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Image Edge Detection Capture Zoom for Facial Recognition Using Gradient Operators

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Abstract

Imagery on edge detection is a process that will display the edges of an image. Basically, edge detection is one of the techniques for the analysis of image quality in the spatial domain and is also one of the initial process in digital image processing. Edge detection serves to detect the border line of an object contained in the image. This study aims to identify and recognize face pattern objects in the capture zoom image. To perform face identification begins with collecting image data, image processing, image edge detection, thinning of the image, and identification process using the template matching method. The method used in edge detection uses 3 methods, namely Sobel, Roberts and Prewitt which are gradient operators to detect edges in facial images. The dataset used is image capture zoom. The trial was carried out in two stages, namely the identification of the face shape and the identification of the edges of the face. The conclusion of the study is that the Roberts operator is the operator that finds the least edge patterns in facial images than the other two operators, namely Prewitt and Sobel. Meanwhile, the Sobel operator produces edge patterns that are better in quality and quantity than using the Roberts and Prewitt operators.

Keywords: Edge Detection, Facial Recognition, Image, Capture Zoom, Gradient Operators.

1. Introduction

In the industrial revolution 4.0 brings new biometric technology and provides various advanced features [1]. Biometric technology is to have a definition related to knowing a person's characteristics by looking at physical forms and unique biological properties. Examples of biometric technology are facial recognition, fingerprint recognition, palm geometry, iris recognition and handwriting recognition [2]. At this time, facial recognition-related research is developing rapidly [3]. Research related to facial detection is growing because it has many benefits [4]. Facial detection is one of the first very important stages in the facial recognition process before it is done [5]. The facial recognition system will be used to compare the input facial image with several other facial images to be able to recognize which face image best matches the input face image [6]. In the concept of image processing, the goal is to change the quality of the image so that it can be easily interpreted by humans or computers [7]. Image processing can be used as pattern recognition from an image. The difference in the pattern of an image can be used as a identifier [8]. In general, operations that are often used in image processing are image repair or modification [9]. The purpose of the operation is to improve the quality of the appearance or to highlight some aspect of the information contained in the image [10]. Other operations in image processing are grouping, matching, or measuring elements in the image, as well as merging parts of the image with other parts of the image [11]. The method used in this image processing is edge detection. Edge detection is a modification of the gray degree intensity value [12]. The purpose of detecting is to classify objects in the image and also to analyze the next image [13]. Edge detection has two parts, namely first-order edge detection and second-order edge detection. First-order edge detection works by using derivatives or first-order differentials, which are included in the first order are Sobel, Prewitt, Robert and Canny. Second-order detection uses a second-order derivative, namely Laplacian of Gaussian (LoG) [14]. This research compares the results of the output using the Roberts, Prewitt, and Sobel methods which are gradient operators to detect edges in facial images. Sobel is an edge detection method which is included in the gradient edge detection. Prewitt has a gradient equation with Sobel but with a constant value equal to 1. Robert is also called the cross operator because the x-direction and y-direction are diagonals in quadrant 1 [15]. This study uses the image captured by zoom as many as seven images tested. Image testing is done with edge detection using the comparison method of Sobel, Prewitt and Robert. Comparison of parameters of the tested method using Matlab 2018a tools. The results of the test will provide information about the methods tested for the image processing performed.

2. Research Method

The research method begins with data collection, by collecting zoom capture images and searching for literature articles related to the research. In this

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research, the Sobel, Prewitt and Robert methods were tested on the images obtained to detect the edges of objects. The comparisons made for edge detection are the line thickness and the thin line edges in the image obtained from each image object. The stages of the research flow can be seen in Figure 1.

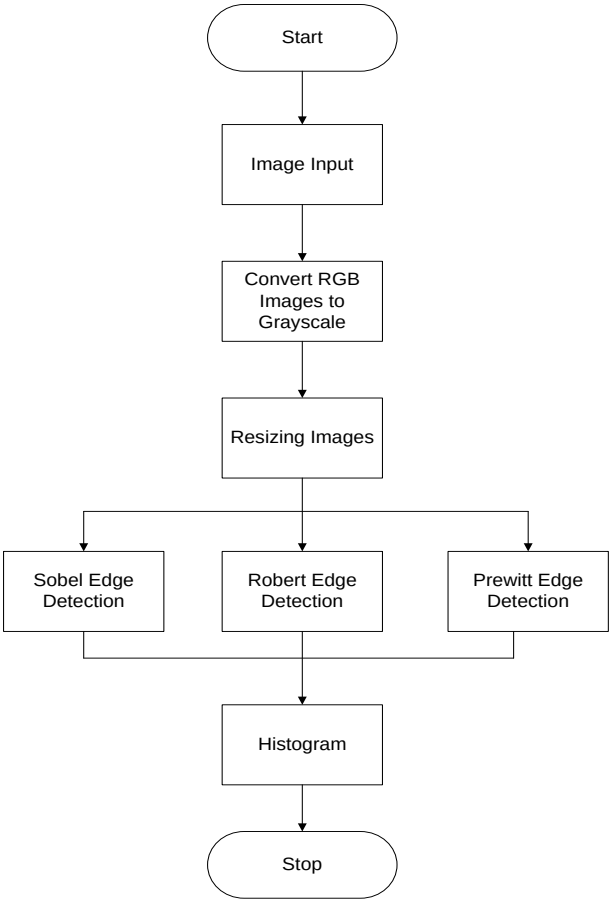

Figure 1. Research Framework

Figure 1 explains the research framework of facial recognition edge detection. In this research framework, it starts with collecting images that will be processed imagery. The image used in this study was a zoom capture image. Where the image is used as input for facial recognition detection of images that are carried out image processing. The image of the caputure zoom result is a color image (RGB). To process the image of a colored image (RGB) is converted to a gray image [16]. The command to convert a color image (RGB) into a gray image is as follows:

graysalce = rgb2gray(RGB);

The next step is to change the size of the image that has been converted to a colored image (RGB) to a gray image. The command to perform image resizing is as follows:

size=imresize (graysacle,[256 256]);

The next step is edge detection, where in this study using the Sobel, Robert and Prewit methods. The Sobel method takes the principle of the Laplace and Gaussian functions which are known as functions to generate High Pass Filter (HPF) [17]. The Prewitt method is the development of the Robert method using an HPF filter which is given a buffer zero [18]. Robert's method is another name for the differential technique in the horizontal direction and the differential in the vertical direction, with the addition of a binary conversion process after the differential is performed [19].

a. Method Roberts

Roberts' method has a matrix of 2x2 size. Matrix size 2x2 makes calculations with a computer very fast [20]. Roberts' method has the disadvantage of being severely affected by noise [21]. In addition, roberts operators give a weak response to the edges, unless the edges are very sharp [22].

b. Prewitt Operator

The Prewitt operator aims to speed up computing where parts worth 0 are not processed [23]. The Prewitt operator uses the same equation as the buckle operator except that it is reversed [24]. These operators are more sensitive to diagonal edges. The prewitt operator uses a kernel of 3x3 pixels [25].

c. Sobel Operator

The Sobel operator is more sensitive to diagonal edges than vertical and horizontal edges It is different from the Prewitt operator, which is more sensitive to vertical and horizontal edges [26]. This is in contrast to the Prewitt operator, which is more sensitive to vertical and horizontal edges. The advantage of this method of the sobel is the ability to reduce noise before performing edge detection calculations [27].

3. Result and Discussion

In this study, a search for image optimization will be carried out by segm enting the image, which is the first to convert imagery or colored images to gray. Furthermore, the gray cira will be used to see the level of image optimization using the image segmentation method consisting of three, including Robert Operator, Prewitt Operator, and Sobel Operator. The syntactic program to perform the conversion of Colored imagery to gray is as follows :

```
clear;
clc;
[filename,pathname]=uigetfile({'*.jpg;*.bmp;*.png'},'
Select anImage');
RGB= imread([pathname filename]);
graysalce = rgb2gray(RGB);
imshow(graysalce);
```

To convert color imagery to gray color first on the coding of the program, an image file will be taken. Then an image change will be carried out from color to

gray image. To see the results of running the program from program coding can be seen in Figure 2.

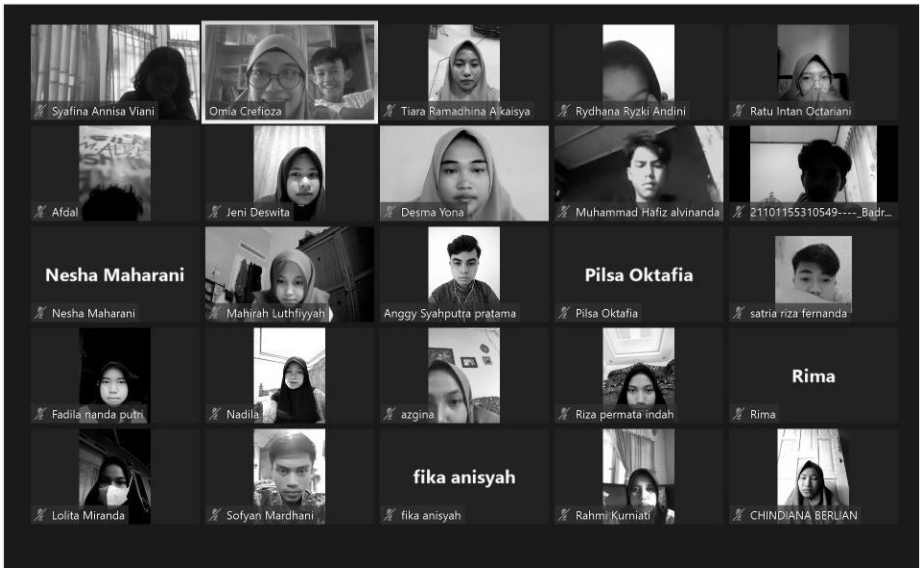

Figure 2. Convert Colored Images to Gray Results

Figure 2 a conversion has been made from a color image taken capture from zoom to a grayish image. The result of the image is in accordance with the size standard. If the image size is too large then it is necessary to resize from the image size. To resize the image can be done by coding the following program:

```
clear;
clc;
[filename,pathname]=
uigetfile({'*.jpg;*.bmp;*.png;*.jpeg'},'Select
anImage');
RGB= imread([pathname filename]);
size = imresize (size,[256 256]);
imshow(size);
```

From the coding of the program will be carried out the retrieval of image files. The image file will be resized. To see the results of running the program from the above program coding can be seen in Figure 3.

Figure 3. Image Resize Results

Figure 3 shows an image size smaller than the result of converting a color image to a gray image. Where the file size of the gray image is 641x608. After resizing, the file size becomes 256x256. After converting the grayish image, we can do edge detection using the Roberts methods. Coding programs to perform edge detection using Robert's method as follows:

```
i = imread('D:/image/gray.jpg');
I = rgb2gray(i);
```

```
BW1= edge(I,'roberts');
imshow(I);
title('original');
imshow(BW1);
title('Roberts');
```

For the coding of the program on the Roberts method is carried out the capture of the gray image file. The image file will be performed edge detection using the Roberts method. To see the results of running the program from coding program can be seen in Figure 4.

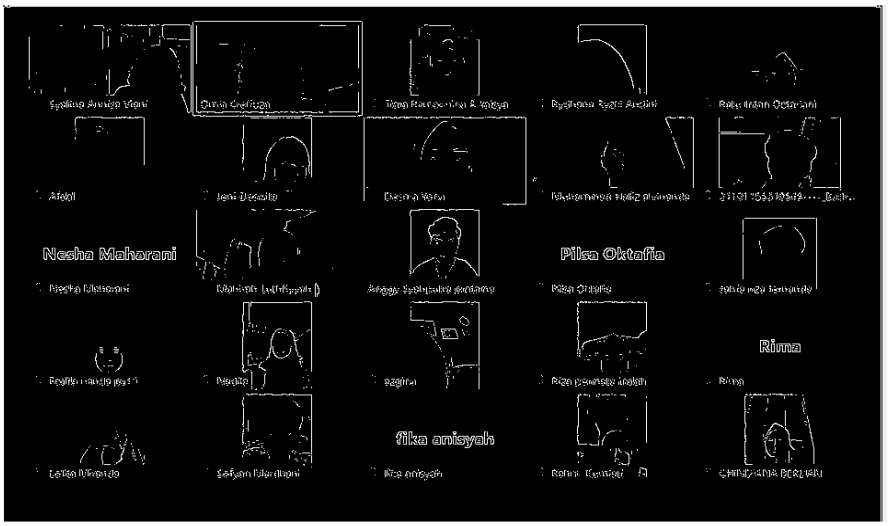

Figure 4. Edge Detection Process Results Using the Roberts Method

In Figure 4, an image of Roberts' method is obtained. Where the result of this method shows the outlines of a fairly clear image. Furthermore, an edge detection process will be carried out using the Prewitt method. Coding programs to perform edge detection using Prewitt method as follows:

```
i = imread('D:/image/gray.jpg');
I = rgb2gray(i);
BW1= edge(I,'prewitt');
imshow(I);
title('original');
imshow(BW1);
title('Prewitt');
```

For coding the program in the Prewitt method, the capture of the gray image file is carried out. The image file will be performed edge detection using the Prewitt method. To see the results of running the program from coding program can be seen in Figure 5.

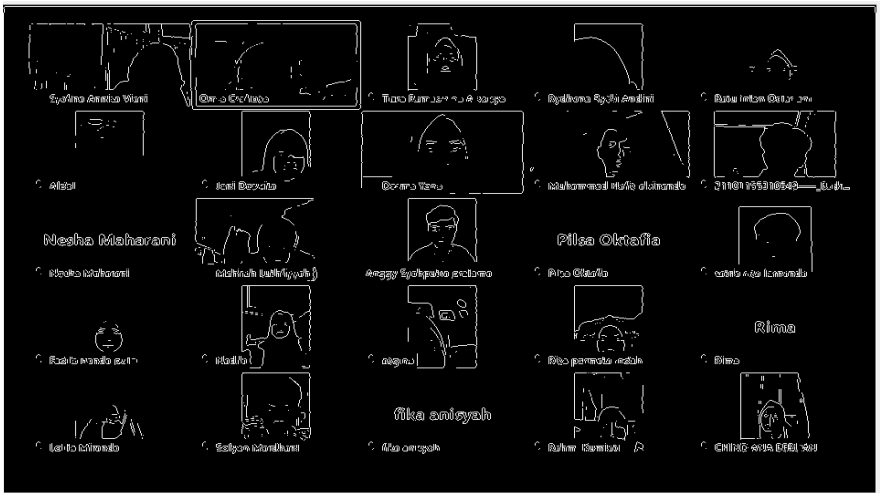

Figure 5. Edge Detection Process Results Using the Prewitt Method

After the edge detection testing is carried out using the Roberts method, Prewitt, finally, edge detection testing will be carried out using the Sobel method. Coding programs to perform edge detection using Sobel method as follows:

```
i = imread('D:/image/gray.jpg');
I = rgb2gray(i);
BW1= edge(I,'sobel');
imshow(I);
title('original');
imshow(BW1);
title('Sobel');
```

For coding the program in the Prewitt method, the capture of the gray image file is carried out. The image file will be performed edge detection using the Prewitt method. To see the results of running the program from coding program can be seen in Figure 6.

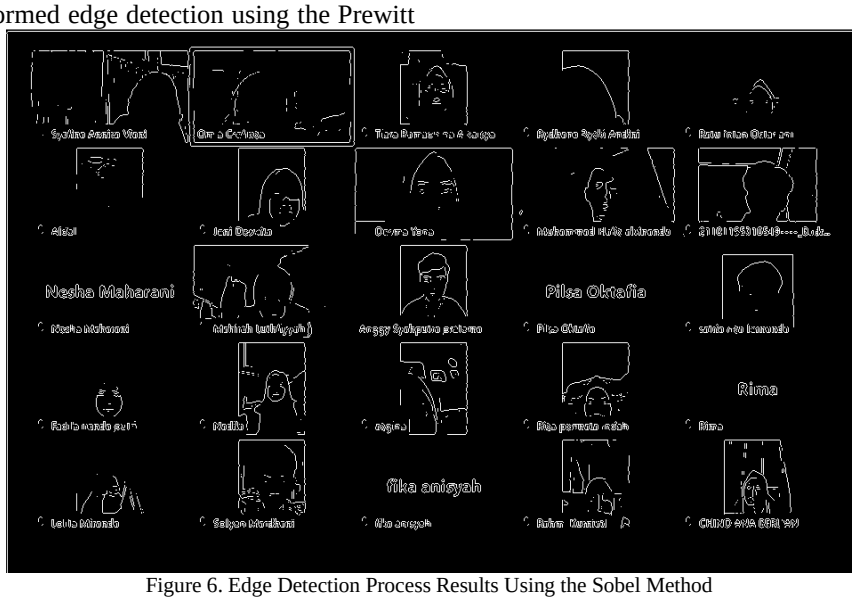

Figure 6. Edge Detection Process Results Using the Sobel Method

After testing the three methods, namely the Roberts, Prewitt and Sobel methods, an analysis will be carried out from the results of the edge detection image. From the analysis will be known the results obtained in each of the three methods in edge detection. The following is the analysis of edge detection testing using the Roberts, Prewitt and Sobel methods:

a. The small filter size in Roberts' method makes computing very fast. Although it has fast computing, this is actually a weakness of Roberts' method, which is very affected by noise. Another drawback of Roberts' method is that it gives a weak response to the edge [28].
b. Edge detection results using the prewitt method have better results compared to the results of the Roberts method [27], will but the computational process of the Prewitt method takes longer than computational process of the Roberts method because the prewitt operator has a matrix of 3 x 3 [29].
c. From the results of the detection carried out, the results were obtained that the sobel method was better than the results of edge detection carried out by the Robert and Prewitt methods. In the Sobel method, the diagonal edge is more sensitive than the edge vertical and horizontal [30]. This is in contrast to the Prewitt method, which is more sensitive to vertical and horizontal edges [31].

4. Conclusion

Based on the analysis of the tests that have been carried out, it can be concluded that the Roberts method can compute image detection faster. The Roberts method has a slight edge pattern in the face image compared to the other two methods of edge detection, namely Prewitt and Sobel. The Sobel method has better edge patterns, both in quality and quantity compared to the Prewitt and Roberts method in detecting face recognition images. Further research can be developed by conducting measurable comparisons of the three methods of edge detection using other images.

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