Identifying Healthy and Infected Medicinal Plants Using Canny Edge Detection Algorithm and CBIR

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ABSTRACT

This paper presents a method to apply canny edge detection algorithm on the healthy and disease sample of medicinal plants. Farmers are suffering from the problem rising from various types of plant traits/diseases. Sometimes plant’s doctors are also unable to recognize the disease that results in lack of identification of right type of disease and this leads to plant spoil if not taken care of at right time. Medicinal plants form the backbone of a system of medicine called Ayurveda and is useful in the treatment of certain chronic diseases. Ayurveda is considered a form of alternative to allopathic medicine in the world. This system of medicine has a rich history. Ancient epigraphic literature speaks of its strength. Ayurveda certainly brings substantial revenue to India by foreign exchange through export of ayurvedic medicines, because of many countries inclining towards this system of medicine. It is necessary to identify the plant is diseased or not and if yes then which type of disease it has? For identifying the plant disease the very first step is to apply canny edge detection algorithm on healthy and diseased samples.
1. INTRODUCTION

Medicinal plants form the backbone of a system of medicine called ayurveda and is useful in the treatment of certain chronic diseases. Ayurveda is considered a form of alternative to allopathic medicine in the world. This system of medicine has a rich history. Ancient epigraphic literature speaks of its strength. Ayurveda certainly brings substantial revenue to India by foreign exchange through export of ayurvedic medicines, because of many countries inclining towards this system of medicine. There is Considerable depletion in the population of certain species of medicinal plants. Hence we need to grow more of these plant species in India. This rejuvenation work requires easy recognition of medicinal plants. Plant diseases have turned into a dilemma as it can cause significant reduction in both quality and quantity of agricultural products. Diseases in leaves cause major production and economic losses in agricultural industry. Monitoring of health and detection of diseases in leaves is critical for agriculture. The most significant part of research on plant disease to identify the disease based on CBIR (Content based image retrieval) that is mainly concerned with the accurate detection of diseased plant. It is important for ayurveda practitioners and also traditional botanists to know how to identify the medicinal plants through computers. Based on the color space, histogram, and edge detection techniques, we can able to find the disease of plant. Hence here is a proposal of identification of these plants using leaf edge histogram, color histogram and leaf area.

The most significant part of research on plant disease to identify the disease based on CBIR (content based image retrieval) that is mainly concerned with the accurate detection of diseased plant. The methodology here gives the identification of medicinal plants based on its edge features. The color image is converted to its grayscale equivalent image. From this grayscale image, calculate the edge histogram. Apply canny edge detection algorithm for this purpose. The next information i.e., the area is calculated by the proposed algorithm. The next information is the color of the image which is extracted in the form of the histogram for the overall image. These algorithms are applied for the test image and the database image and difference in area, edge histogram and color histogram is calculated. Obtain the average value of these three parameters. Repeat this process for all the leaf images in the database and calculate the difference in the average value parameter between the test and database image. The test image and database image pair which gives the least values is the correctly identified image in turn the plant.

Content based image retrieval (CBIR) offers efficient search and retrieval of images based on their publishing, medicine, architecture, etc.

A. Types of Diseases

Plant diseases may be broadly classified into three types. They are bacterial, fungal and viral diseases.

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Name of Plant</th>
<th>Disease</th>
<th>Description</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sugar Beet</td>
<td>Powdery mellow</td>
<td>Sugar beet leaves showing signs of infection with powdery mellow.</td>
<td><img src="image1.jpg" alt="Image" /></td>
</tr>
<tr>
<td>2</td>
<td>melon (Cucumis melo L)</td>
<td>Powdery mellow</td>
<td>Powdery mellow infection on cantaloupe leaves.</td>
<td><img src="image2.jpg" alt="Image" /></td>
</tr>
<tr>
<td>3</td>
<td>Banana Freckle</td>
<td>Freckle</td>
<td>It is caused by a fungus, which has three names, <em>Phyllosticta macularia</em>, <em>Phaeococcomyces maculosus</em> and <em>Phyllosticta croceola</em>.</td>
<td><img src="image3.jpg" alt="Image" /></td>
</tr>
<tr>
<td>4</td>
<td>Mango Leaf gall midge</td>
<td>Insect</td>
<td>It is caused by insect - Galls on leaves caused by mango leaf gall midge.</td>
<td><img src="image4.jpg" alt="Image" /></td>
</tr>
</tbody>
</table>

Fig 1: Types of Diseases
B. Problem of agricultural plant diseases
India is an agricultural country; wherein about 70% of the population depends on agriculture. Farmers have wide range of diversity to select suitable Fruit and Vegetable crops. It can be improved by the aid of technological support. The management of perennial fruit crops requires close monitoring especially for the management of diseases that can affect production significantly and subsequently the post-harvest life. Plant diseases cause periodic outbreak of diseases which leads to large scale death and famine. The forests in India are the principal repositories of large number of medicinal plants, which are largely collected as raw materials in preparation of ayurveda medicine. Ayurveda practitioners use the parts of these medicinal plants such as leaves, stems and seeds in the preparation of medicines. It is necessary to develop an automatic method that identifies the medicinal plants from their images. Different features need to be extracted using image processing techniques for identification. In order to identify plants and to differentiate between them certain features are used, which act as the distinguishing features. Since the effects of plant diseases were devastating, some of the crop cultivation has been abandoned.

C. Content Based Image retrieval (CBIR)
Content based image retrieval (CBIR) offers efficient search and retrieval of images based on their content. With the abundance and increasing number of images in digital libraries and the Internet in the last decades, CBIR has become an active research area. The retrieval may involve the relatively simpler problem of finding images with low level characteristics (e.g. finding images of sunset) or high level concepts (e.g. finding pictures containing bicycles). With the development of the Internet, and the availability of image capturing devices such as digital cameras, image scanners, the size of digital image collection is increasing rapidly. This paper is organized as follows; Section 2 introduces canny edge detection algorithm; Section 3 gives the literature review; Section 4 discusses our proposed methods; Section 5 gives the experimental results and section 6 gives the conclusion to the problem.

2. CANNY EDGE DETECTION ALGORITHM
The methodology here is that first picked up the images of healthy and infected plants. Then apply the canny edge detection algorithm on samples. Canny edge detection algorithm preserving the structural properties to be used for further image processing. The purpose of edge detection in general is to significantly reduce the amount of data in an image. The aim of this algorithm with regards to the following criteria:

i) Detection: The probability of detecting real edge points should be maximize while the probability of falsely detecting non edge points should be minimized. This corresponds to maximizing the signal to noise ratio.

ii) Localization: the detected edges should as close as possible to the real edges.

iii) Number of responses: one real edge should not result in more than one detected edge.

The Canny Edge Detection Algorithm
The algorithm runs in 5 separate steps:
1. Smoothing: Blurring of the image to remove noise. Implemented through Gaussian Filtering with Specific Kernel Size (N) and Gaussian Envelope Parameter Sigma.

2. Finding gradients: The edges should be marked where the gradients of the image has large magnitudes.

3. Non-maximum suppression: Only local maxima should be marked as edges. Find gradient direction and using these directions perform non maxima suppression.

4. Double thresholding: Potential edges are determined by thresholding.

5. Edge tracking by hysteresis: Final edges are determined by suppressing all edges that are not connected to a very certain (strong) edge.

3. LITERATURE REVIEW
H. Al-Hiary, S Bani-Ahmad, M Reyalat, M Braik and Z ALRahamneh presents the plant diseases are detected for few sample only and using the k-map techniques the applications of K-means clustering and Neural Networks (NNS) have been formulated for clustering and classification of diseases that effect on plant leaves. Recognizing the disease is mainly the purpose of the proposed approach. The experimental results indicate that the proposed approach is a valuable approach, which can significantly support an accurate detection of leaf diseases in a little computational effort. Not involving the advantages of hybrid technique Dedicate the future works on automatically estimating the severity of the detected disease [1].
N. Valliammal presents this paper focused on the preprocessing step of CAP-LR. Leaf images normally change to blurred images by the presence of noise and low or high contrast both in the edge area and image area. In this paper, an approach that simultaneously adjusts contrast and enhances boundaries is presented. As multiple noise damages the quality of nature images, improved enhancement technique is required for improving the contrast stretch in leaf images [2].

S. Ananthi S. Vishnu Varthini presents an application of texture analysis in detecting the plant diseases has been explained. Recognizing the disease is mainly the purpose of the proposed approach. The experimental results indicate the proposed approach can recognize the leaf diseases with little computational effort. Automatically detect the diseases from the symptoms that appear on the plant leaves are the research topic is mentioned in this paper. Extension of this project is to increase the recognition rate of classification process [3].

Arunkumar beyyala and Sai Priya beyyala presents Crop diseases are caused by pathogens fungi, virus and bacteria but there is a problem of complexity of visual pattern. Disease is caused by pathogen which is any agent to cause disease. In most of the cases traits or diseases are seen on the leaves or stems of the plant. Therefore identification of plants, leaves, stems and then finding out the diseases, percentage of the disease incidence. Hence there was an enormous demand for specific and sophisticated image patterns understanding [4].

K. Padmavathi present a study was completed to investigate the use of computer vision and image processing techniques in agricultural applications. In biological science, sometimes thousands of images are generated in a single experiment. These images can be required for further analysis of plant diseases [5].

Pranjali Vinayak Keskar, Shubhangi Nimba Masare, Manjusha Suresh Kadam gives the actual database of the project is stored in the PC The disease affected leaf to be tested is compared with database in the PC which gives result and displays. The developed system consists of four stages which includes HSI transformation, histogram analysis and intensity adjustment. Feature extraction is the third stage which deals with three features namely; color, size and shape of the spots. In precious papers they are not using the CBIR system and simple method for detection of leaf diseases [6].

4. PROPOSED METHODOLOGY

The methodology here gives the identification of medicinal plants based on its edge features. The color image is converted to its grayscale equivalent image. From this grayscale image, calculate the edge histogram. Apply canny edge detection algorithm for this purpose. The next information i.e., the area is calculated by the proposed algorithm. The next information is the color of the image which is extracted in the form of the histogram for the overall image. Plant diseases cause major production and economic losses in agriculture and forestry. The bacterial, fungal, and viral infections, along with infestations by insects result in plant diseases and damage. The medicinal plants are used in ayurvedic medicines. Manual identification of medicinal plants requires a priori knowledge. The color histograms are obtained in RGB color spaces. This system of medicine is useful in the treatment of certain chronic diseases such as cancer, diabetes, blood pressure, skin problems etc. But, the knowledge of these plants dies with the experts, because of the fact that the experts do not share with others. Hence it is necessary to use technology and develop tools for the recognition and use of medicinal plants from their image.

Image Acquisition:
The images of leaves of medicinal plants were obtained from a 5 to 12 mega pixel camera and it can be used as per our requirement. The distance between camera and the leaf was maintained to be 15cms and the image was taken from the top view. All the images were taken in natural day light with white background.

Images saved to database:
After capturing the image from camera it has to save in database and apply canny edge detection algorithm.
The methodology here gives the identification of medicinal plants based on its edge features. The color image is converted to its grayscale equivalent image. From this grayscale image, calculate the edge histogram. Apply canny edge detection algorithm for this purpose.

5. EXPERIMENTS RESULTS:

The Canny Edge Detector first smoothes the image to eliminate the noise. It then finds the image gradient to highlight regions with high spatial derivatives. The algorithm then tracks along these regions and suppresses any pixel that is not at the maximum (nonmaximum suppression). The gradient array is now further reduced by hysteresis. Hysteresis is used to track along the remaining pixels that have not been suppressed. Hysteresis uses two thresholds and if the magnitude is below the first threshold, it is set to zero (made a nonedge). If the magnitude is above the high threshold, it is made an edge. And if the magnitude is between the 2 thresholds, then it is set to zero unless there is a path from this pixel to a pixel with a gradient above T2.

6. CONCLUSION

To wind up all the information discuss above, I should like to conclude that it is a efficient and accurate technique for Edge detecting an image significantly reduces the amount of data and filters out useless information, while preserving the important structural properties in an image. Also the healthy and infected samples of images are saved into the database for further training process.
National Conference On
Research Trends In Electronics, Computer Science & Information Technology
And Doctoral Research Meet, Feb 21st & 22nd

References


