International Journal of Future Generation Communication and Networking
Vol. 13, No. 2, (2020), pp. 259 - 264

Identification of Groundnut Bud Necrosis Virus on Tomato Fruits using Machine Learning based Segmentation Algorithm

Kaveri Umesh Kadam
Ph.D. Research Scholar, School of Life Sciences, Jawaharlal Nehru University, New Delhi, India. Email: kaverikadam@gmail.com

Abstract

Disease classification in plants is significant to prevent the failures in the amount as well as the production of agricultural manufactured goods. The difficulties in the farming sector are pointed out by using different Machine Learning and Image Processing Methods. This paper mostly focuses on tomato plant Groundnut Bud Necrosis Virus disease diagnosis using an image as inputs. Different input images give-ups varied superiority of a result and so choosing a classification technique is a significant task. In general, the raw fruit images need pre-processing to distinguish the segmentation functions. These pre-processing functions consist of de-noising and intensity normalization. The preprocessed image is given as input to disease classification using different segmentation algorithms. In this work Support Vector Machine based segmentation algorithm is proposed. Further, the severity is calculated for further processing.

Keywords: *Groundnut Bud Necrosis Virus, Tomato Fruits, Machine Learning, Segmentation Algorithm.*

I. Introduction

Tomato is a berry of the plant Solanum Lycopersicum, fit for human consumption, frequently red and usually identified tomato plants. While the tomato fit into the Solanaceae family, recognized as the "deadly" Nightshade family, it has previously offered a counterfeit status of being toxic as It is a leaf of tomatoes that is poisonous and not fruit or tomatoes. Tomatoes made from the Andes were brought in to Europe in the 16th century. Currently, this plant is general worldwide, also, to have turn into an economically significant crop. Also, this plant is a representation species for identifying agronomically significant genes in dicotyledonous crop plants.

The outbreak of Tospovirus disease has affected many crops including chilli, wange, cowpeas, potatoes, cluster beans, mungbean, udid, musk, soybeans, peas and peanuts. Various types and serological analyzes of hosts in India say that tomato virus is considered as an injury to ***Groundnut Bud Necrosis Virus (GBNV)*** and is selected as **GBNV**. Tuberculosis disease on tomatoes has also been described as bud blight, the leading cause of tomato bud blight, as well as the **Peanut *Germ Necrosis Virus (PGNV)***.

Identifying skills based on the specialty of tomato food engineering, which is the key to awareness of automated tomato sorting equipment so that it can reduce human effort as well as time. This work demonstrates the hierarchical rating technique applied to tomatoes. The work presented in [1] is based on the classification of high-quality as well as bad quality tomatoes. The steps are to extract input tomato image's features moreover then utilize various techniques for example thresholding, segmentation, K-means clustering. Evaluating numerous trained databases provides us a precise class for good as well as bad tomatoes. From the suggested class, one can recognize good as well as bad tomatoes. Thus this paper studies the good as well as bad tomatoes by means of ***Image Processing (IP)*** with great precision with 80% accuracy.

The author **(Claudio Denis, *et al.*, 2009**) proposed a technique of categorization tomatoes supported by IP [2]. The idea consists of a webcam camera for concurrently *categorize the tomatoes based on shape and color*. At shape classification, the method employs an algorithm of IP developed in ***0bject 0riented Language (OOL)*** as well as based on Sobel's filter. At color classification, the method employs a method of color management using ***Multilayer Perceptron Neural Network (MPNN)***. The techniques seem for a robust classification concerning the difference of illumination as well as color brightness with

ISSN: 2233-7857 IJFGCN

tolerance to errors in the sampling method. The purpose is planned to computerization of tomatoes where these fruits are used at the production of sauce in industrial schemes.

The work in [3], clarified a method for automatically distinguishing tomatoes skin surfaces in digital color images. The scheme explains the two-step method in which the initial is detecting areas that are probably to have tomato skin in the color images as well as then takes out information from these areas which may specify the location of tomato in the image. An examination and grading system for a tomato that has been weighted down as an image as well as after that the image accepted through the brightness method.

In the proposed system [4], an effort has been prepared to implement software for pest identification on the infected tomato. The image are captured of tomatoes as well as provides it as an input for further IP process through numerous stages to identify the number of borers, with the intention that a minimum amount of pesticides can be utilized.

The proposed system **(Navnee S. Ukirade, *et al*,. 2014)**, a tomato is utilized as the manufactured goods that to be checked for food superiority [5]. The method is passed out to judge the fruit development based on the color. Evolutionary methodologies using numerous image processing methods including image acquisition, image enhancement as well as feature extraction have been executed in this method. To develop image superiority the gathered images are transf0rmed t0 c0l0r space f0rmat. An ***MPNN*** with back-propagation is proposed to classify of tomato development based on color. The color feature is also used for the prediction age of tomato with the help of IP [6]. The three colors like red, green and blue are used to classify clean tomato with the help of tomato maturity index into six different classes based on the combined surface area less than certain hue angle [7].

The application of [8] research is to estimate a novel open software that facilitates the categorization system for lemon and tomato by identifying fruit shape, v0lume, c0l0r and probably mark at a distinctive glance. **(Shruti1, *et al*., 2014)** presented a paper [9] of a new ***Machine Vision System (MVS)*** that has been suggested that image examines the leaves' appearance of the soil as well as based on sp0ts on leaves, it verifies the type of fungus and its strength into the tomato steam. The image 0f the cr0p leaves are obtained by a high-quality c0l0r camera as well as practiced for receiving a gray c0l0red plus segmented image based 0n the type and size of the fungus. A principle is set for satisfactory and refuses crop superiority based on the fungus intensity. Such different methods for leaf disease classification using ML based algorithms are proposed which show better performance in IP [10]-[11].

In this paper, different tomato images with GBNV diseases are used for diagnosis. The diagnosis of GBNV diseases at an early phase is a measure problem for providing better action. Once a GBNV disease is automatically diagnosed, on the source of this idea the best pesticides will be decided. It is marked that the probabilities of survival of a tomato plant with a disease can be improved extensively if the GBNV diseases are diagnosed specifically in its premature stage. As a consequence, the investigation of GBNV disease using imaging modalities has gained importance in the farming area.

The rest of the paper is organized as follows: Section 2 presents the methods with the steps used in the proposed technique, Section 3 presents the results and discussion, Section 4 presents the conclusions and future work.

II. Methodology

This section provides the source of the GBNV infected tomato image dataset, and the technique applied to execute GBNV infected tomato image segmentation. Total 200 images of GNBV disease and healthy images of tomato are collected. Fig. 1 presents the flow chart of the Identification of Groundnut Bud Necrosis Virus on Tomato Fruits using ***Machine Learning based Segmentation Algorithm (MLSA)***.

- ***Image Enhancement (IE):*** Although there is no well-defined theory for IE, many research works have been approved by noise reduction, increasing the contrast between grayscale images. Besides, observers can decide on the quality of the image, along with individual features.

ISSN: 2233-7857 IJFGCN

- ***Histogram Equalization (HE)*** has superior observations for images such as plant disease, fruit disease as well as natural images as well. HE method is a most excellent use for ***Plant Disease Images (PDIs)***. PDIs have a low contrast ratio and HE boosts or develops the contrast or enhances of PDIs. Still, there are different approaches to develop the nature of PDIs, which require additional enhancement. In which, Local Histogram Equalization, Adaptive Histogram Equalization, and Contrast Limited methods are utilized to increase the quality of PDIs.

  Image Preprocessing (IP): The key task of IP is to progress the quality of the PDIs and construct it in a type suitable for additional processing. Additionally, IP facilitates to advance few parameters of PDIs, for example, improving the SNR, enhancing the visual look of PDI, eliminating the extraneous noise as well as undesired components in the background, smoothing the internal component of the area, and protecting its edges.

- ***Image Segmentation (IS):*** The Support Vector Machine (SVM) algorithm has excellent generalization capability as well as also executes well in undersized sample learning. At present, numerous SVM algorithms have been useful to ***Plant Disease Classification (PDC)***. ***Disease Classification (PDC)***.

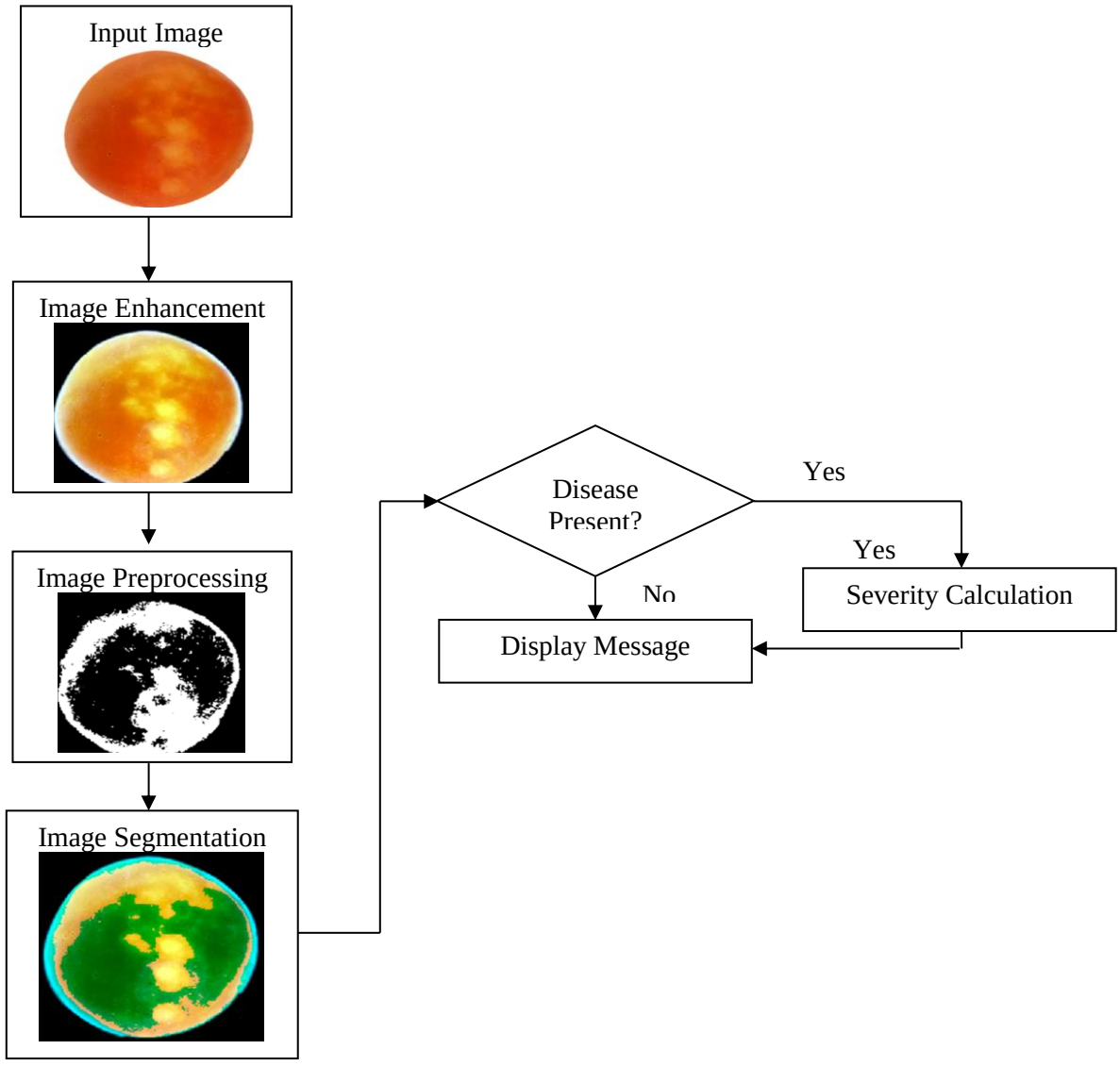


Fig.1. Proposed methodology for Diagnosis of Groundnut Bud Necrosis Virus on Tomato Fruits using Machine Learning based Segmentation Algorithm

ISSN: 2233-7857 IJFGCN

In the SVM training method, training errors are a limiting condition and the assurance level is compacted. In fastidious, the opening of the kernel-function is also tough for high-dimensional sample giving out abilities. The PDI of tomato is segmented with SVM. The primary step is to choose the sample point, then study the sample point, as well as acquire the best classifier. In conclusion, the classifier is utilized to categorize the feature vectors of every pixel in the PDI of tomato. The option of the training sample is extremely significant as well as straightforwardly involves the search of the best classifier.

- ***Severity Calculation (SC):*** Disease severity is the area (relative or absolute) of the sampling unit (leaf) showing symptoms of disease. It is most often expressed as a percentage or proportion. The disease severity of the plant leaves is measured by the lesion area and leaf area ratio. Using image processing method it can be expressed as Eq. 1.

Severity extent (S) = Diseased leaf area (Ad) / Total leaf area (Al……. (1)

Pixel (x, y) Є Rd (Diseased region)

Pixel (x, y) Є Rl (Leaf region) = Σ1 / Σ1 (x, y) Є Rd…….. (2)

Pixel (x, y) Є Rl (Leaf region) = Total pixels in diseased area (Pd) / Total pixels

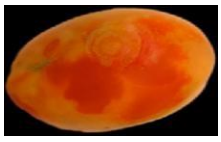
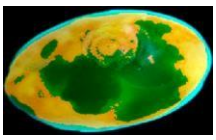
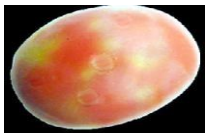
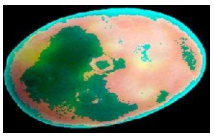
of leaf (Pl) ……...(3)

Then according to disease class average consult table the concluding severity level can be approximated.

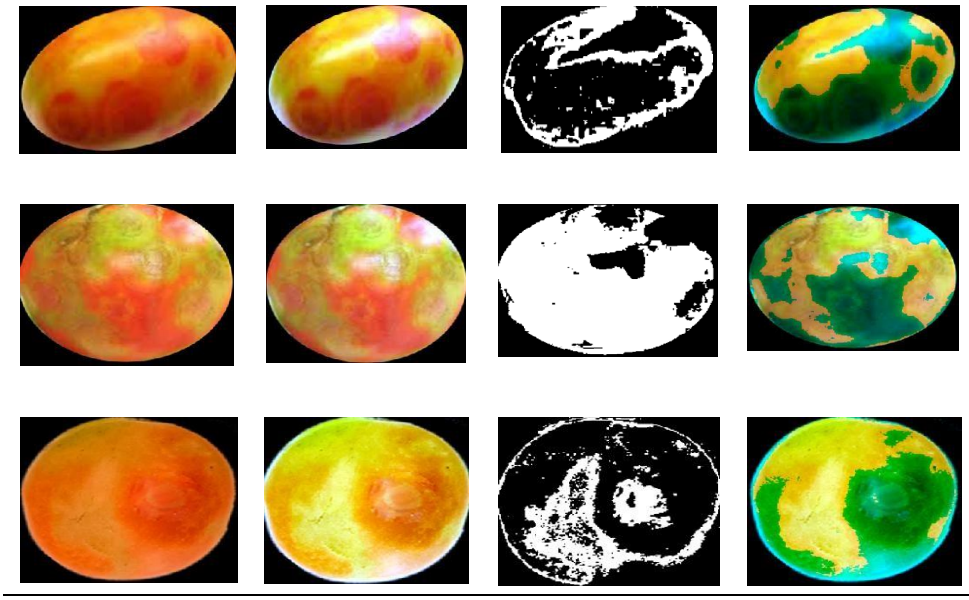
III. Results and Discussion

The accuracy of the ***Plant Disease Classification*** using ***Machine Learning based Segmentation Algorithm*** is tested by approximating the percentage standard recognized area faced by regular known area shapes like Triangle, Circle, Square, as well as Rectangle drawn by means of a device for example paint. Recognized area is evaluated with real area enveloped to calculate Percentage Deviation with Percentage Accuracy [12]. Table I show results for various images and severity calculated by Eq. 4.

Table I .Results of disease severity calculation

Input Image	Image enhancement	Image Preprocessing	Image Segmentation	Severity
				77.35%
				84.25%

ISSN: 2233-7857 IJFGCN



Percentage Deviation (D) = (Targeted value (SM) – Calculated Value (EM)) × 100 / SM...(4)

Percentage Accuracy (A) = 100 – D…… (5)

The results shown in Table I verified that the *Plant Disease Classification* using *Machine learning based Segmentation Algorithm* extended has average accuracy is 97.80 %.

IV. Conclusion

Plant disease identification of the plant show a discrepancy considerably under the various stages of the disease so to the correctness with which the severity of the disease calculated is based upon segmentation of the plant disease image. Support Vector based segmentation is used to estimate the *Groundnut Bud Necrosis Virus* infected area of tomato. The system is implemented using histogram enhancement method. Further SNR is increased using filtering methods. The main task of image segmentation is carried out using Support Vector machine which shows better accuracy in disease diagnosis.

References

1] R.Kalaivani, Dr.S. Muruganand, Dr.Azha.Periasamy, "Identifying The Quality of Tomatoes in Image Processing using Matlab" International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 2, Issue 8, August 2013, PP 3525-3521.

2] Claudio Denis, "Sorting Tomatoes for Industrial Processing through of Computer Vision System Based on Neural Networks", 20th International Congress of Mechanical Engineering by ABCM , November 15-20, 2009, Gramado, RS, Brazil, PP 1-8.

3] N. M. Z. Hashim, N. H. Mohamad, Z. Zakaria, H. Bakri, F. Sakaguchi, "Development of Tomato Inspection and Grading System using Image

ISSN: 2233-7857 IJFGCN

Processing", International Journal Of Engineering And Computer Science , Volume 2 Issue 8 August, 2013 Page No. 2319-2326.

4] Prathibha G P, T G Goutham, Tejaswini M V, Rajas P R, Mrs Kamalam Balasubramani, " Early Pest Detection in Tomato Plantation using Image Processing", International Journal of Computer, Volume 96– No.12, June 2014, PP 22-28.

5] Navnee S. Ukirade, "Color Grading System for Evaluating Tomato Maturity", International Journal of Research in Management, Science & Technology (E-ISSN: 2321-3264) Vol. 2, No. 1, April 2014, PP 41-45.

6] R. B. Dhumale, N. D. Thombare, Leaf Disease Classification using Machine Learning, Journal of Emerging Technologies and Innovative Research,Vol. 6, iss. 4, pp , 429-435,April 2019.

7] Laykin, Shahar & Alchanatis, Victor & Fallik, E. & Edan, Yael. (2002). Image-processing algorithms for tomato classification. Transactions of the American Society of Agricultural Engineers. 45. 851-858.

8] Lino, Antonio Carlos & Sanches, Juliana & Fabbro, Inácio. (2007). Image processing techniques for lemons and tomatoes classification. Bragantia. 67. 785-789.

9] Shruti, Nidhi Seth, "Fungus/Disease Analysis in Tomato Crop using Image Processing Techniques", International Journal of Computer Trends and Technology (IJCTT) – volume 13 number 2 – Jul 2014, PP 61.

10] Bhanu priya, Er.Meenakshi sharma, "Improved leaf disease classification by optimize features using grey wolf optimization with random forest", International Journal of Advanced Science and Technology, Vol. 29, No.02, (2020), pp. 2434-2447.

11] T.Daniya, Dr.S.Vigneshwari, "A Review on Machine Learning Techniques for Rice Plant Disease Detection in Agricultural Research ", International Journal of Advanced Science and Technology Vol. 28, No. 13, (2019), pp. 49-62.

12] Sanjay B. Patil1 , Dr. Shrikant K. Bodhe, "Leaf Disease Severity Measurement using Image Processing", International Journal of Engineering and Technology, Vol.3, Iss. 5, 2011, pp. 297-301.

ISSN: 2233-7857 IJFGCN