Development Of **Binary Similarity And Distance Measures (BSDM)** Algorithm For The Bond Of High Development System Of Video

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**Abstract.** This research makes new innovations in high measurement more effective in minimizing the time in measurement. But there has been no research for recognition of height measurement patterns using the Otsu algorithm and Binary Similarity and Distance Measures (BSDM) algorithms. These two algorithms are combined to optimize the working process of the system to be built. Based on the results of the algorithm's complexity, BSDM has several binary similarities and distances that can be used in testing the system to be built. One of the binary similarities and distances used in testing this research is BSDM $S_{INNERPRODUCT}$ and BSDM $S_{JACCARD}$. From testing the system using BSDM $S_{INNERPRODUCT}$ as effective as BSDM $S_{JACCARD}$, between the two closer to the result of the actual height is testing BSDM $S_{INNERPRODUCT}$. The test data used in this research is in the form of video image in real-time. To improve the quality of system work in future research, can add pattern matching algorithm for height measurement. The addition of the approach will certainly affect the speed of computation on pattern recognition.

**Keywords:** Otsu, Binary Similarity and Distance Measures (BSDM), $S_{INNERPRODUCT}$, $S_{JACCARD}$.

1. **Introduction**

Image processing is a branch of computer science that has been developed and makes it easy to process an image. In the height measurement system, image processing is capable of object recognition. Along with the development of time, image processing was chosen to be used as a medium for measuring height, because basically an image has a lot of content that we can take the information.

Various types of computing technology are increasingly widespread after a variety of methods have been found, both artificial neural networks, transformations, distance, and similarity. In this study the Otsu algorithm will be combined with Binary Similarity and Distance Measures (BSDM) algorithms.

The reason for choosing these two algorithms is because the calculations are not so complex. The Otsu algorithm is intended to separate objects with naturally occurring backgrounds. While Binary Similarity and Distance Measures (BSDM) algorithms are binary similarities and inequalities (distance) play an important role in the problem of pattern analysis such as classification, clustering, etc.

2. **Theoretical Basis**

2.1 **Image Processing**

The image processing is the manipulation of the image to be, especially with the use of a computer, the images that have better quality. Digital image processing refers to the processing of two-dimensional images using a computer. In a broader context, digital image processing refers to the
processing of any two-dimensional data. Digital image is an array containing the values of real or complex which is represented by a specific bit stream.

2.2 Otsu
Otsu method is calculating the threshold value $T$ automatically based on the input image. The approach used by the Otsu method is by performing discriminant analysis that is by determining a variable that can distinguish between two or more groups that arise naturally. Otsu’s thresholding method involves iterating through all the possible threshold values and calculating a measure of spread for the pixel levels each side of the threshold, i.e. the pixels that either falls in foreground or background. The aim is to find the threshold value where the sum of foreground and background spreads is at its minimum. The threshold operation is regarded as the partitioning of the pixels of an image into two classes $C_0$ and $C_1$ (e.g., objects and background) at grey-level $t$, i.e., $C_0 = \{0, 1, 2, \ldots, t\}$ and $C_1 = \{t + 1, t + 2, \ldots, L-1\}$. Let $\sigma_2w, \sigma_2B$, and $\sigma_2T$ be the within-class variance, between-class variance, and the total variance, respectively. [7] Discriminant analysis will maximize these variables in order to separate objects from the background.

Thresholding technique segment scalar images by generating a binary partitioning of the image intensities. A thresholding technique tries to find an intensity value, called the threshold, which separates the desired classes. The segmentation is then obtained by grouping all pixels with intensity greater than the threshold into one class, and all other pixels into another class.

In Otsu method, the threshold that minimizes intra-class variance is determined, which is defined as the weighted sum of the variance of two classes:

$$\sigma_w^2(t) = w_1(t)\sigma_1^2(t) + w_2(t)\sigma_2^2(t)$$

(2.1)

The weights $w_i$ is the probability of two classes separated by a threshold $t$ and $\sigma_i \geq 2$ variations of these classes.

Otsu shows that minimizes intra-class variance is the same as maximizing inter-class variance.

$$\sigma_w^2(t) = \sigma^2 - \sigma_w^2(t) = w_1(t)w_2(t)[\mu_1(t) - \mu_2(t)]^2$$

(2.2)

stated in class probabilities $w_i$ and class mean $\mu_i$. Probability class $w_i (t)$ is calculated from the histogram as follows:

$$w_i (t) = \sum_0^t p(i)$$

(2.3)

while the average class $\mu_1 (t)$ is:

$$\mu_1 (t) = [\sum_0^t p(i) x(i)]/w_1$$

(2.4)

Where $x(i)$ is the value in the middle $i$ histogram. Similarly, to calculate $w_2 (t)$ and $\mu_2$ on the right side of the histogram larger than $t$. Probability of class and class facility can be calculated iteratively. This idea resulted in an effective algorithm.

The optimum threshold value can be obtained in two ways. The first way is carried out by minimizing WCV. The second way is implemented by maximizing the BCV.

2.3 Binary Similarity and Distance Measures (BSDM)
Binary similarities and inequalities (distance) play an important role in the problem of pattern analysis such as classification, grouping, etc. Size of distance and similarity in size are denoted as $dx$ and $sx$. The choice of distance / similarity depends on the type of measurement or object representation (Cha, et.al.2005). Includes definitions of binary similarities and distance measurements used.
Definition for binary data:

\[ S_{INNERPRODUCT} = a + d \]  \hspace{1cm} (2.5)

\[ S_{JACCARD} = \frac{a}{a + b + c} \]  \hspace{1cm} (2.6)

3. Otsu

Flowchart for the process of Otsu in the system is developed based on Figure 3.3:

![Flowchart of the Otsu Process](image-url)

Figure 3.1. Flowchart of the Otsu Process
3.1 Binary Similarity and Distance Measures (BSDM) $S_{\text{INNERPRODUCT}}$

3.2 Binary Similarity and Distance Measures (BSDM) $S_{\text{JACCARD}}$

Figure 3.2. Flowchart of the BSDM $S_{\text{INNERPRODUCT}}$ Process

Figure 3.3. Flowchart of the BSDM $S_{\text{JACCARD}}$ Process
4. Test results of height measurement images

![Figure 4.1. BSDM $S_{\text{INNERPRODUCT}}$](image1)

![Figure 4.2. BSDM $S_{\text{Jaccard}}$](image2)

Your height is 157
4.1 Performance results of BSDM $S_{INNERPRODUCT}$ and BSDM $S_{JACCARD}$

| No | Sampel Citra | Bobot BSDM $S_{INNERPRODUCT}$ | Hasil Pengukuran Tinggi Badan (cm) BSDM $S_{INNERPRODUCT}$ | Hasil Tinggi Badan (cm) Sebenarnya |
|----|--------------|-------------------------------|----------------------------------------------------------|----------------------------------|
| 1  |              | 76                            | 157                                                      | 158                              |
| 2  |              | 115                           | 161                                                      | 162                              |
| 3  |              | 91                            | 160                                                      | 160                              |
| 4  |              | 142                           | 170                                                      | 170                              |
| 5  |              | 113                           | 168                                                      | 168                              |

| No | Sampel Citra | Bobot BSDM $S_{JACCARD}$ | Hasil Pengukuran Tinggi Badan (cm) BSDM $S_{JACCARD}$ | Hasil Tinggi Badan (cm) Sebenarnya |
|----|--------------|--------------------------|------------------------------------------------------|----------------------------------|
| 1  |              | 0.63                     | 150                                                   | 158                              |
| 2  |              | 0.56                     | 161                                                   | 162                              |
| 3  |              | 0.62                     | 159                                                   | 160                              |
| 4  |              | 0.69                     | 169                                                   | 170                              |
| 5  |              | 0.73                     | 167                                                   | 168                              |
5. Conclusions

The results show that the combination method uses the Otsu algorithm and Binary Similarity and Distance Measures (BSDM) algorithms on the height measurement system. Where in the second process this algorithm is very precisely applied to the system, the combination of these two algorithms can optimize the work of the system being built, and for the results of testing the size of binary distance and similarity BSDM $S_{\text{INNERPRODUCT}}$ obtains true detection results which are not much different from BSDM $S_{\text{JACCARD}}$.

Based on the tests that have been carried out in the previous chapter, it can be concluded from the results of the BSDM $S_{\text{INNERPRODUCT}}$ and BSDM $S_{\text{JACCARD}}$ testing, which is closer to the actual height result is BSDM $S_{\text{INNERPRODUCT}}$ test.

In this system weaknesses are still found, this height measurement system is not able to work properly if the area of the object to be measured contains many other objects, because the measuring ruler can move to another object. To get the right end result, the image capture conditions or environment must be considered, the conditions in question include light, place, distance, and position of the object image. the light in the image is not always smooth, meaning that the light varies in intensity depending on the spread of light, what if the light is evenly distributed is not too bright and not too dark the test in the system can work properly.

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