.5 challenges

We have combined data from many farming areas. I have collected around 500 image data from many places. Farmers are afraid of me, they think I have damaged their crops. In this study, I basically created artwork for three different diseases. Rice leaf folder contains three categories of bacterial leaf blight, leaf smut and brown spot diseases. Farmers are trying to cope with the problem of leaf blight in rice. Our nation wastes a lot of flowers due to these problems. Therefore, we are trying to solve this problem by efficiently identifying the appropriate disease according to the technological method. To complete the task our initial solid platform moved to dataset collection. It became impossible to complete the project without working with a significant amount of data. As all our statistics are raw data, we have not collected a single image from the internet

Then, our PC got set up incorrectly. For photo education, we have to face many challenges. Finishing the assignment may be more suitable for us if our laptop has extra configuration.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Research Subject and Instrumentation

In this context, we use a deep convolutional neural network to integrate our self-assembled dataset. This serves as the main framework for our study. We tested the output accuracy of our current version with a few other models. The next section can be used to define the overall form and functionality of these models. As we have already said, the primary aim of our study is to classify the three major diseases found in rice leaves with 1170 photographs. To train the most important CNN model, we used 930 images. Then 240 images for verification needs. Then 120 images are used for testing. In our switch learning model (Sequential, VGG16, and InceptionResNet v2) 120 images are employed for validation capability, while 930 images are used for learning features. 120 photos reduced and tested. For my small amount of data augmented the data set and test on various algorithm.

- What information should be collected?
- How to ensure that the data collected is correct?
- How should each piece of data be organized?
- How should each piece of data be labeled?

3.2 Data Collection Procedure

In explore, I collect all the data different cultivation field. I collect raw picture in my device. Focus length and iso fixed then take picture in my Redmi note 11 android smartphones. This information primarily chosen since those are the crude information and for my venture, I require labeled information. I utilized 1200 essential pictures as preparing information and 250 pictures as approval data.

1) Data Pre-processing

Data pre-processing alludes to the pre-stage of dataset handling. As a rule, crude information sets are not able to be worked on and deliver the anticipated comes about. Subsequently, information pre-processing is required and it is considered as one of the most

vital parts of the inquire about. At this organize I collect more than 400 pictures information from development field and attempt to evacuate clamor from the information pictures. I expel foundation from all picture information physically. Too, for the little number of pictures I expanded the information to increment amount for ger the most elevated accuracy.

2) Data Organizing

In this parcel I partitioned all picture information and organize at that point in two information organizer approval and preparing, too I utilize approval envelope for check prepare information approval. At that point I part those folder's information into more organizer like as bacterial leaf scourge, brown spot, leaf muck and for solid information I make an envelope solid leaf. All information organized by experienced agriculturist who have 40 years' experience.

3) Labeling Data

In this parcel all the names of the pictures were changed to their disease name and also the numbers are serial too. For rename all category picture information I utilize (Fig 3.1) a program to labeling and the title of the utilized computer program is 'FastStone Photo Resizer'.

Table 3.1: Total data amount

Title of the class	Total images
Bacterial leaf blight	300
Brown spot	300
Leaf smut	300
Healthy image	300

3.3 Statistical Analysis

The sum of my add up to picture information is more than 500 that I collect but after pre-processing and increase I get up to 1160 images. The exact information sum are given underneath, we grant sequentially prepare data's in table 3.2 & approval data's in table 3.3

Table 3.2: Train image data amount

Disease Name	Amount
Bacterial leaf blight	225
Brown spot	225
Leaf smut	225
Healthy image	225

Table 3.3: Validation image data amount

Disease Name	Amount
Bacterial leaf blight	60
Brown spot	60
Leaf smut	60
Healthy image	60

3.4 Applied mechanism

In this research, several model we created. Convolutional Neural Network are the most efficient model That I have worked. It gives better accuracy than the other algorithm. The model are below:

- Sequential
- VGG16
- InceptionResNet v2

3.4.1 Implemented Algorithm

Such systems actualize picture seeing not as two-dimensional designs, but or maybe as three- dimensional volumes, a figure that is very opposite to human perceptual capacities. Hence, when comparing the two-dimensional boundary of vision that each individual has, a convolutional arrange has the capacity to decide the profundity of data laid down in an picture.

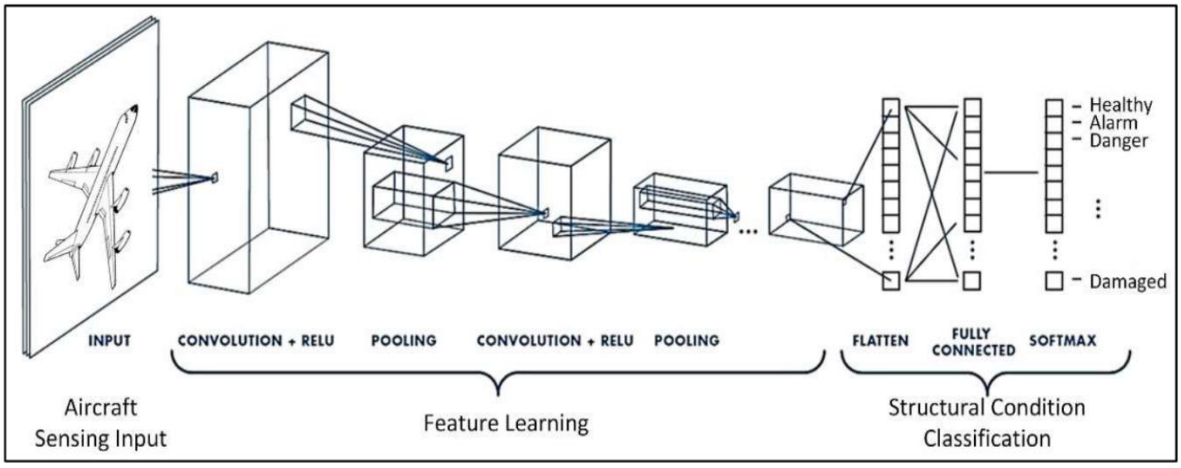


Figure 3.1 CNN architecture

A picture is encoded in RGB, and hence, a convolutional arrange requires three unmistakable profundity layers or channels to begin with expend the picture so that it can prepare the picture. Sometime recently the convolutional organize can utilize it, all the pixel squares go through a sifting prepare. The channel, moreover known as a part, endeavors to find designs that rehash by checking through a few pixels. The actuation outline for a filter's way through an input picture is proportionate to the number of steps that the channel takes. This outline is decided by the number of steps that the channel takes. Pixels that are designed are utilized to make pictures. These designs come about in the development of modern actuation maps, which in turn incited the creation of this unused

volume. These photographs are distant more dimensional than past ones, which implies that handling them takes a parcel more time and computational control. This issue was settled by convolutional systems utilizing dimensionality diminishment procedures like channel walk and down examining.

3.4.2 Prerequisites for Implementation

Amid the execution of the extend, we made utilize of an assortment of machine-learning libraries; the different forms are shown below.

Python:

Version 3.8 of Python is the later discharge. It's a programming dialect with the strictest rules. These days, it makes a difference with the extraordinary larger part of considers that carry out their investigate. It comes profoundly prescribed for programming dialects utilized in AI-based employments since of how basic it is to learn. Moreover, since of its notoriety among software engineers, the more youthful era particularly increases in value utilizing it.

Google Colab:

Users of Google Colab can utilize the open-source Python programming dialect dispersion without having to pay an expense. The positive think that, i can work online utilizing Jupiter Note pad, but we too have full get to a virtual GPU. The fundamental advantage of taking portion in this Google Colab is as follows:

A working framework (Windows 10 is prompted), a hard drive, a web browser with more than 100 GB of memory and RAM (more than 4 GB) are among the determinations for both equipment and software.

3.5 Implementation Requirements

Python 3.8

Python 3. 8 is Python adaptation. Indeed, it operates at a high level of programming language. Some of the greatest of the investigate utilize it to do their investigate. It is said to be the best programming language for AI based works and it is so popular among the

present generation's software engineers because indeed, it is very easy to learn and master.

Google Colab

Google has formulated Google colab to be free for everyone to use open-source for all the Python programming language. We can do work here online in our browser as like as Jupiter note pad, but the basic benefit of this Google colab is it provides us a free online virtual GPU and Smash access.

FastStone Photo Resizer

It is an exceptionally valuable windows free computer program to labeling any kind of picture information as you need. It is free and simple to use.

Hardware/Software Requirements

- Operating System (Windows 7 or above)
- Web Browser (preferably chrome)
- Hard Disk (minimum 4 GB)
- Ram (more than 4 GB)

CHAPTER 4

EXPERIMENTAL RESULT AND DISCUSSION

4.1 Experimental setup

I need to sew several odd and even sets to try out the concepts. This field of computer industry, in fact, is not a new one at all. This I have already discussed under how some of the previous work has informed this. In our research, there are several models of PR knowledge that must be applied.

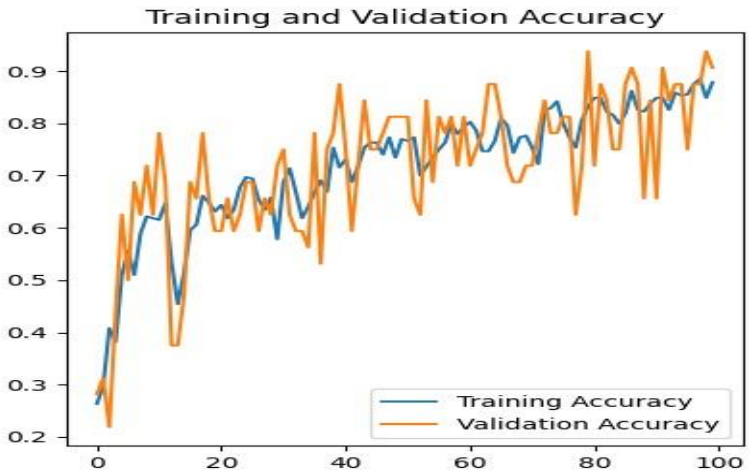
4.1.1 Sequential model

The learning rate, frequently known as the step estimate, is a hyperparameter in machine learning that controls the degree to which as of late learned data supersedes already learned data. We too recognized our learning plot after doing tests. To decide the perfect learning rate, we utilize a successive show. The most reliable learning rate is given by this consecutive approach. Underneath of this models' and algorithm's learning rates.

```
Model: "sequential_2"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 sequential (Sequential)     (32, 256, 256, 3)         0

 conv2d (Conv2D)             (32, 254, 254, 32)        896

 max_pooling2d (MaxPooling2  (32, 127, 127, 32)        0
 D)

 conv2d_1 (Conv2D)           (32, 125, 125, 64)        18496

 max_pooling2d_1 (MaxPoolin  (32, 62, 62, 64)          0
 g2D)

 conv2d_2 (Conv2D)           (32, 60, 60, 64)          36928

 max_pooling2d_2 (MaxPoolin  (32, 30, 30, 64)          0
 g2D)

 conv2d_3 (Conv2D)           (32, 28, 28, 64)          36928

 max_pooling2d_3 (MaxPoolin  (32, 14, 14, 64)          0
 g2D)

 conv2d_4 (Conv2D)           (32, 12, 12, 64)          36928

 max_pooling2d_4 (MaxPoolin  (32, 6, 6, 64)            0
 g2D)

 conv2d_5 (Conv2D)           (32, 4, 4, 64)            36928

 max_pooling2d_5 (MaxPoolin  (32, 2, 2, 64)            0
 g2D)

 flatten (Flatten)           (32, 256)                 0

 dense (Dense)               (32, 64)                  16448

 dense_1 (Dense)             (32, 4)                   260

=================================================================
Total params: 183812 (718.02 KB)
Trainable params: 183812 (718.02 KB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

Fig 4.1: The CNN model used in my project

We may make strides the show and get the best yield with the most elevated exactness by including a thick and smooth layer and exactness of preparing and approving, as appeared



in underneath.

Figure 4.2: Accuracy graph (Sequential)

The correct strategy utilized to prepare and assess the Successive show is shown in Figure 4.2 While the green line appears preparing precision, the ruddy line appears approval exactness. The exactness of the preparing and approval stages dynamically rises for this demonstrate. Preparing and approval continue without any issues. Additionally, the two lines once in a while change from one another. This occasion appears how rapidly our dataset learns unused data. Our Consecutive show approval exactness is at 87.00 percent, the most elevated among other models.

The most commonplace estimation combinations are a preparing misfortune against an approval misfortune over time, as Figure 4.3 outlines. The approval misfortune appears how well successive produces the unused information, as contradicted to the preparing misfortune, which illustrates how viably successive duplicates the ancient information. One outline of the preparing versus approval of misfortune grouping is appeared in Figure 4.3 Successively developed bends for ensure and action misfortunes appear that the

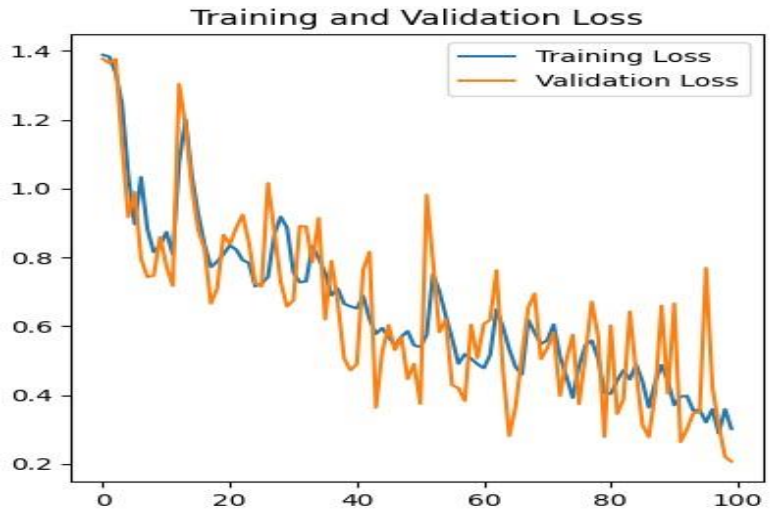


Figure 4.3: Loss graph (Sequential)

Layer (type)	Output Shape	Param #
vgg16 (Functional)	(None, 1000)	138357544
batch_normalization (Batch Normalization)	(None, 1000)	4000
dense (Dense)	(None, 256)	256256
dropout (Dropout)	(None, 256)	0
dense_1 (Dense)	(None, 4)	1028

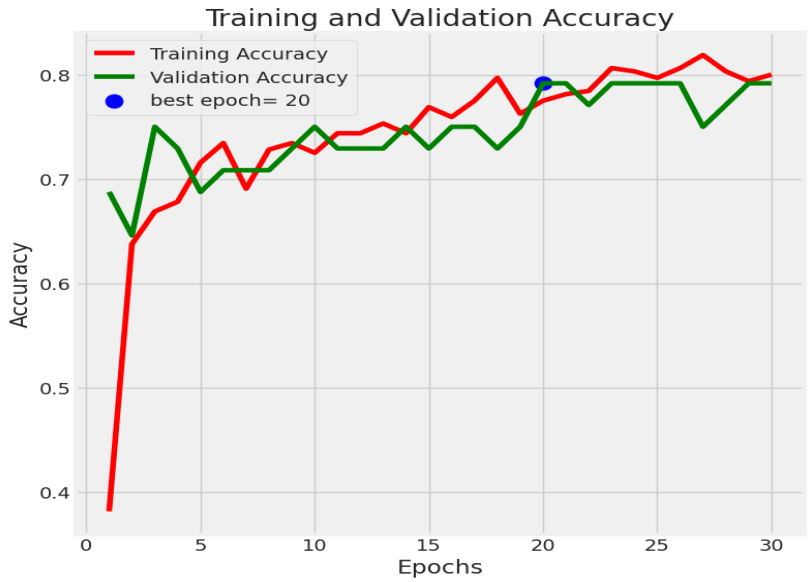
Total params: 138618828 (528.79 MB)
Trainable params: 259284 (1012.83 KB)
Non-trainable params: 138359544 (527.80 MB)

Fig 4.4.: The VGG19 model used in my project

preparing misfortune and the approval misfortune diminish with expanding period time. In this case, learning happens quickly, and there is no sign of consecutive overfitting.

4.1.2 VGG16 model

The learning rate, frequently known as the step measure, is a hyperparameter in machine learning that controls the degree to which as of late learned data supersedes already learned data. We too recognized our learning plot after doing tests. To decide the perfect learning rate, we utilize a VGG16 demonstrate. The steadiest learning rate is given by this successive approach. Underneath of this models' and algorithm's learning rates.



This show appears the thick and dropout layer and exactness of preparing and approving, as appeared in underneath.

Figure 4.5: Accuracy graph (VGG19)

The correct strategy utilized to prepare and assess the VGG19 demonstrate is shown in Figure 4.5. While the green line appears preparing precision, the ruddy line appears approval exactness. The exactness of the preparing and approval stages dynamically rises for this demonstrate. Preparing and approval continue without any issues. Besides, the two lines once in a while change from one another. This occasion appears how rapidly our

dataset learns modern data. Our VGG19 approval precision is 80.06 percent, which is the closest to the precision of a distinctive model.

Figure 4.6: Loss graph (VGG19)

The most commonplace estimation combinations are a preparing misfortune against a approval misfortune over time, as appeared in Figure 4.6. The approval misfortune appears how effectively VGG19 produces the modern information, as contradicted to the preparing misfortune, which illustrates how successfully VGG19 reproduces the unique information. One outline of the preparing versus approval of misfortune VGG19 is appeared in Figure 4.6. Agreeing to VGG19 created bends for ensure and action misfortunes, both the approval misfortune and the preparing misfortune diminish with expanding age time. Learning happens quick, and in this case, there is no sign of VGG19 overfitting.

4.1.3 InceptionResnetV2 model

The learning rate, frequently known as the step estimate, is a hyperparameter in machine learning that controls the degree to which as of late learned data supersedes already learned data. We too recognized our learning plot after doing tests. To decide the perfect learning rate, we utilize a InceptionResnetV2 demonstrate. The steadiest learning rate is given by this successive approach. Underneath of this model's and algorithm's learning rates. This demonstrate appears the thick and dropout layer and exactness of preparing and approving, as appeared in below.

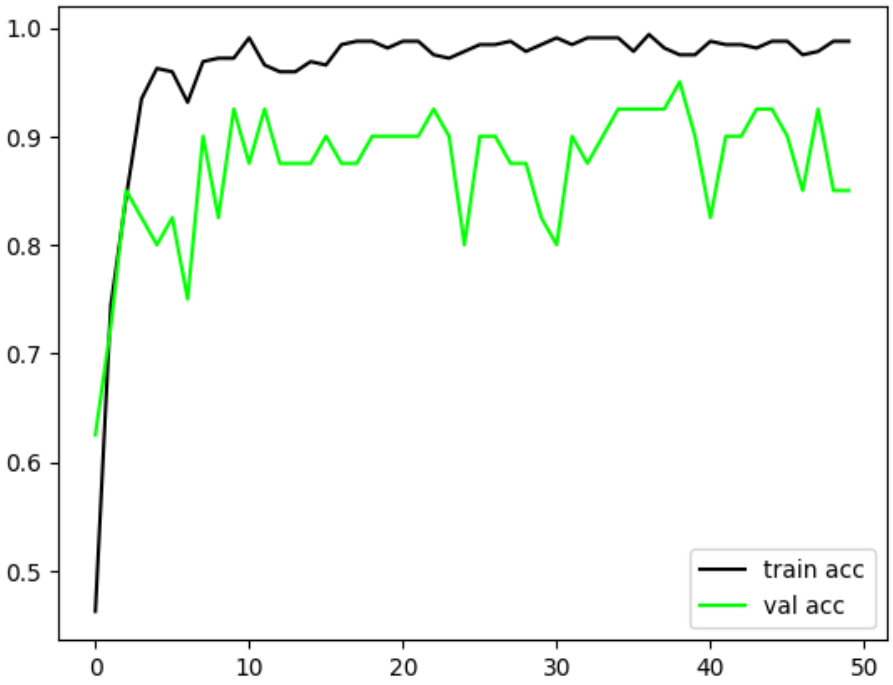


Figure 4.7: Accuracy graph (InceptionResnetV2)

The correct strategy utilized to prepare and assess the InceptionResnetV2 demonstrate is shown in Figure 4.7 Though the green line appears preparing exactness, the ruddy line appears approval exactness. The exactness of the preparing and approval stages dynamically rises for this show. Preparing and approval continue without any issues. In addition, the two lines seldom shift from one another. This occasion appears how rapidly our dataset learns modern data. Our InceptionResnetV2 approval precision is 93.12 percent, which is the most elevated exactness of all diverse model.

The most commonplace estimation combinations are a preparing misfortune against a approval misfortune over time, as appeared in Figure 4.8 The approval misfortune appears how effectively InceptionResnetV2 creates the unused information, as contradicted to the preparing misfortune, which illustrates how viably InceptionResnetV2 reproduces the unique information. One outline of the preparing versus approval of misfortune InceptionResnetV2 is appeared in Figure 4.8 Concurring to VGG19 created bends for ensure and action misfortunes, both the approval misfortune and the preparing misfortune

diminish with expanding age time. Learning happens quick, and in this case, there is no sign of InceptionResnetV2 overfitting.

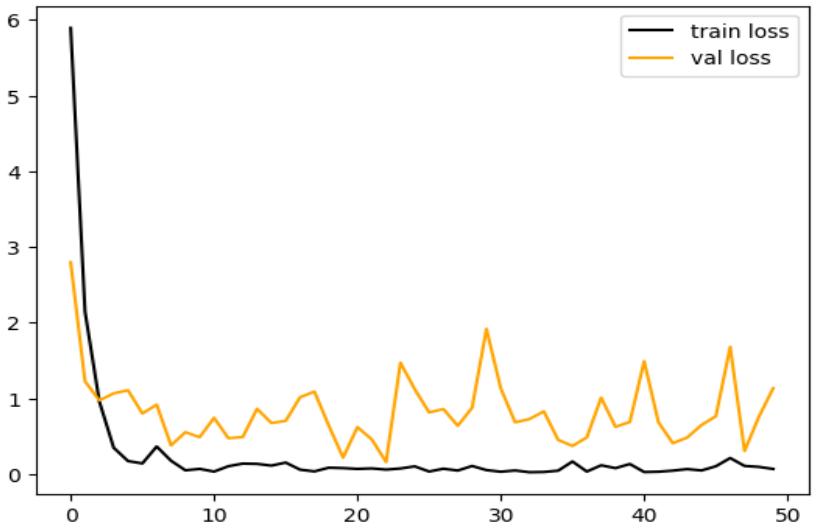


Figure 4.8: Loss graph (InceptionResnetV2)

4.1.3.1 Output of InceptionResNet v3

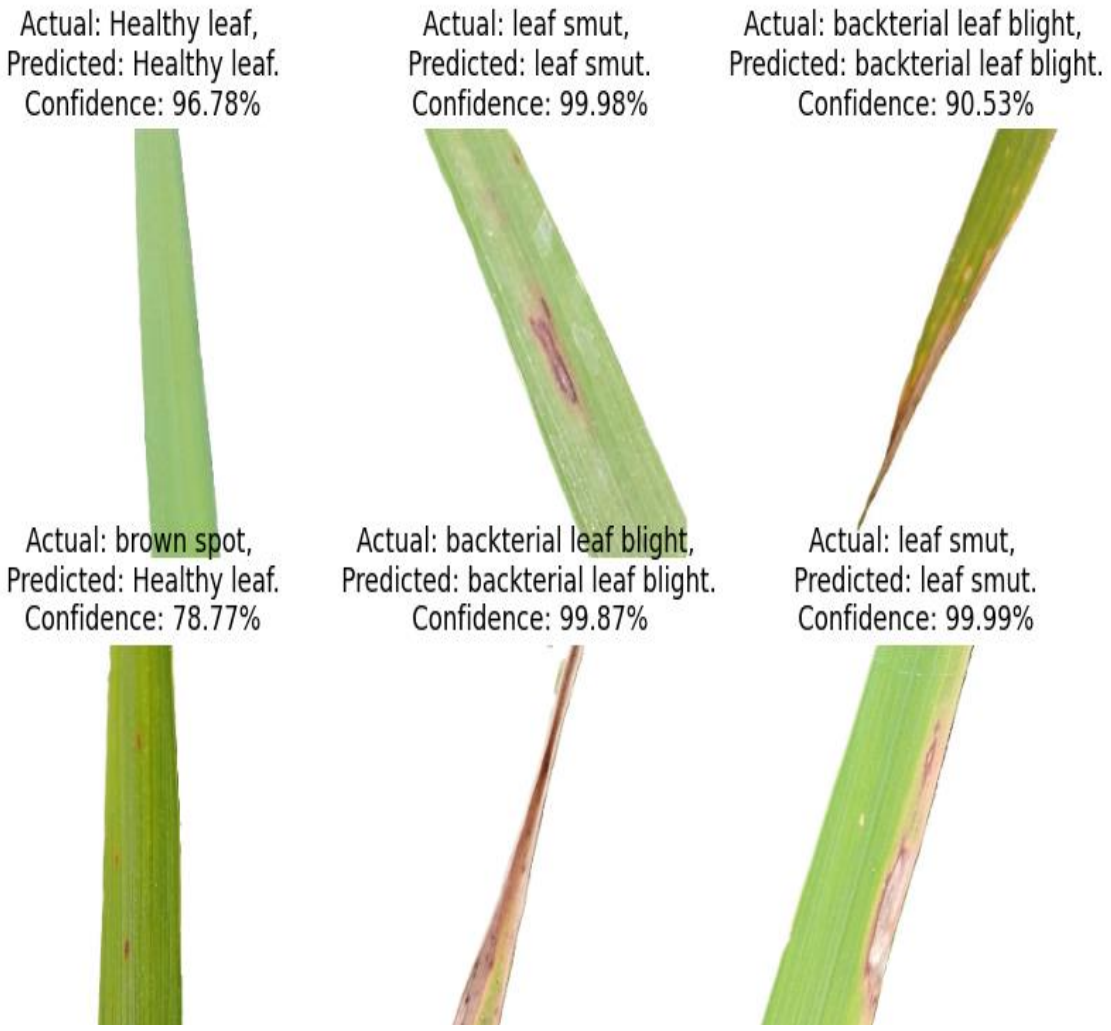


Figure 4.9: Output of InceptionResnetV2 model

4.2 Experimental result analysis

I've emphasized how my inquire about is connected in this area. I've illustrated how my calculation can precisely distinguish sicknesses of leaf clears out. To do this, we utilized preparing information to affirm that the calculation we utilized was precise. The execution show can at that point rapidly recognize takes off bearing the disease's name and recognize between sound, unused leaves.

Bacterial leaf blight

Figure 4.10 Bacterial leaf blight

Figure 3.4.11 appear the to begin with test result of InceptionResnetV2 calculation. I chose a preparing Bacterial leaf scourge to influence the leaf and connected the chosen demonstrate. It conveys extraordinary comes about. It can identify Bacterial leaf scourge infection precisely. Best side of the picture appears the real title of the disease.

Leaf smut

Figure 4.11 Leaf smut

Figure 3.4.12 appear the moment test result of InceptionResnetV2 calculation. I chose a preparing Leaf muck to influence the leaf and connected the chosen demonstrate. It conveys exceptional comes about. It can distinguish Leaf smut infection precisely. Beat side of the picture appears the genuine title of the disease.

Healthy leaf

Figure 4.12 Healthy leaf

Figure 3.4.12 appear the third test result of InceptionResnetV2 calculation. I chose a handling Sound leaf to influence the leaf and connected the chosen show. It conveys exceptional comes about. It can distinguish Sound leaf illness precisely. Beat side of the picture appears the real title of the malady.

4.3 Discussion

Using the accuracy scores indicated, the performance of the three models can be said to be fairly good, with scores of about 77% to about 93%.

The hierarchical model here has an accuracy score of 77%, this shows that the model is right 77 out of 100 times when predicting the target class. This score is regarded as good and such score can be employed in a variety of undertakings.

Comparing with the model which is sequenced, the InceptionResNet v2 model gives higher accuracy score of 92%. This implies that by using the InceptionResNet v2 , more focus is placed on the target class and that the network is more effective in the identification of the target class especially in complex scenes. This model can be employed for the tasks with high precision as for example medical images or objects recognition for self-driving automobiles.

Like the previous models, the five fully connected layers' VGG19 model also has an accuracy of 87%. While it is lower than InceptionResNet v2, it is still pretty good and can be utilized for different tasks. The last arbiter between the three models is that in computing the VGG16 model is faster than the two thus saving more computational resources.
Therefore, and in conclusion, even though all three models emerged with high accuracy score, the InceptionResNet v2 emerged the most accurate. The selection of the model will be based on the particularities of the task in question such as the precision and the time complexity of the algorithm and so forth.

The reality that the demonstrate inspected in this think about worked in each situation loans assurance to the hypothesis that my recommended show will likely cause a blend. Since paddy leaf ailments can be effortlessly recognized with this approach, the most elevated quality trim of takes off will consistently be created. It's very precise. It works accurately, evacuating the plausibility of making a botch in the prepare. Utilizing this thought in the rice-growing segment will lead to a inventive revolution.

CHAPTER 5

IMPACT on SOCIETY, ENVIRONMENT and SUSTAINABILITY

5.1 Impact on society

There was a survey at some time of the year 1979. The field and laboratory tests revealed twenty problems affecting rice; two viral diseases, two bacterial diseases, thirteen fungal diseases, two nematode diseases, and one micronutrient deficiency problem were identified in Akashi Bangladesh. undefined In total, the number sixteen appeared to be particularly powerful for the duration of the record. This infectious disease costs Bangladesh a large number of crops annually. The government is doing something to address this problem. Nevertheless, due to high population density in the United States, the concept of urbanization can be uneven here. We therefore need more sustainability to feed the kingdom. This study will in no doubt assist the grower to identify the disease and make appropriate decisions. In addition, the method of application can give an appropriate guiding principle as export on how the farmer can take steps to reduce the risk.

5.2 Impact on environment

The environment does not possess any contradictory influences. This is the reason why assisting the communities and farmers has become our greatest focus. Therefore, a large effect on the environment is achieved and the price of lost rice will certainly be lower. The most important things is that when our farmers produce more crops they will be happy and also they try to increase farming in a huge amount.

5.3 Ethical aspect

No amount will be charged from our farmers after the last android app is complete. They will always seek help from this service for no reason. The individual criterion of each part is, and each part of the form is designed to ask for a number of items free of charge without any restrictions. Nowadays, most of the farmer are not able to take treatment from agriculture officer for their busy life. They spend most of the time to take care their crops. This app gives then an advantage to known about disease and take care their crops at the same time.

5.4 Sustainability Plan

That is why in this research, I singled out only three diseases. Those are majority diseases in Bangladesh. Those diseases are creating crops illness and accrue negative impact on farming. In future I want to build a web app with user friendly interface. For this time create an application and connect the server is expensive. Also, in real world need to regular update and resolve issue and improvement I need to a team, to give best service our farmers.

Strength

- Easy to utilize for all.
- Only capture pictures and distinguish the illness no highlights for live detect.
- Accurately identify the sound influenced leaves.
- Cover major infection of paddy leaves.

Weakness

- A savvy gadget is mandatory.
- Very troublesome for uneducated people.
- This sort of app is not neighborly to our farmers.

Opportunities

- Rice is creating more crops and diminish the harm rate.
- Leaf infections can be effectively detected.
- It will contribute to the economy by assembly the needs of the country.

Treat

- For various agriculturists, smartphones are a exorbitant purchase.
- If the comes about are not precisely captured, the result may vary.
- Since numerous agriculturists in our country need formal instruction, utilizing this strategy may require costly training.

CHAPTER 6

SUMARRY, CONCKUSION, RECOMMENDATION AND IMPLICATION FOR FUTURE RESEARCH

6.1 Summary of the study

To decide on which rice leaf is contaminated for this research note, I adopted a procedure that studies a set of rules. At a few different stages, the research process is as follow these steps: At a few different stages, the research process is as follow these steps:

I. First step
- Information collection
- Preprocessing image data

II. Second step
- Analysis the statics
- Gathering the knowledge about Deep Neural Network.

III. Third step
- Locking awesome version
- Discover the best version

IV. At the last and last stage
- Execute all the model
- Take the best result among them

6.2 Conclusion

As the result, our farmers will be interested in rice advancement, and they will get an incredible yield. We have used transfer readings with success in several models. That's just one model. I got as many records as I could, but it was not enough. Our supervisor introduced, and then explained every step of the learning principles, to ensure that we understood them. Since not much, if any, work on such projects has been done in Bangladesh, we hope to continue working on this research with a significant amount of data in the future.

6.3 Implementation for further study

We have already suggested some guys in the department who can do this job as we want this employment to be a total success. However, the continuation of the thorough examination is not intended. Through the API we can stitch together previous trends to our application of Android earlier. While that was happening, our device-learning machines become the primary focus and we were not paying focus to areas like Android or server development or API construction. Another step of the further investigation will be the construction of the APIs and server. the very first step on our way to adding this model to the software. will be even this is our only reason for implementing this model.

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APENDEX

Our first problem in performing the analysis was to establish the analytical strategy for our investigation. This was not an ideal task, and little had been done in this regard before. As a result, we couldn't get much help from any sources. We have also started collecting information manually. After much effort, we may be able to achieve this.

Rice Leaf Disease Detection

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