TREE LEAVES SEGMENTATION AND DISEASE CLASSIFICATION USING IMAGE PROCESSING TECHNIQUES

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Abstract- **A robust and accurate method for segmenting objects acquired under various controlled conditions. It improves the performance of the segmentation methods using preprocessing tools such as color distance map and input strokes. Guided Active Contour method is implemented to measure geometric properties of leaf images. Based on the segmentation of the leaf, disease can be classified. Disease management is a challenging task. An automatic detection and classification of leaf diseases can be proposed based on neural network approach.**

Index term- **Segmentation, preprocessing tools, guided active contour, disease management, and neural network.**

I. INTRODUCTION

Image segmentation is the basic step to analyze images and extract data from the image. Digital image processing [20], will improve the quality of the image by removing noise & other unwanted pixels and obtain more information from image. Image acquisition is a process of retrieving an image from the source, that image can be passed through whatever process carried out afterwards.

In the process of tree identification from pictures of leaves in a natural background, retrieving accurate edges is a challenging and crucial issue. A method is designed for simple and lobed tree leaves, to deal with the hurdle raised by such complex images. A first segmentation step based on a light polygonal leaf model is performed, and later used to point the progress of an active contour. The leaves are then classified over leaf datasets, by combining global shape descriptors given by the polygonal model with local curvature-based features.

II. EXISTING SYSTEM

The main aim is to extract accurately the shape of the leaf. A robust and accurate method for Segmentation methods using preprocessing tools such as color distance map and input strokes. Based on these methods, this project can eliminate unwanted boundaries and localize the leaf object efficiently. Guided Active Contour method [8] is implemented to measure geometric properties of leaf images. Based on experimental results, GAC provide improved performance in leaf datasets. GAC is mainly used segmentation processing application such as motion tracking, edge detection or medical purpose tracking tumor. Figure 1 shows the various segmentation processes:

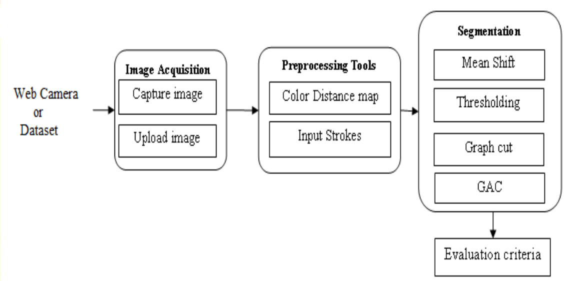

Fig. 1. Architecture of existing system.

Graphcut segmentation method explicitly organizes the image elements into mathematically sound structures, and makes the formulation of the problem more flexible and the computation more efficient. Threshold based segmentation is used to select optimal gray level threshold value for separating object of interest of image from background based on gray level distribution. A snake is a energy minimizing spline influenced by the image force and guided by the external constraint force that pull down toward the line and edges. Snakes are active contour model they lock on to the nearby edges and localize them accurately.

A. Image Acquisition

Image acquisition is a process of retrieving an image from the source, that image can be passed through whatever process carried out afterwards. It is the first step in workflow sequence of image processing because without an image no processing is possible. Tree leaves dataset is illustrated in Figure 2; it consists of natural images with ground truth and with natural condition [15], such as colorimetry changes, illumination problems and defects.

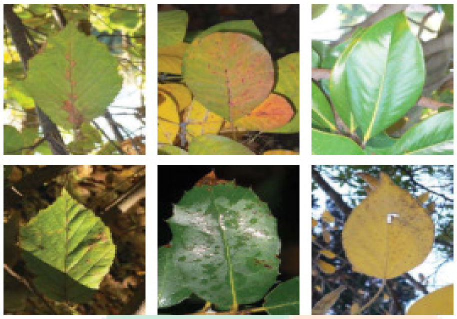

Fig. 2. Sample images from the dataset with colorimetry, illumination problems or defects.

B. Preprocessing

Preprocessing is used to improve the image that increases the chance for the success of the other processes. Two types of preprocessing tools are used: Color distance map and Input stroke. Color distance map is used to enhance the image contrast and therefore the contours. It is based on the two assumptions: object at center and the background is at the corner. This process is characterized by five seed point one for the center and four for the corners.

Color distance map are calculated using coupling global distance/local color (GLC), geodesic distance (GD), minimum barrier distance (MBD). These distance maps are used to enhance image contrast and contours. There are three types of distance map [16]: the first based on coupling global distance and local color [8], (denoted by GLC), only using one seed point (in the center); the second based on a geodesic distance (denoted by GD), using five seedpoints; and the last one based on a approach of minimum barrier distance [10], [12] (denoted by MBD), using single seedpoint. The input stroke is allowing user to locate the leaf objects and initialize the process. This mark is used to have an a priori knowledge on the local color, and for other methods, it allows initializing the determination of the contour.

C. GAC

Image segmentation is the process of partitioning a digital image into something that is more meaningful and easier to analyze. Guided Active contour [8], [13], the main aim is to transform the initial contour, to better define the edges of the object to be segmented. It provide certain properties before segment (i.e.) it will locate the boundaries of the image. Unconstrained active contours applied to the complex natural images, aim at dealing with the produce unsatisfying contours, GAC mainly have two steps for performing operation, illustrate in Figure 3:

(1) First evaluate polygonal iterative estimation.
(2) Initialization of snakes.

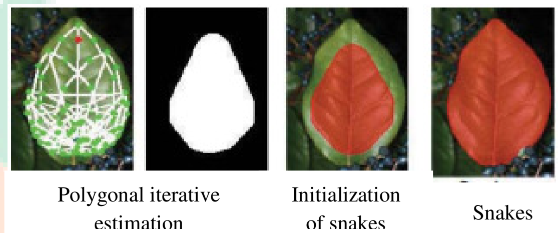

Fig. 3. Illustration of GAC segmentation.

III. PROPOSED SYSTEM

In everyday more urbanized and artificial world, the knowledge of plants, that used to constitute most immediate environment, has somehow been lost and except for a few of specialists. But nowadays, with a certain resurgence of the idea that plant resources and diversity ought to be treasured, to regain some touch with nature feels more and more tangible. It make possible, for whoever feels the need to identify a plant species, to learn its history and properties, as to allow people to get a glance at nature’s unplumbed fortune as much a way to transmit a vanished knowledge. The identification of species is the essential key to understand the plant environment. To identify the species botanists traditionally rely on the aspect and combination of fruits, flowers and leaves.

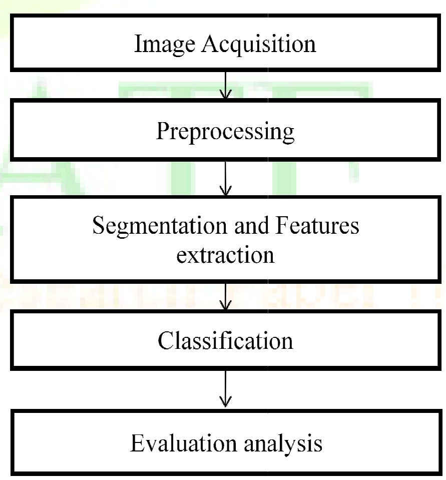

Fig. 4. Architecture of proposed system.

Plant diseases have turned into a big problem as it can cause major drop in both quality and quantity of agricultural products. But the cultivation of these crops for most favorable yield and quality produce is highly technical. It can be improved by the aid of technological maintain. It will affect production significantly, especially for the management of diseases; the management of perennial fruit crops requires close monitoring. The development method for the automatic detection and classification of leaf diseases is based on stereo images and high resolution multispectral.

A. Feature Extraction

After the segmentation, first extract features from preprocessed images. Features extraction [19], means by extracting leaf properties it converts the image data into a representation that allows comparisons between leaf images. The task of the feature extraction and selection methods is to represent that information in a higher dimensionality space and obtain the most relevant information from the original data. Features extraction includes shape, texture and color features.

Shape features

Shape is evidently of prime importance when it comes to distinctive leaves, and has been treated consequently by employing a rich array of both region- and contour-based shape descriptors. Shape features includes

$$\text{Perimeter convexity} = \frac{\text{Perimeter}_{CH}}{\text{Perimeter}} \quad (1)$$

$$\text{Area convexity} = \frac{\text{Area}_{CH} - \text{Area}}{\text{Area}} \quad (2)$$

$$\text{Comp} = \frac{\text{Perimeter}^2}{\text{Area}} \quad (3)$$

$$\text{Elong} = \frac{\text{Area}}{2d^2} \quad (4)$$

Texture features

In image processing an image texture is a set of metrics calculated to quantify the perceived texture of an image. Image texture gives us detail about the color or intensities in an image or selected region of an image, by using spatial arrangement.

Color features

These features are described using color descriptors, specifically the RGB histogram, the LSH histogram, the saturation-weighted hue histogram, and color moments. Color moments are used for characterizing planar color patterns, irrespective of opinion or illumination conditions without the need for object contour detection.

B. Classification

The classification techniques are used to categorize the diseased plant leaves. At this point artificial neural networking (ANN) technique is used. Artificial neural networks are the very flexible tools and have been widely used for tackling many issues. Feed-forward neural networks (FFNN) is a popular structure with artificial neural networks. These efficient networks are widely used to solve complex problems by modeling complex input-output relationships. In this FFNN network train all shape, color and texture features. Various Types of Leaf Spot Diseases:

- Bacterial
- Fungal
- Viral

Most leaf diseases are caused by fungi, bacteria and viruses. Fungi are identified primarily from their morphology, with emphasis placed on their reproductive structure. Bacteria are considered more primordial than fungi and generally have simpler life cycles. With few exceptions, bacteria live as single cells and increase in numbers by dividing into two cells during a process called binary fission viruses are very tiny particles consisting of protein and genetic material with no associated protein.

In classification, based on training and testing the diseases are classified. In the training step the leaf image is preprocessed and then segmented. In testing the disease will be classified.

C. Neural network

Neural network is an important tool for classification. Neural network have remarkable ability, so develop meaning from difficult or imprecise data and can be used to extract pattern and detect trend that too complex to be notice by human or other technique.

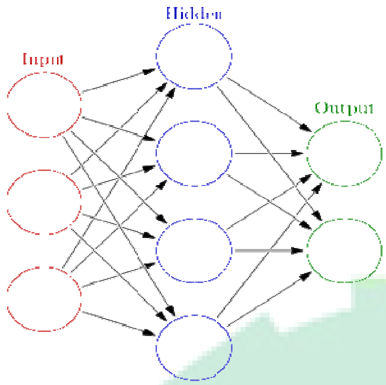

Fig. 5. General Structure of neural network.

Some of the advantages of neural network are:
(1) Neural networks are data driven self-adaptive methods in that they can alter themselves to the data without any explicit specification of functional or distributional form.
(2) It is universal functional approximators, so that it can approximate any function with arbitrary accuracy.

Neural networks have been successfully applied to a diversity of real world classification tasks in application such us industry, business and science. By using the neural network first the segmented leaf image is trained and then the diseases are classified.

An artificial neural network is an interconnected group of nodes, similar to the vast network of neurons in brain. In figure 5, artificial neurons are represented by circular node and the connection from output to input of neurons represented by arrow. For example, a neural network for disease classification of plant leaf is defined by set of input neurons which may be activated by the pixels of input image.

IV. RESULT AND DISCUSSION

The segmentation process is based on a color model that is robust to uncontrolled lighting conditions. But a global color model for an entire image may sometimes not be sufficient, for leaves that are not well defined by color only. The use of an additional texture model is an adaptive color model could lead to a good improvement. These descriptors would also have to be stronger to the change from white-background images to real natural scenes or to little flaws in the contour natural objects inevitably carry. The feature is extracted from the segmented image. The feature is extracted based on the shape, color and texture feature of the leaf. After the feature is extracted the disease in the leaf is classified. Using the neural network approach the disease is classified.

V. CONCLUSION

A various techniques and algorithms are proposed for different segmentation methods to improve the quality of segmentation. But the results show that segmentation algorithms do not work properly and can't implement in large datasets rather than proposed GAC model. It is designed to perform the segmentation of a leaf in a natural scene, based on the optimization of a polygonal leaf model used as a shape prior for an exact active shape of segmentation. This analysis of leaf image after the segmentation is used for the classification of the disease in the leaf. This is mainly focus on the classification of different types of disease in the leaf and it is generalized to other application such as agriculture fields.

VI. FUTURE WORK

In future work, this project can be extended by predicting the diseases in segmented leaves using neural network approach. The severity level of the disease can be predicted and rectified easily in the large estate by using the sensors.

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