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IMPLEMENTING SEGMENTATION METHOD FOR GRAPE LEAF THERMOGRAPHY

Aishwarya Rajendra Suryawanshi[1] & V.S. Narayana Tinnaluri[2]

[1]Research Scholar, Department of Computer Science and Engineering, Sandip University, Nashik, Maharashtra, India

[2]Professor, Department of Computer Science and Engineering, Sandip University, Nashik, Maharashtra, India

ABSTRACT

Thermographic segmentation is used in many application areas to solve the issues in a different form of objects. Thermographic segmentation is used to identify the issues. Early detection of diseases helps to reduce the growth of diseases which results in healthy fruit growth. Thermal images of leaves used for early detection of diseases. The grape leaves are affected by diseases such as powdery mildew, Downy mildew, and Anthracnose. In this paper, we contemplated thermal image segmentation for detecting the thrips and anthracnose. The image segmentation algorithm is used to identify the diseased part over the leaves. The pests and anthracnose affect the part of the leaves. Then it spread over the plant and infect the berries which debase the quality of grapes. The thresholding technique used for the segmentation of thermal images. Thrips are sucking pests and anthracnose is a fungal disease. To identify thrips and anthracnose on the leaves thermal images are used.

KEYWORDS: *Image Segmentation, Thresholding, Thermal Imaging*

INTRODUCTION

Thermal image segmentation is used in agriculture for disease detection on leaves of fruits and vegetables. Thermal images are useful for early disease detection. It will help to identify the diseases over the leaves. Diseases may harm fruits or vegetables. To reduce the growth of diseases on plants there is a need for segmentation of thermal images. Thermal images are used to identify the "region of interest'. Thermal images detect the amount of heat emitted from the object. The heat emitted from an object help to identify the objects or region of interest. Thermal images are conventionally used in biomedical areas. Recently, it has been used in the electrical field and agricultural field.

In India, Maharashtra is one of the big export states. In Maharashtra state, Nashik and Sangali districts are prominent for the cultivation of grapes. Nashik is also known for "Grape capital of India". Grapes are cultivated in a hot and dry climate. Vegetative growth and fruiting of grapes require high humidity. The high humidity affects the vines fruit size and quality. But after forwarding pruning of vines, it may increase the fungal disease.

The grapes are affected by pests or grape diseases. The disease and pests are get differentiated at every stage of growth of grapes. Grapes diseases and pests are varies based on the regions of cultivation. As the atmosphere is really affects the growth of grapes. The pests are mealay bugs, flea beetle, girdle bittle, thrips, hoppers, stem borers, leaf eating caterpillar, and grape leaf folder. The diseases like downy mildew, powdery mildew, anthracnose, greenaria bitter rot,

bacterial leaf spot, alternia blight, black rot.

LITERATURE REVIEW

The image segmentation help to identify the part of the image useful for disease detection. The thermal image segmentation will reduce the task of image pre-processing. This reduces the wastage of time in pre-processing of the image. Thermal image overcomes the timestamp for processing of thermal image segmentation. Thermal image segmentation recognizes the area of interest.

The goal of the image segmentation is to remove the noise at the background, By separating the object from the background the Region of Interest is get highlighted. Distinct segmentation techniques are described in this section.

Global Thresholding

Global thresholding is used in image segmentation for thresholding an image by a single threshold value. The pixel value less than threshold value will set to 0 and high will set to 255. Global thresholding is used in a simple way for thresholding an image for segregate it in two parts. Carlos et al. [9] proposed the method of thresholding to identify the disease named as powdery mildew on cherry leaves. In preprocessing of image HSV plane is used and then S channel and V channel are separated for a clear view of the leaf and disease over leaf respectively. After that thresholding is using Otsu adaptive method applied to differentiate between healthy and unhealthy leaves. After that, some post-processing tools are applied and leaf disease gets distracted.

Otsu Thresholding

Otsu thresholding is a kind global thresholding and also known for. The threshold value of each pixel is set either 0 or 1 i.e. background or foreground. It reduces the conversion of the grayscale image. Salvador et al. [10] propound the most popular thresholding techniques rates through all possible threshold values, after that, it will calculate a measured extent for pixel levels each side of the threshold value by manipulating the sum of foreground and background. Otsu method can be suitable for any application.

Thrips and Anthracnose
Thrips

Thrips are known by scientific name thysanoptera. Thrips are the pests that appear on grape leaves and if they growing then it affects grapes which result in compromised with grapefruit quality and size. Thrips lifecycle embrances four stages first instar, second instar larvae are also known for nymphs, then third is Pre-pupa and then pupa. Nymphs are move down to the soil where pupate are on the top. The pupates are on the upper side of the leaves and they are 8 to 18cm long in size. Pupates are adult thrips. Alike pupa, nymphs do not have wings. Thrips lifecycle is completed in 15 days. Adult thrips live for 10 days. Grape leaves are infected by both nymphs and adults by grating the lower surface of the leaf with their stylets and imbibing the dripping cell sap. The infected surface is marked by the number of miniscle speck thereby producing a speckled silver effect. Generally, undersurface of the leaves they graze in groups may cause the curling of the leaves in case of heavy incidence. Thrips also contaminate blossoms and developing berries. Reduction in fruit setting and capitulate affect the quality of fruit. The thrips are also responsible for scab formation on the berries. The infected berries develop a corky layer and become brown. The degradable quality of grapefruit effectuate the market value of the grapes.

Figure 1: Curling of the Leaves

Figure 2: Brown Spot Appeared on Leaf

Figure 3: Infected Grape Berries

Anthracnose

The term anthracnose elaborate fungal diseases that cause symptoms like distortion, defoliation, blotching, and leaf spot, shoot blight, dieback and twig cankers. Legion, sunken spots that are dark in color are the initial symptoms. Anthracnose often slightly raised lip. The preparatory spores are pink colored and then they develop black-colored. The anthracnose is spreading through water droplets. The flattering reason for anthracnose is warm, humid conditions. The lifecycle starts when conidia and ascospores are produced in the spring within optimal moisture and temperature. Fungal spores thrash young leaves and berries. In the second stage of lifecycle start infecting the cells. Then tissues are getting infected under excellent temperature and moisture with conidium. The third stage -will spread the infected tissues.

Figure 4: Fungal Black Spots

Figure 5: Grape Berries Infected by Fungal

Thermal Image Segmentation

Thermal image segmentation that consumes less time for detection of the region of interest nothing but the diseased part infected by anthracnose and thrips. Simple structure for thermal image segmentation is shown in figure1. The diagram shows only two parts Image acquisition and Image Segmentation. The general image segmentation has three stages one is image acquisition, then pre-processing of the image and then segmentation which consumes time for image

segmentation part. By reducing the time for pre-processing of the image it is possible to reduce the time consumption for image segmentation.

Image Acquisition

For image acquisition, thermal camera is being used for capturing the thermal images. Testo 875i thermal is used. The infrared resolution of this camera is 160*120pixels. It will measure temperature up to 550°C. The super-resolution technology of this camera increases the resolution of testo 875i from 160*120pixels in the testo IRSoft to 320*240pixels. The testo camera with the model 875-2i with lens size32^{o}*23°. The images are captured at Girnare loation, Nashik. The land was partitioned in three parts. The part is an initial growing of the grape plant. The second and third part was growing a grape plant. The diseases are observed on some of the plants infected by thrips and anthracnose.

Figure 6: Healthy Grape Leaf Plant

Image Segmentation

Testo IR soft uses six types of thermal color palates, these formats are useful to focus on the region of interest on the leaves part. The region interest is a diseased part. IR soft is a helpful tool for thermal images.
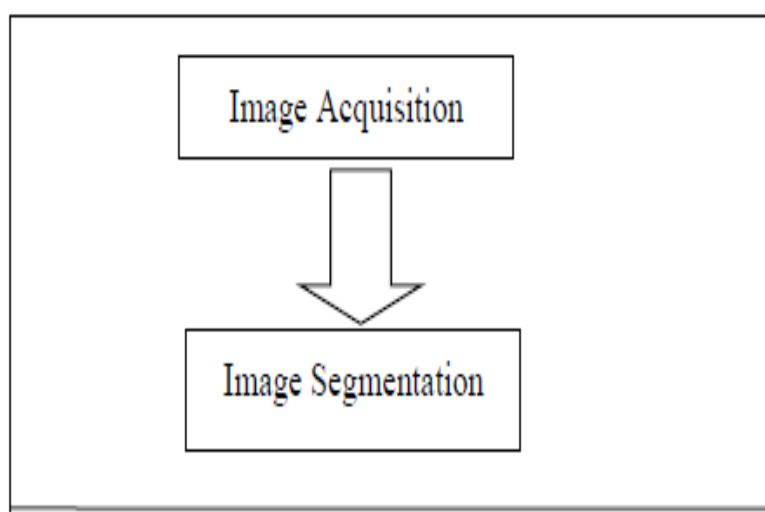

Figure 7: Block Diagram

After this part, it's being easy for segmentation of the image. The simple thresholding technique is able to segment the image. For segmentation of the image, Matlab R2014a software is used. The thresholding technique is applied for segmenting an image.
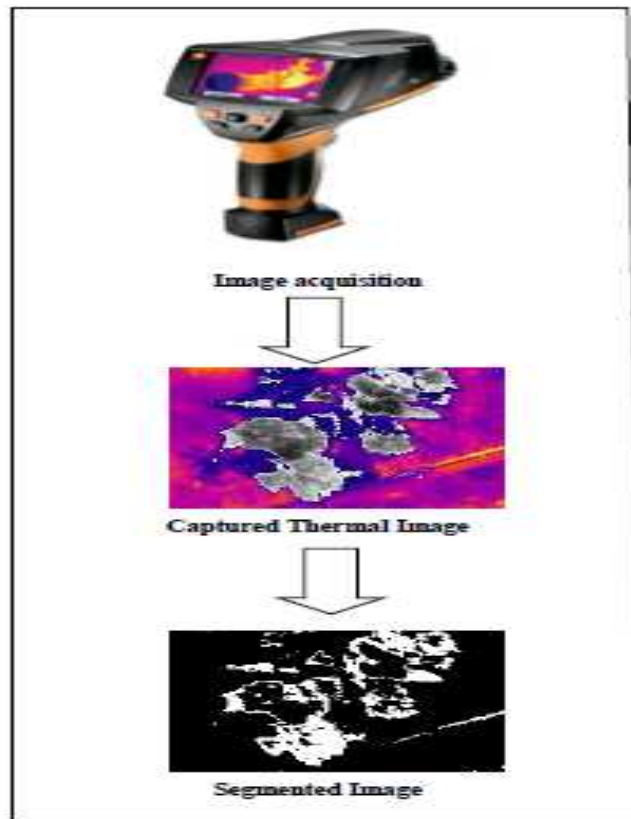

Figure 8: Structure of the System

RESULTS

The comparative result shows the different image format with their accuracy level in the image. When the thermal image with. BMT extension saved as other extension types. The result is shown in the following table.

Table 1: Comparative Result of Image Extensions

S. No.	Name	Size	Bytes
1.	.TIF	120*160*4	76800
2.	.BMT	120*160*3	57600
3.	.JPG	120*160*3	57600
4.	.PNG	120*160*3	57600
5.	.BMP	120*160*3	57600
6.	.BMP	120*160	19200
7.	.BMP	120*160	19200
8.	.GIF	120*160	19200

This result is similar for some image extensions. It is possible only if the image is a thermal image in.BMT format. The result analysis shows that thermal image segmentation is simple and less time-consuming way for image segmentation. Also, the thermal image shows the resultant data in the following way. The thermal report of this grape

leaves concludes with the emissivity of 0.95 and Refl. Temp [^{o}C] of 20.0

The IR soft gives some information regarding thermal images like histogram, temperature details table and color bar which shows the temperature. Here the result of the image transformation with information.
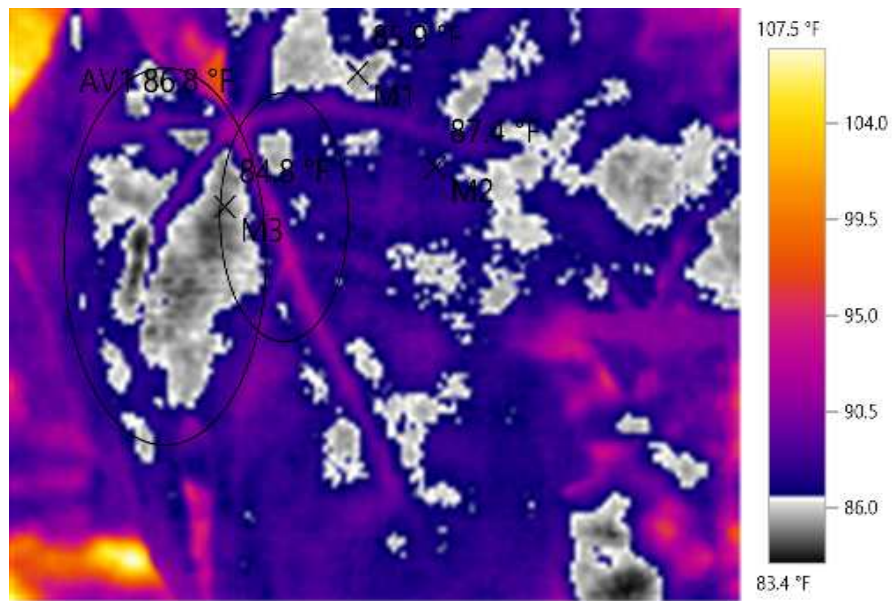
Figure 9: Digital Image

Figure 10: Thermal Image

Table 2: Temperature Measurement

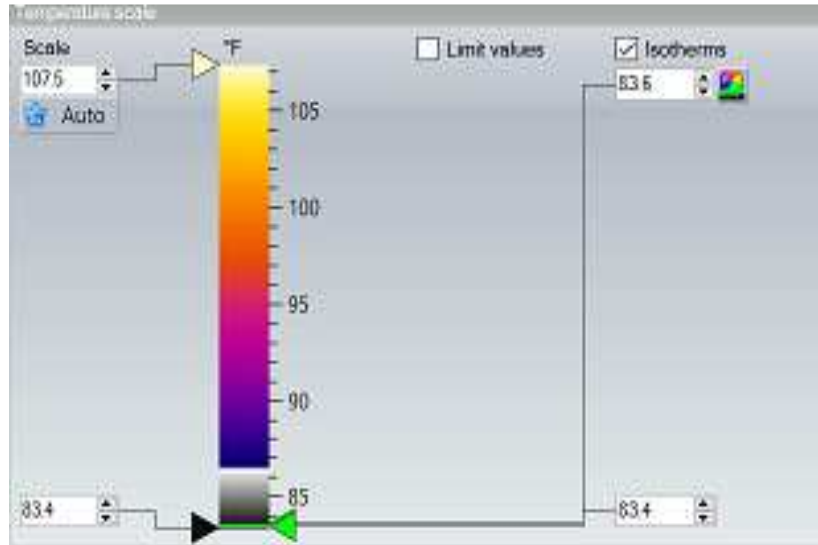| No	Temp. [°F]	Emiss	Refl. Temp. [°F]
M1	85.9	0.95	68.0
M2	87.4	0.95	68.0
M3	84.8	0.95	68.0
AV1	86.8		

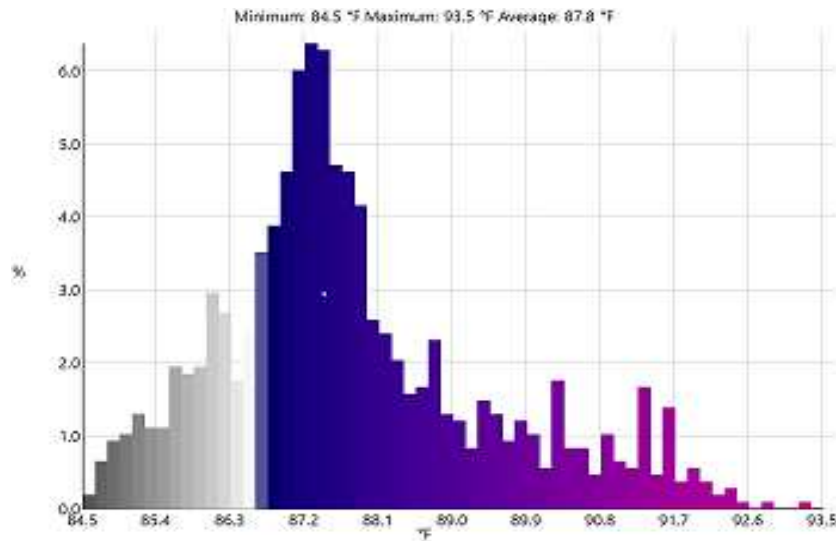**Figure 11: Color Bar with Isotherm Indication**

Figure 12: Histogram Based on Thermal Image

CONCLUSIONS

The research concludes that thermal image segmentation is very useful for agriculture field to identify the data required for the detection of disease part. If it is detected in the earlier part of the crop growth then it will be easier to take necessary action regarding grape development. Thermal image segmentation used in different application areas but it is also useful in agriculture field. Thermal imaging technique reduces the extra processing activity. This part is concluded with segmentation. This effective image segmentation is useful for further processing of the image. This will help in feature extraction and image classification my gives the better result for image processing.

Future Scope

In the future scope of thermal image segmentation, if thermal images are being used with [11] hyper spectral data then it will cover the large classification area. India is being beneficial for farmers as well as for the development of agriculture in India.

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