Plant Disease Diagnosis Using Machine Learning

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Abstract **- Sustainable agriculture is a vital discipline in which now no longer tons interest is given aleven though it's miles notably necessary, so one can display the increase of vegetation for increase in maximum nutritious ways. However, the prevalence of sicknesses on plants should degrade the excellent and reduce the amount of yield. Therefore, in advance detection of plant disorder will assist stopping the plants from extreme contamination and heading off crop loss. Our idea makes use of an SVM algorithms to hit upon kind of sicknesses in order that we are able to hit upon signs at early level and required insecticides may be suggested, complete manner is embedded in android app the complete device being cost effective. The device is able to suggest the right remedy for the disorder in real-time.**

Index Terms **- Android App, Disease detection, Sustainable agriculture, SVM Algorithm.**

I.INTRODUCTION

The agricultural manufacturing value may be drastically accelerated if plant illnesses are not detected and cured of their early stages. The vegetation should be monitored all of the time which will come across the primary signs of an ailment earlier than it is far unfold to the complete crop. Professional agriculture engineers will not be to be had to constantly screen a crop if for instance the crop is living in a far-off region. Remote tracking through gadget imaginative and prescient can provide an opportunity option. Molecular evaluation might also additionally should be done which will verify if a plant is tormented by a selected ailment.

The development of the signs in time can range drastically relying at the biotic dealers and that they may be categorised as number one or secondary. More than one pathogen can infect simultaneously a plant. The signs that seem in this example might also additionally range from the signs because of the individual pathogens. The signs of a pathogen may be frequently expressed as fungal or bacterial leaf spots. Vein banding, mosaic and ringspot also can seem. The leaves may be distorted, or a powdery mould can seem. Spore systems can also be present. The vegetation may additionally be injured through air pollutants or through soil/air chemicals.

Plant illnesses can growth the value of agricultural manufacturing and can enlarge to general catastrophe of a manufacturer if now no longer cured correctly at early stages. The manufacturers want to screen their vegetation and come across the primary signs which will save you the unfold of a plant ailment, with low value and store the essential a part of the manufacturing. Hiring expert agriculturists won't be lower priced mainly in faraway remoted geographic regions.

Machine imaginative and prescient can provide an opportunity answer in plant tracking and such a method might also additionally besides be managed through an expert to provide his offerings with decrease value. Of course, there are numerous extra checks that should be done which will verify a selected ailment however picture processing can supply a primary clue on what absolutely occurs on the field.

This paper represents the technique for plant leaf ailment detection and class the usage of gadget studying incorporated virtual picture processing strategies. We have proposed a prediction version for plant leaf ailment detection and class that follow one-of-a-kind picture processing strategies for pre-processing, segmentation and feature extraction. Different class strategies are considered that classifies ailment into one of the classes.

A. Problem Approach

Farmer's financial boom relies upon at the quality of the goods that they produce, which is based on the plant's boom and the yield they get. Therefore, in area of agriculture, detection of ailment in flora performs an instrumental role. Plants are distinctly susceptible

to illnesses that have an effect on the boom of the plant which in flip impacts the ecology of the farmer. In order to hit upon a plant ailment at very preliminary stage, use of computerized ailment detection method is advantageous. The signs and symptoms of plant illnesses are conspicuous in exceptional components of a plant along with leaves, etc. Manual detection of plant ailment the use of leaf photos is a tedious job. Hence, it's far required to expand computational strategies in an effort to make the system of ailment detection and class the use of leaf photos computerized.

B. Objectives

- Capturing images of different diseases in plants.
- Collecting open-source dataset.
- To come up with ML algorithm to predict the diseased plants.
- Build an android application to capturing and detecting the disease.
- To suggest remedy for the disease that is detected.
- Deploy our project to real time conditions.

II. RELATED WORK

Taohidul Islam et al [1] discusses about the new technique of detecting and classifying disease by directly using the percentage of RGB value of diseased portion. Unlike other techniques which are based on calculation of total area of leaves, this technique is based on percentage calculation. Therefore, it is efficient than other technique as it can detect and classify disease from a small sample of leaf containing diseased portion. Processing the whole leaf in not necessary in this technique and as a result processing becomes lot faster than previously proposed methods. Also, the technique is far simpler due to the use of Naive Bayes classifier to identify the diseases in agricultural field.

Nikos Petrellis et al [2] has described about the mobile application which he built and tested to find out the plant disease through image processing that analyzes the color features of the spots in plant parts. It was evaluated on grape disease with an accuracy that exceed 90% using a small set. But the disadvantage of that concept was he used very small dataset and if we use a greater number of dataset then the accuracy may decrease.

Kurniawati et al [3] proposed system for diagnosing paddy diseases, including Blast Disease, Brown Spot Disease and Narrow Brown Spot Disease mainly based on MATLAB application has been developed in this study. The image processing techniques were used to establish the classification system. Four characteristics of lesion type, boundary color, spot color, and broken paddy leaf color were tested for used to establish the classification system. The ratio of height and width of the lesion spot provided a unique shape characteristic for determining the type of the lesion. Two thresholding methods have been applied to get the best result in diagnosing ninety-four paddy leaf images. The best accuracy of two methods that used local entropy threshold is about 94.7%. Different intensity values and less prone to illumination, thus Otsu method is disabled to perform segmentation task accurately.

Rashedul Islam et al [4] discuss that Image processing technique is very much essential to observe the intensity of disease. As the open eye observation may result poor accuracy and it may vary person to person. So, with the help of K-means clustering, image of paddy leaf can be segmented. And by counting the disease affected pixels and unaffected pixels the percentage of disease affected pixels can be calculated. According the percentage of disease affected pixels the severity of disease can be understood; consequently, appropriate measure can be taken to cure the disease.

III. METHEDOLOGY

A. Capturing the picture

First level of plant sickness detection gadget is picture acquisition. High first-class plant pictures may be obtained the use of virtual cameras, scanners or drones.

B. Image Acquisition

It is the system of pictorial photo advent of a bodily view or the inner shape of an object. Image acquisition may be broadly defined because the interest of restoring a photo from a few origins, usually a hardware-based source which can be processed along with processes that need to appear afterwards. Image acquisition is constantly the preliminary circumstance for the paintings glide collection of photo processing due to the fact as processing is feasible most effective

with the assist of a photo. The photo received is completely herbal and is the result of any hardware which changed into treated to supply it.

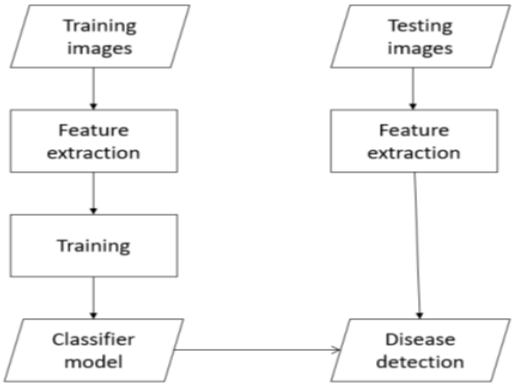


Fig.1 Training of classifier and classification

C. Image Pre-processing

Pre-processing on images is vital to cast off the noise from a picture. Pre-processing involves enhancement of the visual appearance of images, increasing or decreasing the number of pixels of the dataset, resizing images and removing noise from the images. It is likewise had to normalize the depth values from a picture. Image pre-processing is the technique of improving the first-class of picture through casting off history noise and normalizing the depth of the diverse factors of the picture previous to any computational technique implemented on it. Image enhancement and healing may be beneficial to pre-technique a picture. Image Segmentation is the technique of dividing a virtual picture into numerous parts. The number one purpose of segmentation is to understand items or extract the associated records from pix, in order that reading a picture will become easier. Objects and bounding line of pix are placed with the aid of using the usage of picture segmentation. Pixels with comparable label element percentage distinguishing functions for allocating a label to every pixel in a picture. During our test to transform the noisy picture into smooth picture, picture healing strategies are beneficial. We have eliminated the undesirable noise and blur from leaf image the use of special filters like gaussian blur. For overall performance measurement, PSNR and RMSE values are taken into consideration.

D. Feature Selection and Extraction

After making use of suitable pre-processing and segmentation at the sickness affected leaf, diverse characteristic extraction strategies are implemented to reap the centered functions which may be used for the class. Features may be considered as quantifiable houses received from the diverse centered quantities of the picture. For any system mastering primarily based totally software characteristic identity and characteristic extraction is taken into consideration as pioneer step. Overall accuracy of the system mastering algorithms is rather depending on the received functions. Feature choice is taken into consideration because the maximum important step of any pc vision-primarily based totally system mastering task. Feature selection and extraction of our model is based on color and texture.

1) Color features: A fundamental function to examine alternate in diseased plants is color. Color function is normally utilized by many researchers for type of plant illnesses. There are many techniques for color function extraction which includes color histogram, histogram intersection, color correlogram, color co-occurrence matrix, color coherence vector.

2) Texture features: Texture is not anything however a duplicated shape of facts or the association of the shape that happens at uniform intervals. Since each plant ailment has specific shape, texture capabilities are used to discover and classify plant illnesses.

E. Training of classifier and class

It is the technique of inspecting said successions of tokens for the lifestyles of the factors of a few patterns. The assignment of matching set of rules is to evaluate capabilities with index capabilities of the photograph within the database. Classification is a manner of figuring out the class of the determined pattern. Two most important classes of type are supervised and unsupervised. In supervised type, education is needed wherein consumer can pick out pattern pixels to shape a class. Unsupervised type wishes no education and consequences are primarily based totally at the software program evaluation without pattern classes. Classification strategies consisting of support vector machine, neural networks, k- nearest neighbor, fuzzy good judgment etc. are used for plant ailment detection. We use SVM algorithm to train our dataset. SVM is a supervised mastering set of rules used for class or regression problems. Classification is achieved through defining a keeping apart hyperplane withinside the characteristic area. In the unique form, it plays linear class on classes. By the use of kernels,

it may additionally carry out non- linear class. Kernels are used for a green transformation of the unique characteristic area into excessive dimensional or countless dimensional characteristic area, making an allowance for rather non-linear hyperplanes. SVM can match rather complicated datasets and on the equal time show off exact generalization houses. Multiclass class the use of SVM may be applied the use of one-vs-all or one-vs-one strategies. One-vs-all technique trains N classifiers (N is the quantity of classes), wherein every classifier considers examples from one elegance as positive, and all others as negative. One-vs-one technique trains N(N-1)/2 binary classifiers and determines the winner through max-wins voting.

IV. CHALLENGES

There are few challenges in plant disease detection using image processing techniques which are listed below

A. Collection of data set

Basic need of image processing is creating a database of images. To acquire images of plant diseases, one has to travel to different places. Data collection will be a challenging since variety of plant diseases may not be available at some farms and diseases occur only during some seasons.

B. Image background

Image segmentation is important phase of image processing, where we separate most required part of image. Leaf image segmentation may be a challenge if background contains plants, leaves and some other green elements.

C. Image capture condition

Automatic plant disease detection systems give steady and efficient results, only if all the images are captured under same condition. Capturing images under same condition is possible only inside laboratories. It's a challenge to capture images under same condition in the field because of uncontrollable environment.

D. Symptom segmentation

Most plant disease symptoms have no well-defined edges and they fade on plants slowly because of which there will not be a proper segmentation, which will affect final result.

E. Symptom variations

Symptom depends on environment, disease and plant. Any change in these elements may result in symptom variations. It's a challenge to identify the plant disease with symptom variations.

F. Multiple simultaneous disorders

Many times, automatic plant disease detection systems may wrongly assume that there is only one disorder present in an image. Pests and nutritional deficiencies may occur simultaneously because there is maximum possibility of plant being attacked by other disorders after having infected by some disease.

G. Different disorders with similar symptoms

Many plant disorders have similar symptoms such as diseases, nutritional deficiencies, pests, phytotoxicity, excessive cold or heat. It's a challenge to differentiate and identify the disorders by automatic plant disease detection techniques.

V. EXPERIMENTAL RESULTS

Various steps of intermediate results and the final results obtained during the experiment are discussed in this section:

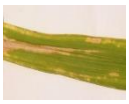
Here 982 images are taken to train the network, from which 118 of Jasmine Bacterial leaf blight, 136 of Jasmine Brown spot, 114 of Jasmine Healthy, 126 of Bell Pepper Bacterial spot, 138 of Bell Pepper healthy, 141 of Rice Bacterial leaf blight, 101 of Rice Brown spot, 108 of Rice leaf smut samples are considered for training and testing.

The infected leaves are initially identified and captured. Since the captured images are of different size, shapes and also vary in many aspects, all are mapped to a normalized size. The samples images of each disease are shown above in the Table 1. Then the normalized images obtained after applying the pre-processing techniques like resizing the images and gaussian blur filter is done. Feature selection and extraction of preprocessed image is done based on the shape, color and texture. Then the features are trained under SVM classifier. The testing image is captured in mobile application and detected disease is shown.

We have experimented with special configurations and located that the first-class effects had been received through the use of the radial foundation characteristic kernel and regularization parameter

C=100. One-vs-all technique turned into used. The carried-out accuracy at the check set is 81.98%.

Table 1. Sample images of each disease

	Jasmine Bacterial leaf blight
	Jasmine Brown spot
	Jasmine Healthy
	Bell Pepper Bacterial spot
	Bell Pepper healthy
	Rice Bacterial leaf blight
	Rice Brown spot
	Rice leaf smut

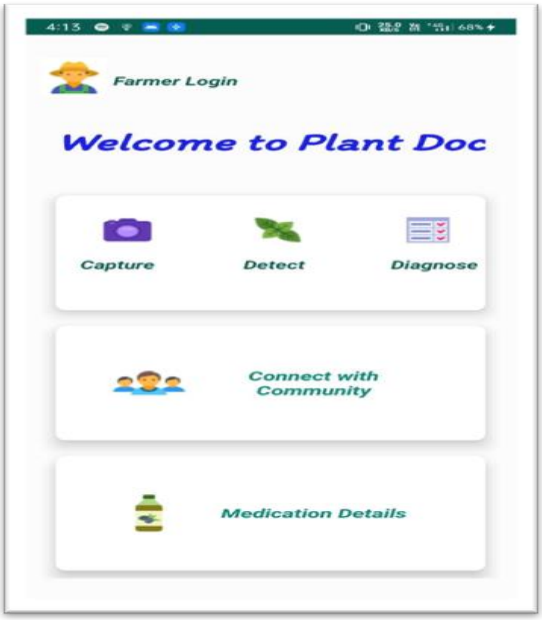


Fig.2 Home page

Fig.3 Rice Bacterial leaf blight disease

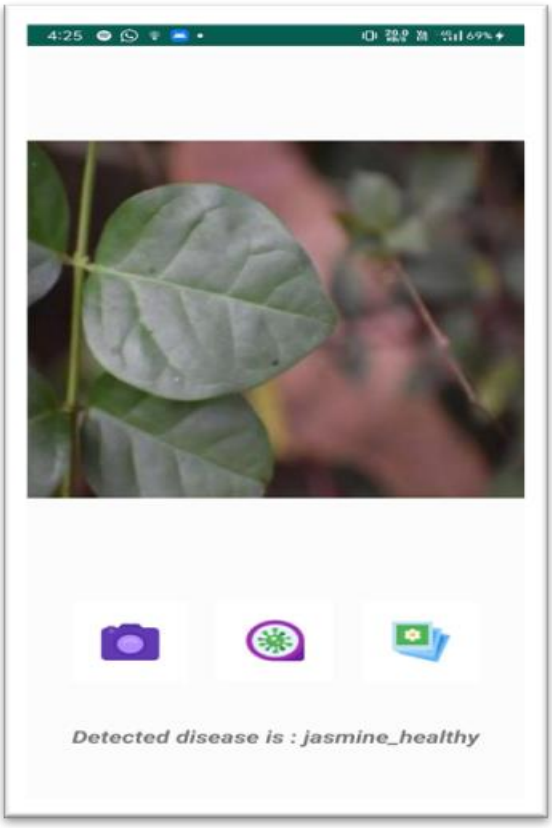


Fig.4 Jasmine healthy plant

VI. CONCLUSION

The paper in particular specializes in the plant disorder detection and through the utility of diverse methodology. Usage of diverse characteristic extraction strategies and a stable, enough facts set have facilitated in acquiring pleasant experimental results. The utilization of classifier “Support Vector Machines (SVM)” have superior the overall performance of the gadget which presents higher results. Development of automated detection gadget the use of superior era like photograph system facilitate to guide the farmers in the identity of sicknesses at an early or preliminary degree and deliver useful facts for its management. we would choose to increase our work on numerous disorder detection.

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