



Designing an Auto Cropping Application System for Fish Eye Image Using the Edge Detection Method

Brian Sulu¹, Jullia Titaley¹, Luther A Latumakulita¹, Altien J Rindengan^{1*}

¹Mathematics Department–Faculty of Mathematics and Natural Sciences–University of Sam Ratulangi Manado, Indonesia

*Corresponding author: altien@unsrat.ac.id

ABSTRACT

Indonesia is one of the largest archipelagic countries in the world with the ocean area is larger than the mainland. This potential provides a great opportunity to do research in the maritime sector. The purpose of this research is to develop the application system that can automatically recognize and separate the fisheye images using the edge detection method. By using 20 fish digital images which taken by digital camera, the application system can recognize and separate the fisheye characteristic features with a good accuracy of 90%.

Article Informations

Received : 14 July 2019

Received after revision : 23 July 2019

Available online : 25 July 2019

Key Words:

*Application System,
Auto Cropping,
Edge Detection,*

ABSTRAK

Indonesia merupakan salah satu negara kepulauan terbesar di dunia dengan daerah laut lebih luas dari daratan. Potensi ini memberikan sebuah kesempatan besar untuk melakukan penelitian di bidang kelautan. Tujuan dari penelitian ini adalah untuk merancang sebuah sistem aplikasi yang dapat mengenali dan memisahkan citra mata ikan secara otomatis dengan menggunakan metode edge detection. Dengan menggunakan 20 gambar digital ikan yang diambil menggunakan kamera digital, sistem aplikasi dapat mengenali dan memisahkan mata ikan dengan tingkat akurasi yang baik yaitu sebesar 90%.

Article Informations

Diterima : 14 Juli 2019

Diterima setelah direvisi : 23 Juli 2019

Available online : 25 Juli 2019

Kata Kunci:

*Sistem Aplikasi,
Auto Cropping,
Edge Detection,*

1. INTRODUCTION

Background

Indonesia is one of the largest archipelagic countries in the world with the ocean area is larger than the mainland with the sea area of 3.25 million km² and consist of 17.504 island. This potential provides a great opportunity to do research in the maritime sector. Technological developments that occur at this time make it easier to process data based on computers, there are various forms of data that can be processed and one of them are multimedia components. Multimedia components include image, sound, and video. One of the multimedia components that can be used in the various sector is image. An image can contain various kinds of important information in it [1]. An image contain a lot of informations, but often there are imperfect images, for example containing defects or noise, having problems in colors such as being underexposed, less sharp or blurred, this is the problem that can be solved using image processing methods. An image that is processed using image processing techniques, will get better quality images so that it can be further processed by humans and computers.

The fisheries sector in Indonesia, especially in North Sulawesi, is one of the sector that use a lot of technological sophistication, although in some parts it still utilizes human judgment in determining fish freshness quality [2]. Fish are marine animals that have

various types of characteristics depending on the type of fish. There are various forms of processing or forms of identification carried out on fish that utilize the image or image of the fish. Fisheye is one of the main components of physical fish that is used for various types of needs such as to identify the condition of fish [3]. Photographs of fish taken have a various types and so the fish image that will be used are only digital image obtained using a digital camera or the results of the conversion of ordinary image using applications or manually using image processing techniques. This is done to avoid any errors in the image processing process such as errors in the compatibility of the image dimensions which will cause the processing to be disrupted.

Research about fisheye images was previously conducted by Bee [4] using fisheye image that had been previously cropped and then the fisheye image was processed to determine the freshness of the fish using the digital image-based least squares method. Research on fish image has also been carried out by Rindengan and Mananohas [5] by manually processing the image of fisheyes. Research about image processing based on digital image application has also been carried out by Koba [6] to determine the coral reef health condition by using K-nearest neighbor and curve fitting method.

Based on this research, an application can be built that can be used to process an image of fish automatically to get the results of segmentation of fisheyes quickly which can even be used by various

groups, as well as to understand the processes that are passed to design this application.

2. Image

Image is one of the multimedia components that play an important role as a form of visual information, because of its characteristics that are rich of informations. Images is a two-dimensional fields that are produced from continuous two-dimensional analog images into discrete images. In order to be processed and represented by a computer, an image must be represented numerically with discrete values. Digital images measuring $N \times M$ are commonly expressed with matrices measuring N rows and M columns as follows:

$$f(x,y) = \begin{bmatrix} f(0,0) & f(0,1) & \dots & f(0,M-1) \\ f(1,0) & f(1,1) & \dots & f(1,M-1) \\ \vdots & \vdots & \ddots & \vdots \\ f(N-1,0) & f(N-1,1) & \dots & f(N-1,M-1) \end{bmatrix}$$

Row index (i) and column index (j) represent a point coordinate in the image, while $f(i, j)$ is the intensity (gray level) at the point (i, j).

$$A = \begin{bmatrix} a_{0,0} & a_{0,1} & \dots & a_{0,M-1} \\ a_{1,0} & a_{1,1} & \dots & a_{1,M-1} \\ \vdots & \vdots & \ddots & \vdots \\ a_{N-1,0} & a_{N-1,1} & \dots & a_{N-1,M-1} \end{bmatrix} \quad (2)$$

With a $(i, j) = f(i, j)$, so the matrix in equation (1) is the same as equation (2) [7].

Image Processing

Image processing is a methods to process an image especially by using a computer, becoming a better quality image. The main purpose of image processing is that an imperfect images are easily interpreted by humans and machines (computers). These operations will be applied to image processing if:

- Used to improve the quality of the appearance or highlight some aspects of the information contained in the image by repairing or modifying the image.
- Need to classify, match or measure elements in the image.
- Need to combine some images with other parts of the image [8].

There are several basic meanings of Image Processing,

- Pixel (picture element), is the smallest point (element) that forms an image on the monitor layer, also called dot.
- Resolution is the number of dots (pixels) that make up an image or layer. The size is the number of horizontal pixels multiplied by the number of vertical pixels. For example, there is an image measuring 640 x 480, meaning 640 pixels flat, and 480 vertical.
- Dots per inch (dpi / pixel per inch) Number of dots or pixels per unit inch. For example 600 dpi, means that there is 600×600 pixels per inch unit.
- Color, there are several color models,
 - a. RGB (red, green, blue) is a combination of red, green, and blue elements. Each point or pixel is a combination of the three color element. Each element has 0-255 color levels. For example black is a combination of $R = 0, G = 0, B = 0$; white is a combination of $R = 255, G =$

255, $B = 255$; yellow is produced from a combination of $R = 255, G = 255, B = 0$. So the color combination that can be formed from RGB mode is $255 \times 256 \times 256 = 16777216$ (16 million colors).

- b. CMYK (cyan, magenta, yellow, black) A color presentation system for 4 color printing processes (cyan, magenta, yellow and black). With this system the image will be saved in 4 channels
- Color Depth, is the amount of data information from 1 sample unit (dot / pixel). Each bitmap / dot / pixel can be black, white, gray or color. Color Depth is expressed in numbers that are used to express several color variations that are capable of being displayed by a bitmap / dot / pixel, which is expressed quantitatively. The formula is 2^n (two powers of n , where n is the amount of bit depth). Example: 1 bit = 2 powers 1 = 2 color variations (monochrome), 2 bits = 2 powers 2 = 4 color variations, 4 bits = 2 powers 4 = 16 color variations, 8 bits = 2 powers 8 = 256 color variations. 16 bits = 2 powers 16 = 2 combinations of 8 bits = 65,536 color variations, 24 bits = 2 powers 24 = 3 combinations of 8 bits = 16,777,216 color variations, 32 bits = 2 powers 32 = 4 combinations of 8 bits = 4,294. 967,296 color variations
 - Calculates the size of the vector image file, the size in bytes = width x height x colordepth. Note:
 - a. Width: the width of the image, measured by pixel
 - b. Height: the height of the image, measured by pixel
 - c. Color depth: the number bit color that can be measured in bit/pixel
 1 byte = 8 byte ,1 KB (kilobyte) = 1024 byte and 1 MB= 1024 KB

RGB Image

CIE (Commission International de l'Eclairage) or International Lighting Committee is an institution that regulates color in 1931. CIE initially standardized the wavelengths of the main colors as follows:

R: 700 nanometer
 G: 546.1 nanometer
 B: 435.8 nanometer

Other colors can be produced by combining these three main colors. The color model used as a reference is called the RGB model [9].

Grayscale Image

Grayscale image is a digital image that has only one channel value in each pixel. These values are used to indicate the intensity of the color. The image displayed from this type of image consists of gray, varies in black on the part of the weakest intensity and white at the strongest intensity. Grayscale images are different from Black / White images, where in the context of computers, black-and-white images only consist of two colors, black and white. The color grayscale image varies between black and white, but the color variations are very large.

Grayscale images are stored in an 8-bit format for each pixel sample, which allows 256 intensities [10]



Figure 1. Examples of (a) RGB and (b) grayscale images

Edge Detection

Edge detection is the first step to cover information in the image. The edges characterize the boundaries of objects and therefore edges are useful for the process of segmentation and identification of objects in the image. The purpose of edge detection operations is to increase the appearance of the boundary lines of an area or object in the image. Because edges are included in high frequency components, edge detection can be done with high-pass filters



Figure 2. Results of conversion of original cameraman image to edge detection.

3. METHODOLOGY

Time and Place of Research

The study was conducted for 4 months from January 2019 to May 2019. The place for conducting research was at the Computer Laboratory of the Mathematics Department, Faculty of Mathematics and Natural Sciences, Sam Ratulangi University, Manado.

Data analysis

This study uses primary data in the form of fish image data taken directly by using a digital camera.

Research methods

The steps taken in this study are:

1. Taking fish digital image data in the form of fish photos
2. Input fish digital image for image processing
3. Convert images from RGB images to Grayscale images
4. Fish Image Segmentation
5. Creating the the range and radius to the image to measure the image size
6. Processing fish images to detect fisheyes using the edge detection method
7. Designing an application by using mathematics computation software to detect the fisheye automatically, with steps i.e:
 - Conducting application designs for main interfaces

- Creating axes as fields to display the image of fish
- Creating a push button for the function declaration in the application
- Applying of image processing methods for identification of fisheye as a function of the application

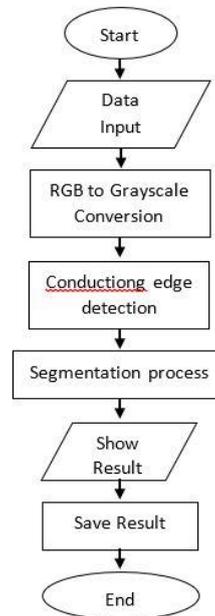


Figure 3. The research methodology flowchart.

8. Application System Testing

4. RESULT AND DISCUSSION

Image Conversion

RGB images that have been input are then converted into a grayscale image which can then be processed using a method to crop images which can only be done if the image form is grayscale.



Figure 4. RGB image and Grayscale image

Image Crop Process

Crop image process is to get the fisheye, by creating a circle that is displayed in the image with a function to separate the eyelets with the other parts of the image.

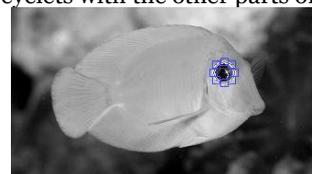


Figure 5. Ellipse which functions to crop fisheye from the original image of the fish

Edge Detection Process

The Edge Detection process is used to separate fishes that have been previously selected. By using the masking process in the image, we get a crop of fishes with a black background where only the fisheye remains in the image.



Figure 6. Results of crop fisheye after masking process

The masking process is carried out by processing grayscale images that have been detected by the fisheye on the image by making a mask on previously processed images, so only the fisheyes will be displayed in the final image of the crop process. The final process of cropping an image is to produce an image with PNG and JPG format stored in a computer drive.

**Application System
Main Menu**



Figure 7. Main application menu

It has a start button that will open a new window to start the image input process and image cropping,

Image Input



Figure 8. Image Input Process Window

The image input process window which has several functions, among others, is to load images that can be selected directly from the drive directory, the button to return to the main menu, the process to locate the eyelets using ellipse, and the results that will open a new window to show results crop fish eye image.

Result

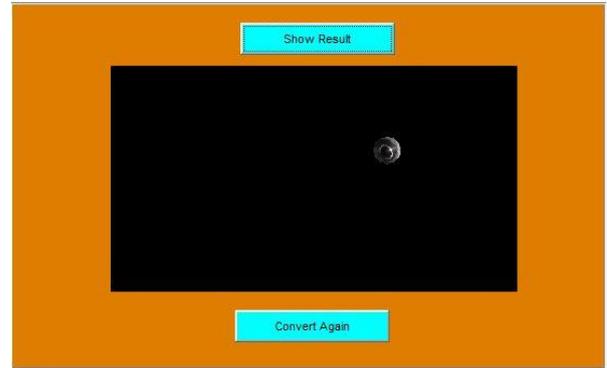


Figure 9. The results window that displays the crop image results

The results window shows the crop image results for the images that have been previously entered. There is a convert button again to return to the previous window to be able to start the process of inputting new images to get crop image results.

Application System Test

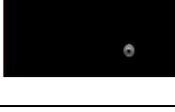
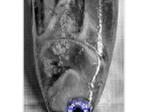
This process is done manually by comparing the results of the cropped image of the fish by calculating the number of the results that get good and bad results.

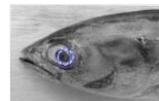
Table 1. Sample list, detection result and crop result

No	Original Image	Image of Fish Eye Detection	Image Of Crop Fish Result
1.			
2.			
3.			
4.			
5.			
6.			

Designing an Auto Cropping Application System for Fish Eye Image Using the Edge Detection Method

d'Cartesian : Jurnal Matematika dan Aplikasi, Vol. 8 No. 2 (September 2019): 141-146

7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			

19			
20			

By using 20 fish samples, 90% of the accuracy level was obtained in the application where all fish eyes were successfully detected but there were 2 samples, i.e samples number 13 and 14 where the radius of the circle used in the detection was greater than the size of the sample fisheye.

To determine the level of accuracy is determined by calculating the amount of test data used, namely 20 sample images divided by the number of sample images that are not detected properly then get a 90% accuracy rate.

5. CONCLUSION AND SUGGESTION

Conclusion

Application system based on digital image using edge detection method can be used to auto cropped fisheye image. By using 20 fish image samples 18 image sample were successfully cropped while 2 samples having a not good result, the final result was 90% for the application test accuracy.

Suggestion

Suggestions in this research are:

1. For further research, a method can be added to process the results of cropped fisheye to get different test results with the results of the cropped fisheye that has been used.
2. Applications can be developed to be based on mobile programming (android) which can be used to simplify the process of taking pictures and processing fisheye images in one application platform.

REFERENCES

[1] Apriliani, D., Murinto. 2013. Analisis Perbandingan Teknik Segmentasi Citra Digital Menggunakan Metode Level-Set Chan & Vese dan Lankton. *Jurnal Informatika*. 7(2) : 62-65.

[2] Kumaseh, M. R., L. A. Latumakulita. dan N. Nainggolan. 2013. Segementasi Citra Digital Ikan Menggunakan Metode *Treshholding*. *Jurnal Ilmiah Sains*. 13(1): 77-79.

[3] Bee, D., W. Ch. D. Weku., dan A. J. Rindengan 2016. Aplikasi Penentuan Tingkat Kesehatan Ikan Selar Berbasis Citra Digital Dengan Metode Kuadrat Terkecil. *Jurnal De Cartesian*. 5(2): 111-121.

[4] Suharto, J. S., Setiyono, B., Isnanto, R.R. 2006. Pengolahan Jenis-Jenis Ikan Menggunakan Metode Analisis Komponen Utama. Makalah

Seminar Tugas Akhir Konsentrasi Elektronika dan Telekomunikasi Teknik.

- [5] Rindengan, A. J., M. Mananohas. 2017. Perancangan Sistem Penentuan Tingkat Kesegaran Ikan Cakalang Menggunakan Metode *Curve Fitting* Berbasis Citra Digital Mata Ikan. *Jurnal Ilmiah Sains*. 17(2): 161-168
- [6] Koba, C. E. Y., A. J. Rindengan., C. E. J. C. Montolalu. 2017. Aplikasi Penentuan Tingkat Kesehatan Terumbu Karang Menggunakan Metode K-Nearest Neighbor dan Curve Fitting Berbasis Pengolahan Citra Digital.
- [7] Gonzalez R. C., R. E. Woods., and S. L. Eddins. 2008. *Digital Image Processing 3rd Edition*. Pearson Prentice Hall, New Jersey.
- [8] Khrisna, D. A., A Hidayatno., R R. Isnanto. 2004. Identifikasi Objek Berdasarkan Bentuk dan Ukuran. Makalah Seminar Tugas Akhir. Konsentrasi Elektronika Dan Telekomunikasi, Universitas Diponegoro.
- [9] Munir, R. 2004. Pengolahan Citra Digital. Informatika. Bandung.
- [10] Purba, D. 2010. Pengolahan Citra Digital. Andi. Yogyakarta.

Brian Sulu (brianrsulu@gmail.com)



Born in Tomohon, North Sulawesi, Indonesia on August 16th, 1997. Take his college in Mathematics Department, Faculty of Mathematics and Natural Science, University of Sam Ratulangi Manado. In 2019 was the last year he took his bachelor degree. This paper is the result of his research that

published.

Jullia Titaley (july_titaley@unsrat.ac.id)



In 1997, she obtained a Bachelor's Degree in the Mathematics Department and Natural Science, Pattimura University Ambon. The Master of Mathematics was obtained from Gajah Mada University in 2001. Becoming a lecturer in the Mathematics Department, FMIPA, Sam Ratulangi University Manado

since 2002 to the present.

Luther Latumakulita (lutherlatu@gmail.com)



In 1997, he obtained a Bachelor's degree from department of Computer Science Gajah Mada University Yogyakarta. The Master of Computer Science was obtained from Department of Computer Science Gajah Mada University Yogyakarta. in 2008. In 2018, he obtained the

Doctoral Degree from Department of Computer Science and Electrical Engineering, Kumamoto University Japan. Becoming a lecturer in the Mathematics

Department, FMIPA, Sam Ratulangi University Manado from 2008 until present. Eexpertise in Fuzzy Systems, Artificial Neural Network and Machine Learning.

Altien Rindengan (altien@unsrat.ac.id)



In 1999, he obtained a Bachelor's degree in the Mathematics Department, Faculty of Mathematics and Natural Sciences, Bogor Agricultural University. The Master of Science in Computer Science was obtained from the Bogor Agricultural Institute in 2012. Becoming a lecturer in the Mathematics Department, FMIPA, Sam Ratulangi University Manado from 2001 to the present.