Monitoring Plant Infections using Soft Computing and Image processing Techniques

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Abstract **- Agriculture plays an important role in farmer's life. Sometimes manual identification of disease is time consuming and need of labor is more. One of the most important facts that reduce the growth of plants is disease attack. Overall study about agriculture shows that quality and quantity of agricultural products may be reduced due to various factors of plant diseases. These diseases can be more easily identified by using machine learning approach as compared to manual method. Hence machine learning method can be used to identify the affected leaf images. Images captured by camera will be processed using different image processing technique. These techniques will help in identifying plant diseases thereby increasing the yield of plants. This survey paper describes plant disease identification using Machine Learning Approach and study in detail about various techniques for disease identification and classification is also done.**

Index Terms **- Crop disease recognition. Crop disease monitoring system. Internet of things (IoT). Sum and difference histogram (SADH).**

I.INTRODUCTION

Agriculture is one of the important sources of income for farmer. Farmers can grow variety of plants, but diseases hamper the growth of plants. One of the major factors that leads the destruction of plant is disease attack. Disease attack may reduce the productivity plants from 10%-95%. At present there are different strategies to get rid of plant diseases such as removing the affected plants manually, mechanical cultivation and last is using different pesticides. The easy method to detect to plant disease is taking help of agricultural expert. But this method of manual detection of diseases takes lot of time and is laborious work. Next method is using pesticide, but excess use of pesticide may increase growth of plants, but it reduces the quality of plant. But using more pesticide for plants without analysing how much quantity of pesticide is needed for particular crop because excess use of pesticide may lead adverse effect on environment and human health. Classification of Plant and Diseased Plants using digital image processing and Machine Learning approach which can help to control growth of diseases on Plants using the pesticides in the quantity needed so that excess use of pesticides can be avoided. Automatic identification of plant diseases is an important task as it may be proved beneficial for farmer to monitor large field of plants, and identify the disease using machine learning approach manual disease identification is less accurate and time consuming.

II. RELATED WORK

For distinctive the unwellness of the plant, work by [16] Ghaiwat et al. is studied. This paper presents survey on completely different classification techniques which will be used for plant disease classification. For given take a look at example, k-nearest-Neighbour technique appears to be appropriate still as simplest of all algorithms for sophistication prediction.

For the prediction of the kind of the unwellness contribution from [17] Mrunalini et al. square measure studied that presents the technique to classify and determine the various unwellness through those plants square measure affected. The approach given during this for feature set extraction is that the colour co-occurrence technique. For automatic detection of diseases in leaves, neural networks square measure used. The approach planned will considerably support associate degree correct detection of leaf, and appears to be necessary approach, just in case of steam, and root diseases, putt fewer efforts in computation.

For early and correct detection of diseases contribution by [18] Kulkarni et al. was studied that presents a technique for early and accurately plant diseases detection, mistreatment artificial neural network

(ANN) and numerous image process techniques. because the planned approach is predicated on ANN classifier for classification and Gabor filter for feature extraction, it provides higher results with a recognition rate of up to ninety-one. associate degree ANN primarily based classifier classifies completely different plant diseases and uses the mixture of textures, colour and options to acknowledge those diseases.

For the aim of classification paper by [19] North Borneo Bashir was studied that presents unwellness detection in Malus domestica through an efficient technique like K-mean bunch, texture and colour analysis. To classify and acknowledge completely different agriculture, it uses the feel and color options those typically seem in traditional and affected areas. In coming back days, for the aim of classification K-means bunch, Thomas Bayes classifier and principal element classifier may be used.

III. FEATURES OF LEAF IMAGE

When crops suffer from several diseases, batches (spots) usually happen on leaves. Leaf spots square measure thought of the necessary units indicating the existence illness and thought to be indicator of crops illness [20]. so as to classify illness leaf samples class, a collection of spot options for classification and detection of the various illness leaves, as in Fig1.

Fig. 1. Samples of Diseased Leaf image

Samples of pathologic Leaf image are investigated during this paper. Spot options square measure extracted from image exploitation the acceptable image process technique.

1. Length and ratio of principal axes: Magnitude relation of principal axes length is axis length divided by axis length.

2. Solidity: Conjointly referred to as compactness, encompasses a price between zero and one, if the spot encompasses a solidity price up to one, this suggests that it's absolutely compacted. it's the magnitude relation the gibbose space and also the space of the spot, computed as:

$$\frac{Spot\ Area}{Convex\ Area}$$

3. Extent: Conjointly referred to as oblongness magnitude relation, the proportion of the pixels within the bounding box that are within the spot. it's a worth between zero and one, once this magnitude relation of spot has the worth one then its form is:

$$\frac{Spot\ Area}{Bounding\ Box\ area}$$

4. Hydraulic Radius: it's calculated by dividing the spot space by the spot perimeter:

$$\frac{4 \times \pi \times Spot\ Area}{(Spot\ Perimeter)^2}$$

5. Complexity: conjointly referred to as scatter index, it indicates the perimeter of unit spot space. the larger price, the spot form is additional complicated, and the other way around. It is computed as:

$$\frac{(Spot\ Perimeter)^2}{Spot\ Area}$$

6. Euler Number: It describes a straightforward, topologically invariant property of spot. it's computed because the range of objects within the region minus the number of holes in those objects.

IV. METHODOLOGY

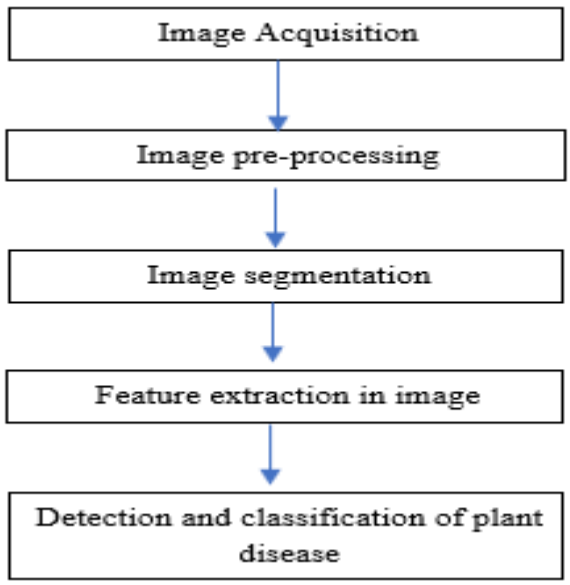

Fig. 2. Basic steps for plant disease detection and classification

A. Image acquisition

The images of the plant leaf area unit captured through the camera. This image is in RGB (Red, Green and Blue) kind. Color transformation structure for the RGB leaf image is created, and then, a device independent color house transformation for the color transformation structure is applied.

B. Image Pre-processing

To remove noise in image or alternative object removal, totally different pre-processing techniques is taken into account. Image clipping i.e., cropping of the leaf image to urge the interested image region. Image smoothing is finished victimization the smoothing filter. Image sweetening is dole out for increasing the distinction. the RGB pictures into the grey pictures' victimization color conversion victimization equation (1).

$$f(x) = 0.2989 * R + 0.5870 * G + 0.114 * B \quad (1)$$

Then the bar graph effort that distributes the intensities of the pictures is applied on the image to reinforce the disease images. The accumulative distribution operate is employed to distribute intensity values.

C. Image Segmentation

Segmentation means that partitioning of image into numerous a part of same options or having some similarity. The segmentation may be done victimization numerous ways like otsu' methodology, k-means clump, changing RGB image into HIS model etc.

1) Segmentation Using Boundary and Spot Detection:

The RGB image is reborn into the HIS model for segmenting. Boundary detection and spot detection helps to search out the infected a part of the leaf. For boundary detection the eight properties of pixels are take into account and boundary detection rule is applied.

2) K-means Clustering:

The K-means clustering is employed for classification of object supported a collection of options into K variety of categories. The classification of object is finished by minimizing the total of the squares of the gap between the article and also the corresponding cluster.

The algorithmic program for K-means Clustering:

- Choose center of K cluster, either indiscriminately or supported some heuristic.
- Assign every pel within the image to the cluster that minimizes the gap between the pel and also the cluster center.
- Again, work out the cluster centers by averaging all of the pixels within the cluster. Repeat steps a pair of and three till convergence is earned.

D. Feature Extraction

Feature extraction plays an important role for identification of an object. In many applications of image processing feature extraction is used. Color, texture, morphology, edges etc. are the features which can be used in plant disease detection.

1) Leaf Color Extraction using H and B components:

The input image is increased by exploitation aeolotropic diffusion technique to preserve the knowledge of the affected pixels before separating the color from the background. to differentiate between grape leaf and also the non-grape leaf half, H and B elements from HIS and research laboratory color area is taken into account. A SOFM with back propagation neural network is enforced to acknowledge colors of malady leaf.

E. Classification

In this methodology each color and texture square measure taken into consideration to induce a singular feature for that image. For that the RGB image is reborn into the HSI translation.

1) Using ANN:

After feature extraction is finished, the training info pictures are classified by victimization neural network. These feature vectors are thought-about as neurons in ANN. The output of the somatic cell is that the perform of weighted add of the inputs. the rear propagation formula, changed SOM; Multiclass Support vector machines may be used.

2) Back Propagation:

BPNN algorithm is used in a recurrent network. Once trained, the neural network weights are fixed and can be used to compute output values for new query images which are not present in the learning database.

V. IMPLEMENTATION DETAILS

Implementation includes image dataset collection, image preprocessing consists of various subsets like removing noise, converting image to hsv color space,

segmentation using k-means, classification using best performing algorithm and finally developing GUI.

A. System Description

Input: The user will input the plant leaf image from the dataset.

Output: Displays whether the leaf is healthy or not, also detects the type of disease.

B. Software Requirements

- Operating System: Windows 7 and above
- Python Version: Python 2.6 and above
- IDE: Spyder
- Development Platform: Google Collaboratory
- GUI: PyQT5

C. Hardware Requirements

- Hardware: intelCORE-i5
- Speed: 2.80GHz
- RAM: 2GB
- Hard Disk: 1 GB
- Keyboard: Standard Windows Keyboard
- Mouse: Two or Three Button Mouse
- Monitor: 15 VGA color

D. User Interface

The user will be provided with Graphical User Interface to choose the plant leaf image to get the predicted test result.

VI. RESULTS AND DISCUSSION

A. Choose Image

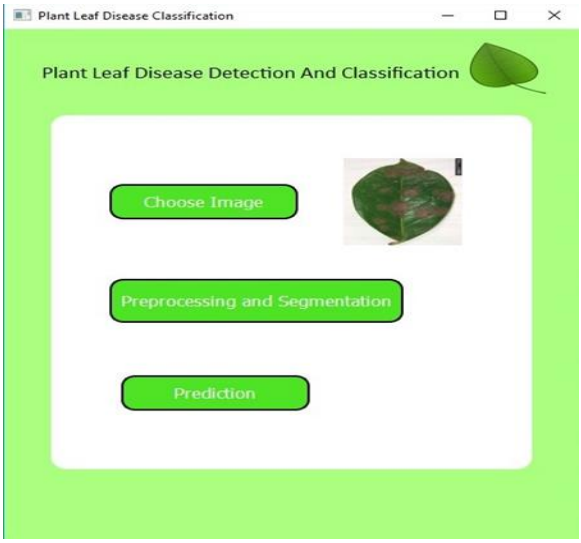

Fig. 3. Choose Image

B. The result of Pre-processing and Segmentation

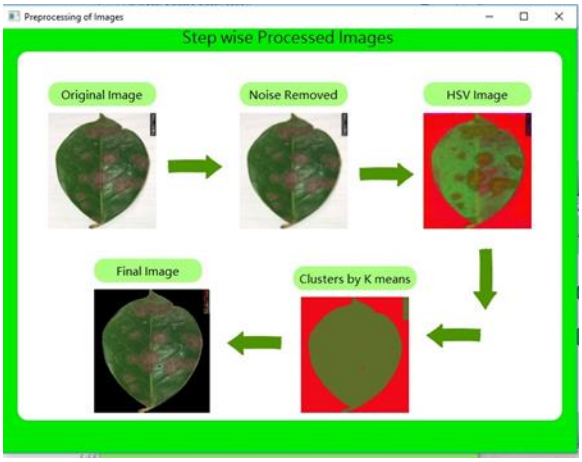

Fig. 4. Pre-processing and Segmentation Steps

C. The result of Prediction

Fig. 5. Prediction - whether the leaf is healthy or not?

Fig. 6. Prediction of the Disease

VIII. CONCLUSION

The proposed monitoring system of crop diseases can effectively solve the problem of human-computer interaction in the process of reasoning. The reasoning process of the monitoring of crop diseases is implemented using the field disease fact image as the basic human-computer interaction method, thus the visualization of monitoring and monitoring is realized. In the monitoring process, users interact with the system, which is similar to the role of plant protection experts in the field, so it is also a process to receive training for the experts and farmers in the monitoring process. At the same time, the system can display the possible diagnostic results in advance in the form of field factual images of diseases for users to choose, which can improve the monitoring efficiency. The system also has the function of recording user monitoring process in the form of field diseases. The user can use it to trace the monitoring and facilitate the examination and study. The image and human-computer interactive monitoring form of this system is its innovative point. It can be used as a monitoring tool for diseases, and can be used as a kind of friendly, real and interactive multimedia training software. It is friendly to human-computer interaction, and the correctness of the monitoring results of diseases is greatly improved. It can not only solve the problem of monitoring and treatment of diseases in production, but also be an ideal multimedia teaching tool. In the future work, more environmental factors will be considered to establish a more perfect disease recognition and prediction model. With the progress of science and technology and the reduction of farm labor force, the large-scale and automatic modern agricultural production mode will gradually replace the traditional empirical agricultural production mode, and this research will contribute to the development of modern agriculture.

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