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APPLICATION OF SPEED UP ROBUST FEATURES (SURF) AND FEATURES FROM ACCELERATED SEGMENT TEST (FAST) FOR INTRODUCTION OF PLACE

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Abstract

With the current technology that is starting to develop rapidly, it can match an image with another image. In recognizing an image, there needs to be a process that will be carried out in image matching, but current image matching is still comparing pixels between two images. To compare between images, the color and resolution and shape of the image pixels affect the recognition results in an image. Therefore, to deal with this problem, the algorithms that can be used in the work process of this program are the Speed Up Robust Features (SURF) algorithm and Features from Accelerated Segment Test (FAST). FAST is a method for determining the angle that is in an image while the SURF algorithm can describe the features that exist in an image so that image matching no longer matches between pixels but based on the descriptors that have been generated and the matched results will be listed on the database, using the SURF algorithm , there is no need to worry about the resolution, color, and shape of the image to be matched. Tests that were carried out were still successful with a precision value of 0.9, which means that the value of successful matching is 9% and with a recall value of 100% and a value that has reached 100% means that the number of points is similar to the number of points that have been matched

Keywords: SURF, FAST, Image Recognition, Precision, Recal

1. Introduction

With the advancement of a developing technology, it cannot be denied that technology helps reduce jobs in humans. Likewise in a place, over time it can be possible that there is a change in structure such as roads, buildings or layout in building forms, so that it becomes difficult to recognize a place and place recognition is needed according to the information needs of the place, to obtain To recognize the place, it requires a process in matching the image between the input image and the image in the database. Matching in this image is a process of taking two images for compared between pixels with the aim of obtaining the same physical area of the image. Image matching aims to determine the identity of the matched image. The problem that occurs in image matching is the difference in resolution, size, color, position, type, pattern and shape of the two images that are matched, the image is a system where the process is carried out by inputting in the form of an image and the result is also an image.

In the image work process that is processed between 2 images aims to find out the place or recognize the place which will be adjusted in the database. Therefore, to deal with this problem, an algorithm can be used in the work process This program is the Speeded Up Robust Features (SURF) algorithm and Features from Accelerated Segment Test (FAST). FAST is an algorithm to determine the angle that is in an image while the SURF algorithm can describe the features that exist in an image so that the matching image no longer matches between pixels but based on the descriptors that have been generated.

2. Theoretical basis

2.1 Image Definition

An image can be defined as a two-dimensional function. f (x, y), where x and y are the coordinates of the plane (spatial), and the amplitude of each pair of coordinates (x, y) is called the intensity of the image at that point. The term grayscale level refers to the intensity of a monochrome image. For example, in the RGB color system, an image contains three individual component images (red, green, and blue). Therefore, many of the techniques developed for monochrome images can be extended to color images by processing the three component images separately.

2.2 Digital Image

Image is a representation (picture), similarity, or imitation of an object. Image is divided into 2, there is an image that is analog and there is an image that is digital. Analog images are images that are continuous, such as images on television monitors, X-ray photos, CT scans etc. Meanwhile, the digital image is an image that can be processed by a computer.

2.3 Color Coordinate System

Color or color space systems created to fulfill a specific purpose or created for a specific hardware platform. According to T. Young's theory, any particular color can be created by combining (trsitimulus) three main colors C1, C2, and C3 with a certain percentage. C = aC1 + bC2 + cC3 .... (2.1) This theory is based on the fact that the human eye has three parts of the retina that can pick up the yellow-green, green, and blue spectral peaks. For the chrominance value of a color is the ratio of a color, namely c_i = c_i / (C_1 + C_2 + C_3), i = 1,2,3 .... (2.2)

2.4 Features From Accelerated Segment Test (FAST)

Angle detection is used as the first step in various processes such as tracking, SLAM (simultaneous, localization, and mapping), localization, image matching and image recognition (Rosten & Drummond, 2006). Because the test does not calculate the angle response function, the non-maximal suppression cannot be applied directly to the resulting features. Consequently, V must be calculated for each detected angle, and non-maximal suppression applied to eliminate angles that are adjacent to a higher value V. Some definitions of V are

1. The maximum value of n for p which is still an angle.
2. The maximum value from t to p which is still an angle.
3. The sum of the absolute differences between adjacent pixels on the outline and pixels that are in the center

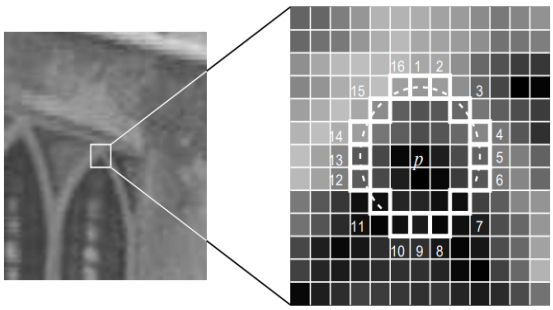

Figure 1. Angle detection with the FAST algorithm

2.5 Speed Up Robust Features (SURF)

SURF is an algorithm for keypoint detection and description where SURF is an improvement over the faster Scale-invariant feature transform (SIFT) algorithm. SURF uses a combination of an integral image algorithm (integral image) and blob detection based on the determinant of the Hessian matrix. The Hessian matrix is a matrix in which each element is formed from the second partial derivative of a function). Suppose f (x) a function with n variables that has a second partial derivative and its derivative is continuous, the Hessian matrix f (x) written H is.

3. Research methods

3.1 Angle detection process with the FAST method

In this process, to get a place search using this method, namely the angle detection stage using the FAST method. The FAST method begins with constant initialization of r, n and t where r is the radius to the center (p) which means that the p value starts from the point [r, r], n is the number of values to be compared with the p value, the maximum value of n is 12 and t are the threshold that will be used in the calculation. Then the next stage is to compare the point p with the values at points 1, 3, 9 and 13. For the next stage it has the next requirement, namely that three of the four points must be greater than p + t or less than p - t. If these conditions are not met, it will be continued to the next point p. If it meets the previous requirements, point p will be compared to point, 16 points around point p, if the amount at the value that meets the same requirements in the previous stage is equal to or greater than n then point p is considered an angle, if it does not meet the requirements then point p is not an angle.

3.2 Process Features with the SURF method

The process this time is to describe the features using the SURF method. In determining the descriptor, first do the orientation calculation, in determining the orientation then initialize the scale, sector and L where the value of L is 7 then perform the algorithm steps using the formula: h (v) = round ((cdf (v) - 〖cdf〗 _min) / ((M × N) - 〖cdf〗 _min) × (Boundary-Boundary)) + Boundary. The calculation is carried out at each point that has been obtained in the previous stage, namely the FAST stage by taking 20x20 of the closest neighbors and dividing it into 4 parts.

4. Analysis and Design

4.1 Image Analysis

In this image analysis process, the first time there will be where the user will input the image where the image can be like a building, street or field and before that the user will input and the database already contains data such as the following example:

figure 2. Sample Image in the matching process

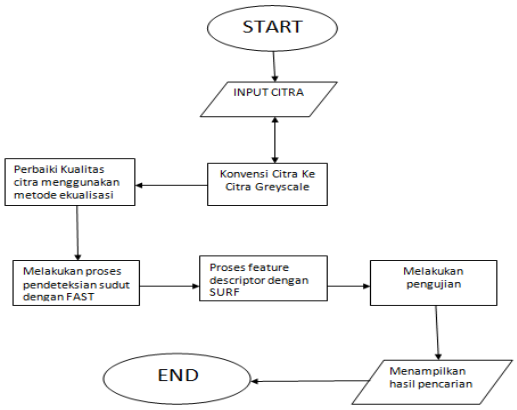

Image 4.2 Place Search Flowchart

4.2 Process Value Data

The data used is data taken from the results of research on the building around the campus area 1 Islamic State University of North Sumatra. Testing is done using the SURF and FAST methods and using precision and recall, where the test is carried out several times with several different input images in terms of color, orientation, size and resolution. The stage this time, for calculations on where the user inputs the image in the form building listed to do the input where the database is there is data for example in the image following:

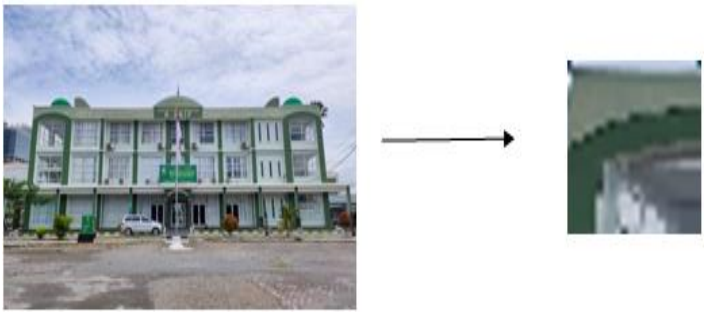

figure 3. Snippet of Image taken

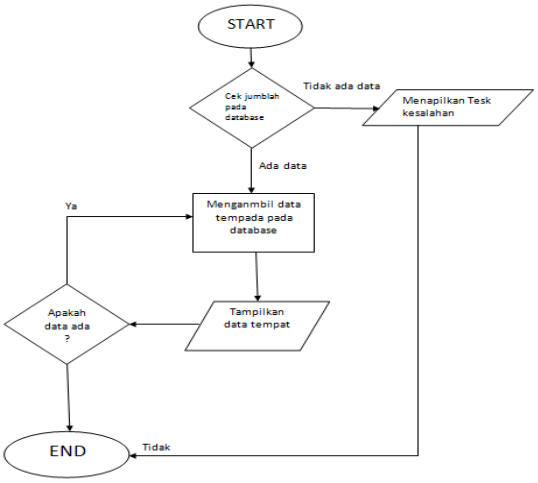

figure 4 Flowchart Show Data

At this time the process that will be done is to change the RGB image into a grayscale image, following the calculation of the RGB image into a grayscale image by taking the slice of the input image above with a size of 8 x 8

144	93	93	93	93	93	59	59
116	56	56	56	56	56	46	46
116	56	56	56	56	56	46	46
116	56	56	56	56	56	46	46
116	56	56	56	56	56	46	46
116	79	79	79	79	79	85	85
116	79	79	79	79	79	85	85
116	79	79	79	79	79	85	85

4.3 Testing program

After designing the program system, the next test is carried out which aims to see the extent to which the program system that has been built is suitable for display on matching places or with place recognition.

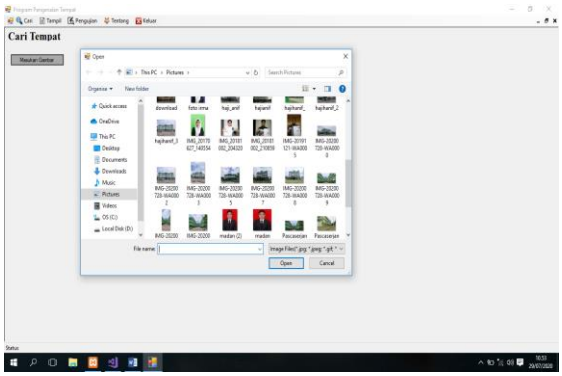

Figure 5. Image Input

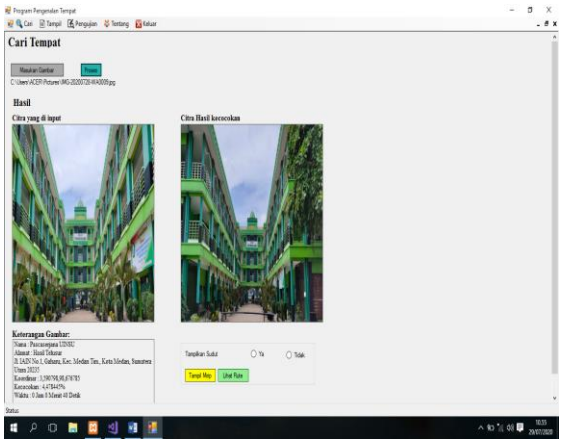

figure 6. Process of image matching

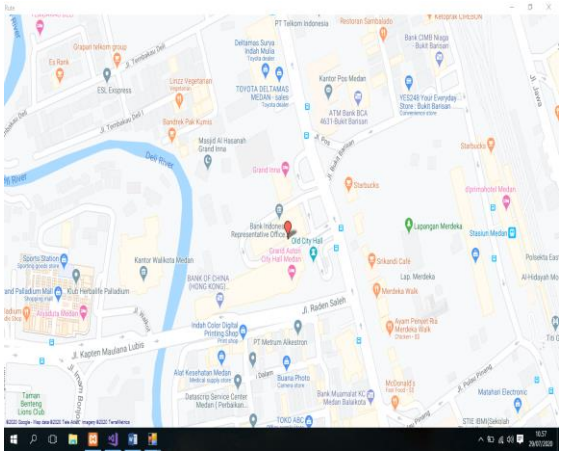
Figure 7. Route Search Results for locations

5. Conclusion

In this research, using the SURF and FAST methods can be collected in the introduction of places, namely: Successful recognition of images with different colors and resolutions. However, there could be a failure at the introduction of the test above if there are more than 200 records stored in the database. This is because the matching depends on precision and recall which state the similarity of the image. The resulting precision and recall in the failed image are higher when compared to the original image so that the recognition results change and cause failure in recognition. From the tests carried out, the success is still successful with a precision value of 0.9. This means that the similarity value of the matching results is 9% and the recall value reaches 100%. A recall value of 100% means that the number of similar points is the same as the number of points matched.

In this research, the writer states that this research is not completely perfect. There are still many deficiencies in the research process and in the process of developing the program created. There are some suggestions in the program this time, namely the accuracy of the same image but different colors can decrease drastically and there are still failed recognition either color images, grayscale images, black white images or images that are cut due to the precision and recall values in the program produced from the match with other images is higher so it will be better if further development can increase the accuracy of the recognition carried out.

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