

Implementation of Digital Image Processing Techniques in Measuring the Diameter of Citrus Fruits

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ABSTRACT

Oranges are one of the many fruits that produce vitamin C. The size of oranges will affect the selling price in the market. Large oranges will be sold at a higher price and even become an export commodity. Oranges are valued by two factors; size and quality. This research aims to develop an automated system to determine the size of oranges using the requirements of the Indonesian National Standard (SNI 3932:2008) on the quality of Kepro oranges. This process uses image processing techniques, specifically segmentation by finding the area of the orange diameter. Orange size is measured by its diameter, and there are four levels of size based on SNI, namely first (70 mm), second (61-70 mm), third (51-60 mm), and fourth (40-50 mm). This size determination is usually done visually, but due to its subjectivity, this research aims to create a more objective automated system. The image processing includes testing several edge detection methods such as Prewitt, Canny, Roberts, and Sobel. In addition, the use of RGB coloring was also explored to improve the clarity of orange edges. The results show that the developed system is successful in acquiring images of oranges and identifying their size according to the requirements of the Indonesian National Standard.

Keyword : Orange size, diameter, image processing.



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1. INTRODUCTION

Oranges are one of the many fruits that produce vitamin C. The size of oranges will affect the selling price in the market. Large oranges are sold at a higher price and even become an export commodity. Oranges are valued by two factors, size and quality. The size itself is measured using the SNI standard with four levels, first = 70mm, second = 61-70mm, third = 51-60mm, fourth = 40-50mm. In particular, size is the dominant parameter that determines the price of oranges. Determination of orange size is done visually by comparing oranges.

Size determination is done visually by comparing oranges. Therefore, this research aims to develop an automated system to determine the size of oranges by adopting the requirements of the Indonesian National Standard on Orange quality (SNI 3932:2008) using image processing techniques. Image processing segmentation is done by finding the area of the diameterslam.

Image segmentation is a process to separate an object from the background, so that the object can be processed for other purposes. With the segmentation process, each object in the image can be taken individually so that it can be used as input for other processes, for example, in the process of reconstructing a 3-dimensional object, a segmentation process is needed to separate the object to be reconstructed from the existing background.

Image Processing has been carried out in the case study of Image Processing to Measure the Smallest Diameter of Wood to Overcome Losses due to Measurement Errors in the Wood Industry. This research aims to make measurements on round wood needed as a standardization of wood measurement methods where the current method has the potential to harm various parties. This is because the use of ruler aids has the potential for error due to differences in measurement perceptions in determining the diameter value when determining the grade value of a wood So that measurement devices are needed to overcome the problem of errors in the measurement method. Through research and manufacture of raspberry-based wood diameter measuring devices using image processing.

2. RESEARCH METHOD/MATERIAL AND METHOD/LETERATURE REVIEW

This study uses experimental research, namely the observation of edge detection is done with the perfection of the circular shape of the orange surface with the help of a flashlight and a digital camera > 10 MP then shooting is done with a distance of 10 cm with sufficient lighting and resolution > 5 MP. image processing begins with several stages to produce objective values. These stages can be seen in Figure 1.

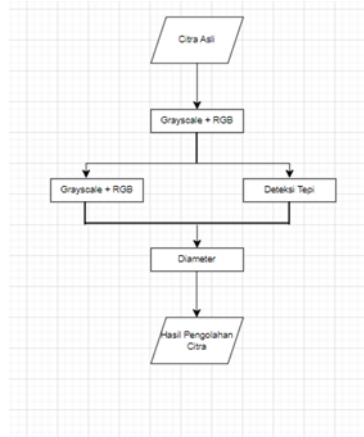


Figure 1. Image processing stages

Image processing stages to produce the perfect diameter of citrus fruit by doing several things contained in the flowchat image above. Observation starts with getting the original image which is then processed with the matlab application to test grayscale plus RGB, then edge detection with four methods of sobell, prewitt, canny and sobel, after that the diameter calculation is done to find out the diameter results with the matlab application automatically to facilitate the selection of citrus fruits by utilizing the original image.

A. Imagery and Image Processing

Image is another term for picture as one of the multimedia components that plays a very important role as a form of visual information. Images have characteristics that text data does not have, namely images are rich with information.

Literally, an image is a picture on a two-dimensional plane. From a mathematical point of view, an image is a continuous function of light intensity on a two-dimensional plane. The light source illuminates the object, the object reflects back as a beam of light. This light reflection is captured by optical devices, such as human eyes, cameras, scanners, and so on.m So that the shadow of the object called the image is recorded.

Image processing is a processing process whose input is an image. The output can be an image or a set of image-related characteristics or parameters. The term digital image processing is generally defined as computer processing of two-dimensional images. In a broader definition, digital image processing also includes all two-dimensional data. A digital image is a sequence of real or complex numbers represented by certain bits. Image processing has several functions, including:

1. Used as a process to improve the quality of an image so that it can be easily interpreted by humans or computers.
2. Used for image processing techniques by transforming an image into another image. Example: image compression as preprocessing of computer vision.

B. Grayscale Image

Grayscale image is a digital image that only has one channel value at each pixel, in other words the value of the RED = GREEN = BLUE part. The value is used to show the intensity level. The colors are black, gray, and white. The gray level here is a gray color with various levels from black to white.

C. Edge Detection

Edge detection is one of the image pre-processing processes required for image analysis. The process aims to increase the intensity of the edges in the image, which will strengthen the high-frequency components of the image.

To produce such an edge image, it is necessary to classify which points in the image are considered as edges of the image. In this case it is necessary to determine the threshold value of the edge point'. $G(x,y) > \alpha$ then (x,y) is an edge $G(x,y) < \alpha$ then it is not an edge. An edge is a sudden (large) change in gray degree value over a short distance.

Some techniques for edge detection:

1. Sobel Operator
2. Prewitt Operator
3. Operator Roberts
4. Canny operator

D. Diameter

In geometry, the diameter (from Greek, diairo = divide and metro = measure) of a circle is the line segment through the center point and connecting two points on the circle, or, in modern usage, diameter means the length of the line segment. In a sphere, the diameter connects two points on the surface of the sphere and passes through the center of the sphere.

Table 1. Diameter

Size Code	Diameter
1	70 cm
2	61-70 cm
3	51-60 cm
4	40-50 cm

The length of the diameter of a circle is 2 times the length of the radius. The diameter can be used to find the circumference and area of a circle. In a 3-dimensional sphere, the diameter can be used to determine the surface area and volume of the sphere. In addition, the diameter is the longest bowstring in a circle.

3. RESULTS AND DISCUSSION

From 30 datasets taken through citrus fruit images, one by one trials were carried out with several stages that have been described previously to measure the diameter of citrus fruits using the Matlab application. In the Indonesian National Standard (SNI), the requirements for citrus fruit diameter size are classified into four. The size of citrus fruit based on SNI is given in Table 1. The output of the image processing process is the result of edge detection and diameter calculation results with pixel units which are then converted from pixels to millimeters and divided into several size codes. The following is the image processing process of diameter detection in citrus fruits using image segmentation.

A. Image sample of citrus fruit

In this research, tangerine fruit is tested which has a variety of sizes so that we can find out that each orange sold has a different size to be sold at a different price.

The image can be seen in figure 2.



Figure 2. Original photo of citrus fruit.

B. Grayscale merging and RGB coloring

After getting the perfect image, grayscale testing is combined by adding RGB (Red, Green, Blue) coloring to produce a perfect image. From the image processing process, it is produced that the grayscale combined with the color Blue is more perfectly visible circle of citrus fruit.

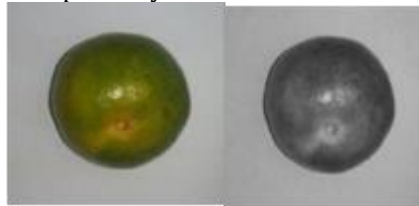


Figure 3. Original Image and Red Image

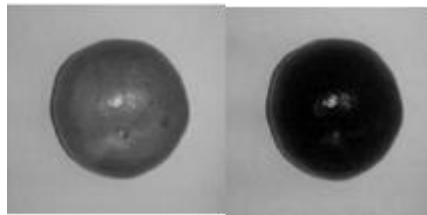


Figure 4. Grayscale and RGB results

C. Edge Detection Testing

After obtaining the results of combining grayscale and RGB, then testing edge detection using four methods, namely the canny method, robert method, sobell method, and prewitt method. The results can be seen in Figure 5.

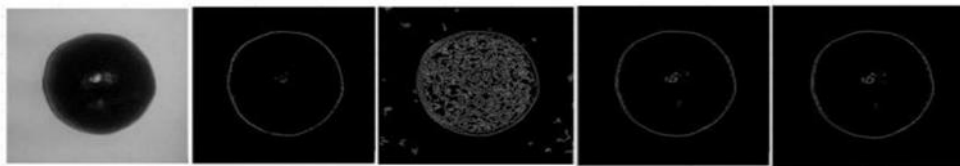


Figure 5. Combining grayscale and RGB.

Grysacle test results with the four methods of canny, Roberts, prewitt and sobel. From the images generated from the grayscale and RGB image processing process, it can be seen that the clearest lines produced are in Robert's method.

D. Diameter Calculation

The last stage in this research is the diameter measurement stage of each citrus fruit that has been tested for grayscale, RGB coloring and edge detection. At this stage the processing of the diameter value can be tested directly by using the source code to calculate the diameter. To see how much the diameter value of each tangerine image can be seen from the test results through the matlab application. These results can be seen in Figure 6.



Figure 6. Diameter calculation results

The process carried out in image processing is carried out with 29 other sample images. The results that appear are pixel values which are then converted from pixels to millimeters and recorded, to then be grouped with the size code according to SNI Citrus fruit. Then the overall sail is known in table 2.

Table 2. Image processing results of citrus fruits

No.	Name	Diameterr(px)	Diameter r(mm)	Codesize
1	Image 1	267,5	70,6	1
2	Image 2	288,5	76,3	1
3	Image 3	279	73,8	1
4	Image 4	307	81,2	1
5	Image 5	253,12	66,9	2
6	Image 6	280	74	1
7	Image 7	260	68,7	2
8	Image 8	266,3	70,4	1
9	Image 9	250,16	60,1	2
10	Image 10	230,55	60,9	3
11	Image 11	273,11	72,2	1
12	Image 12	232,2	61,4	2
13	Image 13	250,27	66,2	2
14	Image 14	302,01	79,9	1
15	Image 15	285,15	75,4	1
16	Image 16	311,27	82,3	1
17	Image 17	205,15	54,2	3
18	Image 18	288,1	55,9	3
19	Image 19	273,15	76,2	1
20	Image 20	255,1	72,2	1
21	Image 21	255,1	67,4	2
22	Image 22	231,72	61,3	2
23	Image 23	297,01	78,5	1
24	Image 24	253,15	66,9	2
25	Image 25	277,16	73,3	1
26	Image 26	203,2	53,7	3
27	Image 27	233,62	61,8	2
28	Image 28	241	63,7	2

29	Image 29	237,11	62,7	2
30	Image 30	221,34	58,5	3

The results of detection of citrus fruit diameter measurements are made in tabular form to facilitate readers in analyzing the results obtained by testing 30 citrus fruits that become samples. The results of research to process images to produce measurements of citrus fruit diameter using matlab applications obtained the results that the image processing method performed can detect the diameter of tangerine fruit in accordance with SNI standards Tangerine fruits are grouped into several size codes. From the table results obtained size code 1 more than 70 mm there are 14 pieces, size code 2 between 61 - 70mm there are 11 pieces, and size code 3 between 51-60mm there are 5 citrus fruits.

4. CONCLUSION

The conclusion of this research is that image segmentation can be done by doing several stages in order to produce a better image to measure the diameter of the orange fruit, because the size of the orange will affect the selling price on the market. Large oranges will be sold at a higher price and even become an export commodity. Citrus fruits are valued by two factors; size and quality. The size itself is measured using the SNI standardized diameter with four levels; first = 70 mm, second = 61-70 mm, third = 51-60 mm, fourth = 40-50 mm. Segmentasi pengolahan citra dilakukan dengan mencari diameter.

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