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Plant Leaf Disease Detection with Classification using Machine Learning

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Abstract - India is an agricultural dependent country wherein most of the economic income comes from agriculture. Improper maintenance and protection of crops leads to more infections and affects the overall production. In India, technology based on modern agriculture is the most requirements in every part of agriculture, to have more profit. This technology helps the farmer to identify what type of diseases that the plant is being affected and suggests some medicine to be given to the affected plant. Thus, the use of this technology in agriculture may help in increasing the productivity and improve the condition of Indian farmers and protection of their product with the use of precision agriculture and also the plant crops can be free from diseases. The infections in the plant parts are processed using the image, and the plants' specific disease is identified. So, using modern technologies identify few diseases of a particular plant which is popularly grown and monitored. This proposed system presents an overview of the classification and detection of plant leaf diseases using machine learning. Within the area of machine learning, neural networks are a subcategory of algorithms built around a model of artificial neurons spread across three or more layers.

Keywords - Image processing, diseased and healthy leaf, Future extraction, Classification Machine learning, neural networks, and MATLAB.

I.INTRODUCTION

The advanced technologies have given human society the power to produce sufficient food to meet the demand. However, food security remains intimidate by a number of factors including climate change, plant diseases and others factors. Plant leaf diseases are not only a threat to food security at the world scale, but can also have disastrous impact for smallholder farmers whose livelihoods depend on healthy plants. Numerous endeavours have been improved to prevent plant loss due to diseases. However, the new techniques are not cost effective and are more time consuming.
In order to develop perfect image classifiers for the purposes of plant disease identification, needed a more, verified dataset of images of diseased and healthy plants. At the present time, server and mobile based method for disease identification has been employed for disease detection. The machine learning for plant disease detection and, such machine learning methods being artificial neural network, and support vector machine (SVM), K-means method, Convolutional neural networks etc.This proposed system aim is to design and develop a control system using sensors in the crop field with data management via smart phone and a web application. The three components are hardware, web and mobile application. Furthermore, this system represents driving agriculture through digital innovation.

II.LITERATURE REVIEW

[1] Jirapond Muangprathuba, Nathaphon Boonnama (2019) “IoT and agriculture data analysis for the smart farm”, villages are located apart from each other and have differences in farming. The example village has lime cultivation and homegrown vegetables. Farmers can spend the time saved on other activities for increased income. The real-time information from IoTs devices in each town is used to control on-off switching of water sprinklers, automatically. Initially, collected IoTs information for five months (170 days) and performed yield analysis with these data. The obtained IoTs information consists of temperature, humidity, and soil moisture, and was collected every 20 min, but for review, the daily averages were used. Moreover, recorded the yields of lime cultivation and homegrown vegetables to determine relationships between IoTs information and the agricultural products.

[2] Zahid Iqbala, Muhammad AttiqueKhana (2018) “Plant leaf diseases detection and auto-medicine" This system consists of a device called Raspberry PI which is Quad-core 64-bit ARM processor 1.2 GHz. It also contains dual-core multimedia co-processor which supports for multimedia applications. The web camera is interfaced with Raspberry PI processor gadget and set in agrarian ranch. This a digital camera or web camera or Closed-Circuit Television (CCTV) consistently catches the picture of leaves and contrasts and the database of the leaves picture

which are pre-put away in the gadget utilizing image preparing strategies. What's more soil dampness and temperature sensors are put in a request to abstain from spreading of illnesses because of progress in climatic conditions. Two transfers are fitted to kill on the valves for the control of water stream and medication stream. This system suggests data about the sicknesses stage and kinds of maladies to the client utilizing the Global System for Mobile Communications (GSM). The picture handling plan comprises of picture procurement through advanced camera or web camera; picture pre-preparing incorporates picture improvement and picture division, morphological systems and arrangement. At long last, the nearness of sicknesses on the plant leaf will be recognized.

III.METHODOLOGY

A. Machine Learning: Machine learning is used to create an algorithm to model knowledge inside the data. It is also a data analytics technique that teaches computers to do what naturally humans and animals where learn from experience. In machine learning, Image processing is a method to convert an image into digital form and perform some operations on it. The four types of machine learning are Supervised Learning, Unsupervised Learning, Semi-Supervised Learning, and Reinforcement Learning.

B. Pre-processing: Pre-processing have four different methods such as Contrast adjustment, Intensity adjustment, Histogram equalization, Binarization which is used to improve the image data that suppresses unwilling distortions or enhances.

C. Segmentation: It is the process of partitioning the pixels of an image into groups. The segmentation is to simplify or change the representation of an image into something more meaningful. The popular techniques are thresholding techniques, edge detection-based technique, region-based technique, clustering based technique, artificial neural based technique etc. Segmentation is mainly used to locate objects and boundaries in images.

D. Feature Extraction: Feature extraction is a process in which the image can be analyzed by using different parameters such as texture, colors, etc. Initially, the raw image can be input and the input image has been converted to a grayscale image for identifying the difference between the affected and unaffected leaf. Further, the image has been undergone the enhancement process. In that process, the affected region has been noted by darkening that region in the leaf. Further, the status of the leaf has been identified.

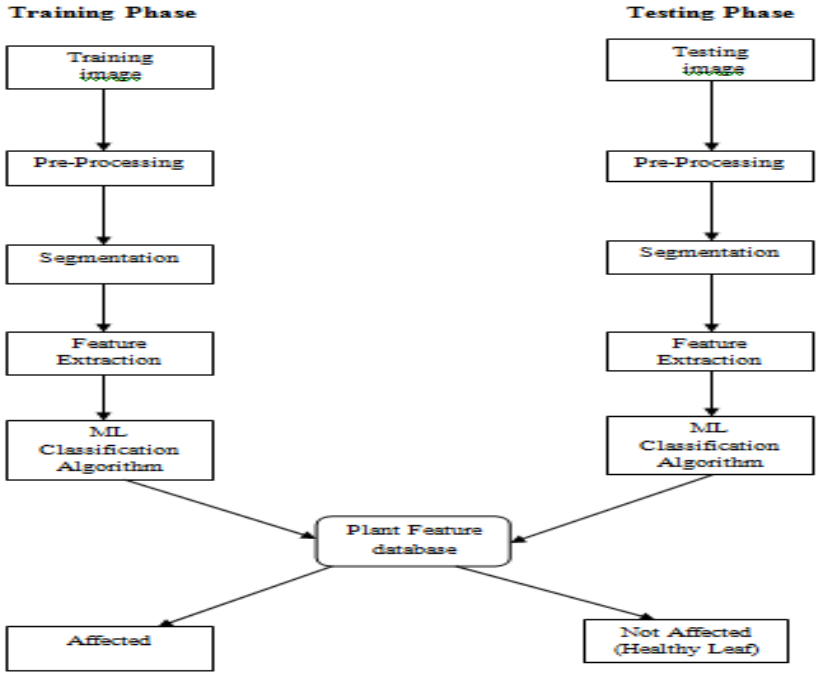
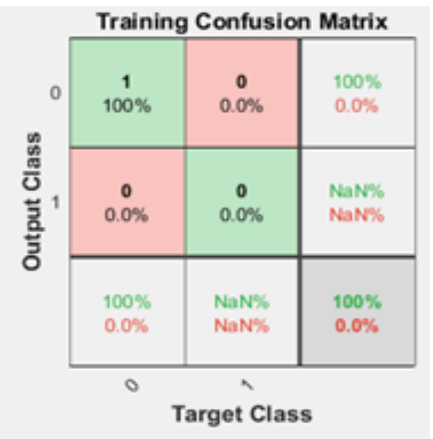
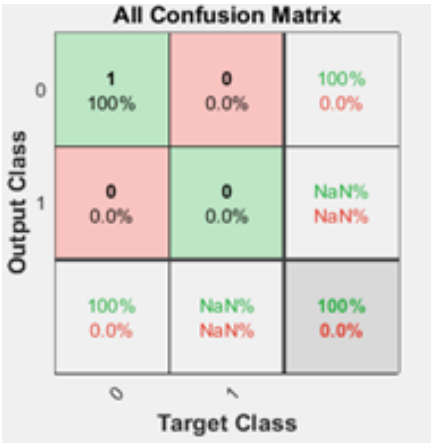


Fig. 1 Leaf Disease Detection System

E. Classification: The image processing classification system consists of a database that contains predefined patterns which are used to detect and classify in proper category. It is used to develop a statistical characterization of the reflectance in each information class. In this project, neural networks have been used to recognize the image. Neural networks are an interconnected collection of nodes that are called neurons or perceptron's. Every neuron takes one piece

as an input data, one pixel of the image has applied for simple computation. Some of the neural networks are Artificial Neuron, Radial basis function Neural Network, Convolutional Neural Network and etc.





F. Support-Vector Machines: SVM is a supervised machine learning models which is used for classification. The idea of SVM is simple and it can solve both linear and non-linear problems.

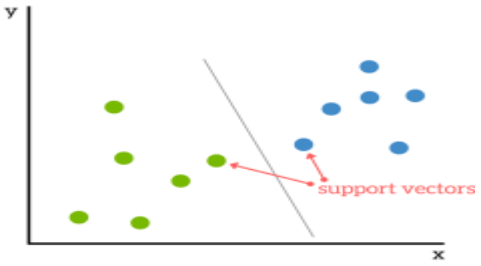


Fig. 2 SVM

IV.RESULTS AND DISCUSSION

The input image, as shown in figure 3, is loaded, and they are pre-processed. The Contrast Enhanced image of the leaf is shown in figure 4.

Fig. 3 Input leaf image

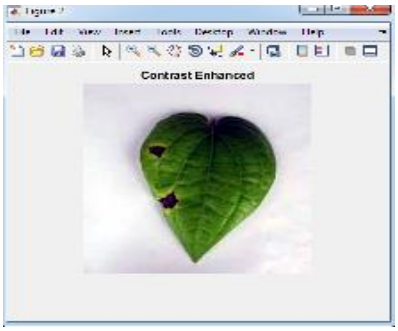
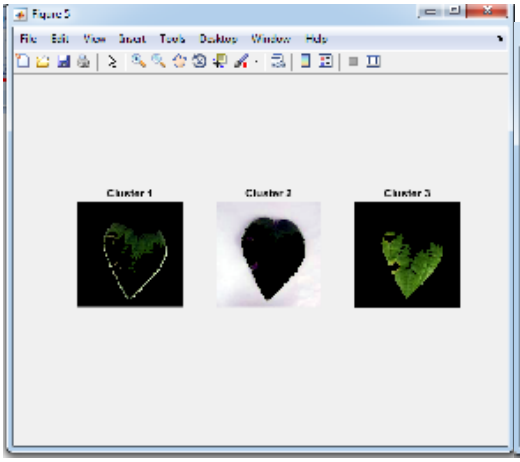


Fig. 4 Contrast-Enhanced Image

The OTSU and HIS segmentation were performed in figure 5 and figure 6 to classify the leaf segments for detecting the status of the leaf.

Fig. 5 OTSU Image **Fig. 6 HIS Image**

After that, three types of cluster images have shown in figure 7, which is helpful for classifying the disease. In those three, user has to select one model for verifying the segmented image status that is shown in figure 8.



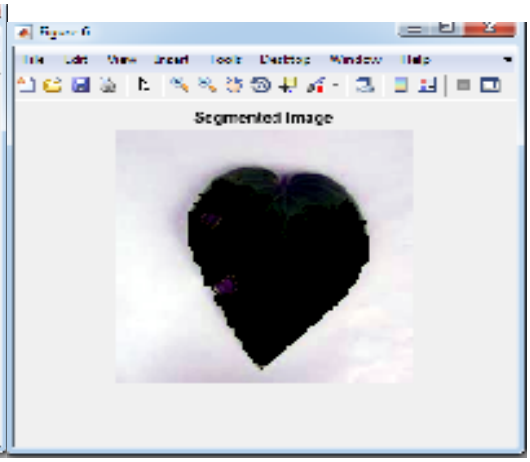
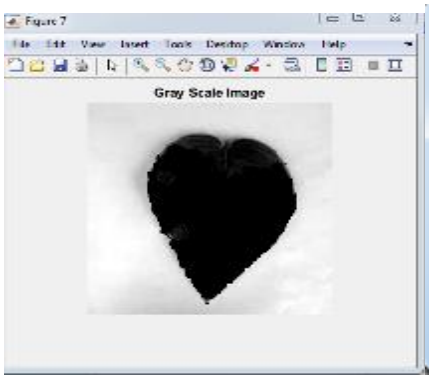


Fig. 7 Cluster images **Fig. 8 Segmented image**

Finally, a grayscale image has shown in figure 9, which is used to identify an affected image or not. After all these processes, a dialogue box is shown as an output in number 10, which will declare the status of the input image**.**



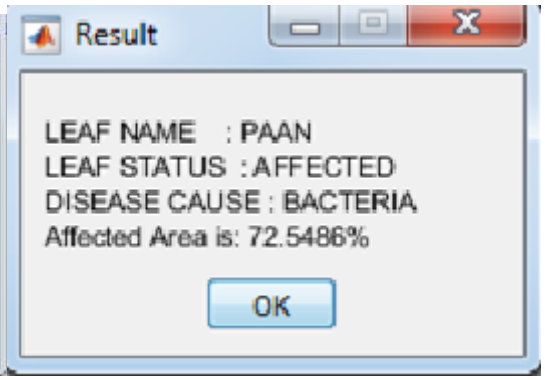


Fig. 9 Gray Scale Image **Fig. 10 Dialog box**

V.CONCLUSION

An application to detect, controls, and monitor the plant disease helps the farmer to reduce their work as well as time. This application helps the farmer to reduce their effort, and also helps in increasing the farm of production. The proposed method helps to find the plant disease and in monitoring the several environmental conditions. After tracking the disease, this application helps the farmer to choose an appropriate medicine for a particular disease. The analysis of the plant leaf disease was implemented and processed in MATLAB software**.** First, contract the image and then cluster

the image and at-last segment it, which gives the intimation about the plant health whether they are in average condition or it is affected by any disease**.** If it is a normal leaf, it will show the output as the healthy leaf, and if it is affected by any diseases such as grey leaf spot, leaf mould, bacterial brown spot etc., It will show the output as affected leaf. The SVM and NN techniques were determined the accuracy of between 80%-84%.

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