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An Efficient Segmentation Approach with Texture Analysis for Plant Disease Identification in CIELAB Space

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ABSTRACT
Agriculture is the major field and it plays a vital role in Indian economy. Day by day there is a rapid growth in Indian population hence it is very important that we need to enhance the crops production, but the effect of disease also more in this field which leads to the degradation in production of crops. Generally the diseases are Bacteria, Fungi, Viruses and Pests. Therefore, we must analyze the affected disease in prior to enhance the production. Here in this, we had implemented an efficient grouping of similar elements (GSE) approach with the texture analysis in CIELAB color space. Our proposed frame work has been designed in five modules. These modules help us to find the disease affected leaf area and the type of disease with the support of a classifier known as Support Vector Machine (SVM). Simulation experiments show that the proposed approach performed superior to the conventional algorithms.

Keywords: Agriculture, crops field, disease detection and identification, segmentation, clustering, feature extraction, GSE, statistical analysis and Support vector machine

I. INTRODUCTION

Horticulture is a standout amongst the most vital hotspots for human sustenance on Earth. Not just does it gives the much vital sustenance to human presence and utilization additionally assumes a noteworthy fundamental part in the economy of the nation. However, Plant illnesses have transformed into a situation as it can bring about huge decrease in both quality and amount of rural items. These days agriculturists are confronting numerous vital issues for showing signs of improvement yield reason for fast change in atmosphere and startling level of creepy crawlies, with a specific end goal to improve yield need to lessen the level of bug. A few a great many dollars are spent worldwide for the wellbeing of harvests, horticultural create and great, sound yield [1]. It involves worry to shield crops from Bio-aggressors, for example, bugs and creepy crawlies, which generally prompt to across the board harm and loss of harvests. In a nation, for example, India, roughly 18% of product yield is lost because of irritation assaults each year which is esteemed around 90,000 million rupees [2]. Routinely, manual nuisance monitoring techniques, sticky traps, dark light traps are being used for bug monitoring and discovery in ranches. Manual bug monitoring techniques are tedious and subjective to the accessibility of a human master to recognize the same. Malady is created by pathogen which is any specialist bringing about ailment. In the greater part of the cases bugs or maladies are seen on the leaves or stems of the plant. In this way recognizable proof of plants, leaves, stems and discovering the bug or ailments, rate of the irritation or malady occurrence, symptoms of the nuisance or illness assault, assumes a key part in effective development of harvests. When all is said in done, there are two sorts of factors which can convey passing and annihilation to plants; living (biotic) and non-living (abiotic) operators [3].

Fig. 1 Disease affected leaf

Living specialist's including creepy crawlies, microorganisms, parasites and infections. Non-living specialists incorporate extremes of temperature, abundance dampness, poor light, inadequate supplements, and poor soil pH and air toxins. Here

the division procedure utilized is GSE and GLCM is utilized to remove the surface components with SVM classifier.

II. RELATED WORK

Ananthi.S, Vishnu Varthini.S[1]studied methods of image pre-processing for acknowledgment of crop diseases. They utilized cucumber fine buildup, spot and fleece molds as study tests and detailed similar investigation of impact of basic filter and middle filter. They expressed that Leaves with spots must be pre-prepared right off the bat keeping in mind the end goal to complete the keen finding to crop in view of image processing and fitting elements ought to be extracted on the fundamental of this. A prediction approach in view of help vector machines [4] for creating weather based prediction models of plant diseases is proposed by Rakesh& Amar. The execution of ordinary multiple regression, artificial neural network (back proliferation neural network, summed up regression neural network) and bolster vector machine (SVM) was thought about. Stereomicroscopic strategy and Image examination [8] technique is thought about for helpfulness of image investigation as a productive and precise strategy to gauge organic product qualities like size, shape dispersal related structures by Mix and Pico. Brendon J. Woodford, Nikola K. Kasabov and C. Howard Wearing in paper titled "Natural product Image Advances in Image Processing for Detection of Plant Diseases" proposed wavelet based image processing strategy and neural network to build up a technique for on line recognizable proof of nuisance harm in pip organic product in plantations. Three irritations that are prevalent in plantations were chosen as the possibility for this exploration: the leaf-roller, codling moth, and apple leaf twisting midge. A novel approach [7] is proposed for coordinating image examination strategy into indicative master framework. A CLASE (Central Lab. of Agricultural Expert System) indicative model is utilized to oversee cucumber crop. The master framework discovers the diseases of client perception. Keeping in mind the end goal to analyze a confusion from a leaf image, four image processing stages are utilized: upgrade, division, highlight extraction and characterization .They tried three unique issue, for example, Leaf mineworker, Powdery and Downey and this approach has extraordinarily diminished mistake inclined discourse amongst framework and client. The morphological components of leaves are broke down for plant grouping and in the early analysis of certain plant diseases. Stereomicroscopic technique and Image examination strategy is analyzed for convenience of image investigation as a proficient and precise technique to quantify organic product attributes like size, shape dispersal related structures by Mix and Pico. When all is said in done organic product length got with image investigation was essentially more prominent than that recorded with a stereo minute. Just natural product length gauges did not contrast between the two methods. A prediction approach in view of help vector machines for creating weather based prediction models of plant diseases is proposed by Rakesh and Amar. The execution of customary multiple regression, artificial neural network (back spread neural network, summed up regression neural network) and bolster vector machine (SVM) was analyzed. Santanu and Jaya portrayed a product model framework in paper for sickness location in light of the contaminated images of different rice plants. They utilized image developing, image division methods to identify contaminated parts of the plants. Zooming calculation is utilized to extract components of the images .Self Organize Map (SOM) neural network is utilized for ordering sick ascent images.

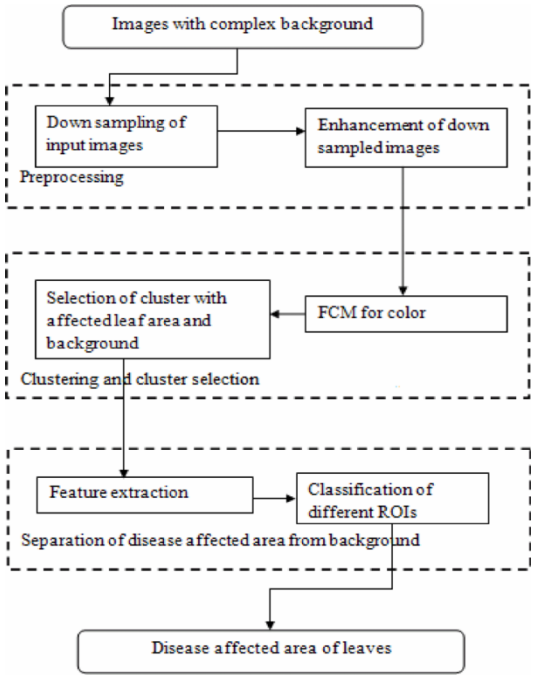

Fig. 2 FCM based disease detection and identification

A. Fuzzy C-means Clustering

The fuzzy logic is an approach to processing the data by giving the incomplete membership value to every pixel in the image. The membership value of the fuzzy set is ranges from 0 to 1. Fuzzy clustering is fundamentally a multi valued logic that allows middle of the road values i. e. , individual from one fuzzy set can likewise be individual from other fuzzy sets in a similar image. There is no unexpected change between full membership and non-membership. The membership function characterizes the fluffiness of an image and furthermore to characterize the data contained in the image. These are three principle fundamental components engaged with described by membership function. They are bolster, Boundary. The center is a completely individual from the fuzzy set. The help is non membership value of the set and boundary is the middle of the road or halfway membership with value in the vicinity of 0 and 1. In fuzzy clustering, each point has a degree of having a place with clusters, as in fuzzy logic, as opposed to having a place totally with only one cluster. In this way, focuses on the edge of a cluster might be in the cluster to a lesser degree than focuses in the focal point of cluster. For each point x we have a coefficient giving the degree of being in the kth clusteruk(x). At the point when m is near 1, at that point cluster focus nearest to the fact of the matter is given substantially more weight than the others, and the algorithm is like k-means.

The fuzzy c-means algorithm:

The fuzzy c-means algorithm is fundamentally the same as the k-means algorithm:

- Choose various clusters
- Assign arbitrarily to each point coefficients for being in the clusters
- Repeat until the point that the algorithm has focalized (that is, the coefficients' change between two cycles is close to the given affectability edge)
- Compute the centroids for each cluster, utilizing the equation above.
- For each point, compute its coefficients of being in the clusters, utilizing the recipe above.

The algorithm limits intra-cluster fluctuation too, yet has an indistinguishable issue from k-means, the minimum is a local minimum, and the outcomes rely upon the underlying selection of weights. The desire boost algorithm is an all the more measurably formalized technique which incorporates some of these thoughts: fractional membership in classes. It has better joining properties and is as a rule preferred to fuzzy-c-means.

III. PROPOSED FRAME WORK

A. Image Pre-Processing and Segmentation

The pre-processing included the methods to prepare the images for resulting examination. The influenced leaf images were changed over from RGB shading arrangement to dark scale images. Division alludes to the way toward clustering the pixels with specific properties into striking districts and these areas compare to various confronts things or normal parts of the things. We proposed GSE system to part objective territories. Target districts are those zones in the image that represented visual indications of a contagious illness.

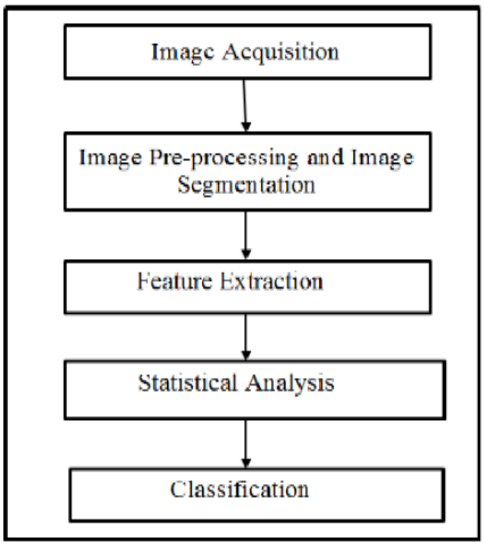

Fig. 3 Proposed disease identification flow chart

B. Feature Extraction

The side effects related with different Phyto-pathological issues of cotton leaves under scrutiny obvious on the influenced leaves were extracted from their particular images utilizing K-means. The image examination was for the most part concentrates on the extraction of shape highlights and their shading based division. The image examination procedure is finished utilizing Gray-level co-event lattice. The influenced territories change in shading and surface and are predominant in characterizing infection side

effects. In this way, we have considered both shading and surface components for acknowledgment and classification reason. The utilization of shading highlights in the detectable light range gave extra image trademark includes over conventional dark scale representation. GLCM is a technique in which both shading and surface elements are considered to touch base at one of a kind components which represent that image.

GLCM expresses the texture feature according the correlation of the couple pixels Gray level at different positions. It quantificationally describes the texture features. But here mainly four things are considered they are energy (E), contrast (I), entropy (S) and the inverse difference (H)

$$E = \sum_x \sum_y p(x,y)^2$$

$$I = \sum \sum (x-y)^2 p(x,y)$$

$$S = -\sum_x \sum_y p(x,y) \log p(x,y)$$

$$H = \sum_x \sum_y \frac{1}{1+(x-y)^2} p(x,y)$$

C. Statistical Analysis

Measurable investigation undertakings are finished to pick the best components that speak to the given picture, along these lines minimizing highlight repetition. We have found that lone 13 highlights contribute as separating components as this is fundamental for better characterization. Extents that are workable to figure by means of the co-event framework are: vitality, entropy, homogeneity, differentiate, Mean, Standard Deviation, RMS, Variance, Smoothness, Kurtosis, Skewness, IDM and connection.

D. Grouping

At present SVM is mainstream grouping tool utilized for example acknowledgment and other characterization purposes. Bolster vector machines (SVM) are a gathering of regulated learning techniques that can be connected to characterization or relapse. The typical SVM classifier takes the arrangement of inclusion data and figures to group them in one of the main two separate classes. SVM classifier is prepared by a given arrangement of preparing data and a model will group test data set up upon this model. Most habitual characterization models are built up on the exact hazard minimization standard. SVM executes the basic hazard minimization guideline which seeks after to diminish the preparation error and a sureness interval term. Various accommodation demonstrated that SVM hold the unrivalled grouping capacity underway with minor specimen, nonlinearity and high dimensionality design recognizable proof. Bolster Vector Machines depend on the idea of choice planes that characterize choice limits. A choice plane is one that parts among an arrangement of items having diverse class affiliation. Classifier that separate an arrangement of articles into their comparing classes with a line. Incomparable grouping undertakings, notwithstanding, are not that humble, and consistently more troublesome structures are required with a specific end goal to make an ideal separation, i.e., effectively arrange new questions (test cases) on the premise of the cases that are accessible (prepare cases). All the confirmation from past procedures is given to multiclass SVM.

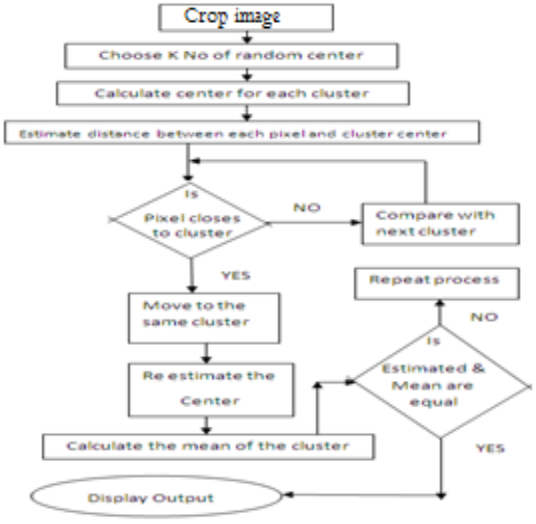

Fig. 4 Flowchart of proposed clustering algorithm

IV. SIMULATION RESULTS

All the experiments have been done in MATLAB R2014a environment with various test images with diseases. We considered the samples with two diseases which have been obtained by image acquisition. Figure 5 shows that the database stored in current directory for testing purpose. Selected leaf for the purpose of testing to detect and identify the disease has been shown in figure 6. CIELAB transformed image shown in figure 7. Obtained

clustered output index images using proposed frame work have been displayed in figure 8. Then we need to select the disease affected leaf from the cluster indexes in which index the disease is visible, this message box has shown in figure 8.

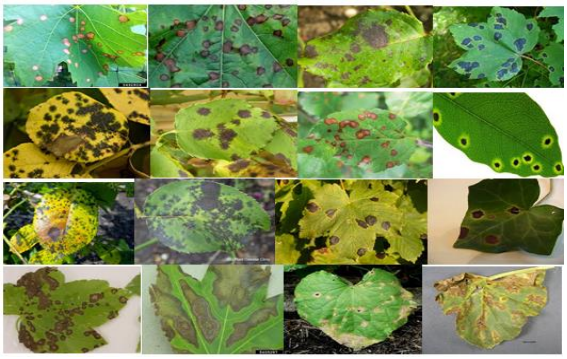

Fig. 5 dataset used for disease identification

Fig. 6 Disease affected leaf from the dataset

Fig. 7 CIELAB spaced image

After selecting the index number it automatically displays the type of disease in the MATLAB command window using SVM classifier.

Fig. 8 Cluster indexes after GSE process

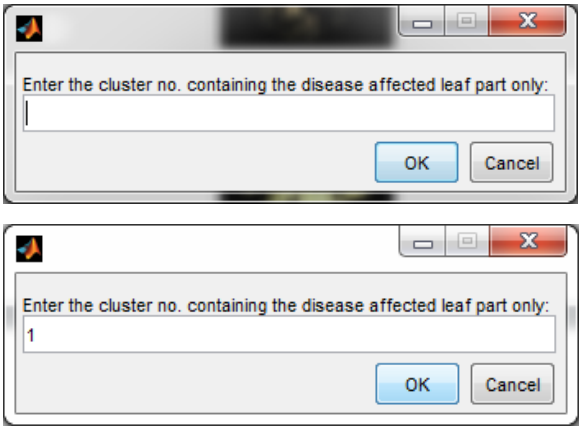

Fig. 9 Select the cluster index in which the disease is presented

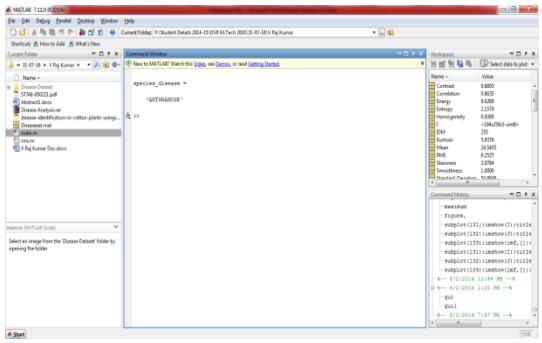

Fig. 10 snapshot of MATLAB environment after the execution of program

Fig. 11 Sample image with disease 2

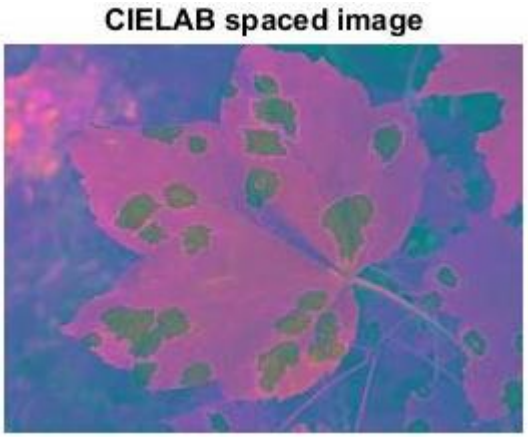

Fig. 12 CIELAB spaced image

Fig. 13 output index images after proposed algorithm

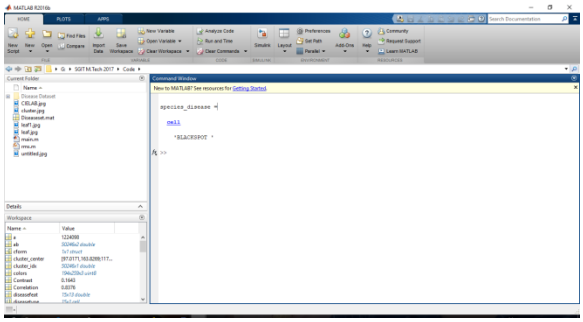

Fig. 14 screen shot of displayed output of leaf disease

Table 1: Number of tested and identified diseases with proposed algorithm

Type of disease	Tested	identified
ANTHRANOSE	15	15
BLACKSPOT	15	15

V. CONCLUSION

In this, we portrayed our work worried with the separation amongst solid and sick to cotton crops utilizing a SVM. In this paper, separately, the uses of GSE have been figured for bunching and characterization of infections that effect on plant takes off. Distinguishing the illness is by and large the drive of the proposed strategy. Along these lines, the proposed procedure was tried on 2 ailments which impact on the plants; they are: Leaf spot and Leaf excavator. These elements are imperative for the shading and morphology of the leaf spots and they give basic information about its visual representation. By utilizing division procedure it is simple for us to extricate the elements of infection leaf of the picture. Another approach in view of elements extraction was proposed for cotton leaf acknowledgment in this work. The entire procedure of leaf arrangement can be executed utilizing leaf identification, highlight extraction and order. For concentrate the proposed technique, the formed dataset is utilized. The dataset contains ailing pictures. Pictures were pre-processed and trimmed to a settled standard size. At that point, components are separated from all the leaf pictures in the dataset utilizing GSE algorithm. For every picture leaf more incessant GSE key focuses are extricated to distinguish an exceptional component. It licenses finding related components for various picture. Eventually, the extricated GSE elements are rendered to a SVM classifier for reason for order. There are recognizing contrasts amongst ailing and non-sick leaf in structure, shading, measure and so forth. Along these lines, ID depends on these distinctions. At the end of the day, contrasts amongst sick and non-unhealthy leaves and the key focuses which are separated from leaf are utilized for characterizing. The diverse strategy is performed and the dataset was separated in two sections, 70% for prepare and 30% for testing.

VI. FUTURE WORK

For future review, we can extend this venture to order infection symptoms influenced on organic products, vegetables, business crops and so on., we may work for better application like we build up an Internet of Things (IOT) based web administration plot where any individual can transfer their picture they will discover there sick and full insight about the illness. What they accomplish for their fields and yields. What is the preferred standpoint and disservice of this sickness and what ought to do to control it.

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