Watershed Segmentation For Face Detection Using Artificial Neural Network

Julian Supardi[1)], Abdiansah[2)], Nys. Ristya Anditha[3)]
Informatics Engineering, Sriwijaya University
[1)] Julian@unsri.ac.id
[2)] canley0110@gmail.com
[3)]ristya.anditha@gmail.com
Palembang – Indonesia

Abstract— In a face image containing objects sometimes face has a color similar to the background color or objects that are nearby. This causes the system to detect any objects in the face in an image. This study wants to try to overcome these problems. The approach used in this study is a dynamic image segmentation. The segmentation will produce region-region are then used as input for the neural network. From the experiments conducted, the method used is good enough to detect faces. The results showed that the approach used in this study can detect all of the data that had trained, while for the data that has not been trained detection rate reached 70%.

Keyword: face detection, artificial neural network, dynamic segmentation

I. INTRODUCTION

The face has a biological structure that is not simple. In addition to dynamic, face shape expression influenced by many things such as, age, and hair. Nevertheless, research shows that some elements of the face has a geometric characteristics that can be measured [1].

Face detection is the first step in the processing of facial images with a computer. Mechanisms are in the area looking for a computer that is considered as the face image. If found, then this area will be taken and then performed the identification process. In this case several methods have been developed, among others, Fuzzy Classifier [2],Viola Jones [3] and neural network [4].

Although some of these methods have been able to make the detection of the face, but still needs to be improved. The complexity of the face detection process is exceptionally high. In addition to dealing with the problem of the size of the face in the image is dynamic, increasing the complexity of the face detection when confronted with an image that contains other objects that might have a similar color intensity to the face.

In the face detection process through which one phase is segmentation. Mechanisms involved in this phase is a separate object with other objects. With this condition of each object can be retrieved, so it can be processed. One method that is often used is the watershed transformation. This method is one that is good enough to get a result object segmentation.

Artificial neural network is a processing model that mimicked the work principal nervous system of the human brain. This method uses the calculation of non-linear elements called neurons interconnected, so it can support the learning process. This condition allows the system has knowledge, so it can be used to solve problems related to pattern recognition, optimization, forecasting, and so forth. Dynamic weight adjustment process has enabled the neural network can be applied to solving problems that are also dynamic.

II. METHODOLOGY

To solve the problems of face detection using artificial neural networks, the steps are as follows:

A. Histogram

A histogram is a graph showing the distribution of the intensity of an image [5]. The histogram of a digital image in the form of a function h (rk) = nk, where rk is the k-th color value and nk is the number of pixels in the image that have that value. In the gray-level, gray-level rk is the k-th level. k = 0, 1, 2, ..., L-1. L is the maximum limit. Normalization of the histogram is to divide each value nk with a total pixel of the image, p (rk) = nk / n. The total number of values (p (rk)) of the normalized histogram is 1 Manipulation of the histogram can be used effectively for image enhancement (improving the quality of the picture). It is also useful for other image processing applications such as segmentation, compression, and others. Histograms are also easy to be calculated in software [5].

B. Dilatation

Dilatation is done to increase the size of the object segment by adding layers around the object. By way of background change all point to the neighboring boundary points into a point object, or simply set the neighbors of each point is a point object into a point object. With A and B lie in Z2, dilation of A by B is characterized by $A \oplus B$

$$A \oplus B = \{x \mid (B)_x \cap A \neq \emptyset\}$$
(2.1.)

This equation is obtained from the reflection of point B on the original and then shifted by x. Dilation of A by B is a collection of all the change x so that B and A overlap at least one element that is not 0 (zero).

C. Erosion

Erosion operation is the inverse of the dilation operation. In this operation, the object size is reduced to erode around the object. By setting all points around the point of the background becomes foreground point. With A and B located at z2, erosion A by B is :

$$A \ominus B = \{x \mid (B)_x \subseteq A\}$$
(2.2)

D. Morphological Gradient

Gradient is one of the morphological approach to segmentation. The concept of morphological gradient is describing an image in 3-dimensional form by assuming gray level is considered as the height and the direction that the higher the color white. So it is more suitable to say that the level of gray as the depth. The principle of morphological gradient is looking for a line Watershed (watershed) is the line along which the dots is the highest point of the depiction of an image into a 3-dimensional form [7]

Gradient is a morphological process that produces output in the form of images obtained from the reduction of the original image dilation results with the results of erosion of the original image, so it can be defined:

$$g = (A \oplus B) - (A \ominus B)$$
(2.3)

E. Minima Removal

Minima removal process is a process of flattening the basis of the minimum so that the minimum area has a uniform value. This process is performed before the image in segmentation, because the images produced by the preprocessing that does not use a threshold has a minimum value that is not flat.

F. Watershed Segmentation

The concept of morphological Watershed is describing an image in 3-dimensional form by assuming gray level is considered as the height and the direction that the higher the color white. So it is more suitable to say that the gray level is a level of depth. The principle of morphological watershed is looking lines (watershed) is the line along which the dots is the highest point of the depiction of an image into a 3-dimensional shape [6]. Determination of the area and checked the line of pixels with values ranging from a minimum to a maximum. If the pixel is a local minimum or do not have a slice with a collection of pixels that are connected to the previous value, then the pixel is forming a new area. If the slices with a collection of pixels that are connected to the previous value of only one component or area of the pixel belongs to the component or area. If more than one then it becomes dam or watershed lines.

G. Artificial Neural Network

Artificial neural network is an information processing system that has certain similarities with his biological neural networks. As a model, artificial neural networks are not as complex as the nervous system of the human brain. The use of back propagation network consists of two stages, namely the stage of learning or training, which at this stage in the back propagation given amount of training data and the target. Testing phase or the use, testing and use of back propagation is done after completion of learning.

Training with back propagation method consists of three steps, namely data is entered into the network input (feed-forward), the calculation and back propagation of the error in question, as well as updating the weights.

Back propagation algorithm consists of the action forward and backward process action. In the process forward action, the first time is to make random weights as initial weights. The next step is to get the output value (y) using random weights that have been obtained. If the output value has not been obtained in accordance with the target, then the program will perform the action backward. The process is carried out is the process of training or training process. In this process, the program will seek proper weight to the value of output produced in accordance with the targets set. Furthermore, the

program will look for the value of z and y as was done in stages the action forward. If the value of y is obtained not in accordance with the intended target, then the next process is to calculate the weighting factor of the output variable and variable weighting factor hidden layer. Furthermore, the weights in the update. Weight update process is done by summing the weights of the old with variable weighting factors have been obtained. The training process is done continuously until convergence. Having obtained the optimum weights, the program is ready to be tested.

In this study activation function used is sigmoid function. The formula sigmoid function is:

$$f(x) = \frac{1}{1+e^{-x}} \qquad (2.3)$$

III. RESULT AND DESSCUSTIOON

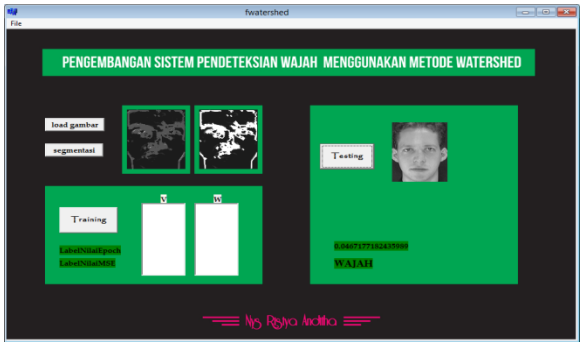
The study was conducted using 8 training data obtained from the data set. Data the train will be tested with the use of artificial neural networks back propagartion. Also used are also 10 primary data obtained was examined by using the weights obtained from the training.

the image that has been segmented region-region is obtained that will be used for the detection process by artificial neural networks. Detection process consists of the process of learning and testing processes. In the learning process, the input values obtained from the results of segmentation. The image has been segmented divided into blocks consisting of 10x10 blocks. Of each block will be taken of how the region that is inside the block. So in the end gained 100 block containing the region-region segmentation results. 100 block will then be input neurons in the back propagation algorithm After the learning process and obtained the optimum weights, so the image is ready to be tested. The test results of the original image (3.1.a) is shown in Figure 3.1 (c) and the results from the watershed segmentation shown in Figure 3.1 (b).

Neural network test results affect face recognition caused by factors not value segmentation obtained in accordance with the target value is determined as the face. Failures that occur in the program due to the results of testing an artificial neural network is> 0:05.

(a)

(b)



(c)

3.1. Result Test Image

Test results of 8 pattern face to generate training data accuracy rate of 100% while the non-face pattern using training data accuracy rate reaches 70%.

IV. CONCLUSSION

Conclusions obtained in this study are as follows:

a. watershed segmentation method is able to produce a feature extraction which will be input in the neural network learning faces.
b. Segmentation is affected by the value of the histogram at brightness level of the image so that the error propagation is also different targets.

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