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Image Segmentation for Oyster Mushroom Grade with Canny Detection for Image Classification

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ABSTRACT

Product quality must remain good to consumers and expand market segmentation to increase income and improve farmers' welfare, post-harvest handling needs to be done. One of the post-harvest handling of fresh oyster mushroom products is grading. The grading process is carried out based on the quality of the oyster mushroom harvest which is classified into three, namely Grade A, Grade B, and Grade C. Computer technology with digital image processing segmentation and image classification using canny edge detection can be the first step in the process of grading fresh oyster mushrooms. so that the image can be processed canny detection, it is necessary to do image segmentation. From the results of thresholding on the oyster mushroom image, the threshold value of T is obtained, namely with T1 below 50 and T2 above 150. The T threshold value is a classification for the canny detection process. Of the six oyster mushroom datasets, five datasets of oyster mushrooms were obtained accurately, while one mushroom had broken lines and noise..

I. Introduction

Mushroom quality is an important part that must be maintained when planting oyster mushrooms until post-harvest. The quality of the mushrooms will be judged based on the size, color, and moisture content of the oyster mushrooms. The Ministry of Agriculture determines the grade rules for oyster mushrooms based on the diameter of the quality of the harvest are: grade A = 10 cm to 15cm, grade B = 5cm to 10cm, and grade C = below 5 cm [1]. The oyster mushroom grading rules are shown in Table 1. Grouping by grade is used to meet consumer satisfaction standards with a higher selling value and increase consumer income. However, the application of grading on oyster mushrooms has not been carried out optimally. In fact, the income from the sale of oyster mushrooms can be further increased from mushroom grading.

Table 1. Table Classification

Classification	Type of Grade		
	Grade A	***Grade B***	***Grade C***
Diameter	10 cm – 15 cm	5 cm – 10 cm	< 5 cm

[a] Sample of a Table footnote. *(Table footnote)*

Computer vision can analyze images or videos as humans can. Computer vision tries to imitate the workings of the human vision system, especially digital image processing, segmentation and image classification [2]. Canny edge detection is a method applied to digital image processing as a result of oyster mushroom harvest quality which is affected by diameter size. Canny edge detection is used to determine the boundary of the oyster mushroom object with the acquisition process [3].

Based on the description of the problem, the optimization of the quality of oyster mushrooms was developed using an image classification process. With digital image processing that involves image classification, it can determine the grade of oyster mushrooms based on the calculated diameter.

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II. Methods

A. *Oyster Mushroom*

Oyster mushroom or in Latin is called Pleurotus sp. is one of the high-value consumption mushrooms, but there are also mushrooms that are efficacious [4]. Several types of oyster mushrooms are commonly cultivated by the Indonesian people, namely white oyster mushrooms (Pleurotus ostreatus), pink oyster mushrooms (Pleurotus flabellatus), gray oyster mushrooms (Pleurotus sajor caju), and abalone oyster mushrooms (Pleurotus cystidiosus). The fruiting body of the oyster mushroom blooms to form a shallow funnel like a conch shell. Pileus is shaped like an oyster shell measuring 5 cm 15 cm and the bottom surface is layered like white and soft gills. The stalk can reach 2 cm or 6 cm. Oyster mushrooms grow in a bag log in a mushroom house with relatively faster production period of oyster mushrooms so that the period and harvest time are shorter.

B. *Grayscale*

Collection of data as datasets using acquisition technique [5]. The aim of image acquisition is to transform the real image to image vision so it can be processed to the next stage [5]. The image dataset must be consistent so that image classification can be accurate. Based on [4, 5], image acquisition technique is shown in Figure 1. The oyster mushroom image taken using a camera with a consistent height of 18 cm (a). Furthermore, The background used for the oyster mushroom image dataset is black.

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D. *Image Acquisition*

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Fig. 1.Image Acquisition Oyster Mushroom; (a): Capture technique; (b): Background color

E. Edge Detection

Edge detection is used to identify image object segmentation which is done by image processing. Edge detection works by looking for very high transition intensity differences in image objects. The intensity of the transition is a feature of edge detection to determine the points. Image processing using edge detection was developed in 1960 and 1970: Roberts, Prewitt, and Sobel. Many new edge detection methods have emerged, but the old edge detection methods are still effective in their use [7].

F. Canny Edge Detection

Canny's edge detection algorithm is a classic edge detection algorithm that has stood the test of time and is still widely used. Canny's approach is based on three goals: low error rate, good localization of the edge points and thin edges. This is a four-stage algorithm:

- Smooth the image with a Gaussian filter for noise reduction
- Compute the gradient magnitudes and angles
- Apply non-maxima suppression to the gradient magnitudes based on the angles
- Use hysteresis thresholding and link the edges

The output of Canny's edge detection algorithm is overwhelming depending on the high and low thresholds (TH, TL) used in hysteresis threshold. When the threshold is low, we get noisy edges, when they are hight, we lose the true edges and contours become disconnected or broken edges (Bastan, Bukhari, & Breuel, 2017).

G. Image Segmentation

Image segmentation is the most important stage in image processing. Image segmentation involves partitioning images into multiple segments and objects [9]. Contour process is one of the methods used for image segmentation. With image segmentation, the target object becomes clearer to classify. Image segmentation on the mushroom image is used to select objects so that the diameter of the mushroom image can be detected and calculated.

H. Active Contour

Image segmentation is applied to isolate the desired object from the entire image. There are several image segmentation techniques which are classified into area approach, boundary approach and edge approach. Active contour model is also called as snake model, first introduced by Kass in 1987.A subsubsection. The paragraph text follows on from the subsubsection heading but should not be in italic [9]. In this study, active contour is used in edge detection to isolate the desired area and then calculate the isolated area. The isolated area will be calculated for the diameter of the pixel area and then it will be converted into centimeters..

III. Result and Discussion

As shown in Figure 2, canny detection has a flowchart system with stages including feature extraction declaration, image acquisition from input dataset image capture, image convert, set threshold, convolution process, active contour, calculate diameter, classification grade. In this flowchart program, there are parts of the pre-processing, namely dataset in feature extraction, collecting data in data acquisition, converting RGB image to grayscale, and setting threshold.

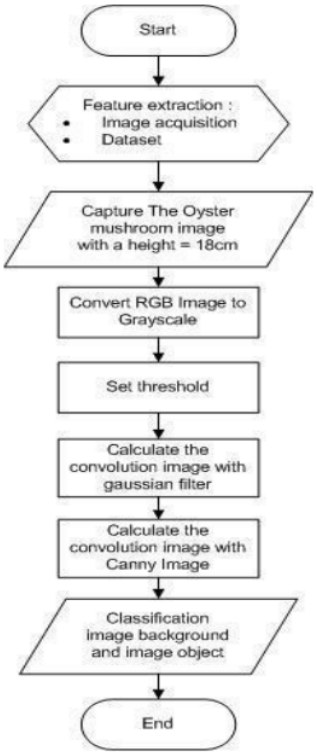

Fig. 2.Flowchart of the Canny Detection Process in Oyster Mushroom classification

A. *Feature Extraction*

Feature extraction is the declaration stage carried out in image processing. In the oyster mushroom classification, there are two declarations including image acquisition and dataset. image acquisition is used for rules in dataset collection.

The image acquisition process explained the oyster mushroom image data captured with a camera at a height of 18cm. Moreover, the black background was chosen because the color contrasts with the oyster mushroom. The contrasting color between the background and the object will simplify the threshold process.

B. *Pre-Processing*

The pre-processing stages in the oyster mushroom image classification are image acquisition which has been described previously, converting RGB to grayscale, and set the threshold. Converting rgb to grayscale is conducted to simplify the model of the image. If the image model is simple, then the image segmentation partitioning becomes more precise [10].

After converting RGB to grayscale, the next process is image segmentation. The image segmentation method to separate the background from the object is the thresholding process. The threshold value T is used to convert into a binary image by involving two T thresholds, namely T1 and T2. Figure 3 shows the analysis of the threshold value T that must be set as the background and object. The threshold T with values less than T1 representing the background and values greater than T2 representing the object.

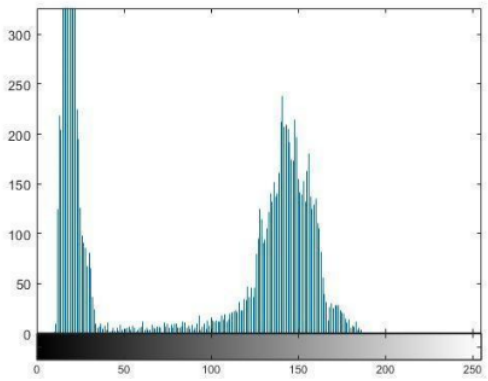

Fig. 3.Histogram of The Oyster Mushroom Image

C. Post-Processing

The initial stage in the canny detection process is image segmentation. In equation 1 shows the results of the threshold analysis to determine T1 and T2 as image segmentation. in equation 1 explains that if the value of T1 is below 70 then the binary image is 0 representing the background. whereas if the value of T2 is above 150 then the binary image is 1 representing the object. As shown in Figure 4, the analysis of four oyster mushroom datasets with a1 and a2 being Grade A, b1 and b2 being Grade B, c1 and c2 being Grade C.

$$ImageSegmentation = IF\ T1 < 50 = 0, IF\ T2 > 150 = 1 \quad (1)$$

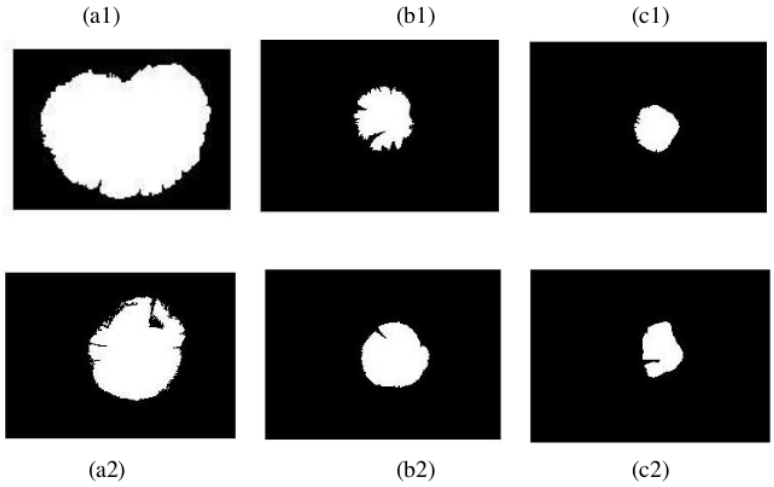

Fig. 4.The result of Image Segmentation (a1) : Oyster mushroom Grade A, (a2) : Oyster mushroom Grade A, (b1) : Oyster mushroom Grade B, (b2): Oyster mushroom Grade B, (c1): Oyster mushroom Grade C, and (c2): Oyster mushroom Grade C

After image segmentation, the next process is canny detection. each edge is calculated and linked by adjusting the direction to the nearest 0, 45, 90, or 135 degrees. Figure 5 showed the result of oyster mushroom with canny detection. Based on the results of canny detection, accurate results were obtained on the Grade A mushroom dataset on a1 and a2, the Grade B mushroom dataset on b1 and b2, and the Grade C mushroom dataset on c2. However, there were different results with the Grade C mushroom dataset at c1. The results are not quite accurate on the c1 dataset on Grade C mushrooms. There are broken lines and noise on the object.

IV. Conclusion

The analysis of oyster mushroom image classification can be implementation using canny detection. Image segmentation is the most important part in determining the threshold value of T. This threshold value is used to classify objects and backgrounds. Based on the oyster mushroom histogram, there are two T threshold values, namely T1 as background and T2 as object with five accurate datasets and one loss..

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