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Survey Paper on Detection of Unhealthy Region of Plant Leaves Using Image Processing and Soft Computing Techniques

Namita M. Butale[1*], Dattatraya.V.Kodavade[2].

[1]Department of Computer Science, DKTE Society's Textile & Engineering Institute, Ichalkaranji, India
[2]Department of Computer Science, DKTE Society's Textile & Engineering Institute, Ichalkaranji, India

e-mail: namitabutale@gmail.com,dvkodavade@gmail.com

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Abstract: - This paper provides a survey on plant leaf disease detection technique by using image processing. Plants play a vital role in a humans life; they fulfil our daily needs from food to breathing, We must take care of plants. India is an agricultural country, and about 70% of people depend on agriculture. Plant disease detection is an emerging field in India as agriculture is an important sector that affects the economy and social life, so leaf disease detection is a significant research topic. Fungi, bacteria, and viruses cause most of the diseases on plants. Due to the diseases on the plant the quality and quantity of agriculture product are reduced. To detect the disease on plants, there is a need of experts, but it is the very costly procedure and time-consuming too. To reduce the cost and for the better results, we are using the automation techniques, which will be very helpful in detecting the disease at early stage. The paper discusses an automatic disease detection technique using soft computing.

Keywords: Image Processing, Image segmentation, Genetic algorithm, Feature Extraction, Disease classification.

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1. Introduction

Indian economy is highly dependent on agricultural productivity. Therefore, in the agriculture field, detection of plants disease plays the main role. If proper care of plants is not taken then it causes severe effects on plants and due to which several product quality, quantity or productivity is affected. The unhealthy region of plant leaves is the area on the blade which is affected by the disease, which will reduce the quality of the plant. The automatic disease detection technique is beneficial at the initial stage for detecting disease. The existing method for disease detection in plants is naked eye observation by experts. For doing this massive team of experts and constant monitoring of plant is required, which costs very high for large farms. In some countries, farmers don't have proper facilities or even the idea that they can contact experts.

Due to which consulting experts even cost high, and it is time-consuming too. In such conditions, the suggested method is beneficial for monitoring large fields of crops. Automatically detecting diseases by just looking at the symptoms on leaves makes it easier and cost effective. This provides support for machine vision to give image-based automatic process control, inspection and robot guidance. Detection of plant disease by the visual way is challenging as well as less accurate. Whereas If Automatic disease detection is used then it will give more accurate results, within less time and fewer efforts.

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Some general diseases are yellow and brown colour spots, early and late scorch and others are viral, bacterial and fungal diseases. Image processing is a technique which is used for calculating the infected area of, and also it determines the colour difference of the infected area. Image segmentation is the process of separating or grouping image into different parts.

Image segmentation can be done in various manners ranging from simple threshold method to advanced colour image segmentation method. This corresponds to something that the human eye can easily separate and view as an individual object. Computers are not able to recognise the objects; several techniques are developed for image segmentation [1]. The image segmentation process is depending on various features found in the image. These are a segment of image, colour and boundaries information. A genetic algorithm is used for segmenting colour image.

2. Related Work

The author H. Al-Hiary& et al. [2], describes the three methods of leaf disease detection:

1) To identify the affected part of the leaf by using K-means Clustering. 2) To solve the affected part of the leaf by using colour co-occurrence methodology for texture analysis. 3) To find and classify the type of disease by Neural Networks (NN's). The first step is acquiring RGB images of leaves and applying for colour transformation structure. After that image segmentation is done by using K-means clustering. Masking and unmasking techniques are applied on green coloured pixels on a leaf. For thresholding, Otsu's method is used. The RGB images set the zero value for converting colour co-occurrence technique. After that infected cluster was converted into Hue Saturation Value (HSV).SGDM matrix is used for texture analysis. Finally, the process executed the solution by Neural Networks.

Mrunalini R et al. [3], presents the technique to classify and identify the different disease through which plants are affected. A Machine learning based recognition system will prove to be very helpful. It saves human efforts, money and time too. Feature Extraction is done by using Color Co-occurrence method. Neural networks are used for automatic disease detection. The approach proposed can significantly support an accurate detection of leaf, and seems to be an important approach, in case of steam, and root diseases, putting fewer efforts in computation.

Author Piyush Chaudhary et al. [4], describe an algorithm for disease spot segmentation in plant leaf using an image processing technique. In this paper, the process of disease spot detection is done by comparing the effect of HSI, CIELAB, and YCbCr color space. For Image soothing Median filter is used. In the final step, by applying Otsu method on a colour component, calculation of threshold can be done to find the diseased spot. There is some noise because of the background which is shown in the experimental result, camera flash and vein. For noise removal CIELAB colour model is used.

SmitaNaikwadi et al. [5], proposed plant disease detection using histogram matching. The main steps for disease detection of the leaf are Image acquisition,image-processing, Image Segmentation, Feature Extraction and Statistical Analysis. First, the RGB image is converted to HSI. Then masking of the green pixels and removing of masked green pixels is done. Otsu's method is used for masking. If the green component of pixel intensities is less than the pre-computed threshold value, the red, green and blue components of this pixel are assigned to a value of zero. In feature extraction colour and texture,, features have extracted using Color-Co-Occurrence methodology. The clustering technique used is K-means clustering. It is hard to predict K-Value. K-means does not work well with global clusters. Also, it did not work well with different size and different density clusters.

Khirade et al. [6], has discussed some segmentation and feature extraction algorithm that can be used for the disease detection on the plant by using the image of their leaves. It is tough to detect the plant diseases manually due to the requirement of excessive time, knowledge of plant diseases and much amount of work. The author has divided the entire process of plant leaf diseases detection into five steps: Image acquisition, Pre-processing, Image Segmentation, Feature extraction and Final classification of diseases. In image acquisition, the transformation structure is used for RGB leaf image. Then the image is pre-processed to remove the noise and enhance the image contrast. Segmentation is done for the partitioning of an image into various feature parts using k-means clustering, Otsu filters etc. The feature extraction is performed on the segmented image, and the classification is done by using different classification techniques. In this manner, plant diseases can be efficiently detected.

Prakash M. Mainkar et.al [7], proposed the plant disease recognition technique, in which the first step is to create a colour transformation structure for the RGB leaf image.Then RGB colour values are converted to the space specified in that structure. The colour space transformation is applied. K-means technique is used for image segmentation. In the second phase called as Masking of green pixels, the unnecessary part such as the green area within the leaf area is removed. In third phase, texture features for the segmented object are calculated and

unmasking is done by removing the masked cells inside the boundaries of the infected cluster. Infected cluster is converted from RGB to HSI. For H and S SGDM matrix is generated. In the fourth phase, GLCM function is used to calculate the features and compute the texture statistics. Finally, the extracted features are passed through a pre-trained neural network for disease recognition.

Vijay Singh,A.K.Mishra et al. [8], proposed plant leaf disease detection using a genetic algorithm. Genetic Algorithm (GA) is an optimisation algorithm. The algorithm starts with a population that is set of solutions. From one population solutions are selected and the new community is created. This is done with the expectation that the new community will be enhanced than the old one. According to the fitness, offsprings are selected. The convenient solution has more probability to reproduce. The classifier used in this is Support Vector Machine (SVM).SVM is a very potent method to solve classification problems.

3. Proposed Work

Fig no.1 shows system architecture of proposed plant leaf disease detection system. Image acquisition is the very first step which depends on a hardware device. Digital camera or similar devices are used to capture images of leaf. Also, the images from datasets are used as input to the system to identify an infected area of the leaf.

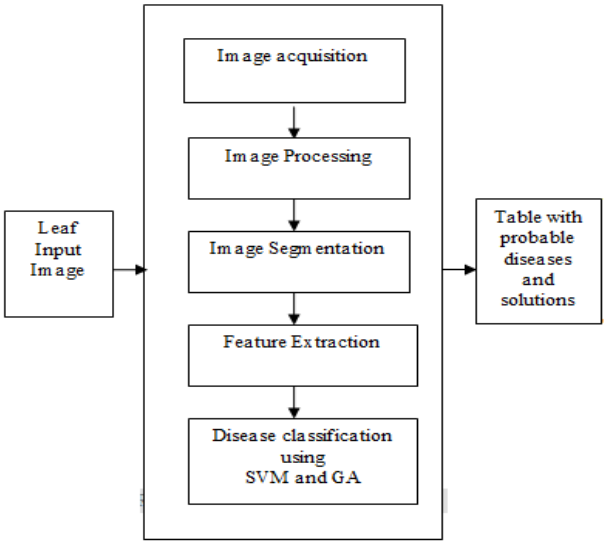

Fig1. System Architecture

In the second step image pre-processing, the aim of image pre-processing is an improvement of image quality. Different model pre-processing techniques are applied to the input image; image pre-processing methods are consist of image smoothing, image clipping, Image Enhancement. Smoothing of the image is done to reduce the noise from the image. The smoothing filter is used for image smoothing, image enhancement is the modification of an model by changing the pixel brightness values to improve the visual appearance of imaging. To get the interested region of leaf image for processing clipping of image is done. The next step is Image segmentation. It is the process of subdividing the image to get useful segments. There are several image segmentation methods available such as Edge based, Region-based, Clustering-based and Split/merge approaches. In this proposed work Image segmentation is done using Genetic Algorithm. A genetic algorithm is an optimisation technique. The genetic algorithm includes steps such as in the first step initialisation of population is done, in the second step selection is achieved which is an important procedure in the algorithm where the chromosome is selected from the population based on the fitness function. The next step is a crossover operation in which swapping between the chromosomes is done. There are different crossover methods available such as one point crossover, two-point crossover, intelligent crossover and uniform crossover. The next step is a mutation. In particular mutation gene from chromosome is altered to increase the fitness of chromosome, the chromosome is made up of genes. By following these steps, the Genetic algorithm performs segmentation. When segmentation is done feature extraction is the next step to obtain the features. Feature extraction is the process of extracting high level features from the image for classification. Feature extraction plays essential role in pattern reorganisation and image processing. Highlights are the properties of representation that are unique. Feature selection is the most important factor in feature extraction.In this proposed system feature extraction is done using color co-occurrence method. In the phase of classification extraction and comparisons of co-occurrence features like shape, clolor and texture are done using Support Vector Machine. The output produced by the system is table consist of the name of the detected leaf diseases and solution or remedy for the detected disease.

4. Conclusion

This paper gives the survey on plant leaf disease detection and classification techniques using image processing. In this paper Image processing methods along with soft computing, techniques are discussed to identify disease on plants leaves in an early stage and to take preventive measures.

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Authors Profile

Namita M. Butale has completed Bachelor of Engineering in Computer Sc. & Engineering in year 2017, She is currently pursuing Master of Technology in Computer Sc. & Engineering at DKTE Society's Textile & Engineering Institute, Ichalkaranji. MS. India.Her research area is AI & Machine learning, Computer Vision.

Prof Dr. D. V. Kodavade , Professor of Computer Science & Engineering, at DKTE Society's Textile & Engineering Institute, Ichalkaranji ,India. He is a member of Board of Studies in Computer Sc. & Engineering at Shivaji Unviersity, Kolhapur, MS. India. He is member of ISTE, CSI, ACM, USA. His area of research includes AI, Deep Learning, IoT, High Performance Computing, Parallel Programming.

