EYE BLACK CIRCLE OF MILKFISH SEGMENTATION ON HSV COLOR SPACE

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ABSTRACT

One of the popular fish consumed by the people is milkfish. The freshness of milkfish can be observed from eye condition. maka segmentasi lingkatan hitam mata ikan bandeng penting dilakukan we conduct experiment in milkfish image segmentation to get region of interest in eye circle. Kami mengusulkan frame work untuk segmentasi lingkaran mata ikan bandeng menggunakan filter spasial pada komponen Hue dan Value ruang warna HSV. By using 10 milikfish images, we get segmentation performance with average of precision 84.04%. But we get bad performance in recall, because achieve recall 43.08%.

Keywords: *eye black circle, milkfish, segmentation, Hue, Value*

1. INTRODUCTION

Human protein needs can be met both from animals and plants. Easy source of animal protein can be fulfilled from fish. One of the popular fish consumed by the people is milkfish. The high demand for milkfish causes the seller cheating by selling not fresh milkfish. The freshness of milkfish can be observed from eye condition. The previous research on freshness detection of fish conducted in [1] aims to detect the freshness of the fish with accuracy obtained up to 96%. But in this study, not clearly described the type of fish that was detected. So the results obtained are also not yet clear whether it can be applied to all types of fish. Though visually, shapes, colors, and texture outside the fish are many different. Especially in fish eyes, many differences between fish with each other. To detect the freshness of milkfish based on the eyes, it takes segmentation of fish image to get the black circle of fish eye.

Figure 1. Milkfish image

The milkfish image is presented in Figure 1. The freshness of milkfish can be observed from the dark circle condition of the eye. In fresh milkfish, the color of the circle looks black coated with a clear membrane, the color of this membrane is increasingly becoming less clear (whitish) as the freshness of the fish decreases. Therefore, to detect the freshness of milkfish based on the eyes, then the black circle segmentation of milkfish is important. This is to get an eye-circle pixel only object, where these pixels are to be classified to know the freshness level.

In this research, we conduct experiment in milkfish image segmentation to get region of interest in eye circle. We propose frame work for the segmentation of milkfish eye-circles using spatial filters on HSV color space components. This is based on research [2] performing mango leaf segmentation, successfully achieving good segmentation performance. We use the Hue and Value components as a basis for segmenting. We also use logical

operators to combine the two best segmentation results. To measure the performance of segmetnasi, we use ground truth images as a benchmark of results. Ground truth is a binary image of the best-made segmentation results manually. Our performance results are presented using precision and recall parameters. Precision to determine the level of accuracy of the obtained segmentation results, while the recall to determine the level of success of segmentation of the results that should be obtained.

The presentation of this paper is divided into 4 sections. Part 1 provides preliminary background of the author doing research. Section 2 presents the research framework. Section 3 presents the result and analysis. And section 4 presents the conclusions of the research.

2. RESEARCH FRAMEWORK

2.1 Segmentation Framework

This research conduct segmentation of milkfish image to get the intereted area that is black circle of fish eye. We use the frame work segmentation circle of fish eye fish as in Figure 2.

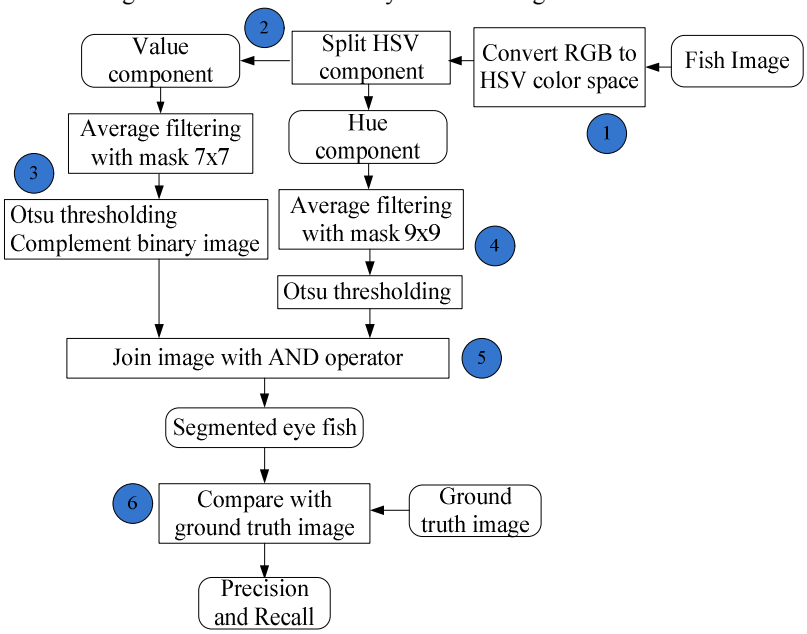


Figure 2. Black circle fish eye segmentation frame work

Figure 2 is a frame work that we design and implement to get the pixel of black circle of milkfish eye. The frame work steps are as follows:

1. Convert RGB to HSV color space
   This is the first step in frame work. We use the HSV color space, then the RGB input image must be converted to HSV (Hue, Saturationm Value).
2. Split HSV component
   In this frame work, we use Hue and Value components only, so we have to split the HSV image into three separated components. Based on the experimental results, the Hue and Value color space components can be used as the basic image to form the binary image of segmentation results.
3. Value component processing
   Value is a component of the light intensity received by objects in digital images. The Value component is often used as a basis for image processing. We use an average filtering with a 7x7 mask size [3]. This filtering aims to refine unnecessary image details and may interfere with segmentation results. Next, we do a thresholding with the Otsu method [3] with threshold 0.2. Since the circle of the fish is black, in the binary image, the pixel of the circle of the eye is black as well, while the background is white. The image is converted by reversing the image, so the eye circle becomes white while the background becomes black.
4. Hue component processing
   Hue is a component of HSV space that represents the pure color value of pixels [3]. The value is represented in the color angle from 0 to 360. In the Hue component, we use an average filtering with a 9x9 mask size.

This filtering also aims to smooth out small details that are not needed. Next, we do a thresholding with the Otsu method [3] with threshold 0.6.

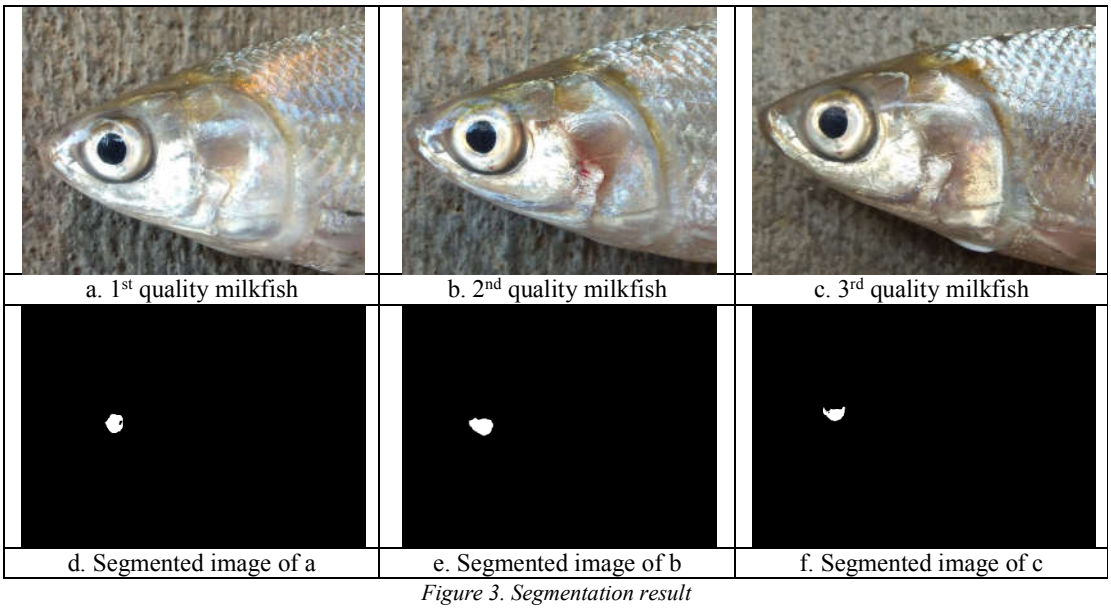
5. Joint two binary image
   The results of segmentation on the Value and Hue components have complementary results. The result of segmentation on the Value component gives the result of good eye circle segmentation but the shadow part of the fish body is still strong so that it becomes part of the segmentation result. While on the Hue component, the result of segmentation on the eye circle is also good, but the white part of the fish head is also strong and appears as a result of segmentation as well. If two binary images are combined with And logic operator, then a binary image is generated where the dark circles of the fish's eye are well segmented while others can be removed.
6. Performance measurement
   To measure the performance of segmentation, we conduct a comparison between the image of the segmentation with the ground truth image of the black circle of the fish eye. The ground truth image is a binary image where the object is a circle of fish's eye. The results of the comparison we serve to be precision and recall.

2.2 Data set

Data set used in this research is 10 image of milkfish. We divided into three kinds: 4 images of milkfish quality 1, 4 images of milkfish quality 2, and 2 images of milkfish quality 3. milkfish quality 1, 2 and 3 each is milkfish that has been out of water in time up to 2, 4 and 6 hour. Examples of each fish are presented in Figure 3.

3. RESULT AND ANALYSIS

The tests results on 10 images are shown in Figure 3. Figure 3 (a), (b), and (c) are the results of the acquisition where each is milkfish of quality 1, 2, and 3 While Figure (d), (e), and (f) is the result of our segmentation. In general, the segmentation conducted successfully separates the dark circle of the eye, but the area of the circle that is obtained is not as wide as the black circle should be.



a. 1st quality milkfish | b. 2nd quality milkfish | c. 3rd quality milkfish

d. Segmented image of a | e. Segmented image of b | f. Segmented image of c

Figure 3. Segmentation result

We also evaluated the performance of segmentation by comparing binary image of segmentation result to ground truth binary image. The results of the evaluation are presented in Table 1.

Table 1. Segmentation performance evaluation

Image	Precision (%)	Recall (%)
1	92.60	52.69
2	87.94	31.11
3	100.00	16.29
4	90.98	62.35
5	94.52	63.18
6	77.60	66.93
7	97.67	44.41
8	99.26	49.42
9	0.00	0.00
10	99.84	44.44
Average	**84.04**	**43.08**

From the data presented in Table 1, it is known that the system has not been able to achieve perfect precision or recall. Most images get precision above 90% but recall below 70%. There is even one image that get precision value and recall 0, this means the image failed to be segmented. The overall performance of segmentation is obtained on average of precision 84.04% and recall 43.08%.

In general, for successfully segmented images has good precision, even up to 100%. But good precision without a good recall balanced also shows poor performance. As in image 3, although the precision is 100%, but the recall is only 16%, this means the pixels that come out as a result of segmentation are all black eye circle images, but only 16% are found, 84% are missing. With an average precision of 84.04%, good precision performance, while the 43.08% recall is still ugly because most of the pixels of the eye circle fail to be obtained.

4. CONCLUSIONS

From the research conducted, it can be concluded that segmentation framework on eye black circle of milkfish proposed in this research is achieved good performance in precision. This is shown by average of precision 84.04%. But this system get bad performance in recall, because achieve recall 43.08%.

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