The Monitoring of Corn Sprouts Growth Using The Region Growing Methods

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Abstract. The aim of this research is to apply plant growth monitoring function using region growing method and Matlab application with an object of corn sprouts and parameters of length and time. The research process is done by taking pictures digitally change the color level (Red Green Blue) to grayscale, cropping the image and then calculate the growth of the plant using region growing. From the results of the study, region growing can be used to calculate the growth of plant length with parameters of length and time. The results of manual measurements show the growth of plant length by an average of 2.1 cm / day then the results of measurements with region growing show an average plant length of 2.3 cm / day, this result shows the comparison between manual and region growing measurements is 0.2 cm. The difference between manual calculation and region growing is caused by the accuracy of shooting and image cropping process.

1. INTRODUCTION

Image processing is computer science that developed in various fields such as archaeology, astronomy, biomedical, industrial and agrology. Image processing focused on how to transform image picture using a certain technique that can deliver information from inside the image easier and faster.

In general, digital image processing is image processing (two dimension image) using a computer with the aim that the image of easily interpreted and transformed into other images, by man or machine. Based on the value of the digital image pixel can be arranged into three types namely the image of colors (RGB), grayscale image, and binary image [1].

The types of digital image processing activities are grouped into two, that is improve the quality of the image, so that the image is more easily interpreted and process information in the images for the purpose of introducing an automatic object. [2]. In digital image processing, the input and output are images, but the output image has better quality than the input image [3]
Indonesia is a country with a very large area and has a rapid population growth rate which of course requires abundant crops to meet the food needs of its population, so monitoring plants are needed to reduce the risk of crop failure. Monitoring of plants starts from the plants in the form of seeds until the harvest period. Monitoring plant growth must be carried out continuously and requires accuracy to produce maximum crop yields, while manual plant growth monitoring methods can be said to be less than optimal due to human physical factors, such as fatigue and inaccuracy.

Germination is the initial process of the growth of grain plants which was originally in a dormant condition which then undergoes physiological changes so that plant seeds develop into young plants called sprouts. Epigeal and hypogeal are two types of germination in which epigeal is germination that brings cotyledons out of the soil surface, one example of plants that experience epigeal germination is green beans, while hypogeal is germination which perpetuates cotyledons in the soil, one example of plants that have germination this is corn [4].

Image segmentation into homogeneous areas is one of the important problems in image processing. In image analysis, segmentation is the first step that must be done. Image processing methods, such as threshold histogram, clustering, or region growing are some of the image segmentation methods that have been used. Image processing to monitor plant growth can be done using the region growing method with parameters of length and time [5].

The segmentation process is the initial process in the separation of objects. Inaccuracies in process results are influenced by inaccurate segmentation processes. There are three types of segmentation processes, namely classification based segmentation, edge-based segmentation, and region-based segmentation [6]. Image segmentation is an image processing process where objects involving visual perception will be more easily recognized and analyzed by separating between region objects and background regions [7].

Seed Region growing segmentation is an image segmentation method that uses region-based techniques, adjacent pixels in the same area have the same visual features as gray levels, color values, or textures. The principle of Seed Region Segmentation is growing by starting the determination of seed points, from the seed area will be developed with the addition of each seed where the neighboring pixels have a characteristic similarity to the seed. Seed Region growing segmentation will try to find accurate image segmentation into regions with proportions where each component of the interconnected area meets one of the seeds [7].

The growing region is used to create a region map by grouping pixels against region-regions, where labels on image pixels are a classification of regions for those pixels [7]. This study aims to apply plant growth monitoring functions using the region growing method and the application of Matlab with corn sprout objects and parameters of length and time.

2. Literature Review

Image processing has been carried out to identify size, one of which is a study conducted by Rika Favoria Gusa entitled "Digital Image Processing to Calculate the Former Area of Tin Mining" by utilizing satellite imagery. This study used a field survey to obtain coordinate data and the size (length and width) of the former tin mining land. The initial image is a satellite image with a color image (RGB) which then changes the color level of the grayscale image. Furthermore, improvements are made to grayscale images through a contrast stretching process before the changes are made into binary images. To
calculate the number of pixels in the former tin mining area, morphological images are applied, namely erosion and dilation in binary images [1].

The research was conducted by Suryani, entitled "Seed Growing Segmentation Region and Momentum Backpropagation Neural Network for Classification of White Blood Cell Types". This study discusses the growing region seed used in image preprocessing. Then feature extraction produces four numerical parameters of the image, namely the area of leukocytes, the edge of the area, the balance and the nucleus ratio. The results showed that the seed growing region can segment leukocyte images by 96.795% which can then be extracted properly [7].

The research was conducted by Syahrul Awalludin and Dessy Irmawati entitled "Image Processing for Identification of Eggs by Size". The image processing process starts with changing the color to a grayscale color level. Then the threshold method is used to change the grayscale color level to binary. The filling holes morphology is used to eliminate noise from the threshold image until it displays the egg classification decision [7].

Another study entitled "Web-Based Plant Growth Monitoring Using Machine Vision" conducted by L. Sutiarso. This study discusses the use of digital image processing to monitor plant growth in real time. Segmentation is the initial process of image processing that is used to recognize plant objects. The algorithm used is the method of excess green and color normalization. The Otsu method is used to calculate plant area. The test results show the success rate of monitoring systems using machine vision by 70% [8].

The research was conducted by W. A. Saputra entitled "Seeded Region Growing in HIS Color Space for Tuna Image Image Management" with seed and threshold parameters. The initial image is an RGB color image which is then transformed into the HSI space (hue saturation intensity). Seed region growing is used in the hue space segmentation process. RAE (relative foreground area error), MAE (misclassification error) and MHD (modified hausdorff distance) are evaluation methods used to test 30 images of tuna. The final results showed that the values of RAE, ME and MHD were 5.40%, 1.53%, and 0.41% respectively [2].

The research was conducted by F.N Riza, entitled "Region growing segmentation to detect nodules as an indication of lung cancer". This study discusses the segmentation of lung objects and nodule objects based on the morphology of the nodules themselves. Then the nodule area is calculated based on the number of pixels that form the nodule area. The test results show that segmentation can be performed on slices of lung CT images [7].

The research conducted by Diah Anggraeni entitled "Digital Image Segmentation of Fish Using Thresholding and K-Means Method". Image processing methods carried out are Thresholding and K-Means. The threshold process begins with inputting a digital image and then changing the color level to grayscale, local or global threshold selection, edge detection process using The Canny operator or Laplacian and dilation process. The K-Means process begins with inputting images, changing the level of grayscale color by the K-Means method. The results showed that the local Threshold method was able to separate fish eye objects [9].

The research conducted by A. Aprilia, discussed the Identification of the Quality of Rice Using Digital Images. Image processing is done to identify the quality of rice by using a decision tree classification. The testing process through digital image processing is done by looking at the white value, the net value, and the whole value of rice. The HSV value (Hue, Saturation, Value) is used to analyze
the net value and white value of rice, while the analysis of the area of the object area is done to get the whole value of rice. The test results showed an accuracy value of 96.67% [4]. Research that has been done shows that image processing and region growing can be used to carry out classification and monitoring.

3. Methodology

The study began with planting corn sprouts for 7 days using cotton planting media instead of soil. Image processing begins with taking the image of sprouts every day for 7 consecutive days. The image obtained is in the form of a color image (RGB) which is then changed to grayscale to facilitate the subsequent image processing. The image is converted into a grayscale color level and an image cropping process is performed. The image that has gone through the cropping process is processed using data growing regions using the Matlab application. In region growing process the original image is changed to color level into gray (grayscale) level, then the image cropping process is performed. Image that has gone through the process of cropping then do data processing using the Region Growing, after that is measuring the corn spourt length by the image using image tool. The diagram flow of plant growth monitoring using region growing method are follows:

![Flowchart monitoring growth of corn sprouts using region growing method](image)

**Figure 1.** Flowchart monitoring growth of corn sprouts using region growing method

4. Result And Discussion

The results of the study included a change of image into a gray scale image are as follows:

![Color image (RGB) changes become grayscale images](image)

**Figure 2.** Color image (RGB) changes become grayscale images
The next process is cropping the image to be measured. The following is the result of image cropping that has been done:

![Image Cropping Result](image1.png)

**Figure 3. Image Cropping Result**

The next step after image cropping process is measuring the corn spout length by the image using region growing method. Figure 4 shows the results of the calculation process of corn sprout length using region growing:

![Calculation Results](image2.png)

**Figure 4. The results of calculations are using region growing method.**

After the length growth of the sprouts is known, the next process is, data collection results of measurements of plant length to produce graph data from growth of corn sprouts length for 6 days.

![Graph Data](image3.png)

**Figure 5. Corn Sprout Growth Chart for 6 Days**
Figure 5 is a comparison chart of measurement of germination growth using manual measurements (ruler) which shows the growth of the average length of corn sprouts by 2.1 cm / day and the results of measurements with region growing show the average length of corn sprouts 2.3 cm / day. These results indicate a comparison between manual and region growing measurements is equal to 0.2. The difference between manual calculation and growing region is caused by the accuracy of shooting and image cropping process.

5. Conclusion

Research conducted shows that image processing using the Region growing method can be used to measure the growth of plant. The results of manual measurements show the growth of plant length by an average of 2.1 cm / day then the results of measurements with region growing show an average plant length of 2.3 cm / day, this result shows the comparison between manual and region growing measurements is 0.2 cm. The difference between manual calculation and region growing is caused by the accuracy of shooting and image cropping process.

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