SUMMER INTERSHIP REPORT

A PROJECT REPORT

Submitted by

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in the Department

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CERTIFICATE

Certified that this project report entitiled "**Analysis of Infrared Image Data Using MATLAB**''submitted by **" Priyanka Dutta'' ,** 6th semester in the Department of Electronics & Communication Engineering, Gauhati University Institute of Science and Technology, Gauhati University, Assam who carried on the project under my supervision.

This report has not been submitted by any other university or institution for the award of degree.

SIGNATURE

SUPERVISOR

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DECLARATION

I certify that

a) The work contained in this report has been done by me under the guidance of my supervisor.
b) The work has not been submitted to any institute for any degree or diploma.
c) I have followed the guidelines provided by the institute in preparing the report.
d) Whenever I have used materials (data, theoretical analysis, figures, and text) from other source, I have given the credit to them by citing them in the text of the report and giving their details in the reference.

Date: 1/7/2020

Name: Priyanka Dutta

Acknowledgement

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CONTENTS

ASSIGNED PROJECT WORK:

To develop post-processing tools to investigate droplet evaporation and identify the droplet boundary and track its evolution from Infrared images by Image Processing in MATLAB

ABSTRACT:

This report describes an algorithm for contour extraction of infrared image. Morphological operations were employed to extract the approximate contour effectively including filters and edge detection techniques. Structural element was chosen accordingly with respect to its shape feature to obtain a better result. Several approaches were tried, the results and comparison of different approaches are demonstrated here.

INTRODUCTION:

Infrared image is a kind of multi-source multi-sensors image. However, infrared images lack structural details. Absolute contour cannot be observed in an infrared image. A clear analysis of infrared image data is done using MATLAB. Here, post-processing tools are developed to investigate droplet evaporation and identify the droplet boundary and track its evolution by Image Processing.

PROBLEMS IN THE INFRARED IMAGES:

1) Noise in the boundary of the droplet
2) Unable to detect the proper edge of the droplet

POST PROCESSING TOOLS:

Median Filtering & Gaussian filtering: Median filtering is a nonlinear operation often used in image processing to reduce "salt and pepper" noise. A median filter is more effective than convolution when the goal is to simultaneously reduce noise and preserve edges [1]. On increasing the size of the median filter, e.g: 7X7 rather than 4X4 based on the image, we get a clearer image as compared to the one with lower size. Moreover, upon varying the value of ‘sigma’, we have got the desired results in Gaussian filtering.

a) **Resizing the image:** Resizing the size of the image (here in the code we have resized the image to 0.25) and then performing the morphological and edge detection processes leads to a better result of contour extraction as compared to that of original size.

b) **Edge Detection Techniques:**

Edge Detection Techniques	Advantage	Disadvantage
Roberts (Based on First Order Derivatives)	Produces more accurate position of edges	Not reliable to extract the edge in presence of noise
Sobel (Based on First Order Derivatives)	Good noise suppression characteristics	Produce moderate result
Prewitt (Based on First Order Derivatives)	Masks have longer support, Prewitt is less vulnerable to noise	Produce sometimes noisier result
LOG (Based on Second Order Derivatives)	Having fixed characteristics in all the directions, detects good edges and its orientations	Sensitive to noise, generate closed and non-realistic contour
Canny (Based on Second Order Derivatives)	Better detection specially in noise condition	Complex, time consuming, false zero crossing

Table 1: Advantages and disadvantages of different edge detection techniques [2]

Based on the advantages and disadvantages, we have tried different edge detection techniques in order to get an output with perfect edge (with less noise). We got more desired outputs on using Prewitt operator for edge detection in our work. Using canny operator, leads to detection of some unwanted parts (considered as noise).

c) **Morphological Operations:** We have tried changing the size and shape of the structural element in the image. As per the coding and outputs, 'disk' shaped structural element results a better output. Regarding other morphological operations, we have performed dilation, erosion, opening and closing and achieved the desired results.

d) **Active Contour:** Active contour segmented the grayscale infrared image into foreground and background regions using active contour based segmentation. The output image is a binary image. The active contour technique which is also called snakes, is an iterative region-growing image segmentation algorithm We can use the 'activecontour' function to evolve the curves towards object boundaries. BW = activecontour(A,mask,method) is used here. It specifies the active contour method used for segmentation, either 'Chan-Vese' or 'edge'.[3]

CONCLUSION:

Here, we tried to carry out a systematic research on droplet evaporation on a hot-plate and hence the boundary of the droplet is identified using various image processing techniques that contains morphological, edge detection, resizing, operations so as to reduce the noise level and achieve a perfect contour of the image. Active contour led us to extract the approximate contour from the infrared image within a very short duration around 7.84 seconds.

REFERENCES:

[1] https://in.mathworks.com/help/images/ref/medfilt2.html

[2] Mohd. Aquib Ansari, Diksha Kurchaniya and Manish Dixit, "A Comprehensive Analysis of Image Edge Detection Techniques", International Journal of Multimedia and Ubiquitous Engineering Vol.12, No.11 (2017), pp.1-12 http://dx.doi.org/10.14257/ijmue.2017.12.11.01

[3] https://in.mathworks.com/help/images/ref/activecontour.html