

HYBRID MODEL FOR CROP MANAGEMENT SYSTEM

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Abstract: Cultivation of crops plays an important role in the agricultural field. The food loss is mainly due to infected crops, which reduces the production rate. Our project is used to explore the leaf disease prediction at a fast action. We propose an enhanced k-mean clustering and Hough transform to predict the infected area of the leaves. The Hough transform (HT) is used to detect and recognize line crops, due to its robustness. But its performance is dependent on the applied segmentation technique. Infected region is segmented and placing it to its relevant classes by using a color based segmentation model. Samples images in terms of time complexity and the area of infected region were done by Experimental analyses. By image processing technique, Plant diseases can be detected. Image acquisition, image pre-processing, image segmentation, feature extraction and classification these are steps involved in Disease detection. Our project is used to detect the plant diseases and shows the affected part of the leaf in percentage.

KEYWORDS

Hough Transform (HT), MATrix LABoratory (MATLAB), Image Segmentation, Feature Extraction and Classification.

1. INTRODUCTION

Naked eye observation is a method for recognition and detection of plant disease in the old and classical approach, which gives very less accuracy. Due to availability of consulting experts to find out plant disease is expensive and time consuming. Irregular check-up of plant results in growing of various diseases on plant which requires more chemicals to cure and also these chemicals are toxic to other animals, insects and birds which are helpful for agriculture. To detect the symptoms of diseases in early stages, automatic detection of plant diseases is essential.

This project introduces a MATLAB based system in which we focused on leaf diseased area and used image processing technique for accurate detection and identification of plant diseases. By capturing the digital high-resolution images, MATLAB image processing is started. For experiment healthy and unhealthy images are captured and stored. For image enhancement the images are applied for pre-processing. Captured leaf images are segmented using k-means clustering method to form clusters. Features are extracted before applying K-means and Hough for training and classification. Finally, diseases are recognized by this system.

2. EXISTING SYSTEM

2.1 TECHNIQUES ON IMAGE PROCESSING

Ghulam Mustafa Choudhary and Vikrant Gulati (2015) were analysing the diseases in plants. Observation of health and detection of diseases in plants and trees is vital for property agriculture. To the most effective of our data, there's no device commercially accessible for period assessment of health conditions in trees. The classification strategies are often seen as extensions of the detection strategies, however rather than attempting to observe just one specific sickness amidst totally different conditions and symptoms, these ones attempt to determine and label whichever pathology has effects on the plant.

2.1.1 NEURAL NETWORKS

This is the strategy to segmentation of the photographs into leaves and background within the following variety of size and color options are extracted from each the RGB and HSI representations of the image. Those parameters are finally fed to neural networks and applied mathematics classifiers that are accustomed confirm the plant condition. Throughout its execution, this method uses many color representations. The

separation between leaves and background is performed by an MLP neural network, that is including a color library designed a priori by suggesting that of an unsupervised self-organizing map (SOM). The colors gift on the leaves is then clustered by suggesting that of an unsupervised and undisciplined self-organizing map. The quantity of clusters to be adopted in every case is determined by genetic algorithmic program. Morbid and healthy regions are separated by Support Vector Machine (SVM).

2.1.2 FUZZY CLASSIFIER

In feather palm plants, this method tries to spot four totally different organic process deficiencies. The image is segmental consistent with color similarities. Once the segmentation is completed, variety of color and texture options are extracted and submitted to a fuzzy classifier, which, rather than outputting the deficiencies themselves, reveals the amounts of fertilizers that ought to be accustomed correct those deficiencies.

2.1.3 COLOR ANALYSIS

The method aims to sight and discriminate between four sorts of mineral deficiencies (nitrogen, phosphorus, potassium and magnesium). Victimization fava bean, pea and yellow lupine leaves the tests were performed. The photographs are born-again to the HSI and L*a*b* color areas, before the color analysis. The color variations between healthy leaves and also the leaves underneath taking a look at then confirming the presence or absence of the deficiencies. Geometer distances calculated in each color area quantify those variations.

2.1.4 FEATURE-BASED RULES

Methods to spot and label the three totally different types of diseases that have an effect on paddy crops. As in several different strategies, the segmentation of healthy and morbid regions is performed by suggesting that of thresholds. The two types of thresholds are tested. One is Otsu's and another is native entropy. Afterwards, variety of form and color options is extracted. Those options are the premise for a collection of rules that confirm the sickness that most closely fits the characteristics of the chosen region.

2.1.5 KNN

K-Nearest Neighbour could be an easy classifier within the machine learning techniques wherever the category identification is achieved by distinctive the closest neighbours. In KNN the classification, the calculation of the minimum distance between the given purpose and different points are taken. As a classifier the closest neighbour doesn't embody any coaching method. During this method it finds out similar measures and consequently the category for taking a look at samples. A sample is classed supported the very best variety of votes from the k neighbours, with the sample being assigned to the category most typical amongst its k nearest neighbours. K could be a positive whole number, generally tiny. If k = 1, then the sample is just assigned to the category of its nearest neighbour.

2.2 DISEASE CLASSIFICATION

Saradhambal G and Dhivya R (2018) detects the plant diseases and show the affected part of the leaf by image processing technique. The existing system can only identify the type of diseases which affects the leaf. We will provide a result within fractions of seconds and guided you throughout the project. Samples of images are collected that comprised of different plant diseases like Alternaria Alternata, Anthracnose, Bacterial Blight, Cercospora leaf spot and Healthy Leaves. Database images and input images are classified for each disease from different number of images. Shape and texture-oriented features are the primary attributes of the image. The sample screenshots display the plant disease detection using color based segmentation model.

Table-1: Measuring time complexity and area estimation of infected regions

Type of diseases	No. of images	Clustering time	Area of affected region (%)
Alternaria Alternata	22	Below 20 s	15.0062
Anthracnose	23	Below 20 s	15.0915
Bacterial Blight	7	Below 20 s	13.0093
Cercospora leaf spot	9	Below 20 s	18.2951

2.3 PLANT DISEASES FUNDAMENTALS

Sabah Bashir and Navdeep Sharma (2012) detects that in the field of crop production, plant disease is a significant factor that degrades the eminence and quantity of the plants. Classification and detection model are the common approach followed in plant diseases.

2.4 BACTERIAL DISEASES

“Bacterial leaf spot” is generally referred as the bacterial disease. It is initiated as the small, yellow green lesions on young leaves which usually seen as deformed and twisted, or as dark, water-soaked, greasy - appearing lesions on older foliage.

2.5 VIRAL DISEASES

All viral disease presents some degrees of reduction in production and the life of viruses infected plants is usually short. The most available symptoms of virus-infected plants are frequently appearing on the leaves, but some viruses may cause on the leaves, fruits and roots. The Viral disease is very difficult to analyse. Due to the virus, growth may be undersized and leaves are seen as wrinkled and curled.

2.6 FUNGAL DISEASES

Contaminated seed, soil, yield, weeds and spread by wind and water can be influenced by Fungal disease. In the introductory organize it shows up on lower or more seasoned clears out as water-soaked, gray-green spots. Afterward these spots are obscure and at that point white fungal development spread on the undersides. In wool build-ups yellow to white streaks on the upper surfaces of more seasoned clears out happens. On the leaf surface, it spreads outward and causing it to turn yellow.

2.7 FAILURE DETECTION

Malti K Singh and Subrat Chetia (2017) proposed that aerial images have been extensively used for applications related to precision agriculture, together with the digital image processing techniques. Nowadays, these images can be easily converted into different products, such as ortho photos, water stress maps,

indexes of plant diseases infestation, and others. One product that is greatly desired by companies working on precision agriculture is crop failures identification, aiming to make early decisions in order to avoid financial losses. Considering the range of options when using digital image processing techniques, the proposed methodology uses mathematical morphology operators to identify row crop failures. The main idea is to apply different mathematical operators sequentially, seeking to highlight otherwise hidden failures.

2.8 MORPHOLOGICAL OPERATIONS

Sujatha R, Y Sravan Kumar and Garine Uma Akhil (2017) were analyses the mathematics behind morphological operations on an image is based on the algebra of non-linear operators operating on object shapes. An output image is produced with pixels values that depend on the structuring element, the neighbourhood in the original image that is covered by the structuring element and the type of operation. In binary images several morphological operations have been used in this project. Two-dimensional set of points (pixels) that are either “on” or “off”, (1 or 0) is called binary image. In the following definitions for binary images 1 is all the pixels in the output image, X is the set of pixels in the input image with value 1 and B is the structuring element.

3. PROPOSED SYSTEM

3.1 WORK FLOW OF K-MEAN CLUSTERING ALGORITHM

K-mean clustering algorithm is used to explain about the leaf disease prediction. This project includes several steps image acquisition, image pre- processing, feature extraction, and neural network-based classification. It works as follows:

- image acquisition
- image pre-processing
- image segmentation
- feature extraction
- training and classification

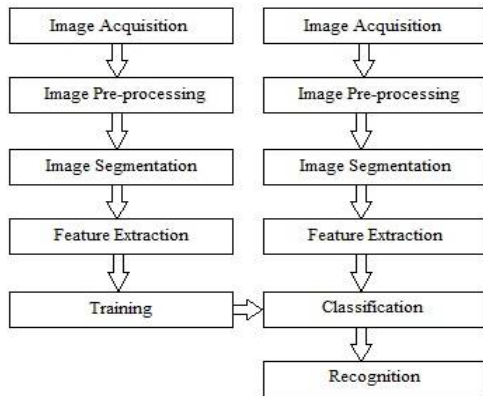


Fig-1: Framework of proposed system

3.2 IMAGE ACQUISITION

In Digital Image Processing (DIP), Image acquisition is the first method and it uses digital camera to capture the image and the image is stored in digital media for further MATLAB operations. For further processing, an action of retrieving an image can be processed. Captured healthy and unhealthy images of leaves by using digital camera is shown in fig 2 for MATLAB image processing system.



Fig-2: Original image of diseased leaf

3.3 IMAGE PRE-PROCESSING

To improve the image data contained unwanted distortions or to enhance some image features, image pre-processing is used. Various techniques used in pre-processing method such as change in size and shape of image, noise filtering, conversion of image, image enhancement and morphological operations. To resize image, to enhance contrast and RGB to gray scale conversion, various MATLAB codes are used and the image is shown in fig. 3.



Fig-3: contrast enhanced image

3.4 IMAGE SEGMENTATION

Conversion of digital image into several segments and rendering of an image into something for easier analysis by using a method called image segmentation. For locating the objects and bounding line of that image using image segmentation. In segmentation, K-means clustering method is used for partitioning of images into clusters in which at least one part of clusters contains image with major area of diseased part. To classify the objects into K number of classes according to set of features, K-means clustering algorithm is applied. The classification is done by minimizing sum of squares of distances between data objects and the corresponding cluster. Image is converted from RGB Color Space to L*a*b* Color Space in which the L*a*b* space consists of a luminosity layer 'L*', chromaticity-layer 'a*' and 'b*'. From the results of K-means, labelling of each pixel in the image is done also segmented images are generated which contain diseases. Input image is partitioned into three clusters for good segmentation result. Leaf image segmentation with three clusters formed by K-means clustering method is shown in figure 4.

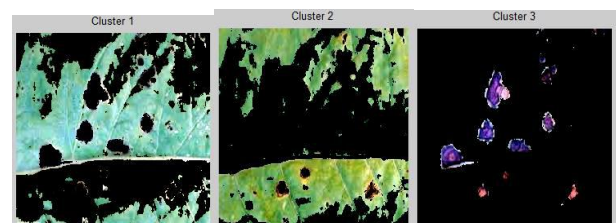


Fig-4: Diseased leaf image clusters

3.5 FEATURE EXTRACTION

In feature extraction desired feature vectors such as colour, texture, morphology and structure are extracted. Involving number of resources required to describe a large set of data accurately, a method called feature extraction. For texture analysis, Gray level co-occurrence matrix (GLCM) formula is obtained by statistical texture features and texture features are calculated from statistical distribution of observed intensity combinations at the specified position relative to others. In GLCM, numbers of gray levels are important. Energy, sum entropy, covariance, information measure of correlation, entropy, contrast and inverse difference and difference entropy are the different statistical texture features of GLCM.

3.6 ORTHOGONAL IMAGE

An orthophoto, orthophotograph or orthoimage is an aerial photograph or image geometrically corrected ("ortho rectified") such that the scale is uniform: the photo has the same lack of distortion as a map. To measure true distances, an orthophotograph can be used because it is an accurate Earth's surface representation. An ortho rectified image differs from "rubber sheeted" rectifications as the latter may accurately locate a number of points on each image but "stretch" the area between so scale may not be uniform across the image. A digital elevation model (DEM) is required to create an accurate orthophoto as distortions in the image due to the varying distance between the camera/sensor and different points on the ground need to be corrected. An orthoimage and a "rubber sheeted" images can both be said to have been "georeferenced" however the overall accuracy of the rectification varies. Software can display the orthophoto and allow an operator to digitize or place line work, text annotations or geographic symbols (such as hospitals, schools, and fire stations). Orthophoto can be processed by some software and it produce the line work automatically.



Fig-5: Aerial image



Fig-6: Ortho image

3.7 RANDOM HOUGH TRANSFORM

The Hough transform is a line detection algorithm based on the point to line duality principle. The basic idea of the Hough transform algorithm is to map a set of points in image space to a set of lines in parameter space. The points in image space are all located on the line ($y = kx+b$), while the mapped lines in parameter space pass the common point (k, b). The algorithm changes line detection in image space to point detection in parameter space. The Hough transform algorithm needs huge computation with excessive redundancy. At the same time the quantization precision of parameter space also affects the detection accuracy. In real-time system application, the Hough transform algorithm is limited. Because of the shortcoming of the Hough transform algorithm, Xu and Oja [10] proposed a randomized Hough transform algorithm (RHT). Hough transform algorithm deficiency is overcomes by RHT. The basic idea of the RHT is described as following. In image space (XY), two points are selected randomly. Then only one point (k, b) is identified in parameter space (KB) by the equation as follows.

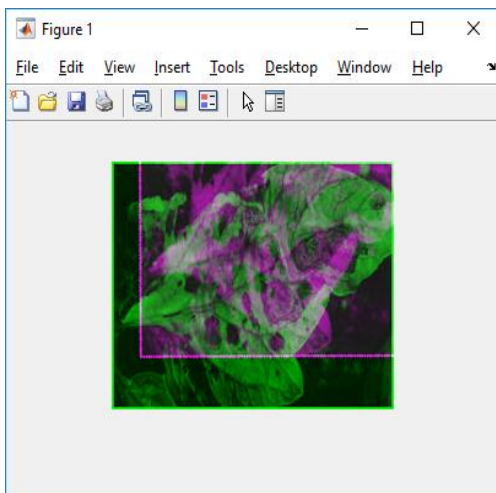
$$k = (y1 - y2) / (x1 - x2)$$

$$b = (x1y2 - x2y1) / (x1 - x2)$$

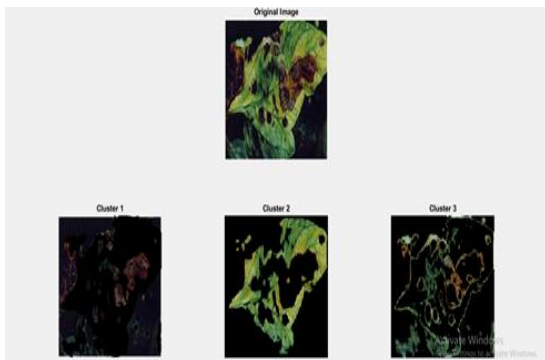
The Hough transform is the dispersion mapping from one to many while the Random Hough transform is the merger mapping from many to one. Merger mapping effectively reduces the amount of computation and improves the calculation speed. Due to the random sampling, there are many invalid mappings. The introduction of linear gradient information can overcome the invalid mapping. The randomized Hough transform algorithm based on gradient was applied to detect the centre line of a crop row and test the detection of crop rows with three plant distributions, which are sparse, general and intensive.

4. IMPLEMENTATION RESULTS

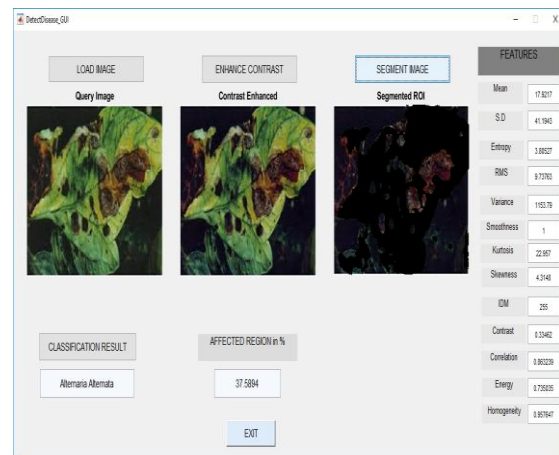
- ORTHO-IMAGE CONVERSION



- SEGMENTED IMAGE CLUSTERS



- RESULT OF DISEASED IMAGE



5. CONCLUSION

Image processing is used to find the accurate detection and classification of the plant disease for the successful cultivation of crops. The proposed methodology in this project depends on K-means and Hough transform which are configured for leaf disease detection. For digital image processing, MATLAB software is flawless. K-means clustering and Hough transform provides high accuracy and consumes very less time for entire processing. In future work, we will extend our database for more plant disease identification with more input plant images.

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