Leaf Diseases Detection and Classification Using Image Processing and Deep Learning Techniques

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Abstract

In India's economy, agriculture is essential. To avoid crop loss and future disease transmission that could endanger consumers, early detection of plant illnesses is crucial. Most plants, including apples, tomatoes, cherries, and grapes, have apparent disease symptoms on their leaves. It is possible to recognize these obvious patterns to accurately predict the disease and take preventive action to stop its spread. Deep learning and machine learning methods can be used to get around this. We therefore provide a technique for identifying plant diseases using photographs of their leaves. Support Vector Machine (SVM), Random Forest, and deep learning techniques are used in this instance to carry out the operation.

I. INTRODUCTION

I. Agriculture will always be the account the environmental repercussions that have become apparent in the environment's deterioration, the goal here is to increase production. Specifically indicating the quality and quantity of plants in the growth of agriculture, plant diseases are particularly important. Fungi, bacteria, viruses, mold, and other pathogens can cause illnesses in plants. Plant diseases are typically categorized by farmers or experts using visual examination. However, this method may be time-consuming, expensive, and unreliable. Deep learning algorithms are therefore more useful for the detection and categorization of plant diseases since they are more practical and produce reliable findings. Images of plant infection signs are used to identify plant diseases and to detect and classify plant. This can be done quickly and accurately using deep learning technology and computer image processing; studies also show that deep learning techniques are useful for classifying plant illnesses. To detect and diagnose plant illness, primary efforts have been made to improve the dependability, correctness, and accuracy of picture analysis.

A. The system avoids the process involved in gathering inputs for studying them in the laboratory, because of pre-existing images taken in place of the plant diseases. It examines the chances where a particular plant is concurrently simulated with higher than one pest or disease in the unchanged recorded input. The outlook deploy inputting of various images apprehended by various cameras with diverse resolutions, like mobile phone and the other available cameras devices. The project is systematically pact with different conditions related to illuminations, the size of actors in an image, and surrounding distinction, etc., holding across that plant's neighboring part. It imparts a feasible functioning approach that can maneuver in the domain by not using costly, complex, and compound technologiesMaintaining the Integrity of the Specifications

To boost the output and throughput, a wide range of people and technological organizations are active in agriculture. In the past, a variety of methods have been employed to address issues with disease spread in tomato plants. Technology advancements have made it easier and more accurate to identify diseases in tomato plants. In our system, a different method, the KNN algorithm, is applied to get the same results. The type of plant disease has recently been identified using a variety of ways. Some of these involve the analysis and study of chemical analysis methods to identify plant illnesses, as well as indirect methods including the use of physical techniques like imaging and leaf spectroscopy to learn about the characteristics of tomato plants.

II. LITERATURE REVIEW

Machine learning in detecting and classifying diseases of a plant leaf Identification of diseases is one of major area in agriculture which needs to be taken care of, though many practices have been done and implemented to cope up with this issue, rapid and quick identification of the diseases remains in state of inchoate. The use of machine learning in facilitating identification and detection helps counter this problem much more. Reviewing classification and detection

on plants using ML. The paper gives an elaborate view about the techniques which can be implemented for detecting and classifying the various plant leaf diseases caused by bacteria, viruses, and fungi. Based on their morphology i.e., their form, shape, or structure the diseases detected through classification are categorized. The techniques used in classification aids in automatic detection of the diseases of plant leaf.use of hard returns to only one return at the end of a paragraph.

A. Machine learning for jute plant stem disease identification.

B. In this study, the HSV, GLCM, and SVM algorithms are used to perform and begin the segmentation process, followed by feature extraction and classification, respectively, to detect stem plant diseases. It talks about converting RGB images to HSV and vice versa as well as removing noise [19].

C. employing papaya leaves for training and spotting problems in plant leaves.

D. Papaya leaves were used to train and conduct research on the detection and identification of plant problems. With approximately seventy percent accuracy, the random forest classifier was trained using images of leaves for categorization [20].

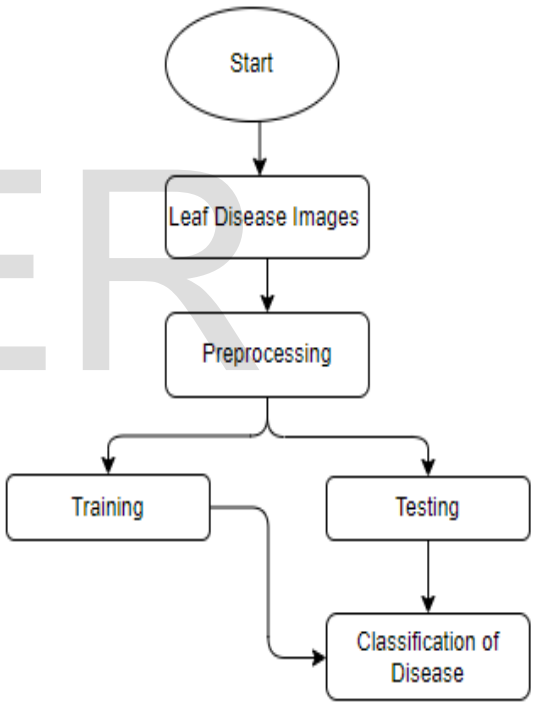
E. detection of apple leaf disease.

Equations

- utilising image processing to determine severity.
- To segment the lesion area and area of the leaf, simple threshold methods and triangle threshold methods are employed. Calculating the ratio of the leaf and lesion regions is how categorization is done.
- Many distinct types of these illnesses can affect the quantity, quality, and yield of a crop in plants like sugarcane. Knowing the severity of the diseases is crucial for timely application of the correct quantity of fertiliser, so preventing this.
- In our job, improvisation:
- We used a technology that monitors the plants and its leaves from the very beginning because we were aware of the hardships and efforts farmers endure, as well as how much time is spent cultivating a crop for one season. Segmentation
- Segmentation is an important and well-known aspect of image processing because it creates usable data sets from useless data by dividing the many components of the image into smaller, more manageable sections. Based on region, edge threshold, feature, and model, it can be categorised. Out of the projects mentioned above, ours deals with feature extraction, so segmentation on this basis is crucial to simplify the subsequent work. We discovered that the K-Mean algorithm, which is effective for feature extraction segmentation, is also one of the most widely used and simple to implement algorithms. So, we made the decision to accept it.
- Future trends and current
- The tomato plant is the second most widely grown and produced vegetable in the world. Moreover, it is impacted by about 200 illnesses. With a growth in the number of people, vegetable demand will only rise in the future.
- Identifying disease in tomato plants
- When compared to other plants like sugarcane, jute, papaya, cucumber, paddy, etc., tomato plant illnesses can be easily detected. With the development of technology, many novel techniques have been used to identify tomato illnesses, but most fall short in terms of rapid and early disease detection, which ultimately impacts crop productivity.
- Plant Pathology Research Advances.

F. System Design

shows how the system works and how the control moves from one cycle point to another. There, we'll talk about the hardware control flow of the system, from image capture to disease diagnosis and presentation



Mobile devices or digital cameras are used to take pictures of the diseased plant leaf. The process of image processing then begins after the image has been captured and transferred to the system.

This software system receives the final image as input. Our testing data, which will be used to assess the system's correctness, is comprised of this image.

Before being tested on our machine learning model, the image is first downsized, then recolored, and then modified to fit using a variety of methods. Testing can begin with this

image.

G. Proposed System

A variety of phases and algorithms come together in the digital image processing process in a controlled flow. The process that the photos go through to produce the final product is depicted in the flowchart below.

In this phase, the test image is processed to match the size, color, and quality of the images that make up our dataset. The image passes through several stages in this. These are the stages:

1. Image Resizing: Using MATLAB's "immersive ()" method, the image's dimensions are adjusted to match those of the training images. Image scaling is important because if all the training and test photos have different dimensions, the pixel values may change.

2. Smoothening: To create a smooth image, smoothing causes the pixel values to gradually balance out at all the image's points.

3. Noise filtering: Noise refers to the unwanted extras that are present in images and complicate the process of extracting and identifying features. Thus, the elimination or averaging of the pixel values that add noise to the image is part of the noise filtering process. "Median Filter" is the procedure employed in our system to assure noise elimination.

4. Figure Extraction

A technique for dimensionality reduction called feature extraction helps to represent the interesting portions of a picture in a small feature vector. When image sizes are huge and simplified feature representations are necessary for efficient image matching and retrieval, this approach proves to be quite helpful.

Convolution Neural Network (CNN) of deep learning together with machine learning techniques are being used in the purposed method to do the classification of either the Plant Leaf Disease detection. As techniques for detecting leaf disease based on image analysis. Therefore, accurate characterization of the Leaf illness is crucial, something that our suggested method will provide. Below is a block schematic of the suggested method.

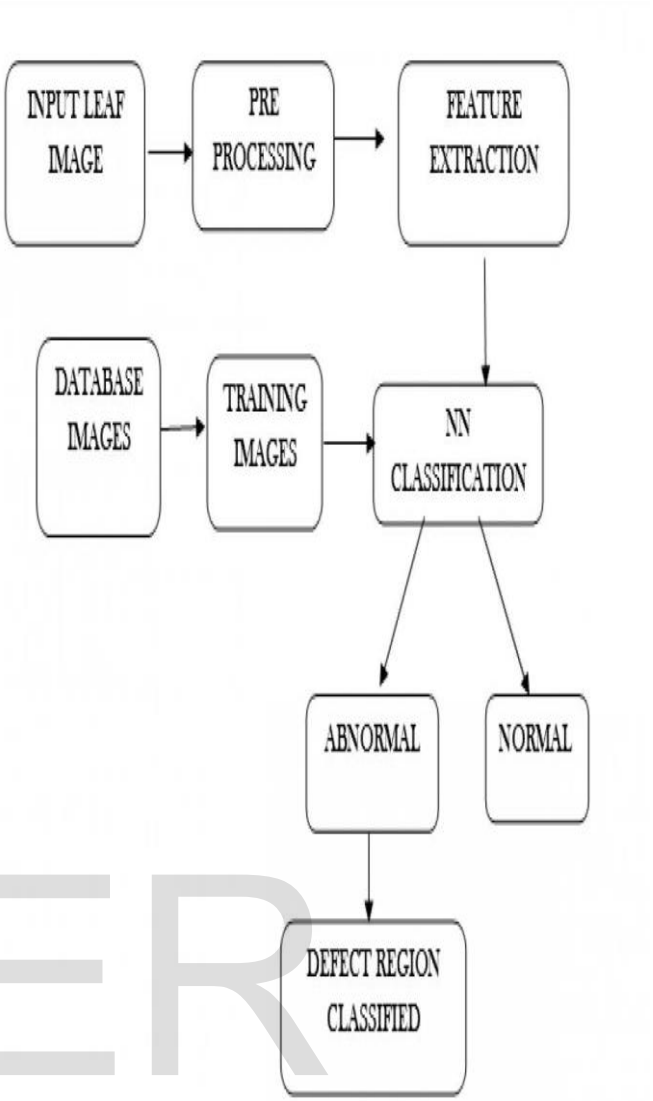
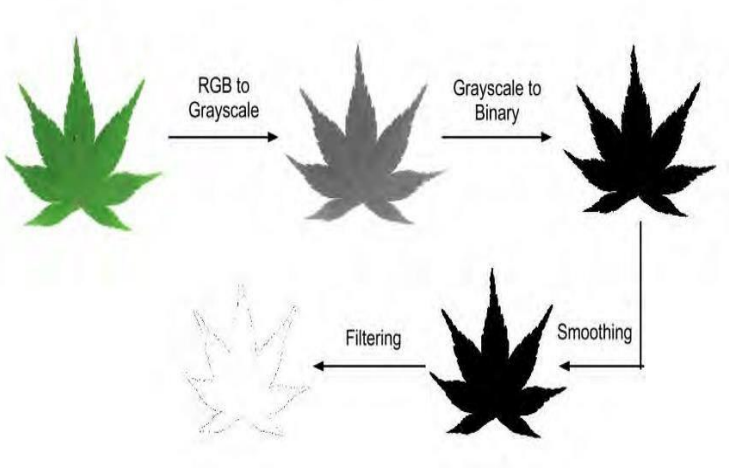


Fig 1 System Design

The training of the dataset and testing of the images against the learned model constitute the last stage of our image processing phase. This categorization model employs the KNN algorithm. The KNN algorithm, which can be used to solve both classification and regression issues, can be described as a supervised machine learning algorithm. This algorithm starts off with the presumption that items with a



higher degree of similarity exist nearby, or alternatively, that items with a high degree of similarity are adjacent to one another.

In the KNN algorithm, we first load the data and initialise K to the chosen number of neighbours, after which we calculate the distance between each example in the data and the query example from the available data. The obtained data is then arranged in ascending order of distance, from smallest to largest. Next, we select the first k entries from the arranged collection, and we take the labels of the chosen k entries.

Regression causes the method to return the mean, and classification causes it to return the mode value. Due because of this technique, the disease group to which each of our photographs belongs is determined. It is an extremely exact and efficient method which yields reliable results.

Classification

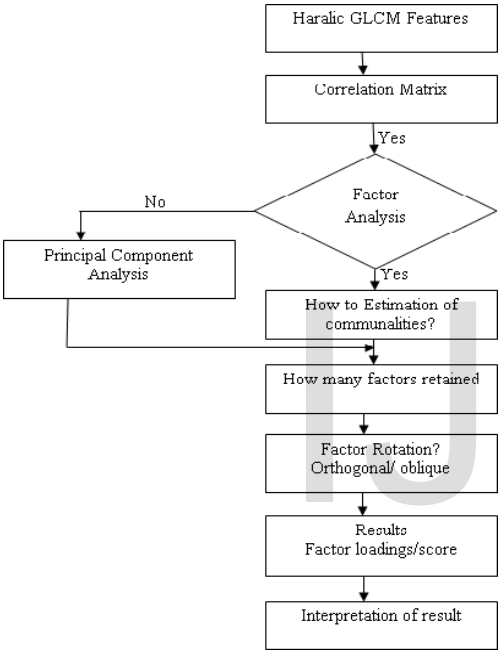


Fig 2. KNN Classification Algorithm

Conclusion

This research proposed a robust methodology to detect and classify these diseases with accurate and quick results based on computer resources and Deep Learning Methods. This is due to the significance of agriculture and plants in the entire world as well as in our country, Iraq, as well as the fact that there are numerous plant illnesses that exist today. We carried out this research to get the results using the CNN algorithm. We achieved high results above 98%, which enabled extremely quick and accurate identification of the disease kind and the plant type that hosts it through the leaf of that plant. Tobacco, potatoes, and peppers are three internationally renowned and crucial crops in our country, Iraq, that are among the fifteen groups of plant diseases. Put sponsor acknowledgments in the unnumbered footnote on the first page.

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