Scientific Journal of Informatics
Vol. 3, No. 2, November 2016
p-ISSN 2407-7658 http://journal.unnes.ac.id/nju/index.php/sji e-ISSN 2460-0040

Model of Multilevel Sub-Image to Find the Position of Region of Interest

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Abstract

Searching image is based on the image content, which is often called with searching of image object. If the image data has similarity object with query image then it is expected the searching process can recognize it. The position of the image object that contains an object, which is similar to the query image, is possible can be found at any positionon image data so that will become main attention or the region of interest (ROI). This image object can has different wide image, which is wider or smaller than the object on the query image. This research uses two kinds of image data sizes that are in size of 512X512 and in size of 256X256 pixels.Through experimental result is obtained that preparing model of multilevel sub-image and resize that has same size with query image that is in size of 128X128 pixels can help to find ROI position on image data. In order to find the image data that is similar to the query image then it is done by calculating Euclidean distance between query image feature and image data feature.

Keywords: *image feature, region of interest* (ROI), *Euclidean distance*

1. INTRODUCTION

This research relates with a part of searching image process by using content or sample of the image (content-based image retrieval, CBIR). This process is done by comparing the image content that is searched (query image) with image data. The term of searching image content is known also as searching image object. If the image data has similarity object with the query image then it is expected the searching process can recognize it [1][2]. Here, location or position of image object can be found at any location on the image data. Through the process of preparing sub-image in the image data then it is expected that can help to solve it.

On the result of searching image content, beside the position of the object that can be found in any position on image data, the image object can also has different wide object that is wider or smaller than object in query image [3]. Through process of preparing sub-image on the image data then it is expected can help to find the position which becomes main attention or region of interest (ROI) in image data. The searching process by searching the nearest image feature is owned by query image and image data with calculating Euclidean distance.

2. METHOD

Research method that is used is preparing model to adjust the size of image data (resize) into several sub-images. Sub-image is arranged levelly and structurally in the same size with query image. In order to obtain image data that is similar to query image then it is done by calculating Euclidean distance between the feature that are owned by query image and the feature of image data. Roll of research process can be seen in Figure 1.

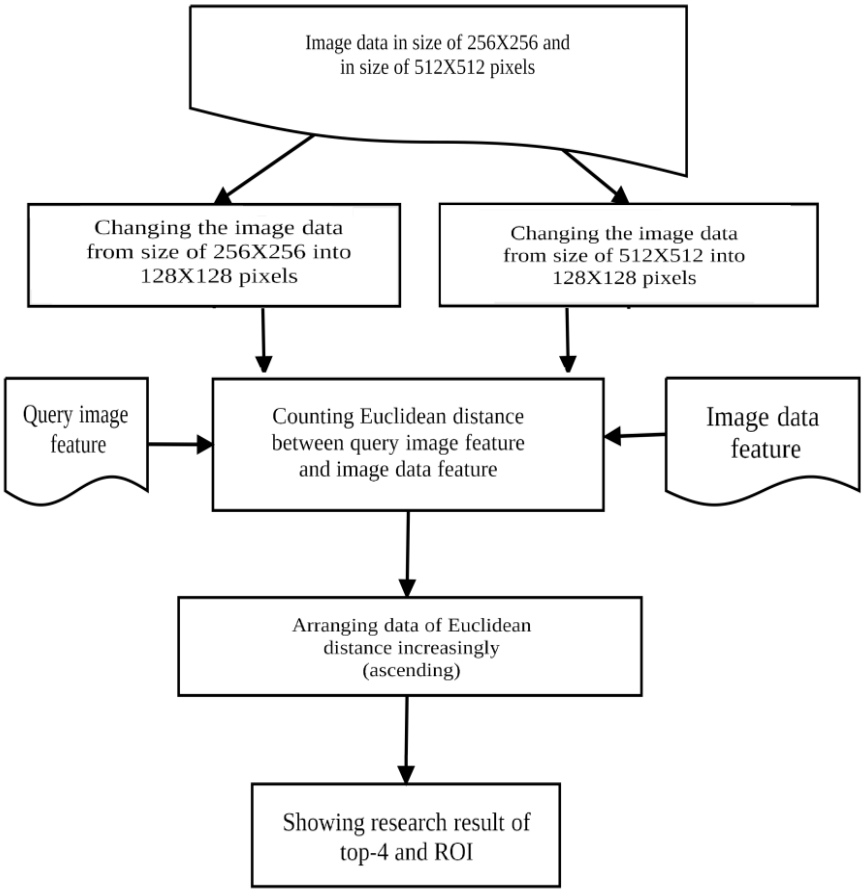

Figure 1. Roll of research process

The image data or original image that is used for this research is in size of 512X512 and in size of 256X256 pixels. Resize process aims to adjust the size of image data so that image data size is equal to the size of query image, on this research is in size of 128X128 pixels. The image data in size of 128X128 pixels is also known by the term of sub-image.

2.1. Adjusting Wide Image (resize)

Resize technique that is used is taking the average value of the pixel on a certain position [4]. Wide image that is taken is customized with the ratio that can be seen in Table 1 and Table 2. Equation 1 and Equation 2 are used to obtain the average value of the pixels (Pr) with consecutive data compression ratios are 16:1 and 4:1.

Table 1. Image data in size of 512X512 pixels and sub-image that are produced

Number	Size of image data in beginning (a)	Size of sub-image that is produced (b)	Total of sub-image that is produced	Compression ratio (a:b)
1	512X512	128X128	1	16:1
2	256X256	128X128	5	4:1
3	128X128	128X128	25	1:1

Table 2. Image data in size of 256X256 pixels and sub-image that are produced

Number	Size of image data in beginning (a)	Size of sub-image that is produced (b)	Total of sub-image that is produced	Compression ratio (a:b)
1	256X256	128X128	1	4:1
2	128X128	128X128	5	1:1

$$\mathrm{Pr}_{1,1} = \frac{\left(\sum_{b=1}^{4} \sum_{k=1}^{4} P_{b,k} \right)}{16} \quad (1)$$

$$\mathrm{Pr}_{1,1} = \frac{\left(\sum_{b=1}^{2} \sum_{k=1}^{2} P_{b,k} \right)}{4} \quad (2)$$

2.2. Preparing Sub-image

The process of preparing sub-image and adjust wide image aims for sub-image as a result of searching can refer to the original image data and also to know which position of the image data that is most similar to the query image. This research uses an approach of preparing sub-image that have ever conducted by Fauzi and Lewis who make multi-scale approach on image of Museum's collection and searching image, which are using texture feature by the method of discrete wavelet frames (DWF) [5]. The research by Guan, You, and Newmann that examine method of matching image is efficient for mobile augmented reality application [6]. Both of these researchers have never done image division levelly.

This research proposes to divide the image position levelly. The position or a part of image data that is similar to query image, if it is observed then it will be more interesting than the other parts so that this research is also called region of interest (ROI). The similarity here is obtained from calculation result of Euclidean distance between query image and sub-image. The total of sub-image that are produced are 6 sub-images for 256X256 pixels image data, and 31 sub-images for 512X512 pixels image data.

2.3. Searching of Content Image

Euclidean distance is the measurement method that is commonly used to calculate the similarity of two vectors [4]. Euclidean distance will calculate the root from difference square of two vectors. Euclidean distance between two vectors *p* and *q* can be calculated by using Equation 3.

$$d(p,q) = \sqrt{(p_1 - q_1)^2 + (p_2 - q_2)^2 + ... + (p_n - q_n)^2} \quad 3)$$

The smaller score d (p, q) then the more similar the feature of two vectors that are compared, this method can be used to detect the similarity of image by the way of filling the vector values p and q with using the value of image feature that will be detected the level of similarity.

3. RESULT AND DISCUSSION

3.1. Development of Sub-Image Model

Development of sub-image model is done by adjusting the wide image (resize) so each sub-image becomes in the same size with query image that is in size of 128X128 pixels. Six sub-images (sc) that come from the image in size of 256 x 256 pixels are arranged by coordinate (x_1, y_1, x_2, y_2) as follows:

1. sc01 (1, 1, 256, 256)
2. sc02 (1, 1, 128, 128)
3. sc03 (1, 129, 128, 256)
4. sc04 (129, 1, 256, 128)
5. sc05 (129, 129, 256, 256)
6. sc06 (65, 65, 192, 192)

In order that the entire size of the sub-image become similar to the size of equal image that is in size of 128X128 pixels then in sc01is done resize process from 256X256 pixels into 128X128 pixels. For sc02 up to sc06 resize process is not been done because each has in size of 128X128 pixels.

The thirty one sub-images (sc) that come from the image in size of 512X512 pixels are arranged by the coordinate (x_1, y_1, x_2, y_2) as follows:

1. sc01 (1, 1, 512, 512)
2. sc02 (1, 1, 256, 256)
3. sc03 (1, 257, 256, 512)
4. sc04 (257, 1, 512, 256)
5. sc05 (257, 257, 512, 512)
6. sc06 (129, 129, 384, 384)
7. sc07 (1, 1, 128, 128)
8. sc08 (1, 129, 128, 256)
9. sc09 (1, 257, 128, 384)
10. sc10 (1, 385, 128, 512)
11. sc11 (129, 1, 256, 128)

and so on...

23. sc23 (65, 65, 192, 192)
24. sc24 (65, 193, 192, 320)
25. sc25 (65, 321, 192, 448)
26. sc26 (193, 65, 320, 192)

and so on...

31. sc31 (321, 321, 448, 448)

In order that the entire size of the sub-image become similar to the size of query image that is in size of 128X128 pixels then in sc01 is done resize process from 512X512 pixels into 128X128 pixels. For sc02 up to sc06 is done resize from 256X256 pixels into 128X128 pixels. For sc07 up to sc31 resize process is not been done because each has in size of 128X128 pixels.

3.2 Approach of Multilevel Sub-Image to Image Retrieval

Visual form of image retrieval result can be seen in Figure 2. Here is shown the query image and 4 pieces of image data that are most similar to it. The position image data that is interesting is marked with square that is the position of the object, which is similar to the query image. In Figure 2 can be seen the searching result of the first rank that comes from image data in size of 512X512 with ROI in size of 256X256. On the searching result of the third rank comes from image data in size of 256X256 with ROI in size of 128X128. While the searching results of the second and fourth rank come from image data in size of 512X512 with ROI in size of 128X128. If it is observed then ROI of image data on the first and fourth rank are most similar to the query image [7][8].

In Figure 3 can be seen the searching results of the first and fourth rank come from the image data in size of 256X256 with ROI in size of 128X128. In the searching results of the second and third rank come from the image data in size of 512X512

with ROI in size of 128X128 [9]. If it is observed then ROI of image data on the first rank is the most similar to the query image.

Figure 2. Searching result of image and region of interest (i)

Figure 3. Searching result of image and region of interest (ii)

4. CONCLUSION

Image data in size of 512X512 and in size of 256X256 pixels are to facilitate the process of preparing sub-image and resize. Two kinds of those image data size can be made as a pattern for preparing sub-image with another image data size. Through the preparing model of multilevel sub-image and resize with the same size by query image that is in size of 128X128 pixels, if it is found the image data that is similar to the query image then it can be known the position of image object or can be found region of interest in the image data.

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