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Jnana Sangama, Belagavi-590010

PROJECT ENTITLED

"PLANT DISEASE DETECTION USING CNN"

Submitted in partial fulfillment for the requirements for the award of degree of

BACHELOR OF ENGINEERING
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COMPUTER SCIENCE AND ENGINEERING

For the Academic year 2020-2021

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CERTIFICATE

It is certified that the project work entitled "**PLANT DISEASE DETECTION USING CNN**" is a bonafide work carried out by **SANMATI R M (1MV17CS097), UTKARSH SRIVASTAVA (1MV17CS0116), VAISHNAVI S KORLAHALLI (1MV18CS420), VARSHITHA K (1MV18CS422)** bonafide students of **Sir M Visvesvaraya Institute of Technology** in partial fulfilment for the award of the Degree of Bachelor of Engineering in Computer Science and Engineering of the **Visvesvaraya Technological University, Belagavi** during the year **2020-2021**. It is certified that all corrections and suggestions indicated for Internal Assessment have been incorporated in the report deposited in the department library. The project report has been approved as it satisfies the academic requirements in respect of project phase I prescribed for the course of Bachelor of Engineering.

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DECLARATION

We hereby declare that the entire final year project work embodied in this dissertation has been carried out by us and no part has been submitted for any degree or diploma of any institution previously.

Place: Bengaluru

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ABSTRACT

Agricultural productivity highly influences the economy of any country, especially in India where agriculture makes up about 20% of the country's GDP. In such situations, if the plant is affected by diseases and it is not treated properly at the right time, it will lead to economic losses and also increases the global food problem. To prevent this from happening, plant diseases must be detected and treated early so as to prevent serious consequences. The existing manual method of detecting plant diseases is time- consuming and not very pocket-friendly to farmers and may sometimes result in incorrect diagnosis as well.

Thus, we can make use of technologies like image processing and deep learning to successfully detect the diseases affecting the plant in the early stages. Most of the plant diseases can be visually seen, so it is convenient to apply image processing techniques to detect and classify them. In our approach, we use the technique of Convolutional Neural Network which uses the concept of hidden layers to classify the different diseases that affect the plants. Our model is successfully able to classify the diseases mentioned in the Apple, Tomato, Potato and Corn subsets of the Plant_ Pathology_2020_fgvc7 dataset with an accuracy rate of 92%.

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CHAPTER 1

INTRODUCTION

1.1 A BRIEF HISTORY OF PLANT DISEASE RECOGNITION

Plant pathology has developed from antiquity, starting with Theophrastus, but scientific study began in the Early Modern persiod with the invention of the microscope, and developed in the 19th century.

Plant pathogens cause diseases with a range of different symptoms. These symptoms can be used to identify the pathogen and then cure the disease, or limit its effects.

Diseased plants can be identified by abnormal growth or by signs of the disease-causing organism, such as bacterial slime (an external sign of a disease called bacterial wet wood) or insect larvae which hatches from eggs and feeds on leaves.

Farmers and gardeners often use books and the internet to identify plant diseases. They can also take a small cutting of an infected plant (or a photograph of it) to a local garden centre, which have staff that can often help identify and treat the disease.

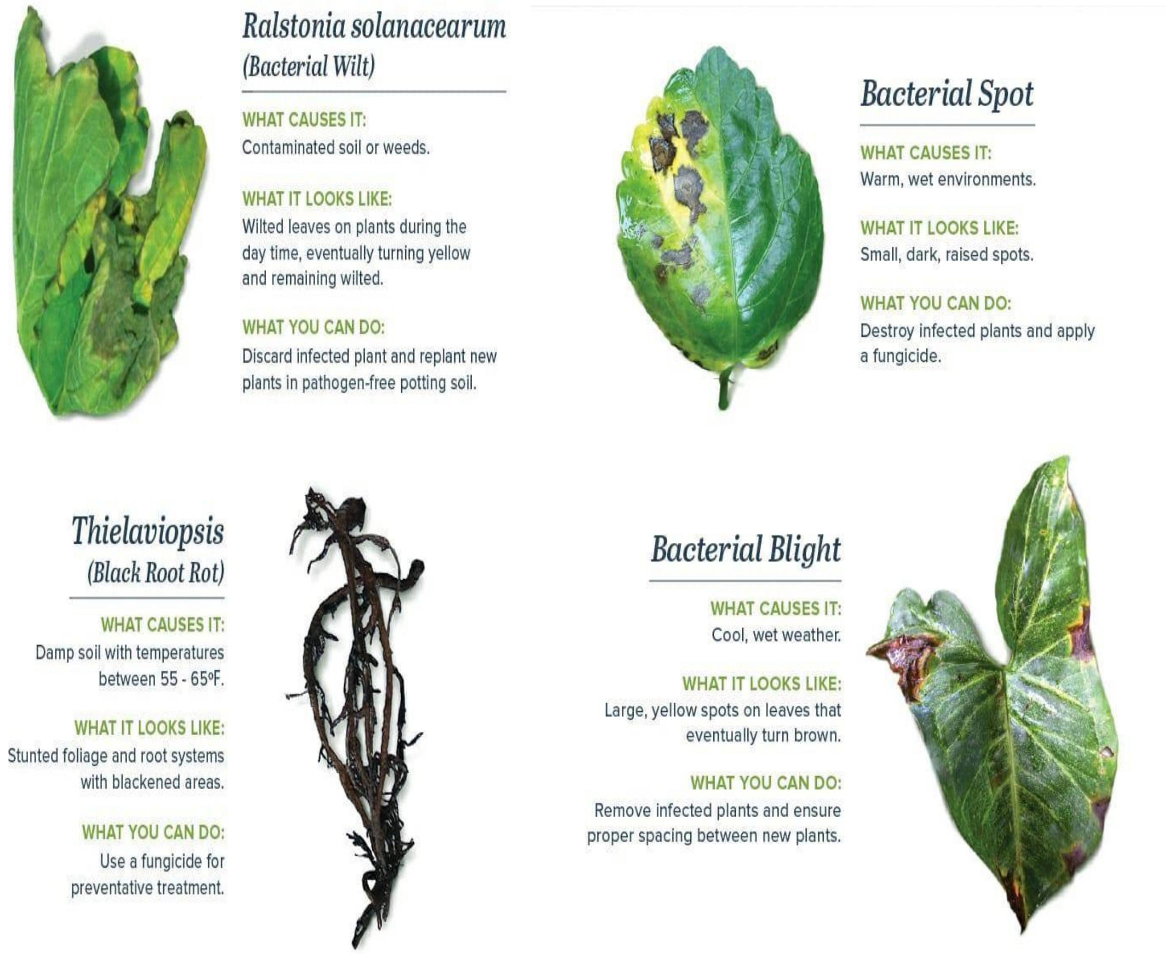
Pathogens can be grown on agar plates and viruses can be cultured in controlled conditions. Biochemical tests are then used to identify bacteria and viruses which have been cultured, possibly using testing kits containing monoclonal antibodies.

1.2 BASIC TERMINOLOGIES

- **Plant injury** is an abrupt alteration of form or function caused by a discontinuous irritant. Plant injury includes insect, animal, physical, chemical or environmental agents.
- A **causal agent** is a general term used to describe an animate or inanimate factor which incites and governs disease and injury. A causal organism is a pathogen of biotic origin. When a pathogenic agent is virulent it can cause disease and if the agent is avirulent it is a variant of a pathogen that does not cause severe disease

- A **parasite** is an organism which lives on or in another organism and obtains its nutrition there from. An obligate parasite is an organism which is wholly dependent for its nutrition on another living entity. Obligate parasites are biotrophs which also depend entirely on a living host for its nutrition. An autotroph is a plant that can make its own food through photosynthesis
- A **host** is an organism that is harboring a parasite or pathogen from which it obtains its nutrients. The host range refers to the various kinds of host plants that a given pathogen may parasitize. A host is considered resistant when it has the ability to exclude, hinder or overcome the effects of a given pathogen or other damaging factor.
- **Symbiosis i**s the mutually beneficial association between two or more different kinds of organisms. The organisms in this association are referred to as symbionts. An example of symbiosis is demonstrated in the beneficial relationship between mycorrhizal fungi and the roots of over 85% of the plants in nature..
- The **signs and symptoms** of plant disorders are the appearance or manifestation of changes in the normal form and/or function of the plant. Signs and symptoms are usually the first indication you will notice in plant problems. Signs are the appearance and/or physical evidence of the causal factor of the plants abnormality. Signs are the physical evidence of damage caused by biotic or abiotic agents such as the pathogen itself, pests, spores, fruiting bodies, chemical residue, bacterial ooze and so forth. Symptoms are the visible response of a plant to biotic and/or abiotic factors that result in a change or abnormality in the plant. Symptoms can take form as galls, chlorosis, ring-spots, wilt, rot and so on
- **Infection** is the establishment of a parasite on or within a host cell or tissue. The infection court is a certain part of a given plant that is susceptible to a particular pathogen or pathogens. Successful infections usually result in the appearance of disease symptoms. Colonization of a host results from the establishment, growth and reproduction of the pathogen on or in infected plant.
- An **epidemic** is the unarrested, widespread increase of an infectious disease, usually limited in time. An epidemic may extend over a single season or many years and over a wide or relatively small area. An endemic disease is one that is permanently established in a moderate or severe form within a defined area.

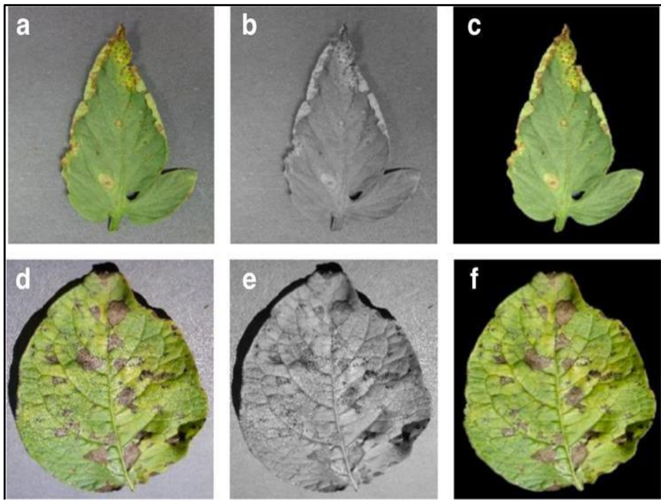
1.3 COMMON PLANT DISEASE



1.4 PLANT DISEASE DETECTION Vs. PLANT DISEASE CLASSIFICATION

Table 1: Difference between Plant Disease Detection and Plant Disease Classification

PLANT DISEASE DETECTION	PLANT DISEASE CLASSIFICATION
Detection is a method for Identifying Disease using Image Processing .	Classification is a process which comes after detection. Here the detected disease is divided into separate groups
Procedurals steps: Data acquisition, input processing, face image classification and decision making.	Procedurals steps: Plant detection, feature extraction and expression classification.
Algorithms: Ostu method, K-means Clustering	Algorithms: Open CV



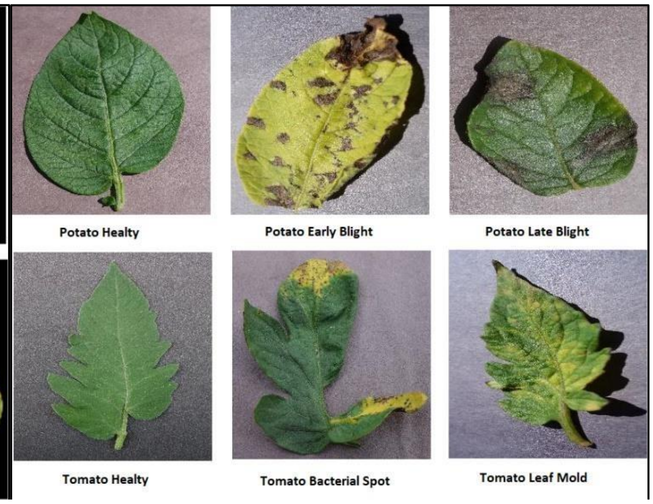


Fig. 1.1 Disease Detection **Fig 1.2 Disease Classification**

1.5 Plant disease detection Framework: In this section, the basic steps for plant disease detection and classification using image processing are shown (Fig. 1.2)).

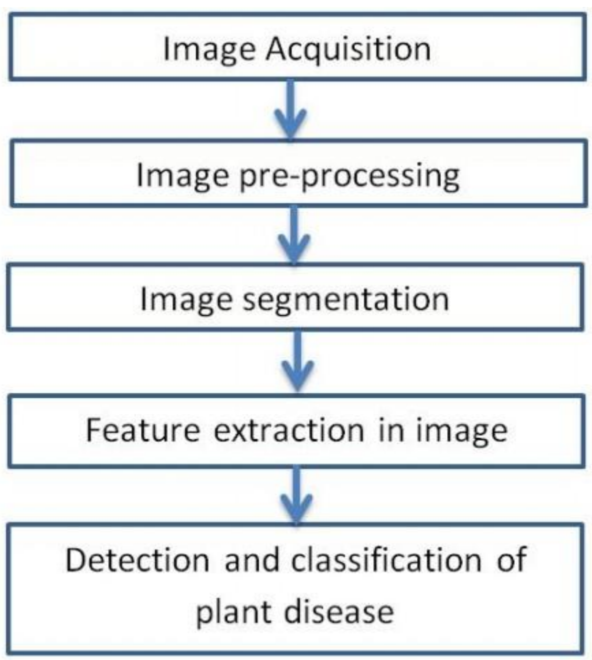


Fig 1.3 Plant detection and classification Framework

Step 1: Image Acquisition

The images of the plant leaf are captured through the camera. This image is in RGB (Red, Green And Blue) form. color transformation structure for the RGB leaf image is created, and then, a device-independent color space transformation for the color transformation structure is applied.

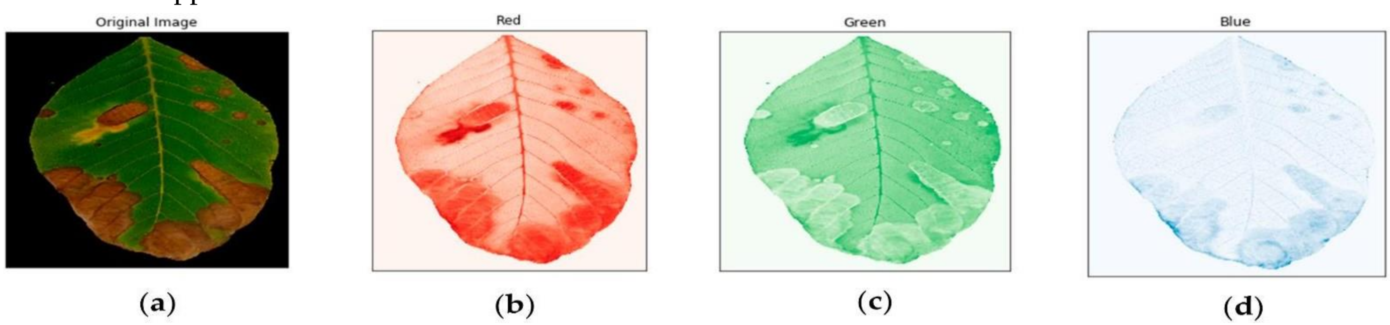


Fig 1.4: Image Acquisition

Step 2: Image Pre-processing

To remove noise in image or other object removal, different pre-processing techniques is considered. Image clipping i.e. cropping of the leaf image to get the interested image region. Image smoothing is done using the smoothing filter. Image enhancement is carried out for increasing the contrast. the RGB images into the grey images using color conversion using equation (1). f(x)=0.2989*R + 0.5870*G + 0.114.*B--------------------- (1) Then the histogram equalization which distributes the intensities of the images is applied on the image to enhance the plant disease images. The cumulative distribution function is used to distribute intensity values.

Step 3: Image Segmentation

Segmentation means partitioning of image into various part of same features or having some similarity. The segmentation can be done using various methods like otsu' method, k-means clustering, converting RGB image into HIS model etc.

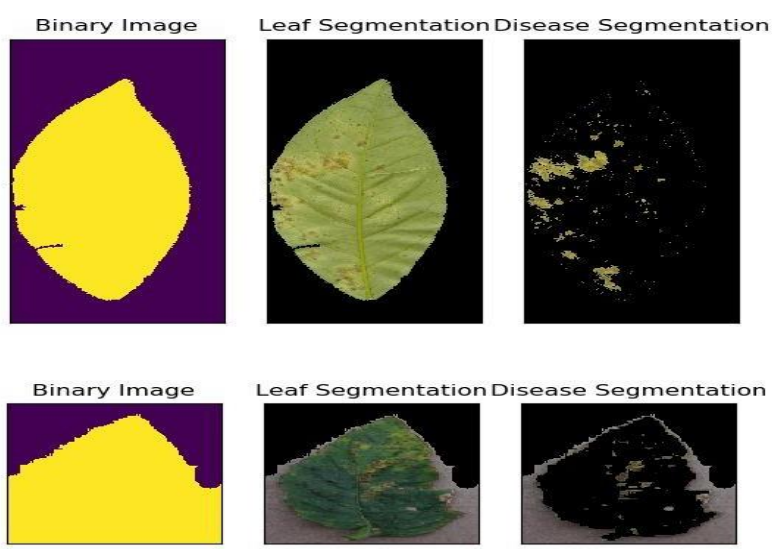


Fig 1.5: Image Pre-processing

Step 4:Feature Extraction:

Feature extraction plays an important role for identification of an object. In many application of image processing feature extraction is used. Color, texture, morphology, edges etc. are the features which can be used in plant disease detection. Monica jhuria et al considers color, texture and morphology as a feature for disease detection. They have found that morphological result gives better result than the other features. Texture means how the color is distributed in the image, the roughness, hardness of the image. It can also be used for the detection of infected plant areas.

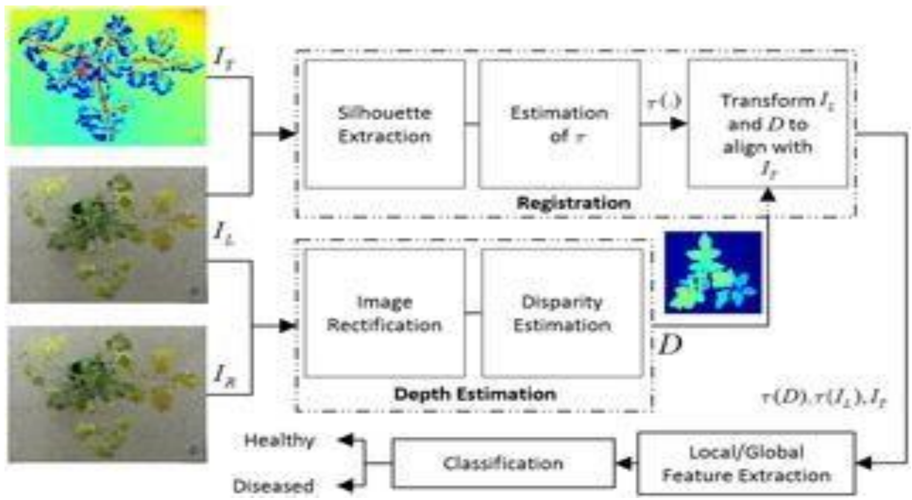


Fig 1.6: Feature Extraction:

Step 5 :Classification:

Classification and data augmentation is done through OpenCV techniques. One among the OpenCV techniques we used are Horizonal Shift with us under random module. Horizontal shift or translation is shifting the image left or right based on a ratio that defines how much maximum to shift. To resize the image back to its original dimensions Keras by default uses a filling mode called 'nearest'.

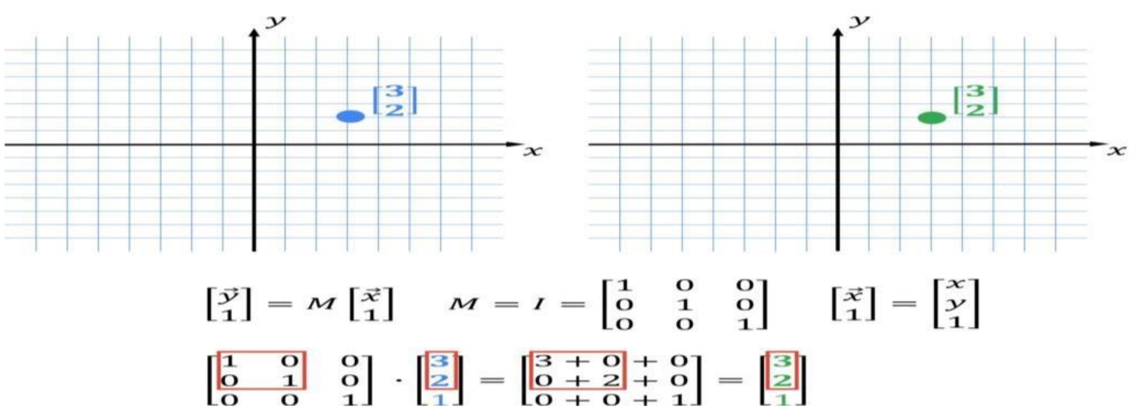


Fig. 1.7 Disease Classification Techniques

CHAPTER 2

AIMS AND OBJECTIVES

2.1 MOTIVATION

Classification of leaf disease is necessary in evaluating agricultural produce, increasing market value and meeting quality standards. Identifying and taking further dealings for further diffusion of the diseases it is also helpful.

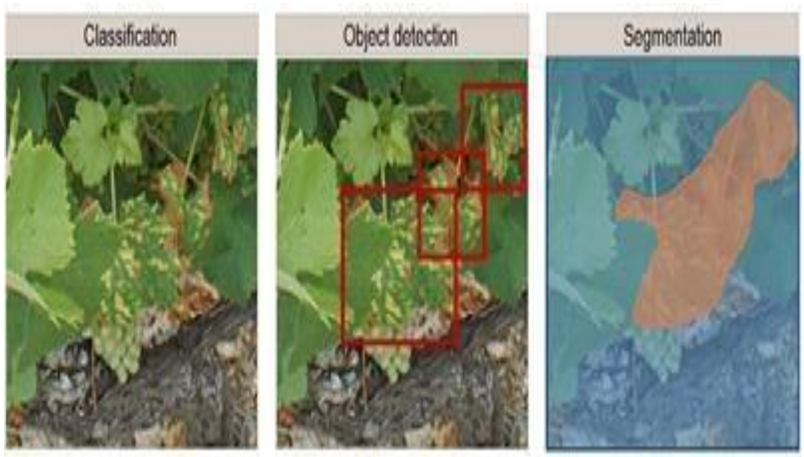


Fig 2.1 Model Working Image

We have also been motivated observing the benefits of physically handicapped people like deaf and dumb. But if any normal human being or an automated system can understand their needs by observing their facial expression then it becomes a lot easier for them to make the fellow human or automated system understand their needs.

2.2 PROBLEM DEFINITION

Plant disease detection can be easily classified into 4 basic types: healthy, scrab, Rust, Multiple disease. We visualize one leaf image over channel distribution i.e red, blue, green channels and visualize targets. By Image Processing and augmentation we under go into four steps namely: canny edge detection, flipping, convolution, and blurring of the image. The models that are used are EfficentNet model, Efficient NoiseStudent model and Densenet model to train our Convolutional Neural Networks (CNN). Our model display the results with the help of Exploratory Data Analysis (EDA) which is very easy to analyze.

2.3 AIM

Our main aim is to present a novel method for detection and classifying plant disease from leaf images. Our approach leverages on the recent success of Convolutional Neural Networks (CNN) with Exploratory Data Analysis (EDA) with deep learning modules on leaf disease detection problems.

2.4 OBJECTIVES

The proposed novel deep convolutional neural network architecture, will be consciously designed

- To efficiently classify given images into seven facial expressions, namely
  - Healthy
  - Scrab
  - Rust
  - Multiple disease
- To be lightweight in order to make it possible to be used on machines with limited computational power.

CHAPTER 3

LITERATURE SURVEY

This section basically deals with various technologies and algorithms used to recognize different plant disease on leaf images. Various papers describing this is illustrated and discussed here. Table 2 gives an overall summary of few of the plant disease recognition systems and also gives a remark on their performance.

1. **N Gobalakrishnan, K Pradeep, C J Raman, L Javid Ali and M P Gopinath:** uses image processing techniques with machine learning algorithms that are applied in various stages of a plant's life cycle and also come up with treatments for the suitable disease in the plants. In this paper, referred several papers (1-10) à techniques à diseasesà accuracy.

2. **Sammy V. Militante:** In this paper, CNN architecture is used for disease classification and identification. The methodology in the study involves three key stages: acquisition of data, pre-processing of data and image classification. Steps used in this methodology are : Input Dataset, Image Acquisition, Image pre-processing and Classification. A 96.5% accuracy rate was achieved using 75 epochs during the training of the model. The model also achieved a maximum accuracy rate of 100% when testing random images of plant varieties and diseases.

3. **Abdul Hafiz uses K-Means Segmented Support Vector Machine for Detecting diseases in Chilli Plants**. In this paper, an Artificial Intelligence based image processing algorithm is proposed to detect diseases on a Chilli plant using its leaves images. The proposed solution focuses on using k- means clustering algorithm for image segmentation and compares different Support Vector Machine (SVM) algorithms for classification. Computed images' features are extracted and used to classify these images into classes. Different parameters and different kernel functions are used to compute different SVM classification algorithms. The results are classified into background, healthy and unhealthy (Cucumber Mosaic) and can differentiate between health and unhealthy plants.

4. **Suma V, R Amog Shetty, Rishab F Tated, Sunku Rohan, Triveni S Pujar**: uses CNN with artificial Neural Networks(ANN) and Machine Learning Algorithms (image processing techniquesà using 5000 datasets). The Network is trained using the images taken in the natural environment and achieved 99.32% classification ability. This shows the ability of CNN to extract important features in the natural environment which is required for plant disease classification. Image classification, Image Categories, Feature Extraction, and Training Data is carried out. The algorithm is implemented with training data and classification of given image dataset. The test input image is compared with the trained data for detection and prediction analysis. From the results, it is clear that the model provides reliable results.

5. **Praveen Kumar Joshi:** proposes the use of Support Vector Machine(SVM) algorithm for plant disease detection and classification. To carry out the process, the entire framework is divided into five sequential steps, namely Image Collection, Image Pre-processing, Image Segmentation using Otsu's method, Feature Extraction using Gray-Level Co-Occurrence Matrix(GLCM) and Classification using SVM. Author was successfully able to detect Bacterial Spot, Septoria Leaf Spot, Leaf Mold and Average Mold with an accuracy of 100%, 60%, 80% and 85% respectively.

6. **Md. Arifur Rahman**: This paper mainly focuses on implementing an improved segmentation technique using a combination of thresholding and morphological operations. For classification, they have used the deep neural network. This method includes four important stages namely: enhancement, segmentation, feature extraction and classification. Their proposed method has achieved 99.25% accuracy in the Plant Village database.

7. **Sharath D M, Akhilesh, S Arun Kumar, Rohan M G and Prathap C:**The proposed system uses the canny edge detection technique for detection of the disease affected areas in the fruit after the segmentation of the image using grab cut segmentation. After segmentation the edges of the affected fruit area is calculated in terms of pixels. Based on the number of pixel counts, the percentage of infection in fruits is determined and based on the disease with which the fruit is affected, the preventive measures, biological and chemical solutions are provided.

8. **S.Santhana Hari proposes the use of CONVOLUTIONAL NEURAL NETWORK(CNN)** for detection of plant disease by leaf image. Disease identification is done by using a deep learning method. All the classification was done based upon the images of the crop's leaf, which contains both the healthy and affected leaf. This model has produced an accuracy of about 96.3%. Deeper Network architecture is implemented for the grading of plant species. Their result produced an accuracy of 86.2% which is considered to be less accurate.

9. **Santhosh Kumar.S**: Literature survey has detailed explanation of the importance of disease detection both to plants and to mankind. To have a meaningful impact of plant diseases & techniques in the area of agriculture, deliberation of proper input is necessary. Research issues addressed here are to develop a systematic approach to detect and recognize the plant diseases that would assist farmers and pathologists in prospect exploration. The paper depicts the importance of image processing in the agriculture field and considereing the type of disease for further research work.
10. **Mercelin Francis**: uses Convolutional Neural Network and deep learning models. (image processing approach). In this paper, Implemented a convolutional neural network to detect and classify whether the leaf is diseased or healthy. Apple and Tomato plant leaves are used to detect whether the plant is healthy or affected by the disease. The achieved accuracy is 88.7 with minimum number of parameters ie. 45K when compared to other existing models. Creating and training a CNN model from scratch is a tedious process when compared to the usage of existing deep learning models for various applications to achieve maximum accuracy. So depending on the application various models can be used or retrained. Therefore in the future work, it is planned to utilize a model efficient than VGG and other existing architectures, such that it gives higher accuracy with minimum size and complexity, so that it can be used in mobile or any other embedded applications.
11. **Endang Suryawati:** evaluates and compares different CNN architectures with varying depths like CNN baseline(2 convolutional layers), AlexNet(5 convolutional layers), VGGNet(convolutional layers) and GoogleNet(not only deep architecture but also wide). Author makes use of the tomato subset of the Plant Village Dataset for the experiment. After the experiment, the Author states the accuracy rate of each of the tested architectures as 84.58%, 91.52%, 89.68 and 95.24 for Baseline, AlexNet, VGGNet and GoogleNet respectively.

12. **Melike Sardogan**: uses CNN with Learn Vector Quantization(LVQ) Algorithm. Tomato plant leaf is used for disease detection and classificationà 500 datasets. Three different input matrices have been obtained for R, G and B channels to start convolution for every image in the dataset. Each input image matrix has been convoluted. reLU activation function and max pooling have been implied to the output matrix. Total 500 feature vectors which obtained from original images have been used for training and testing operations in the LVQ algorithm. It is concluded that the proposed method effectively recognizes four different types of tomato leaf diseases. To improve the recognition rate in the classification process different filters or different sizes of convolutions can also be used.

13. **Huu Quan Cap, Katsumasa Suwa, Erika Fujita, Satoshi Kagiwada, Hiroyuki Uga, Hitoshi Iyatomi:** This paper presents a simple and accurate leaf regions detection system with high affinity with other existing disease diagnosis systems. We confirmed that the performance of 78.0% in F1-score is sufficiently acceptable for this task from visual assessment. Precision and recall are trade-off criteria. Considering the practical application of the whole plant diagnosis schema in, it is not necessary to detect exactly the whole full leaf from the images. In the fact that we need to detect some of, or at least one infected leaf per disease in the image. Conversely, we should not pass completely the wrong area to the classifier followed by especially when the following classifier is not so robust. That is, we need a certain level of precision. Therefore, appropriate control of balance between false positive and false negative is required.

14. **Mrs.Divya Unni ,Anjali K , Arya M S:** The main approach of this approach is to recognize the diseases. Speed and accuracy are the important characteristics required for disease detection. Hence, the extension of this work will focus on developing the advanced algorithms for fast and accurate detection of leaves with disease. This paper gives the survey on different disease classification techniques that can be used for plant leaf disease detection and an algorithm for image segmentation technique used for automatic detection as well as classification of plant leaf diseases has been described later. Therefore, related diseases for these plants were taken for identification. Using very less computational efforts the optimum results were obtained which also shows the efficiency of the proposed algorithm in recognition and classification of the leaf diseases.

15. **Halil Durmas:** uses the technique of deep learning to classify the different diseases in the tomato subset of the Plant Village dataset. Author compares two architectures namely AlexNet and SqueezeNet. Author makes use of the supercomputer Nvidia Jetson Tx1 for both training and testing. Accuracy results are obtained from Caffe tests. Even though the SqueezeNet model(2.9Mb) is 80 times smaller than the AlexNet model(227.6Mb), it's accuracy is 94.3% as compared to 95.6% accuracy of AlexNet architecture. Hence, Author concludes that the SqueezeNet model is a good candidate for mobile applications of plant disease detection due to its light-weight property and low computational needs.
16. **Mrunmayee Dhakate:** proposes a method for diagnosis of pomegranate plant diseases. This method uses the technique of K-means clustering for segmentation of the images, GLCM for feature extraction and multi-perceptron architecture with back-propagation algorithm for classification of the images. The categories used for classification are Good Fruit, Fruit Spot, Bacterial Blight, Fruit Rot, Good Leaf and Leaf Spot. The proposed method works with an accuracy of 100%, 83.33%, 85.71%, 83.33%, 100% and 87.5% for the mentioned categories respectively. Hence, the Author concludes that the proposed method gives a satisfactory average accuracy of 90%.

Table 2. A summary of some plant disease detection systems

S.N	Author Name	Title & Year of Publishing	Algorithm used	Accuracy
1	N.Gobalakrishnan *et al.*	"A Systematic Review on Image Processing and Machine Learning Techniques for Detecting Plant Diseases", 28-30 July 2020	-	-
2	Sammy V. Militante	"Plant Leaf Detection and Disease Recognition using Deep Learning", 3-6 October 2019	Convolutional Neural Networks	96.5%
3	Abdul Hafiz Bin Abdul Wahab *et al.*	"Detecting diseases in Chilli Plants Using K-means Segmented Support Vector Machine", 27-29 July 2019	K-means clustering and Segmented SVM Image Classification Algorithm	Aprrox 90% for chilli plants and 57.1% for cucumber mosaic1
4	Suma V *et al.*	"CNN Based Leaf Disease Identification and Remedy Recommendation System", 12-14 June 2019	Convolutional Neural Networks	99.32%
5	Praveen Kumar Joshi, Anindita Saha	"Detection and Classification of Plant Diseases using Soft Computing Techniques" , 17-18 May 2019	Support Vector Machine(SVM)	100%, 60%, 80% and 85% respectively to detect Bacterial Spot, Septoria Leaf Spot, Leaf Mold and Average Mold.
6	Md. Arifur Rahman	"Improved Segmentation Approach for Plant Disease Detection" , 3-5 May 2019	Deep neural network	99.25%
7	Sharath D M *et al.*	"Image based Plant Disease Detection in Pomogrenate Plant for Bacterial Blight", 4-6 April 2019	Canny Edge Detection	-
8	S.Santhana Hari *et al.*	"Detection of plant disease by leaf image processing convolutional neural network", 30-31 March 2019	Convolutional Neural Network	86.2%
9	Santhosh Kumar.S,	"Diseases Detection of Various Plant Leaf Using	-	-

	B.K Raghavendra	Image Processing Techniques", 15-16 March 2019		
10	Mercelin Francis, C Deisy	"Disease Detection and Classification in Agricultural Plants using Convolutional Neural Networks- A Visual Understanding", 7-8 March 2019	Convolutional Neural Network	88.7%
11	Endang Suryawati *et al.*	"Deep Structured Convolutional Neural Network for Tomato Disease Detection", 27-28 October 2018	Convolutional Neural Network	84.58%, 91.52%, 89.68 and 95.24 for Baseline, AlexNet, VGGNet and GoogleNet respectively.
12	Melike Sardogan *et al.*	"Plant Leaf Disease Detection and Classification based on CNN with LVQ algorithm", 20-23 September 2018	CNN with Learn Vector Quantization(LVQ)	86%
13	Huu Quan Cap *et al.*	"A Deep Learning approach for On-site Plant Disease Detection", 9-10 March 2018	Convolutional Neural Network	78.0%
14	Mrs.Divya Unni *et al.*	"Detection of unhealthy plant leaves using image processing and genetic algorithms with Arduino", 6-10 January 2018	-	-
15	Halil Durmus *et al.*	"Disease Detection on the leaves of the Tomato Leaves by using Deep Learning", 7-10 August 2017	Convolutional Neural Network	95.65% for AlexNet and 94.3 for SqueezeNet
16	Mrunmayee Dhakate, Ingole A B	"Diagnosis of Pomogrenate Plant Disease using Neural Network", 16-19 December 2015	K-means clustering	100%, 83.33%, 85.71%, 83.33%, 100% and 87.5% for Good Fruit, Fruit Spot, Bacterial Blight, Fruit Rot, Good Leaf and Leaf Spot respectively.

CHAPTER 4

PROPOSED WORK

4.1 ISSUES IN THE PREVIOUS WORKS

- Accuracy of recognition is low due to lack of training done in system.
- Representation of data for some expressions are almost identical.
- Previous analysis cannot deal with:
    - leaves having wrinkles/curls.
    - leaf with changes in colour..
- Few of the papers have also stated that their results and performance are dependent on the databases.

Issue 1: Good parameter and feature selection process is inflexible.

Along with other improvements the feature selection steps should be optimized, and choosing good parameters should be considered for further experiments.

Issue 2: The confusion matrix were used for the validation dataset results. Overall, no errors were recorded in any Potato or Tomato classes.

Issue 3: YcbCr, HSI, and CIELB colour models were used in the study; as a result, disease spots were successfully detected and remained unaffected by the noise from different sources, such as camera flash.

Issue 4: The biggest problem with doing this is that these semantic expression vectors present very less information on expressions. Therefore, they may not give good results when they are used to predict.

4.2 OUR WORK

In light of the issues surveyed by comparatively analyzing through the papers studied in detail, we have chosen in our current work to overcome the following issues:

- Developing the PDD technique to identify features of leaf under uneven lighting conditions.
- Improving the performance rate of the model for recognizing the diseases in the leaf.
- Making the model database independent.
- Use of Max pooling which is very similar to convolution
- Use of ReLU activation function which helps introduce non-linearity in the neural network, thus
- increasing its capacity of model the image data.

4.3 CONSTRAINTS

- **Latency:** Given an image, the system should be able to predict the expression immediately and transfer the result. Hence, there is a low latency requirement.
- **Interpretability:** Interpretability is important for still images but not in real time. For still images, probability of predicted disease can be given.
- **Accuracy:** Our goal is to predict the disease of a leaf in the image as accurate as possible. Higher the test accuracy, the better our model will perform in real world.

4.4 FORMULATION OF THE PROJECT

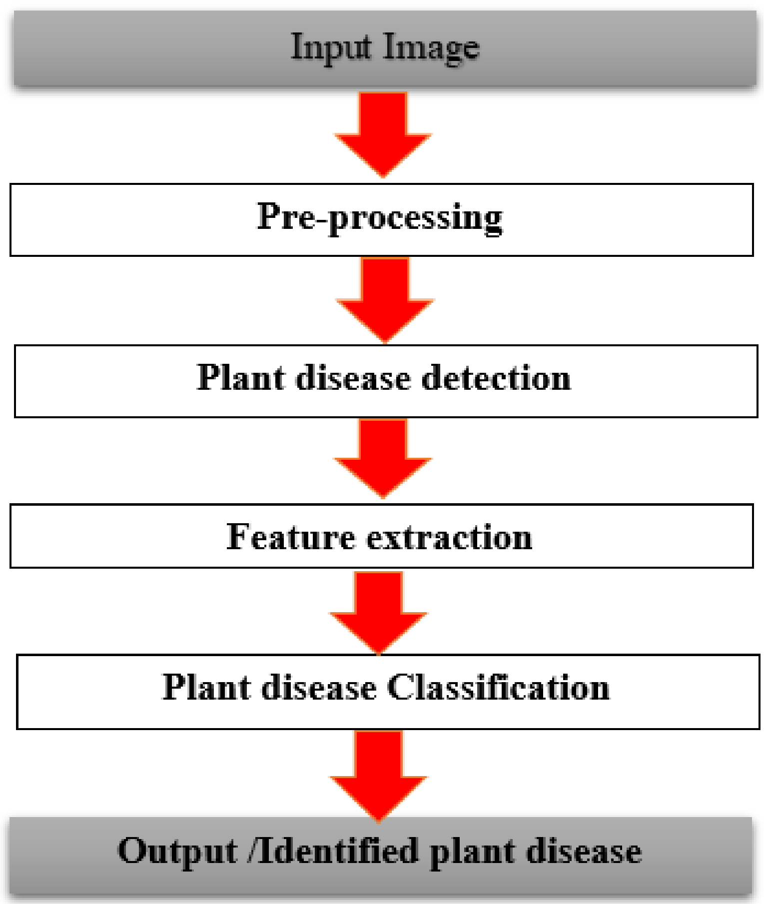


Fig 4.1 Formulation of the Project

CHAPTER 5

PLAN OF ACTION

5.1 WATERFALL MODEL

We will be developing our project as per the iterative waterfall model as show in the figure below:

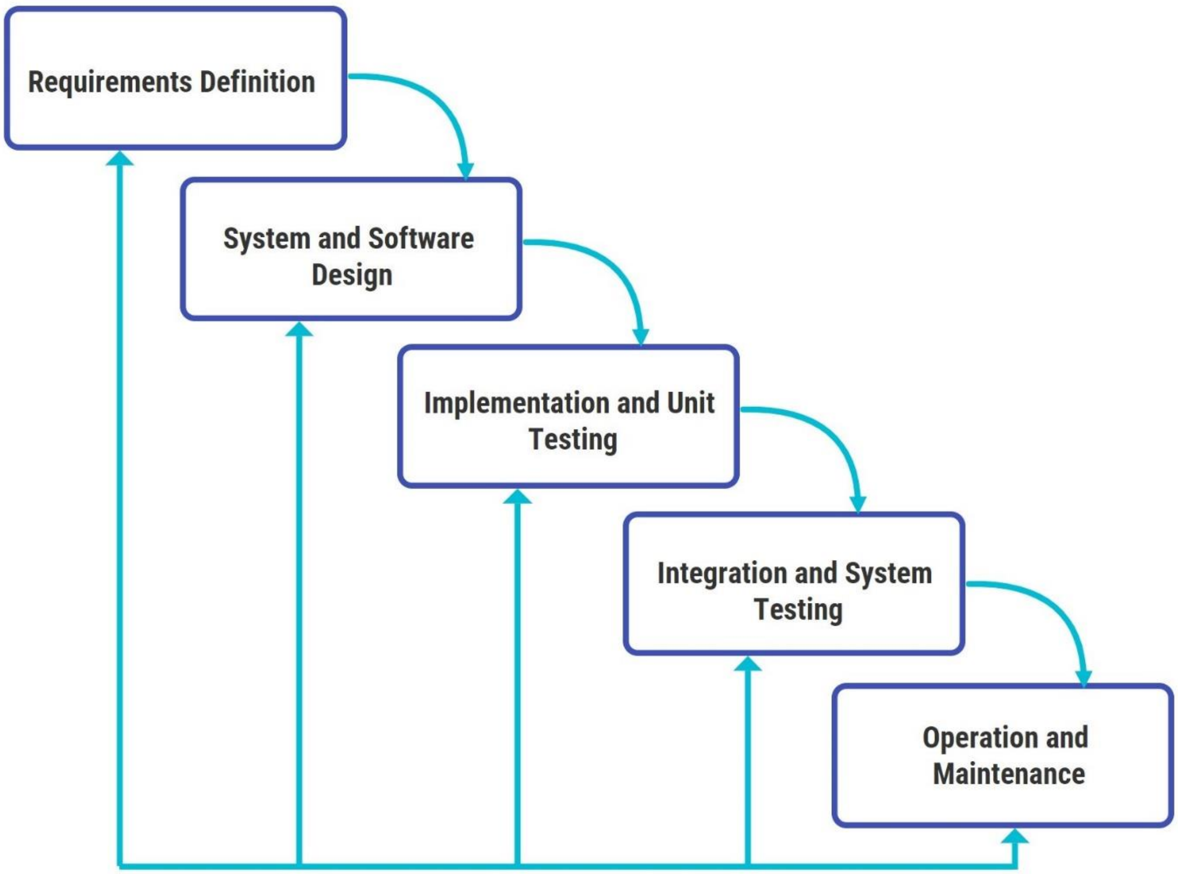


Fig 5.1 Waterfall Model

5.2 PLAN FORPHASE II

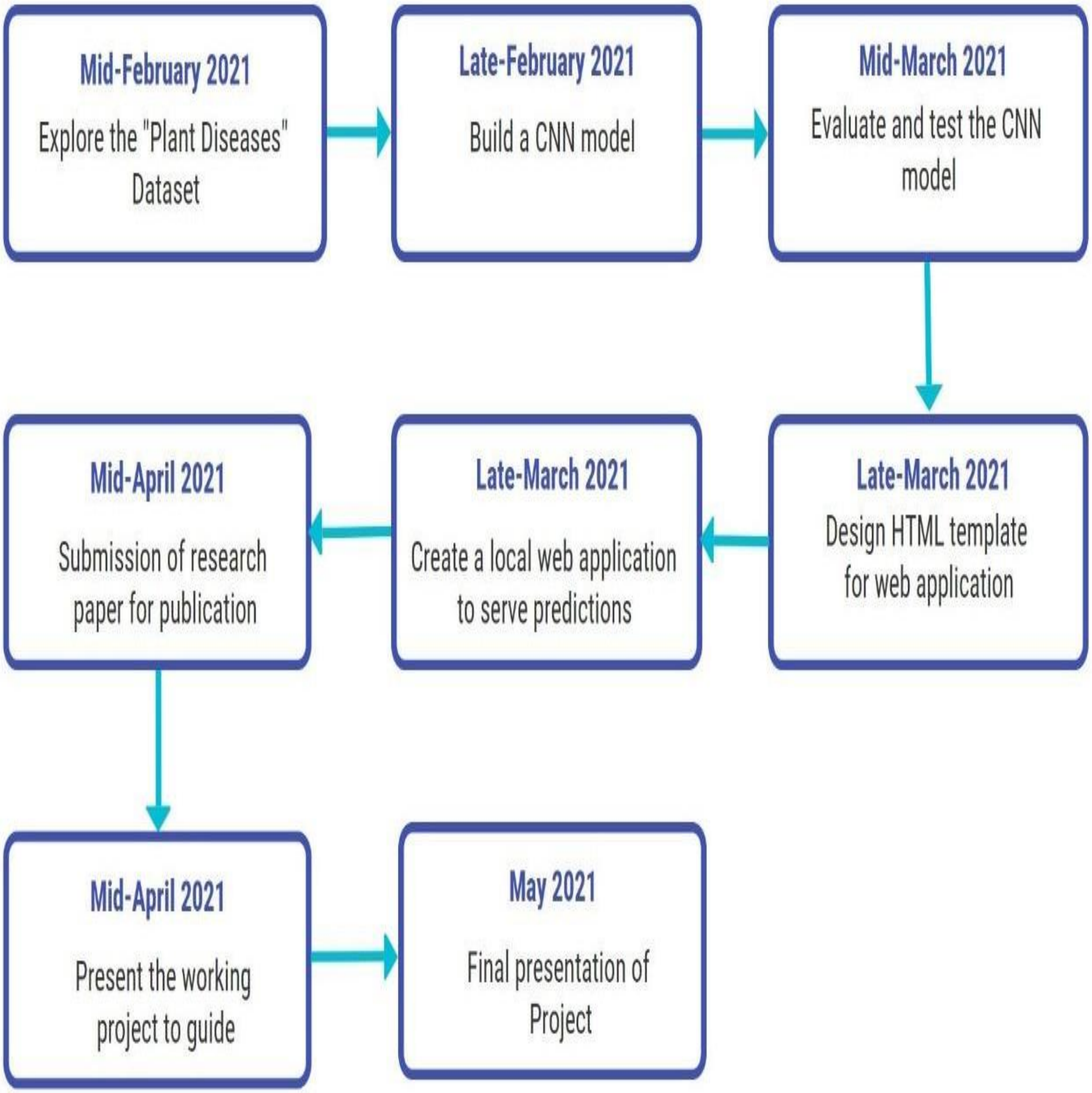


Fig 5.2 : Phase II Plan

CHAPTER 6

STATUS OF PUBLICATION

Table 4: Paper Details

TITLE	A Review on Different Plant Disease Detection Techniques
PUBLISHER	International Research Journal of Engineering and Technology(IRJET)
VOLUME NUMBER	7
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CHAPTER 7

CONCLUSION

The people around the world rely on the agricultural sector as one of the most important sectors where crops are the basic need for food. Early recognition and detection of these diseases are crucial to the agricultural industry. This model has achieved its goal to detect and recognize different plant varieties and plant diseases using convolutional neural networks. The trained model can be used to test real-time images to detect and recognize plant diseases.

An additional plant variety and different types of plant diseases may be included in the existing dataset to increase the trained models. Other CNN architectures may also use different learning rates and optimizers for experimenting the performance and accuracy of the model. With the achieved accuracy of 92%, the proposed model can assist farmers to detect and recognize plant diseases.

CHAPTER 8

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Engineering. (3-6 October,2019)

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