Identification of Cotton Leaf Diseases Using Raspberry Pi

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Abstract— In India cultivation of crop is carried out by traditional methods and techniques. Today tremendous improvement in field of agriculture technologies and products can be seen. The plant diseases affect the overall production drastically. Image processing technique can be key technique for diagnosis of plant diseases. A simple system can be implemented using Raspberry pi with computer vision technology and image processing algorithms.

Keywords- *Application in agriculture, Raspberry Pi, computer vision, scale invariant feature transform, machine learning*

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I. INTRODUCTION

India is well known for its agricultural economy. India ranks second worldwide in farm output. More than sixty percent of people depend on farming business directly or indirectly. Agriculture product contributes significantly in India's gross domestic product. Slow agricultural growth is main concern for Indian farmers. Traditional agricultural practices are neither economically nor environmentally suitable for agriculture development. There is requirement of precise and efficient technology for agricultural development.

Agriculture production highly affected by disease occurs due to various environmental factors and false practices of farmers. Most of the plant diseases occur on plant leaves. Hence area of interest to diagnose the disease is plant leaf. Cotton leaf diseases shows visual symptoms on it leaves. Image processing can give solution to detect the diseases on the basis of their visual symptoms. [1]

The diseases like Bacterial blight, White fly and Curl Gemini are affecting the crop from early stage of cultivation. It reduces the production and quality of product drastically. To diagnose these diseases precisely is crucial step for good cultivation of crop. Bacterial Blight can affect the cotton plant in all growth stages. It infects stems, leaves and bolls. In this disease small dark-green spots occur initially and spots increase in diameter to 5 mm, become angular brown and later turn dark brown to blackish, becoming visible on the upper surface. Whiteflies are small insects that typically feed on the undersides of plant leaves. The eggs of white flies generally are laid near each other on the plant, usually on a leaf, in spiral patterns or arcs, sometimes in parallel arcs. Leaves of infected cotton curl upward and bend on the underside along with vein thickening. Plants infected early in the season are stunted and yield is reduced drastically. [2][3]The visual features can be extracted from leaf images and classify them according to their feature using image processing techniques.

II. SYSTEM DESIGN

The system proposed is developed on Raspberry pi module. Raspberry pi is powerful credit-card sized single board computer can be used for many applications. It is the popular board format for small dedicated applications. Its key benefits are low cost, fast processing, low power requirement, compact board format and high reliability. Coding is done in python language as it is an object-oriented high-level scripting based programming language. . It enables the programmer to express his ideas in fewer lines of code without reducing any readability. The Python interpreter and the extensive standard library are available in source or binary form without charge for all major platforms.

III. METHODOLOGY

Initially image is taken from the training dataset. Preprocessing of image is done for further process. In pre processing, image resize into 250x250 pixels. The image converts from RGB to Gray scale to reduce computation complexity. The scale invariant feature transform is applied to get highlighted features from the image. These features are given to k-mean cluster which make a bag of feature's labels and their respective parameters. Then compute histogram of these parameters. Histogram equalization carried out to improve performance. Histogram parameters are stored into codebook file. This codebook file is given to SVM to classify the images according to their feature characteristics. The model file of SVM is use to test the input image with different classes in dataset.

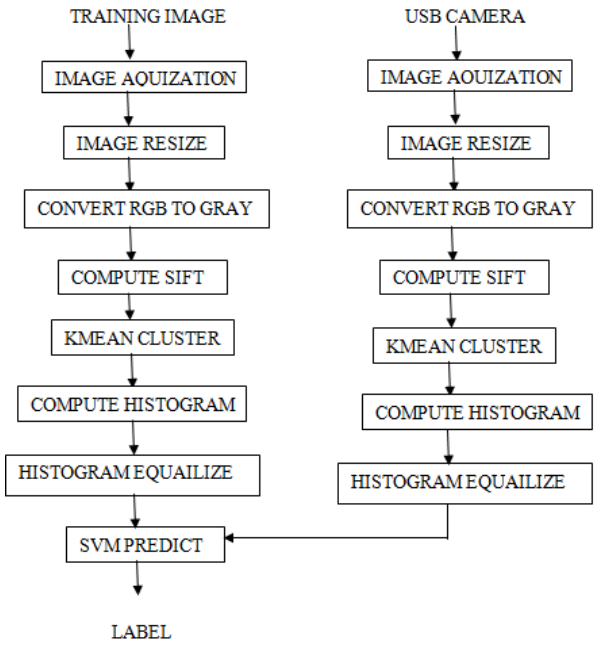

Figure1: Flow Chart

To test the image, at first the image is taken from USB camera. Then all the processing is done to compare its features with the model file of SVM. At last the result is displayed on display as class label.

IV. Result and Discussion

An example of Detection of disease on cotton plant leaf:

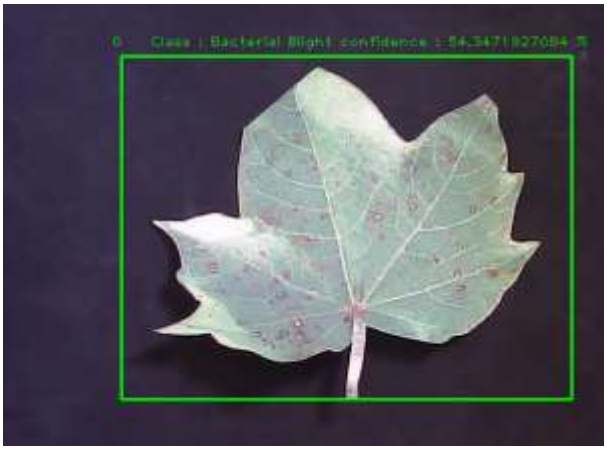

Figure2: Result screenshot

A. *Prediction of disease:*

Image dataset contains images of infected plant leaves. Different diseases show different visual features. SIFT features are extracted from image to detect the local features of infected leaf. SVM is train and use to classify the infected image. SVM predict the disease and return label as name of disease which infected the plant. In example disease predicted is Bacterial blight.

B. *Confidence of prediction:*

Confidence value shows matching percentage of test image features with dataset image features. It gives numeric value to diagnose of disease infecting the plant. In example confidence value is 54.34 percent.

C. *Time of execution:*

Time of execution can be improved by proper implementation of algorithm on available hardware. With limited hardware processing capacity choice of algorithm plays important role in performance of system. The use of algorithm also depends on application requirements. The use of SIFT for feature extraction along with SVM for classification gives good processing efficiency. In example time of execution is 0.45 seconds.

V. Conclusion

The system can detect the cotton leaf diseases based on training model. The proposed system shows that image processing applications can be implemented on credit card size computer like Raspberry pi which is more efficient and economical. The system performance is improved by histogram equalization. The system can be improved up to certain extent considering processing capability of Raspberry pi. There are other algorithms can be used for image processing and dataset can be improved for training to increase accuracy.

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