

Plant Leaf Healthcare System Using Fuzzy Based Algorithm

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Abstract— Agriculture is a critical field on which Indian economy highly depends. This is the reason why disease detection in plants plays a vital role in this field, as having disease in plants is quite natural. Many of the farmers are unable to recognize new disease at an early stage. If proper care is not taken then it results in serious effects on plants, due to which product quality and productivity are affected. Detection of plant diseases through some automatic technique is beneficial as it detects the symptoms of diseases at early stage. This paper presents an algorithm for image segmentation technique which is used for automatic detection of plant leaf diseases and describes how the proposed system work on plant leaves which are affected by making use of image processing to detect diseases. Segmentation of the input image is a necessary aspect for disease detection. It is achieved through fuzzy logic for detection of plant disease. A test image is taken and compared with database image and then using Artificial Neural Network (ANN), dissimilarity is calculated with extracted parameters which are extracted using the Grey Level Co-occurrence Matrix (GLCM) method. In case of disease being detected the corresponding person is alerted via message using GSM module.

Key words: Image Processing, Segmentation, Fuzzy Logic Algorithm, GLCM, ANN

I. INTRODUCTION

Most of the Indian population depends on agriculture. The cultivation can be improved by support from the technology side. At any environmental condition, mostly diseases are caused by pathogens in plants. Probably diseases are seen on the leaves, therefore leaf disease detection process must be considered for the good of farmers. These diseases may be caused by various microorganisms, bacteria, fungi, viruses, etc. Sometimes unhealthy environment is also responsible for diseases in plants. There are many methods to detect the different types of diseases in leaves in the early stages itself. The most conventional method for disease detection is naked eye observation and it is not much effective for large crops. Using image processing, the disease detection in plants will be efficient, less time consuming and accurate. This technique saves time, efforts, labors and use of pesticides. This paper defines the technique to detect leaf diseases, in which various algorithms such as Fuzzy logic (used for segmentation), GLCM (used for feature extraction) and ANN (used for classification) are involved. The image is also pre processed before undergoing all these steps.

II. PROBLEM DEFINITION

Due to industrialization and globalization concepts the agriculture field is facing hurdles. On top of that the awareness and the necessity of the cultivation need to be instilled in the minds farmers. Now a day's technology plays vital role in all the fields but till today people are using some

old methodologies in agriculture. Identifying plant disease wrongly leads to huge loss of yield, time, money and quality of product. Identifying the condition of plant plays an important role for successful cultivation. In olden days leave disease is detected manually by the experienced people but nowadays due to lot of environmental changes the older way of prediction is tough. So a leaf disease detection system is necessary.

III. PROPOSED SYSTEM

The proposed system involves image processing techniques such as, pre-processing, segmentation, feature extraction, classification which is used for detection of plant leaf diseases. Image segmentation, the very first step in input image analysis is done using fuzzy based algorithm for detection of leaf diseases. From the segmented image the features are extracted using the GLCM method (Feature Extraction). A test image is taken and compared with database image and then dissimilarity is calculated with extracted parameters using ANN. In case of disease being detected the corresponding person is alerted via a SMS using the Arduino and the GSM (Global System for Mobile communication) module.

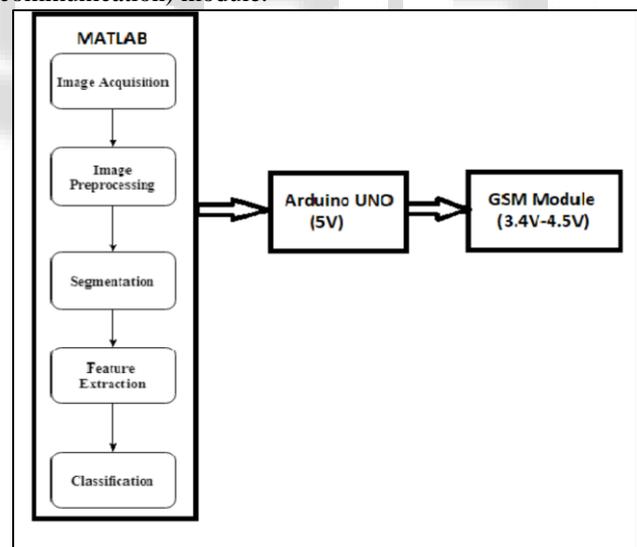


Fig. 1: Proposed System

IV. METHODOLOGY

The proposed methodology involves the following modules which are performed through MATLAB and Arduino.

A. Image Acquisition

Image Acquisition is a process of getting an input image for the process of automatic detection of leaf disease. Image acquisition is the very first step that requires capturing an image with the help of a digital camera. The captured image is then compared to the trained image in MATLAB. It is the first step of any image processing based system.

B. Image Pre-processing

As the images are acquired from the real field it may contain dust, spores and water spots as noise. The purpose of data preprocessing is to eliminate the noise in the image, so as to adjust the pixel values. It enhances the quality of the image.

C. Image Segmentation using Fuzzy with PSO

Image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics. The result of segmentation of the input image is a set of segments that collectively form the entire image, or a set of contours extracted from the image (see edge detection). Each and every pixel in a region are similar with respect to certain characteristics, such as color, intensity, or texture. The proposed system uses Fuzzy Particle Swarm Optimization (FPSO) algorithm for image segmentation.

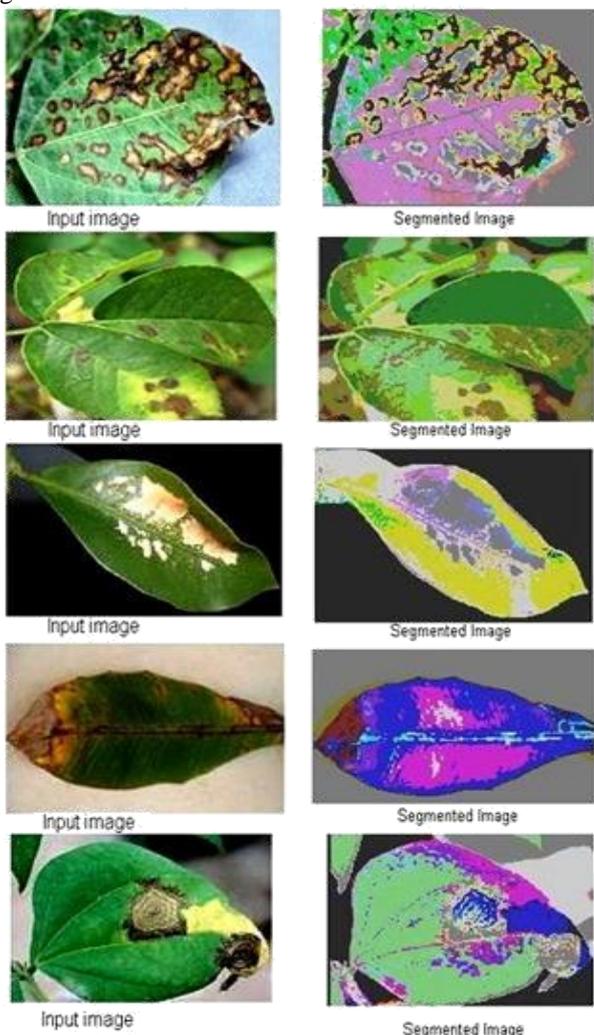


Fig. 2: Segmentation of input leaves

D. Feature Extraction using GLCM method

Feature Extraction is a key function in various image processing applications. These features can be extracted in several ways. The most common way is using a Gray Level Co occurrence Matrix (GLCM). It is a tabulation of how different combinations of pixel brightness values occur in an image. GLCM contains the information about the positions of pixels having similar gray level values as input.

E. Classification using ANN

Image classification analyzes the numerical properties of various image features and organizes data into categories. Classification algorithms involve two phases of processing: training and testing. In the initial or training phase, characteristics of a typical image features are isolated and, based on these features, a unique description for each and every classification category, i.e. training class, is created. Testing phase makes use of these feature space partitions to classify input image features. Artificial neural networks (ANN) or connectionist systems are computing systems which are based on the biological neural networks. It is an information processing paradigm which is used to study the behavior of a complex system by computer simulation.

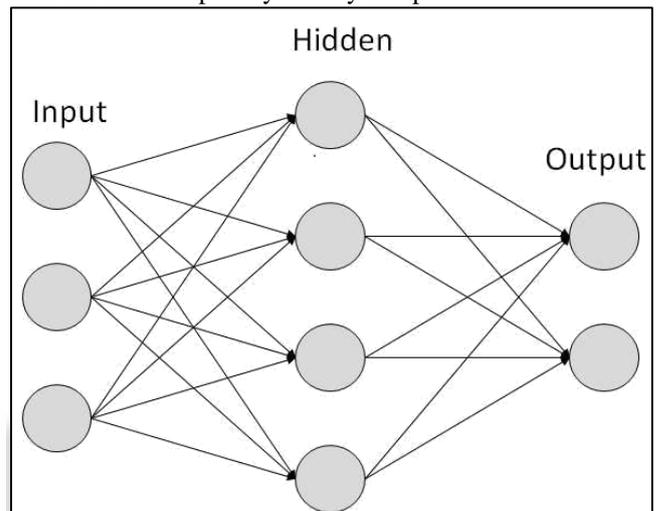


Fig. 3: A Simple ANN

F. Communication using GSM

In the proposed system, SMS application is used which is intended for farmers. When the presence of any disease in leaves is detected, the alert messages through GSM are sent to the corresponding farmer. The code has been computed successfully. It is user friendly, and had required options, which can be utilized by the user to perform the desired operations. The code need to be dumped in the Arduino IDE software.

V. CONCLUSIONS

This paper summarizes the proposed system involving image processing used for identification of leaf diseases. The leaf diseases are identified using Fuzzy with PSO and ANN. This approach plays a vital role in accurate detection of leaf disease. Also the presence of any harmful disease is intimated to the farmer using Arduino and GSM module. By computing type of disease present in the leaf, we can use sufficient amount of pesticides to effectively control the pests in turn the crop yield will be increased. This approach can be further developed by using different algorithms for segmentation, classification. The classification results may be integrated to cloud for further references or for some sort of study purpose. To improve recognition rate in classification process, Bayes Classifier, and hybrid algorithms can also be used.

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