

A Survey on Thermographic Segmentation

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ABSTRACT: Image segmentation is used in many application areas to solve the issues in different form of objects. Thermographic segmentation is used to identify the issues of Surface Temperature. 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 Plant leaves are affected by the diseases such as powdery mildew, Downy mildew and Anthracnose. In this paper we contemplated thermal image segmentation for detecting the thrips and anthracnose. 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 Plants. The thresholding technique used for the segmentation of thermal images. Thrips are sucking pests and anthracnose is fungal disease. To identify thrips and anthracnose on the leaves thermal images are used.

KEYWORDS: Thermal image, Image segmentation, Thresholding.

I. LITERATURE REVIEW

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 growth of diseases on plants there is need for segmentation of thermal images. Thermal images are used to identify the "region of interest". Thermal images detect the amount heat emitted from object. The heat emitted from object help to identify the objects or region of interest. Thermal images are conventionally used in biomedical areas. Recently, it has been used in electrical field and agricultural field.

In India, Andhra Pradesh is one of the big export state. In Andhra Pradesh state Hyderabad and Sangali districts are the prominent for cultivation of Plants. Hyderabad is also known for "Plant capital of India". Plants are cultivated in hot and dry climate. Vegetative growth and fruiting of Plants requires high humidity. The high humidity affects the vines fruit size and quality. But after forward pruning of vines it may increase the fungal disease.

The Plants are affected by pests or Plant diseases. The disease and pests are get differentiated at every stage of growth of Plants. Plants diseases and pests are varies based on the regions of cultivation. As atmosphere is really affects the growth of Plants. The pests are mealay bugs, flea beetle, girdle bittle, thrips, hoppers, stem borers, leaf eating caterpillar, and Plant leaf folder. The diseases like downy mildew, powdery mildew, anthracnose, greenaria bitter rot, bacterial leaf spot, alternia blight, black rot. The image segmentation help to identify the part of 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 overcome the timestamp for processing of thermal image segmentation. Thermal image segmentation recognize 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.

A. Global Thresholding

Global thresholding is used in image segmentation for thresholding an image by 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

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and V channel are separated for 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 get distracted.

B. 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 grayscale image. Salvador et al. [10] propound the most popular thresholding techniques rates through all possible threshold values, after that it will calculate a measure 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.

II. THRIPS AND ANTHRACNOSE

A. Thrips

Thrips are known by scientific name thysanoptera. Thrips are the pests that are appear on Plant leaves and if they growing then it affect to Plants which results in compromised with Plant fruit quality and size. Thrips lifecycle embrances four stages first instar, second instar larvae 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 does not have wings. Thrips lifecycle is completed in 15 days. Adult thrips live for 10 days. Plant 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 Plant fruit effectuate the market value of the Plants.



Curling of the leaves

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Brown spot appeared on leaf



Infected Plant berries

B. Anthracnose

The term anthracnose laborate 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 pre-paratory spores are pink colored and then they develop black-colored. The anthracnose are 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 get infected under excellent temperature and moisture with conidium. Third stage -will spread the infected tissues.

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Fungal black spots

III. THERMAL IMAGE SEGMENTATION

Thermal image segmentation that consumes less time for detection of region of interest nothing but the disease 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 stage 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.

A. 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 increase 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 size 32°*23°. The images are captured at Gurnare loation, Hyderabad. The land was partitioned in three parts. The part is initial growing of Plant plant. Second and third part was growing Plant plant. The diseases are observed on some of the plants infected by thrips and anthracnose.



Healthy Plant leaf plant

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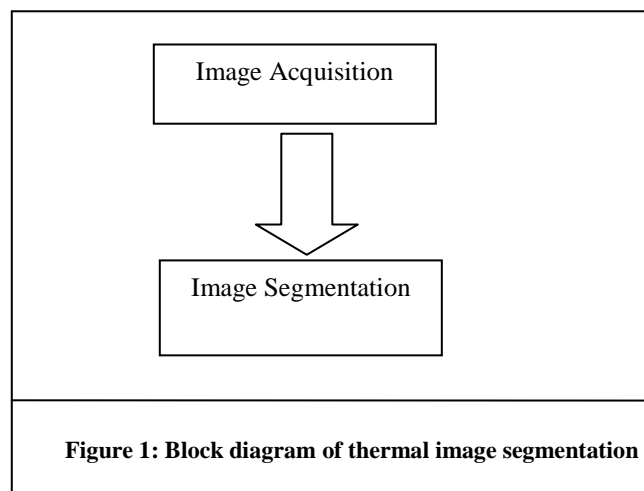
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B. Image Segmentation

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



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



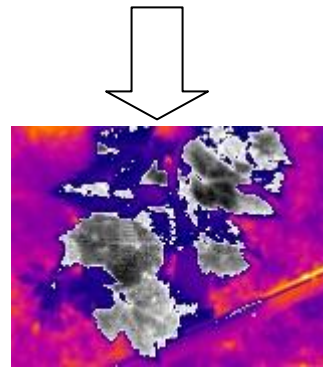
Image acquisition

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Captured Thermal Image



Segmented Image

Figure 2: The structure of Thermal Image Segmentation

IV. RESULT

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.

Sr. 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

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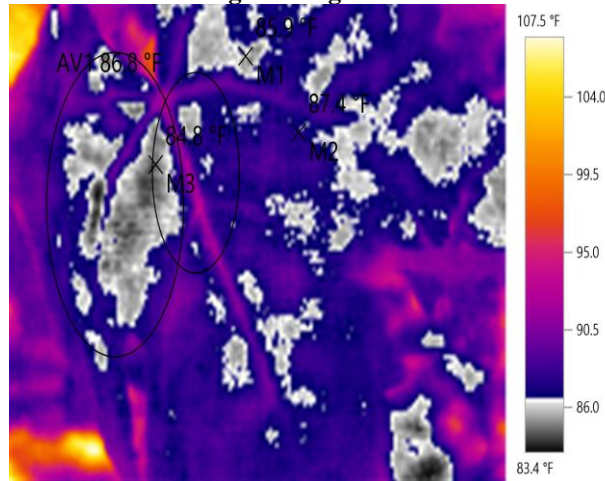
Comparative result of image extensions

This result is similar for some image extensions. It is possible only if the image is thermal image in .BMT format. The result analysis shows that thermal image segmentation is the 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 Plant leaves conclude with the emmissivity of 0.95 and Refl. Temp [°C] of 20.0

The IR soft gives the 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.



Digital image



Thermal Image

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		

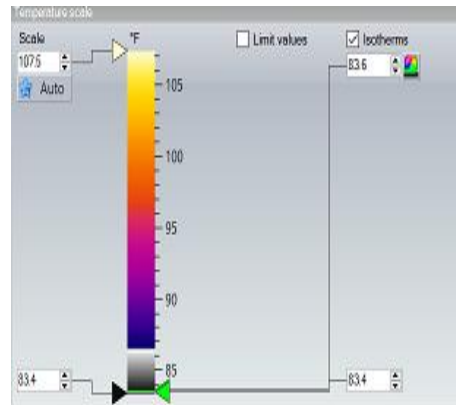
Temperature Measurement table 1

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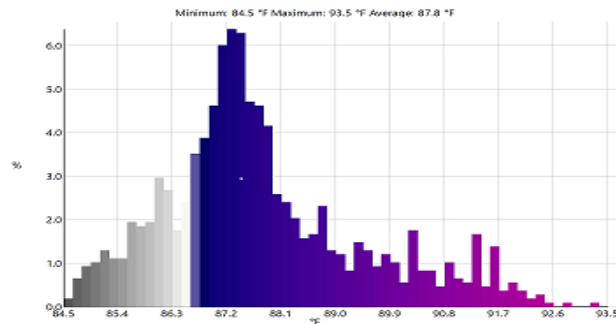
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Color bar with isotherm indication



Histogram based on thermal image

V. CONCLUSION

The research concludes that thermal image segmentation is very useful for agriculture fields to identify the data required for the detection of disease parts. If it is detected in the earlier part of the crop growth, then it will be easier to take necessary action regarding plant development. Thermal image segmentation is used in different application areas but it is also useful in agriculture fields. Thermal imaging techniques reduce extra processing activity. This part is concluded with segmentation. This effective image segmentation is useful for further processing of images. This will help in feature extraction and image classification, which gives a better result for image processing. The scope of thermal image segmentation, if thermal images are being used with [11] hyper-spectral data, then it will cover a large classification area. For India, it is being beneficial for farmers as well as for the development of agriculture in India.

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