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Leaf Disease Detection

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***Abstract* - In a developing country like India agriculture plays a noteworthy role. Agricultural intervention in the livelihood of rural India indulges by about 58%. Thus, preventing significant loss in quantity and yield of these plants is important and majorly dependent on recognition and classification of diseases those plants might possess. Advanced and developing technologies like Image processing are used to classify such issues using different types of algorithms and techniques. Initially, the leaf of a plant gets affected, when plant develops a particular type of disease. In this project, four consecutive stages are used to discover the type of disease. The four stages consist of pre-processing, segmentation, extraction of features and their classification. To remove the noise we are doing the pre-processing and to part the affected or damages area of the leaf, image segmentation is used. The k-nearest neighbors (KNN) algorithm, which is a guided, supervised and advance machine learning algorithm, is implemented to find solutions for both the problems related to classification and regression. During the terminal stage, user is recommended treatment that might help. Mostly live plants are adversely affected by the diseases. This paper conveys representation of leaf disease detection by using image processing that can identify drawbacks in the said plant by inputting images, based on color, bound and texture to give the brisk and reliable results to the farmer.**

Keywords: Convolution Neural Network, Agriculture, farmers, Machine Learning.

I. INTRODUCTION

In India about 70% of the populace relies on agriculture. Identification of the plant diseases is important to prevent the losses within the yield. It's troublesome to observe the plant diseases manually. Hence, image processing and machine learning models can be used for detection of plant diseases. In this project, we have described the technique for the detection of plant diseases with pictures of leaves. Image processing and Machine learning are used for the project. The color of leaves, area of the leaf, amount of damage to leaves, texture parameters are used for classification. In this project we have analyzed different image parameters or features to identify different plant leaves diseases to achieve the best accuracy. Previously plant disease detection is done by visual inspection of the leaves or some chemical processes by experts. Doing so requires large team of experts and continuous observation of plant, which costs high. In such conditions, the recommended system proves to be helpful in monitoring large fields of crops. Detection of the diseases automatically by simply observing the symptoms on the plant leaves makes it cheaper and easier.

II. OBJECTIVE

The objective is to make effective and efficient use of Image Processing and Machine learning algorithms which saves not only time but cost for farmers to detect diseases in plants, how they affect yield and what remedies are needed.

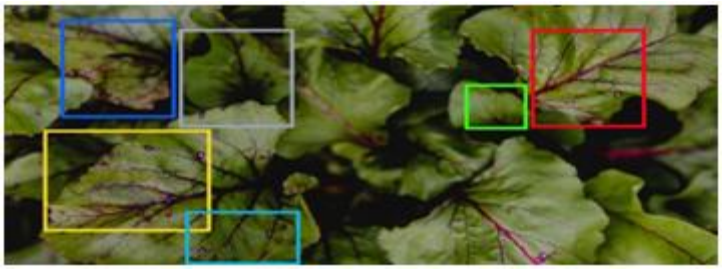

Figure 1: Leaf Disease Detection

Some Features and benefits of Leaf Disease Detection include:

1) Study of etiology, symptoms, predisposing factors and recurrence of such diseases.
2) Plant pathology deals with different aspects of plant diseases and has wide scope than human pathology which only deals with only one aspect i.e. plant health.
3) Eliminate costly processes used during manual disease inspection and remedy.
4) Provide accurate remedy for diseases that have been detected.
5) Keep records of diseases that have been found and either remedy have been provided or not.

This project will be especially helpful for those farmers who reside in rural areas and will help them in saving the yields from diseases as farmers lose a huge amount of their cultivated crops because of these diseases and this system will help them to avoid the said situation. Also we have tried to implement this project in a simple manner so as to make things more understandable for farmers. This project can also provide them cure by suggesting pesticide names and their quantity according to the prevailing disease and this project will also display and give an idea about the effect of crop disease on crop yield.

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III. SETUP AND SOFTWARE REQUIREMENTS

The term system requirements mean the minimum hardware and software requirement of a computer. If the computer fulfills this minimum requirement then the system will run smoothly.

Given below are the hardware requirements for optimum performance of the system.

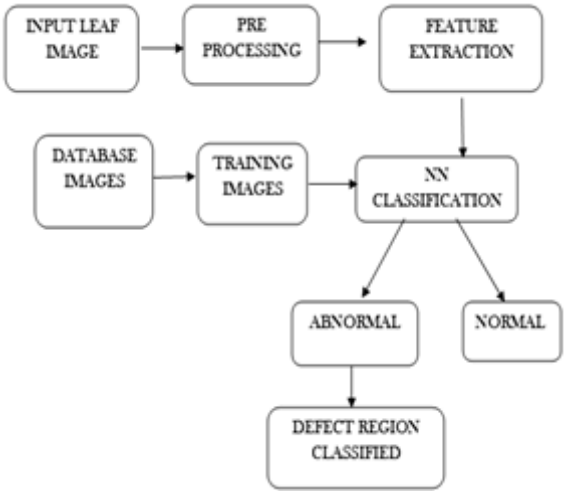

Figure 2: Use case diagram of working system

Table 1: Hardware requirements

Hardware	Minimum Requirement
Processor	Intel Pentium 4 processor or equivalent, 1GHz or faster
Memory	4 GB RAM
Disk Space	1 GB
OS	64-bit

a) Internal System Architecture

The images of the diseased plant leaf are captured using a mobile or a digital camera. Captured image is then transferred to the system and then followed by the process that involve the image processing stage. The image is given as an input to the software system. This image forms our testing data which will determine the accuracy of our system. The image before being actually tested on our Machine Learning model is first resized, then recolored , and made fit using various techniques The dataset that is used in our system is a collection of various plant leaf images that are either healthy or not. The dataset collected forms the training data which is trained against our image processing model. This model is then saved and used to test the images taken in by the camera. The Web interface comes into requirement when we need a user interface wherein a user needs to upload the captured picture into the front-end and the model is pre-trained by the dataset of images in the back-end. The result is generated on the user interface without needing the user to navigate between training and testing phase of the system. This interface renders easy and smooth flow of control and the user does not need to know the entire mechanism behind the Plant Disease Identification System.

b) Components and objective of system

Software Requirements

- OS: Ubuntu, Windows, Mac
- Tools: PyCharm 2021
- Programming Language: Python
- Dataset: A Dataset of 80,000 Images
- Libraries/Tools: Pandas, NumPy, SciKit-Learn, Pytorch, Pickle

User Interfaces

- Front End Software: Python Tkinter
- Back End Software: Python Machine Learning

As the system does not involve any heavy machinery and electricity, the system proves to not only be a cost-effective solution, but also an environment-friendly one. Plants are highly prone to diseases that affect the growth of the plant which in turn affects the ecology of the farmer. In order to detect a plant disease at very initial stage, use of automatic disease detection technique is advantageous. The symptoms of plant diseases are conspicuous in different parts of a plant such as leaves, etc. Manual detection of plant disease using leaf images is a tedious job. Hence, it is required to develop computational methods which will make the process of disease detection and classification using leaf images automatic.

IV. PERFORMANCE TESTING

To better understand how our approaches will perform on new unseen data, we experiment across a whole range of train-test dataset splits, for example 80–20 (80% of the dataset is used for training, and 20% for testing), 60–40 (60% of the whole dataset used for training, and 40% for testing), 50–50 (50% of the dataset is used for training, and 50% for testing), 40–60 (40% of the dataset is used for training, and 60% for testing) and finally 20–80 (20% of the dataset used for training, and 80% for testing).

For each experiment, we calculate the mean precision, mean recall, mean F1 score, along with the overall accuracy over the entire period of training at intervals. We use the final mean F1 score for the comparison of results across all of the different experiments.

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We note that with multiple class labels on a dataset, randomly guessing will only achieve an overall accuracy of 2.63% on an average. Across all our experimental configurations, the overall accuracy we obtained on the dataset varied from 75.86% to 92.72%. Hence, showing strong promise of the deep learning approach for similar prediction problems.

Table 2: Depicting the throughput for different configurations

Test Case No.	Option	Expected Output	Output
1	Browse Button	Dialog box appears	Dialog box appears
2	Reset Button	Clears the area	Clears the area
3	Submit Button	Submit the image Uploaded and give remedy if unhealthy	Submit the image uploaded

V. FLOWCHART

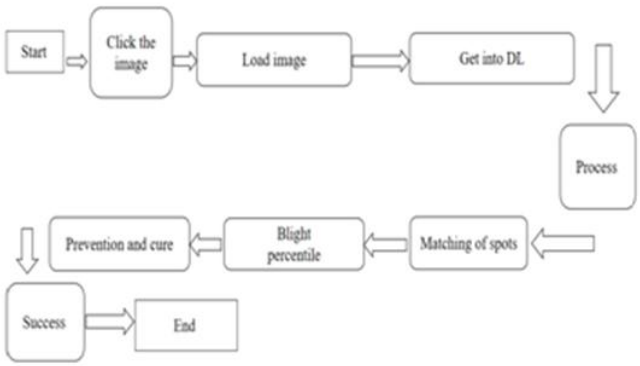

Figure 3: Flow chart

VI. SYSTEM DESIGN

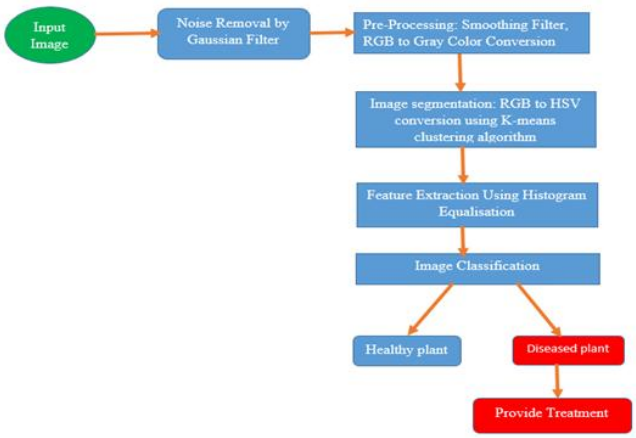

Figure 4: System design

VII. HARDWARE USED IN THE SYSTEM

Figure 5: Processor

A processor (CPU) is the logic circuitry which responds to and processes the basic instructions that run a computer. The CPU is seen as the main and most important integrated circuit (IC) chip in a computer, as it is responsible for interpreting and executing most of computers commands.

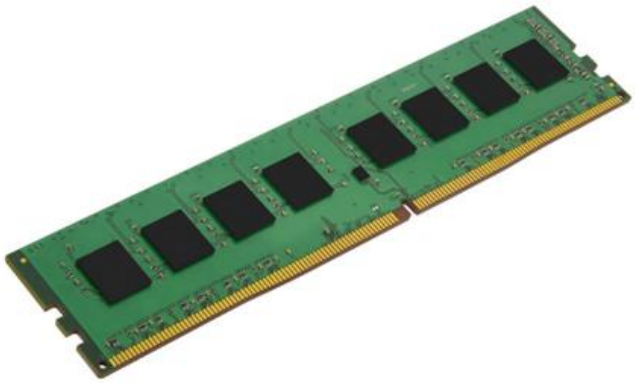

Figure 6: RAM

RAM stands for random-access memory. The computer RAM is essentially short term memory where data is stored as the processor needs it. This type of memory is volatile and the data is erased when system is turned off.

Figure 7: Hard Disk

A computer hard disk drive is a non-volatile storage device. Non-volatile means that even when the system is turned off, the data is not erased unlike in the case of RAM.

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VIII. COMPARATIVE STUDY

Table 3: Comparison of study

	Method Used	Advantage	Accuracy
Approach 1	K-Means Fuzzy C Means Hierarchical	Valuable Less Effort Accuracy	75.86 80.05 92.72
Approach 2	K-Means	Complexity Decreases	90.50
Approach 3	K-Means Support Vector Machines(SVM)	Normal & abnormal leaves are studied Confusion matrix is plotted	88.89

IX. CONCLUSION AND FUTURE SCOPE

There are number of ways by which we can detect disease of plants and suggest remedies for them. Each has some pros as well as limitations .On one hand visual analysis is least expensive and simple method, it is not as efficient and reliable. Image processing is a technique which is most spoken for very high accuracy and least time consumption is major advantages offered. The applications of K-means clustering and Neural Networks (NNs) have been formulated for clustering and classification of diseases that effect on plant leaves. Recognizing the disease accurately and efficiently is mainly the purpose of the proposed approach. The experimental results indicate that the proposed approach is a valuable approach, which can significantly support an accurate detection of leaf diseases in a little computational effort. Alongside the supply of cultivation tools, the farmers also need access to accurate information that they can use for efficient crop management and there is no better way than providing them a service that they can use through the software.

In future this project can be modified by adding few more things like:

- We can add more diseases to the datasets.
- Can enhance the level of security.
- We can add a description of the diseases with the cure.
- We can add a cloud-based storage system.
- Can be used as image recognition and used in integration with water irrigation.

Table 4: Lines of Code

Language	Lines of Code
Python	1600
XML	250
CSS	300
Total	2150

The above table depicts the breakdown of the lines of code in my project with respect to the language.

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