FACULTY OF INFORMATICS AND COMPUTING

BACHELOR OF INFORMATION TECHNOLOGY (INFORMATICS MEDIA)

SEMESTER III SESSION 2024/2025

COURSE CODE: IF221126

DIGITAL IMAGE PROCESSING

TITTLE: LEAF SEGMENTATION FROM BACKGROUND USING DIGITAL IMAGE PROCESSING

LECTURER NAME:

ZULHAJ ALIANSYAH

Prepared By:

MATRIC NUMBER	NAME
083631	WAN NURUL NISA' BINTI WAN NASRUL HAKIM

1. INTRODUCTION

Over the last few years, digital image processing has been used extensively in many different ways including but not limited to, Medicine, Agriculture, Security, and Industrial Inspection. A major application within the agricultural field is the monitoring of plants to help ensure healthy crop development and to produce maximum yields. The overall health of a plant is determined by several characteristics; size and condition of individual leaves typically represent a primary indicator.

Historically, to evaluate individual leaves, growers have relied upon the manual observation and measurement of the leaves. The development and use of improved digital image processing techniques enable the automation of leaf image evaluations through the use of either digital cameras or mobile devices. The first step in the evaluation of individual leaves is to segment (separate) the leaf from the background. The accuracy of segmentation is vitally important because the accuracy with which the image is segmented directly affects all subsequent evaluations including calculating the amount of leaf area, determining the overall shape of the leaf, and diagnosing diseases. Therefore, this project's primary objective is to successfully utilize basic digital image processing techniques to segment individual leaf images from their backgrounds.

2. OBJECTIVE

The objectives of this project are:

1. To segment a leaf from a plain background using image processing
2. To highlight the segmented leaf region
3. To calculate the leaf area in pixel units

3. PROBLEM STATEMENT

Images captured using a mobile camera usually contain both the object of interest and the background. Without proper segmentation, the background may interfere with the analysis of the leaf, resulting in inaccurate measurements. Hence, there is a need for an automated image processing method that can effectively segment the leaf region from the background.

4. TASK SELECTION

This project is based on Task (b): Segmenting object(s) from the background.
A leaf image captured on a plain background is selected as the object of interest for segmentation.

5. METHODOLOGY

First, the input image is converted from the BGR color space to the HSV color space. The HSV color space is chosen because it provides better color representation and is less sensitive to lighting variations compared to RGB. Next, green color thresholding is applied to generate a binary mask that separates the leaf from the background.

Morphological operations, including opening and closing, are then applied to remove noise and fill small holes within the leaf region. After obtaining a clean binary mask, contour detection is performed to identify the boundary of the leaf. The largest contour is selected as the leaf, and its area is calculated using contour area computation. The final result highlights the segmented leaf along with its calculated area.

6. FLOWCHART

Input Leaf Image
↓
Convert BGR to HSV
↓
Green Color Thresholding
↓
Morphological Operations
↓
Contour Detection
↓
Leaf Segmentation and Area Calculation

7. RESULTS

The results show that the proposed method is able to segment the leaf effectively from a plain background. The original image, binary mask, refined mask, and final segmented result are presented to illustrate each processing step. The final output highlights the leaf region with a bounding box and contour.

Based on the segmentation result, the calculated leaf area obtained from the experiment is 115407 pixels

Figure 1: Original Image

Shows the original leaf image captured using a mobile camera on a plain background.

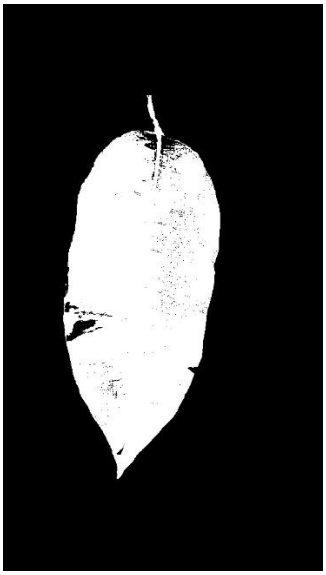

Figure 2: Raw Mask

Illustrates the raw binary mask produced after applying green thresholding in the HSV colour space, where the leaf region is separated from the background.

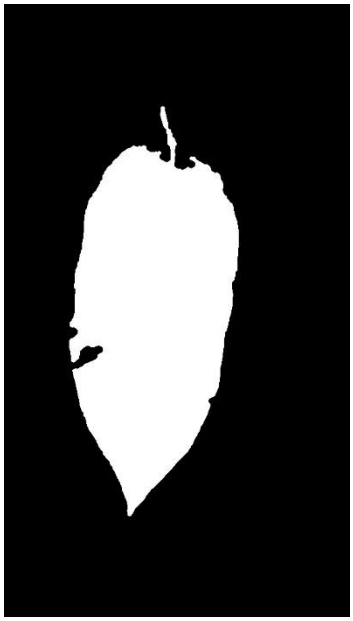

Figure 3: Clean Mask after Morphology

Shows the refined mask after morphological operations, which successfully remove small noise and fill gaps within the leaf region.

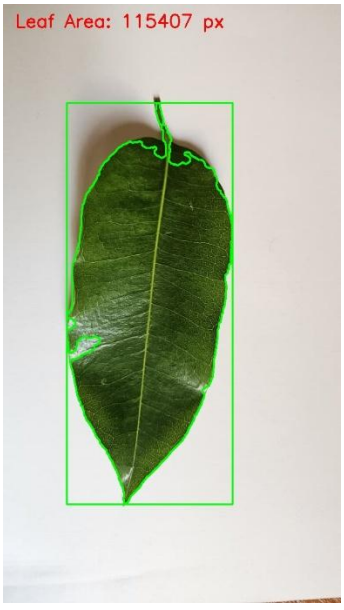

Figure 4: Final Result with Bounding Box

Presents the final segmentation results with the leaf boundary highlighted using contour detection and a bounding box.

Figure 5: Segmented Leaf Image

Shows the extracted leaf image after background has been removed, clearly isolating the leaf object.

Based on the final segmentation result, the calculated leaf area obtained from the experiment is 115407 pixels, which represents the total number of pixels belonging to the leaf region.

8. CONCLUSION

In conclusion, this project successfully demonstrates the use of basic digital image processing techniques to segment a leaf from its background. The system is able to isolate the leaf region and calculate its area automatically. This approach can serve as a foundation for further plant monitoring and analysis applications.