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Efficient Knowledge Based System to Detect Diseases in Lemon Leaf

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Abstract *–Managing diseases in plant is a challenging task. Diseases are mostly seen on the leaves or stem or fruits of the plant. Systematic disease identification should be undertaken so that crop yield can be maximized. Some diseases can be handled by the farmer before the disease spreads. Farmers will find automatic disease identification software easier with their occupation. A large of such diseases can be identified using the leaves of the plants. The proposed system automatically detects the patterns of diseases in their early stage. It serves as an efficient disease diagnosis system that focuses on plant disease identification by processing acquired digital images of lemon leaves. These images are enhancement by applying a set of pre-processing methods. The enhanced image is segmented and canny edge detection is used to extract the diseased portion. Then, a satisfying set of visual features from the region of interest is extracted by applying histogram for detecting diseases accurately. The advisory helps farming community to protect crops from diseases and increase the productivity. There by, the proposed approach improves crop yield and uplifts farming community's economy.*

Keywords*: Classification, Gradient boosting , Feature Extraction, Threshold and Segmentation.*

I INTRODUCTION

India is an agriculture based country where almost 50% of the population are indulged in farming activities directly or indirectly .India is known as the world's largest producers of many fruits , vegetables and cereals which are being exported to other countries as well. Need of the hour is to produce high quality products with an optimum yield. Lemon is a medium heighted tree believed to have originated from Assam. Lemon serves various purposes in both culinary and non-culinary activities. It is used in industries and medical fields due to its anti-bacterial and aroma therapy properties. Diseases to lemon plant can occur mainly through the leaves of a lemon tree. The previous system is an efficient knowledge based system to detect diseases in lemon leaves. The system has used a method to extract texture and colour from a lemon image .The main problem was the stage and severity of the disease on the plant was unknown to the farmers. The system uses gradient boosting technique to increase the efficiency of the extraction process. Here, the Research work involves automated computing environment to identify the disease along with the type of disease and its severity. Pictures of lemon leaves are taken using a smart phone or a digital camera and are evaluated using pre-processing and support vector machine is used to classify and compare the image under test with the image stored in dataset. The principle behind the system is image processing technique. This method would identify the occurrence of the disease in the plant and classify it based on the threshold value of the image and notify the farmer about the disease the plant has contracted and the stage of disease.

1.1 Image processing in disease detection

Image processing is helpful in following places.

1. To identify an item correctly
2. To identify an item correctly
3. To determine the size and shape of the object.
4. To outline the boundaries and colour of infected area.
5. To calculate the infected area by the disorder.
6. To find out the stage of the disease that has affected the plant.

1.2 Types of diseases on lemon leaf

Citrus canker is a exotic disease infecting the leaves. Its causal organism is a bacteria named Xanthomonas axonopodis.It easily spreads from one plant to other and the infection causes lesions on the leaves, stems, and fruit of citrus trees, including lime,

oranges and grapefruit and the leaves starts falling off at an earlier stage at a faster rate. Copper fungicides can help in mitigating the disease.

Anthracnose is a fungal disease caused by Colletotrichum. It causes the twigs to dieback, premature leaf drops and dark fungal spores and staining on the leaf and lemon fruits. Usage of fungicides with potassium bicarbonate can control the disease.

Citrus greening disease also known as HLB is a disease caused by motile bacteria Candidatus Liberibacter.It is difficult to maintain the infected plant and to regenerate it. It can be treated with antibiotics like biocide 2,2-dibromo-3-nitrilopropionamide and penicillin G sodium and to manage the effects of the disease**.**

Citrus leafminer is a very small, light-colored moth, less than 1/4 inch long. It consists silvery white iridescent forewings with brownish white markings and a distinct black spot on each wing tip. Citrus leafminers can be eradicated by using various parasites and predators, including tiny nonstinging, naturally occurring wasps such as Pnigalio and Cirrospilus species. Imidacloprid sprayed to the base of citrus trees provides the longest duration of control, 1 to 3 months. Imidacloprid should only be applied only once in a year. Imidacloprid applications should be properly timed to protect periods of leaf flushing, such as in the spring and fall.

Bacterial blast also known as citrus blast ia a bacterial disease caused by pseudomonas syringe. It starts its infection by curling of leaf and rapidly spreading dark brown blothes that develop on the back of the leaf. Predominantly visible lesions is another major symptom for the disease. Sooty mold is a fungal disease caused by Scorias ,Capnodium and Fumago. Sooty mold in itself doesn't cause harm to the plants but they get deposited on places where honeydew drops get collected. Coated leaves are deprived of sunlight and the leaves may fall prematurely.

II RELATED WORK

Automated identification of diseases in plants is a vital topic to be researched upon as it is helpful in managing wide range of crops and plants in an agriculture field. It is important to detect diseases in the early stage to prevent spreading of disease to other parts of the plant and also to neighbouring plants of the same kind or different kind. The system enables us to detect the abnormality and provide the farmer possible remedies. The objective of this paper is to focus specifically on lemon leaf disease detection based on feature extraction from the image of a leaf, identify the type of disease and the stage of the disease. S.Arivazhagan et al.[1] attempted to detect unhealthy regions of plant using texture features. The image is transformed to HSI colour module since its based on human perceptions. Texture features like contrast ,energy, local homogeneity ,cluster shade and prominence are computed. From these features plant diseases can be further classified.Tejal Deshpande et al.[2] introduced a graded approach to automatically detect diseases on leaves of pomegranate plant. The paper intends to use image processing technique to address main problems associated with the plant pathology i.e. disease grading. The final outcome of the paper provide accuracy and satisfactory results when compared to manual grading and has proved itself in the market for its efficiency and effectiveness. K.Lalitha et al.[3] proposes to manage a knowledge based system for leaf disease classification.It utilises the canny edge detection technique to identify a wide range of edges in the image hence being more accurate. classification of pictures is performed by using threshold based segmentation and comparing the threshold values with various image's threshold values.Malik Braik[4] introduced an accurate and faster technique to detect the diseases in leaf using k-means clustering based segmentation ana classification based on neural netwoks. Neural networks reduces cost and are comparatively more accurate.The precision level is around 93% according to the paper. Jianping Fan et al.[5] proposed a hierarchical multi-task structured algorithm to learn large number of species of flora with the help of a visual tree construction. This paper stated that controlling the inter-level propogation of error ,tree classifiers achieves a greater discrimination power among wide range of plant varieties.Salwa-El-Gammal et al.[6] intends to a new method in which hue saturation intensity (HIS) model transformation is applied to the original picture input and is segmented using Fuzzy C-mean technique. W.Forstner et al.[7] has proposed a classification system for plant diseases that is completely automated and is based upon stereo and multispectral images. Sweet beet leaves have been tested in this approach. The diseased area is extracted using segmentation and is graded as per the calculations of disease spot and areas of leaves. According to M.Hemalatha et al.[8] technological strategies that use mobile captured symptoms of Cotton Leaf Spot images and categorizes the diseases using neural network. The classifier is being trained to achieve intelligent farming, including early detection of disease in the

groves, selective fungicide application, etc. The work proposed is based upon image edge detection Segmentation techniques. Radhiah Binti et al.[9] developed a prototype for detection of paddy diseases using neural networks and image processing which results in 92.5% accuracy rates.

2.1 Existing System

The plant disease recognition is an automated system to identify and classify the disease caused in citrus plants. The automated knowledge based system helps in finding out diseases by capturing an image and comparing the available image and the image to be tested. Here they have used canny edge detection to extract the features present in the leaf. Image segmentation focuses on the morphological feature such as the shape. Comparing the obtained threshold value with pre-determined threshold values of each disease. This work reduces the effort and time of a farmer.

III EFFICIENT KNOWLEDGE BASED SYSTEM

The proposed system automates the detection of disease in lemon leaf in order to find out the diseases with ease so that farmers need not check manually and randomly. This system reduces man force. If an automated efficient knowledge based system is enabled, all diseases can be easily found by capturing image of the picture continuously and comparing it with the trained database which is known as classifiers used to find the defect in all parts of the leaf. The leaf images in RGB format is converted to gray scale using MATLAB. The gray scale images are then segmented into binary images using gray level threshold segmentation. Feature extractions of segmented leaves are done by using canny edge detection. The threshold value of the leaf can be calculated using and gradient boost algorithm. The threshold value is compared with normal threshold values of the leaf stored in classifiers. By using the range we can easily conclude that the leaf is infected or not. The threshold value of normal leaf ranges between 30-32 . If the leaf is infected, the value differs from the range. Classification occurs, a database called the classifiers is created in MATLAB. In the classifiers we will store the disease name with the threshold value and remedy. If it's infected, then alarm will be generated in order to intimate the owner about the disease occurrence. Speakers are used to announce the disease name and remedy to the owner. Thus the system is used for automatically detecting and classifying diseases that are occurring in the lemon leaf.

3.1 Step by step process

1. RGB image acquisition
2. Convert RGB to grey scale
3. Mask green pixels
4. Remove masked pixels
5. Segment the image
6. Obtain necessary segments
7. Compute features using Canny edge algorithm
8. Evaluate texture
9. Obtain Gradient Boost Algorithm
10. Compare with threshold value
11. Display message
12. Announce the output in the speakers

3.2 Proposed Work

3.2.1 Image acquisition

Image acquisition is the process of digitization and storage of images. Images of lemon leaf are captured using a camera. RGB colours are obtained from the image. Image acquisition is followed by applying various methods of pre-processing to the image to perform different vision tasks required. However, if the images are not captured properly, techniques that are followed do not show good result. JPEG format is used to save these images.

3.2.2 Image Pre-Processing

Pre-processing is a task that involves a set of procedures to be done to prepare the image for enhancement. It involves removing low frequency background noise, normalizing the intensity of the individual particles images, removing reflections, and masking portions of images. Leaf image which is in RGB color format is converted to a gray scale image.

RGB-Gray Conversion G= rgb2gray

$G = 0.299*r + 0.587*g + 0.114*b$

3.2.3 Segmentation

Image Segmentation is a process of partitioning a digital image into its constituent regions or objects so as to change the representation of the image into something that is more meaningful and easier to analyze. .Image segmentation based on gray-level threshold segmentation is adapted and the binary image is obtained.

3.2.4 Feature extraction

Descriptors such as number of the object, area of the shape object, width and length of the object, and area of image are used to extract the feature in the RGB space, in which the colour at each pixel is

represented as a triplet (R, G, B), where R, G and B are respectively the red, green, and blue value. This value is obtained from a colour image capturing device. The features represent the colour characteristics .The mean and variance of the gray level of the red, green and blue channel of the spots and other features reflect the morphological and geometrical characteristics of the spots. Segmentation technique extracts the features of disease leaf. The image analysis focuses on the shape. Feature extraction is done using canny edge detection algorithm.

3.2.5 Classification

Images are classified by comparing each image with a particular threshold range. Based on the calculated threshold value, a comparison is done. If the disease is detected, the name of the disease and the remedy is sent to the farmer via speakers.

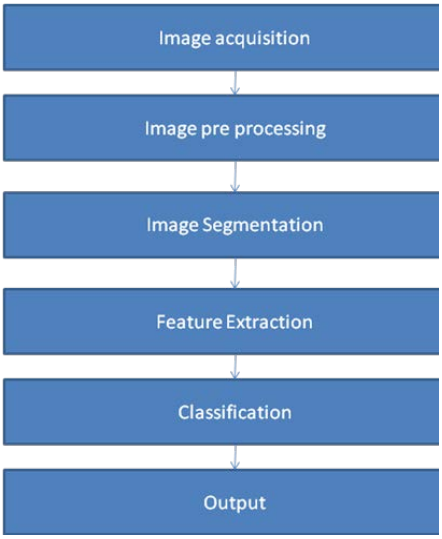

Fig 3.2.6 : Flow chart

3.3 Canny Edge Algorithm

The Canny edge algorithm is used to detect a wide range of edges in images using multi-levels. Each level, gives an accurate detection of the edges. The edge selected should be uniquely marked. Edges are marked using a edge point.

It includes the following steps to be taken,

i. Smoothing
ii. Gradient discovery
iii. Non- Maxima Suppression
iv. Double threshold
v. Edge tracking

Gradient Boost Algorithm

Gradient boosting is a technique that is used to enhance the features obtained to get an accurate vision. This algorithm uses typical prediction trees. Like other boosting methods do, it builds the model in a step-wise fashion. It takes the output of the segmentation block as its input. The main features are,

- Angle
- Magnitude
- Gradient

4. Experimental Result

The input image is digitized and masked to get clear RGB format. The RGB image is converted into gray scale image.

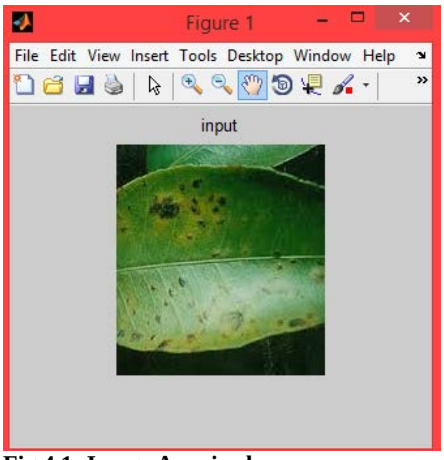

Fig 4.1: Image Acquired

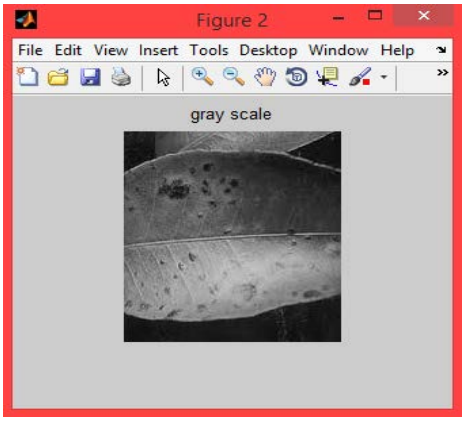

Fig 4.2: RGB to Grey Scale

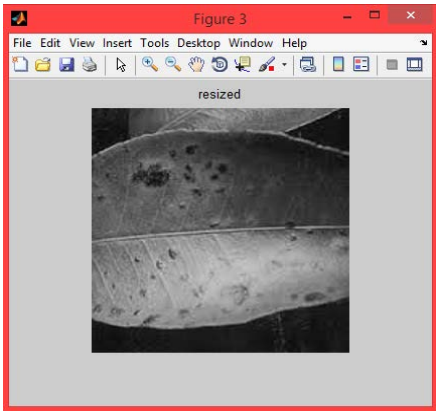

Fig4.3: Image Pre-processing

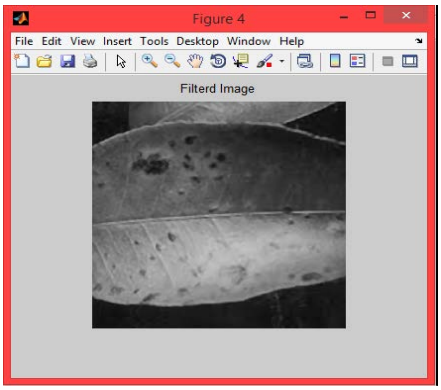

Fig 4.4: Filtered image

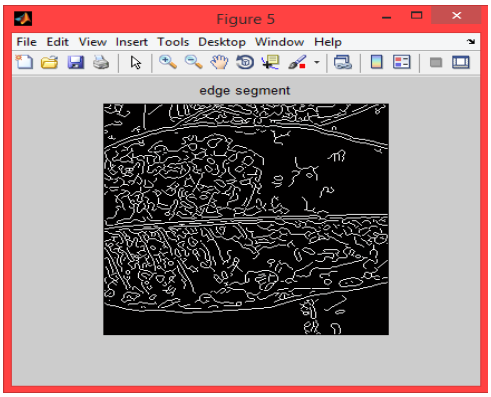

Fig 4.5: Segmented image

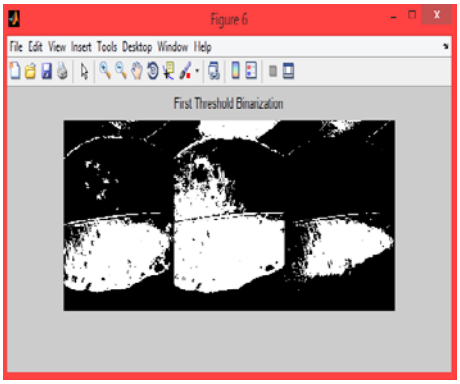

Fig 4.6: Threshold calculation

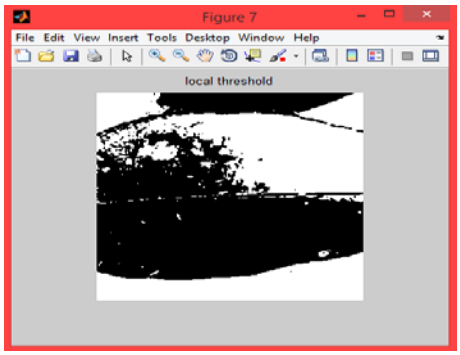

Fig 4.7: Stored threshold (30-32)

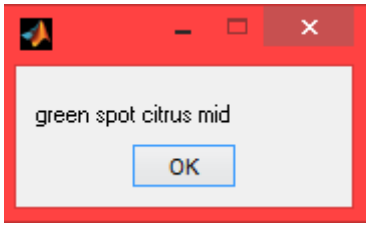

Fig 4.8: Final output

IV CONCLUSION

The proposed system enables us to detect abnormality in lemon leaf , identify all major citrus diseases and notifies the stage of the disease to the farmer. The system is based on gradient boosting that gives an accurate feature extraction and SVM that gives effective comparison between the image-under-test and the one stored in database. The system is efficient, accurate and fast. The system makes the detection of disease easier by complete automation and notification of the disease and remedies are sent to the farmer promptly. It becomes helpful to prevent the disease from spreading by detecting the diseases at an early stage.

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