Classification And Detection Of Diseases In Plant Leaf Using K-means Segmentation And Clustering

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Abstract - **The analysis of the plant diseases may involve the detection of the abnormalities introduced in the plant leaves.The conventional methodology of naked-eye observation is an inefficient way of identifying the diseases in crops on a large basis. An artificial intelligence technique has been implemented by using k-means clustering (segmentation). This work focuses the detection and recognition of leaf diseases.K means clustering is used for segmentation of images. This method provides a solution to the early recognition of diseases. By using this method we can automatically identify the leaf diseases at initial stages.**

keywords - **K-meansclustering, Image acquisition, leaf detection**

I. INTRODUCTION

An image is nothing more than a two dimensional signal. It is defined by the mathematical function f(x,y) where x and y are the two co-ordinates horizontally and vertically. Since capturing an image from a camera is a physical process. The sunlight is used as a source of energy. A sensor array is used for the acquisition of the image[1]. So when the sunlight falls upon the object, then the amount of light reflected by that object is sensed by the sensors, and a continuous voltage signal is generated by the amount of sensed data. In order to create a digital image , we need to convert this data into a digital form. This involves sampling and quantization. The result of sampling and quantization results in an two dimensional array or matrix of numbers which are nothing but a digital image.

Research work develops the advance computing system to identify the diseases using infected images of various leaf spots. Images are captured by digital camera mobile and processed using image growing, then the part of the leaf sport has been used for the classification purpose of the train and test. The technique evolved into the system is both Image processing techniques and advance computing techniques.Agriculture is one of the largest sectors of our Indian economy, in terms of generating employment as well as for the provision for the food for the ever increasing population. Even though the contribution of agriculture to the GDP is vividly vast, it suffers from serious problems out of which the frequent failure of the crops is the one of the biggest problems and therefore is of utmost importance. The green plants provide most of the world's molecular oxygen and are the basis of most of the
earth's ecological systems. As diseases of the plants are inevitable, detecting diseases in plants assumes importance. The disease in plant may be due to biotic (fungi, bacteria, viruses/viroids, nematodes) or abiotic reasons (temperature, moisture, nutrition, toxicity, cultural). Plant diseases vary in how much trouble they cause, depending on a variety of conditions, including the susceptibility of the plant and the organism's disease cycle.Mostly diseases are seen on the leaves or stems of the plant. Precise quantification of these visually observed diseases, pests, traits has not studied yet because of the complexity of visual patterns[3]. Hence there has been increasing demand for more specific and sophisticated image pattern understanding.Most leaf diseases are caused by fungi, bacteria and viruses. Fungi are identified primarily from their morphology, with emphasis placed on their reproductive structures. Bacteria are considered more primitive than fungi and generally have simpler life cycles. With few exceptions, bacteria exist as single cells and increase in numbers by dividing into two cells during a process called binary fission viruses are extremely tiny particles consisting of protein and genetic material with no associated protein. The analysis of the plant diseases may involve the detection of the abnormalities introduced in the plant leaves, which may or may not be visible to the naked eyes[2]. With the layman's idea of the problems in plants, one cannot proceed with any random solution in the form of any pesticide or fertilizer, unless there's a sheer and accurate understanding of the disease spots and proper pattern recognition which otherwise would lead to a catastrophic situation where besides the loss of the money, the plant will remain untreated and the diseases will also get more time to spread. In order to combat this situation effectively, an artificial intelligence technique has been employed in this paper using k-means clustering (segmentation). The work begins with image acquisition, image enhancement and restoration, and information extraction from images for further computer analysis[4].

II. IMPLEMENTATION METHODS

Classification of Cotton Leaf Spot Diseases Using Image Processing Edge Detection Techniques:

This paper consists of two phases to identify the affected part of the disease. Initially Edge detection based Image segmentation is done, and finally image analysis and classification of diseases is performed using our proposed Homogeneous Pixel Counting Technique for Cotton Diseases Detection (HPCCDD) Algorithm.

Fast and Accurate Detection and Classification of Plant Diseases:

In this paper detection of leaf diseases has been used method is threefold:
1) Identifying the infected object based upon k-means clustering;
2) Extracting the features set of the infected objects using color co-occurrence methodology for texture analysis;
3) Detecting and classifying the type of disease using NNs, moreover, the presented scheme classifies the plant leaves into infected and not-infected classes[6].

Color Transform Based Approach for Disease Spot Detection on Plant Leaf :
In this paper a comparison of the effect of CIELAB, HSI and YCbCr color space in the process of disease spot detection is done. Median filter is used for image smoothing. Finally threshold can be calculated by applying Otsu method on color component to detect the disease spot. In Method 1: disease sports are segmented by applying Otsu threshold on RGB image. In Method 2: RGB image is first converted into YCbCr color space using color transform formula[8]. Then median filter is used for image smoothing.

Detection of unhealthy region of plant leaves and classification of plant leaf diseases using texture features :
In this paper four main steps are first a color transformation structure for the input RGB image is created, and then the green pixels are masked and removed using specific threshold value followed by segmentation process, computing the texture features using color co-occurrence method for the useful segments, finally the extracted feature are passed through the classifier.

Grading Method of Leaf Spot Disease Based on Image Processing :
The process of image segmentation was analyzed and leaf region was segmented by using Otsu method. In the HSI color system, H component was chosen to segment disease spot to reduce the disturbance of illumination changes and the vein. Then disease spot regions were segmented by using Sobel operator to examine disease spot edges. Finally plant diseases are graded by calculating the quotient of disease spot and leaf areas.

A semi-automatic method for the discrimination of diseased regions in detached leaf images using fuzzy c-means clustering :
This paper describes the segmentation consist in image conversion to HSV color space and fuzzy c-means clustering in hue-saturation space to distinguish several pixel classes. These classes are then merged at the interactive stage into two final classes, where one of them determines the searched diseased areas[10].

III. PROPOSED SYSTEM

Automatic detection of diseases in the plant leaves is an evolutionary and important topic of research as it may be helpful for proper monitoring of large fields with precision, which wasn't possible with the conventional techniques employed by farmers so far[14]. The proposed methodology can be briefed into the form of following points:

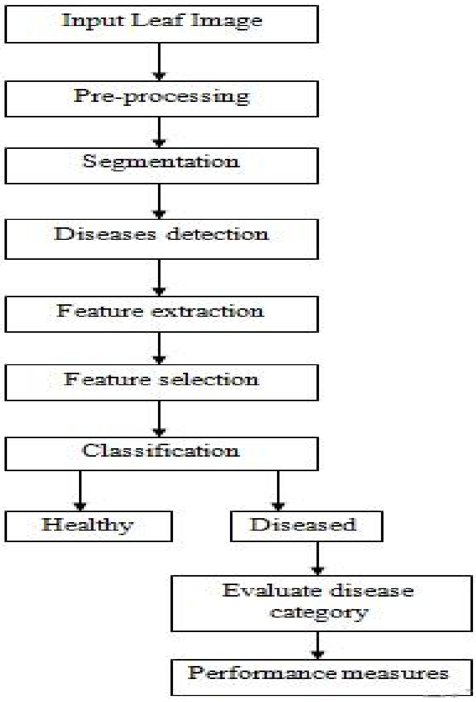

Fig 3.1: Proposed System

IMAGE ACQUISITION: Image Acquisition is defined as the action of retrieving an image from some source, usually a hardware-based source for processing[12]. The aim of pre-processing is an improvement of the image data that suppresses unwilling distortions or enhances some image features important for further processing. Image segmentation is the process of dividing an image into multiple parts. Feature extraction a type of dimensionality reduction that efficiently represents interesting parts of an image as a compact feature vector. Feature Selection is the process where you automatically or manually select those features which contribute most to your prediction variable. It is the first step in the workflow sequence because, without an image, no processing is possible.

IMAGE PREPROCESSING:

Pre-processing is a common name for operations with images at the lowest level of abstraction - both input and output are intensity images. These iconic images are of the same kind as the original data captured by the sensor, with an intensity image usually represented by a matrix of image function values (brightness's)[15]. The aim of pre-processing is an improvement of the image data that suppresses unwilling distortions or enhances some image features important for further processing, although geometric transformations of images (e.g. rotation, scaling, and translation) are classified among pre-processing methods here since similar techniques are used.

IMAGE ENHANCEMENT:

Image enhancement is the process of digitally manipulating a stored image using software. The tools used for image enhancement include many different kinds of software such as filters, image editors and other tools for changing various properties of an entire image or parts of an image[13].Some of the most basic types of image enhancement tools simply change the contrast or brightness of an image or manipulate the gray scale or the red-green-blue color patterns of an image.

IMAGE SEGMENTATION:

Image segmentation is the process of dividing an image into multiple parts. This is typically used to identify objects or other relevant information in digital images.The goal of image segmentation is to cluster pixels into salient image regions, i.e., regions corresponding to individual surfaces, objects, or natural parts of objects. Segmentation could be used for object recognition, occlusion boundary estimation within motion or stereo systems, image compression, image editing, or image database look-up.

NON-CONTEXTUAL THRESHOLDING

Thresholding is the simplest non-contextual segmentation technique. With a single threshold, it transforms a greyscale or colour image into a binary image considered as a binary region map. The binary map contains two possibly disjoint regions, one of them containing pixels with input data values smaller than a threshold and another relating to the input values that are at or above the threshold. The former and latter regions are usually labelled with zero (0) and non-zero (1) labels, respectively. The segmentation depends on image property being threshold and on how the threshold is chosen.

CONTEXTUAL SEGMENTATION: REGION GROWING

Non-contextual thresholding groups pixels with no account of their relative locations in the image plane. Contextual segmentation can be more successful in separating individual objects because it accounts for closeness of pixels that belong to an individual object[7]. Two basic approaches to contextual segmentation are based on signal *discontinuity* or *similarity*.

FEATURE EXTRACTION:

Feature extraction a type of dimensionality reduction that efficiently represents interesting parts of an image as a compact feature vector. This approach is useful when image sizes are large and a reduced feature representation is required to quickly complete tasks such as image matching and retrieval[19].

COLOR FEATURES COLOR SPACES:

A color model is an abstract mathematical model describing the way colors can be represented as tuples of numbers, typically as three or four values or color components. When this model is associated with a precise description of how the components are to be interpreted (viewing conditions, etc.), the resulting set of colors is called a color space[5].

TEXTURAL FEATURES

From a perceptual point of view, a texture may be defined by its ”coarseness”, ”repetitiveness”, “directionality” and “granularity”. However in terms of digital images, the texture of an image or region is defined as a function of the spatial variation in pixel intensities (grey values), Tuceryan and Jain, 1998[20]. The analysis of texture is used to determine regions of homogeneous texture, the boundaries between these regions can then be used to segment the image.

IV. RESULTS AND DISCUSSION

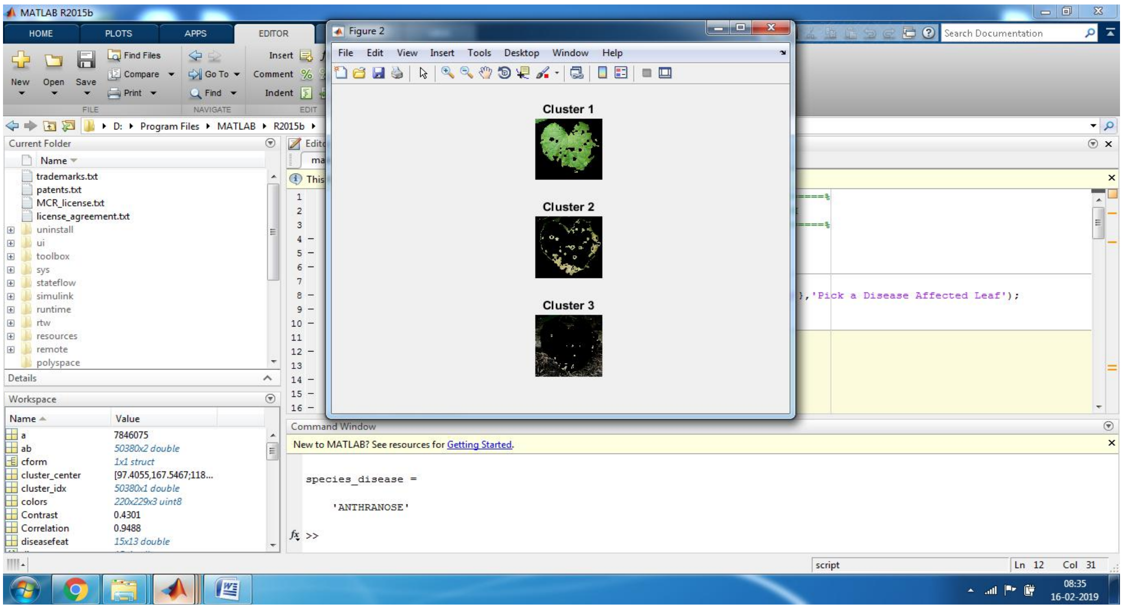

Fig 4.1: Detection of disease in leaf

From the Fig 4.1 we can observe that cluster 1 represents the actual image of the leaf that is the input image which is then pre-processed then the image is gone through image segmentation after the process the image is processed and we can observe the disease in the leaf by observing cluster 2 and cluster 3

V. CONCLUSION

An artificial intelligence technique has been implemented in by using k-means clustering (segmentation). Plant diseases vary in how much trouble they cause, depending on a variety of conditions, including the susceptibility of the plant and the organism's disease cycle. Automatic detection of diseases in the plant leaves is an evolutionary and important topic of research as it may be helpful for proper monitoring of large fields.The image processing technique provides a more reliable and accurate alternative to the conventional naked-eye observation, which is subject to person-to-person analysis. The overall concept of disease detection using image processing will help the farmers during their daily struggles on disease outbreaks.Smart irrigation environment helps to optimize the water usage in the field and provides a remote controlling and monitoring for the irrigation system. Using Internet of Things concepts, the system communicates and processes data from sensors and using android

application as user interface, notification about humidity and moisture level is given to the farmer so as to control the water supplied to the farm. Digital capturing of visually observed symptoms on the stem and leaf of the plant and images processing on it is used for detecting the plant disease at an early stage. Treatment is suggested corresponding to the recognized ailment which will help farmers with low experience to prevent the vegetation.

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