Smart Mobile Application for Pomegranate Disease Detection

Prof.M.D.Nirmal [1], Mrs.Bhalerao Samiksha [2], Mr.Bhavar Sudarshan [3], Mrs.Vikhe Harshada [4], Mr.Bramhane Vipul [5]

Department of Computer Engineering, PREC Loni, India

ABSTRACT

Pomegranates are a highly valuable fruit that grow in profusion in various Asian nations. However a variety of reasons cause the plants to become afflicted with several diseases that decimate the entire crop, resulting in catastrophically low product production. This research presents an image processing, supervised and unsupervised technique to healthiness detection and categorization of pomegranate leaf to address the challenges in phytopathology. The environment and diseases that are transferred by insects have an impact on the leaves. These conditions include rot, spot, and the blight bacterium, for instance. The suggested system uses various images for testing and training purposes. To isolate the leaf damage, a colour image must first be preprocessed using k-means clustering. The pre-processing procedure includes locating the Area of Interest (ROI), scaling, colour conversion, and filtering. The next step is to extract features and classify the data using supervised learning models like ResNet and MobileNet. The best-performing model is found using classification criteria.

Keywords - *Pomegranate, Images, Healthy, Disease SVM, CNN*

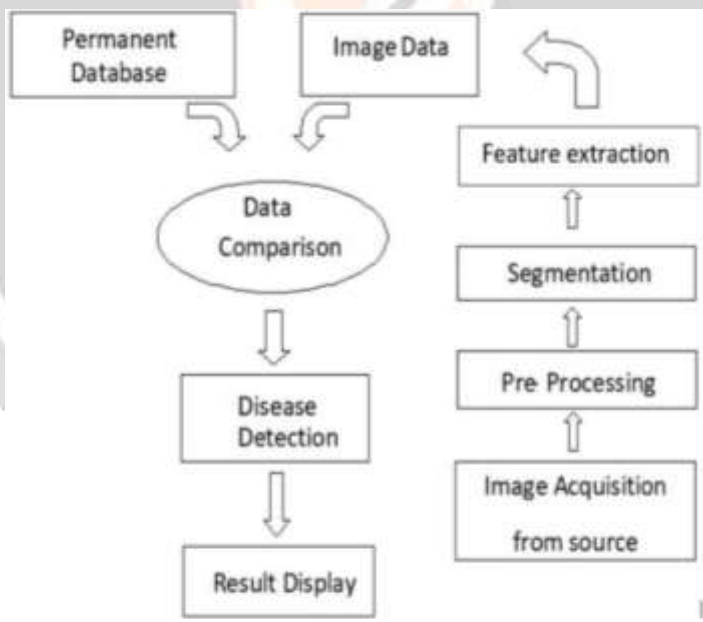
INTRODUCTION

Maintaining the safety of all nations' food supplies depends on agricultural production. Plant diseases, which are the primary cause of crop loss, are generally not well-understood by the majority of rural agricultural workers. Farmers don't become aware of the illness until it has progressed. Farmers who don't know how to treat plant illnesses typically rely on chemicals, which depletes the soil of nutrients and harms the ecosystem. In agriculture, the capacity to identify plant diseases is crucial. The definition and classification of plant diseases are aided by the ability to automatically recognise plant ailments. Several novel plant diseases were found. They pose a serious hazard to plant life and have a short half-life. If the diagnosis had been made sooner, perhaps things would have gone more smoothly. One common method for identifying the cause of plant illness is professional consultation. The tactic is effective, but at a high price. However, many nations lack professional teams; in those that have, farmers can encounter difficulty comprehending the expert counsel that is given to them. Farmers must invest a large amount of effort in crop monitoring, even with professional advice. A plant disease is challenging to spot just by looking at it. The efficiency of the strategy also depends on the knowledge of experts. Precision agriculture helps farmers obtain essential and reasonably priced information and control technologies as a result of advancements and exposure in numerous sectors. Increased revenue, standardised agricultural inputs, and diminished environmental effects are among the objectives [2]. Punica granatum, a type of pomegranate tree, thrives in dry and semiarid climates. Temperatures between 25 and 35 degrees and 500 to 800 millimetres [3] of annual rainfall are suitable for growth. Sickness has caused a recent decline in pomegranate harvests. The orchards have been destroyed by these horrible illnesses. The fruit sector is undoubtedly "high risk" in terms of business.

To obtain disease features from the surface of the leaf, namely those linked to the three most common tomato leaf illnesses, the study [5] uses tomato leaves as research objects. Deep Learning (DL) is used to retrieve these features. The network can categorise photos according to whether or not they fall under the disease category after being taught in an endless loop. For each of the three disorders, one thousand photographs were chosen, of which 900 were utilised for training and 100 for testing. They employ Resnet-50 as the primary network model in this investigation. The initial convolutional layer (Convl) of the model is now more capable of handling complicated problems thanks to the transition to Leaky-ReLU as the model's activation function and an increase in kernel size from 10 to 11. After the upgrade, the accuracy of the training and test sets both increased. In order to detect diseases affecting the banana plant, a convolutional neural network (CNN) was used to analyse RGB photos of banana leaves in the journal [6]. Three models were looked at for development: one without regularisation, one with dropout, and one with weight regularisation. Neural network (NN) training was accelerated by the Adam optimizer, and hyperparameters were adjusted through K-fold cross-validation. The performance of the NN was assessed using a variety of metrics. There are a total of 27 possible hyperparameter combinations for each model type, and the best one was selected. The results revealed that CNN performed better than the other models in forecasting illnesses in banana plants, despite the fact that there were fewer observations to take into account. The author [7] offers experimental support for the best cluster size, k, to locate sick leaf areas. The suggested method calls for the collection of photos, preliminary processing of those images, segmentation of those images, and then highlighting of the leaf damage. Otsu's thresholding method was used to transform the photos to grayscale and isolate them from their surroundings. The different parts of the test photos were divided using the K-means clustering technique. In order to locate the diseased leaves, a median filter was lastly applied to the clustered pictures. Also, the sample photos had the ill areas coloured differently. The study [8] proposed automatic infected area segmentation using a segmentation-based approach. The segmented region is used to categorise diseases and determine their severity. The suggested technique for identifying leaf illnesses includes preprocessing, segmentation, feature extraction, training, classification, and finally severity measurement from the sick zone. They evaluated the efficacy of several feature extraction techniques, including classification methods and those based on colour, texture, and form factors. Farmers are urged to adopt the suggested automated method due to tomato plants' outstanding performance in disease identification and severity evaluation. Work [9] created an automated system based on pre-processing, segmentation, feature retrieval, and disease diagnosis for spotting plant illness. The results of a literature review on the various research methods are also taken into account in this study. They outline the voting classifier and apply the Gray Level Co-Matrix method to classify the condition by looking at the symptoms of diseased leaves. This classifier incorporates traditional Machine Learning techniques to improve the accuracy of early disease diagnosis.

PROPOSED SYSTEM

The step involved in the following figure identification and classification of diseases using image processing.



The main goal of the proposed system is to create a tool for identifying illnesses in pomegranate fruit. The system's operation is divided into two phases: training and testing. During the training phase, a database made up of pictures of pomegranate fruits is built. It will keep all the necessary data on the illnesses. The algorithm is tested during the testing step by using a large number of photos as input.

Image Acquisition: If the image has already been taken, selecting it from the gallery is another option for capturing the infected area of the picture using a camera and an application.

The image that was captured is typically in RGB format. When taking the picture, the farmers received instructions. The diseased portion of the fruit and a specific distance should be the focus. Pre-processing involves the image's scaling and colour transformation.

Pre-processing: To speed up computation and improve the algorithm's effectiveness, the input image will be scaled to 500x500 pixels in Pre-processing. The pre-processed image is utilised for further processing to extract the region of interest (ROI) from the input image after noise, shadow, and illumination effects were removed in this procedure.

Segmentation: Segmentation is nothing more than dividing a picture into segments with comparable characteristics, and by doing this, the ROI that is required for the application's additional processing can be extracted.

The system for detecting plant diseases in pomegranates has been discussed in this paper. The ROI from the image was extracted using Grabcut segmentation to improve the algorithm's effectiveness and accuracy. Various forms of segmentation employ regions, edges, and thresholds.

Grabcut: It is 2D segmentation technique for input images. It's a type of graph segmentation, which is a iterative segmentation technique. In path trimming, the image is treated as a path and segmented using the image's histogram. There is a starting point for the foreground and pixels for the background, and all adjacent pixels are away from the source material to see if a pixel belongs to any of the regions. Then the image is divided into two parts, namely the foreground and the background.By comparing the pixels, we get the final result divided into segments. Labeling is done by minimizing the energy function.

In grabcut segmentation, an imaginary rectangle is drawn around the object. The user must specify the approximate boundaries of the rectangle around the object to be extracted. pixels outside the rectangle are considered background pixels and pixels inside the rectangle are considered foreground pixels. The Gaussian Mixture Model (GMM) is used to identify all pixel data, regardless of whether belongs to the foreground or background. GMM creates K components for both regions, so in the image contains 2K components.The pixels outside the rectangle are zero-masked. Each pixel within the rectangle was compared to the pixel background and foreground components if they are equal to the background, i.e. H. a = 0, it is masked to zero. if not meVolume. α=1. is kept unchanged.

Feature Extraction: Extraction plays an important role in disease detection. The edges and color spaces of are used as a feature to identify the disease. Color Spaces: In a common color space, colors are represented as blue, green, and red (BGR) values. In other words, BGR denotes a color as a three-component tuple of . For an 8-bit image, each component can take on values ranging from 0 to 255, where black is represented by (0, 0, 0) and white is represented by (255, 255, 255).This method is mainly used to identify diseases in which a specific part of the fruit is affected, and the color of the affected part can be distinguished from the color of the fruit. In the affected part, an area of BGR pixels is found and a cutoff of is set. Pixels that have BGR values out of bounds are masked and then the affected part is extracted into the cutoff and used for further processing.

Edge Detection: An edge is the main feature of the target in the frame. It shows a sudden change in signal strength. The higher the quality of the edge map, the more auxiliary information can be used for further processing in the steps Among many edge detection operators, the Canny Edge is recognized as one of the most effective operators because it is insensitive to noise, has a high SNR -Value and good localization.

Canny Edge Detection Algorithm: The canny operator generates information from two aspects: the strength and direction of the edge gradient with good signal-to-noise ratio (SNR) and the position of the edges. It has a very good performance with the multi-stage algorithm, since each step refines the result. This is a three process algorithm

1.Noise removal by Gaussian filter
2. Computing amplitude and direction of the gradient
3. Non maxima suppression for gradient magnitude

After the edge detection of the infected fruit was completed, an image was identified by the number of white pixels on the edge of , which is used to classify pomegranate diseases. If the number of pixels is less than 500, then the infected fruit is classified as Pomegranate moth infection identified, and if it is more than 500 and less than 4000, the picture is considered Cercospora, and if it is more than 4000, then disease ends bacterial plague. This is how the pomegranate is classified based on its information and infected fruit.

Compare data and visualize results: After disease detections, farmers are informed of solutions and preventive measures to defeat the infection at an early stage. When the infection reaches a higher CBR value, they receive information about the appropriate pesticides and herbicides to control the infection from . This helps farmers to prevent future crop infections and cure the current infection. In this way, farmers with higher yields want to increase their productivity.

RESULT ANALYSIS

The processed image information of the infected fruit is used for disease classification and identification of pomegranate . Disease classification follows the criteria listed in Table 1. Image classification is based only on the number of edges. Figure 2 of the article is the input image and itself is used for segmentation. 3 shows a sliced image, and edge information of the sliced image is obtained.Figure 4 shows an image of the detected edge. Based on advanced information, diseases are classified. After the classification information on preventive measures to overcome the infection and solutions for farmers when the infection is at an early stage. When infection reaches severe levels, pesticide and herbicide information is provided to prevent farmers from infecting remaining or subsequent crops on crops.

The research is launched using the Mendeley data. The data is prepared for unsupervised and supervised learning approaches by processing it. In this part, the supervised algorithm's output is described in depth.

CONCLUSION

The algorithm was designed to detect the three pomegranate diseases, namely bacterial downy mildew, European corn borer and Cercospora. Depending on the disease detected, preventive measures are taken. The accuracy of disease detection was determined to be 85%. This can be further improved by using advanced image enhancement methods. Edge detection can be further improved in frames corrupted by various types of noise. In addition, can provide better accuracy using deep learning methods to train the algorithm with frames.Overall, this method of detecting plant diseases using image processing can be performed in less time and at a lower cost than manual methods in which experts examine plants for diseases. In addition, this algorithm can be modified and applied to other crops 1087 that are highly susceptible to disease. For farmers, you can build an Android platform where they can take and upload a picture and instantly learn about the disease and interact with other farmers and experts to find better solutions.

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