The results of implementing Abrasion actuator in HDL level of image processing

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Abstract—

Mathematical Morphology is a relatively new technique that works on images and is based on set theory and arithmetic operations Minkowski. The aim of this study is to evaluate the results of the implementation of the operator wear in the HDL for image processing. In this study, in according to the nature of research that it is automatic motion detection system monitoring applications, basic theory and literature and history of the library were used. First section, wear operator has been designed using structures OFTC and OFOC-M, OFOC and then Matlab Simulink simulated and tested directly. The operator extension designed by using the structure OFOC and than in Simulink Matlab simulated and tested. The results of the simulation for operator expansion indicated that these structures are faster than the P. The results of the proposed method shown that wear operator increased the percentage of image recognition by up to 98 percent.

Index Terms— **implementation, wear operator, HDL, Image processing, Noise elimination.**

I. INTRODUCTION

Image processing is a broad field of based on different experiences developed over decades. The most important feature of image processing systems has led to the design of experiments and experiences that to reach acceptable solutions are required [1]. The cost and time required to implement the system is saving. Processing and image analysis can be a practical and technical structure, correcting, and reshaping the images that can be seen high definition [2]. The purpose of this operation is increasing the relative quality of the information that will be extracted later. In fact, the operational transformation is performed on the input and output images to a number that gives information about the image. Different techniques of image processing techniques are available, however, referring to large-scale operation that can act on the forms and formats of images [3]. Mathematical morphology, a relatively new technique that is operated shaper definition based on the theory of algebraic operations based Minkowski[4]. The mathematical morphology is very effective tool for extracting structural information from the image. Morphological regarded mathematics as a tool for extracting useful components of the image, where the main figures are presented and discussed, is used [5]. In general, morphological operators, a primary image in the interaction with other images with specified size and shape of the structural element is called, with different characteristics from the original image to image convert [6]. In this article, we examine the results of implementation of the operator's wear HDL level image processing.

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II. MATERIALS AND METHODS

In this study, the search function is abrasion-level image processing operations can be performed in two stages. The research objective of this study the results of the implementation of the deterioration in the level of HDL function in the processing of images. Therefore, in this study we will use image processing to the image processing. Image processing generally divided into:

The first is that the data consists of an array of numbers that do not have any specific information of the object or image structure. Processing that is done in this sector improved image quality and can be somewhat reduced picture noise [7,8]. The second level is the level of information and the level of image features that are used to detect extracted and sent to the next stage. The third level is the level of knowledge, in which the information outlined in the previous steps to recognize objects or describe the image is used. Because the general morphology operator for pre-processing and eventually faster recognition of biometric images used in this thesis based on fingerprint image is placed.

Fingerprint images with approximate dimensions of 300 × 300 points, and each point is expressed by one byte. In other words, the images are 256 levels of same brightness. But the images of a person, because the images in a stable environment in the period has been low, low light changes its TCB can be neglected. Data collection images used in this article, are the proposed conditions, computer taken, including 10,000 image.

The images are created equally. Then into a binary structure Shvnd.sps to achieve a uniform threshold brightness histogram is used. There is irrefutable noise in digital images and to extract information from image is very destructive. The simplest kind of low pass filters are average. Average m * n contains a filter coefficients are positive that all the coefficients of filter coefficients are multiplied by the total picture, in other words all the elements of the mask amount equal to 1 / mn said. If the noise is pepper and salt, the image is too bright or dark spots added randomly median filter can be used to better filter than the average in this case. Then remove and apply using a threshold and combines it

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with the final image can be produced. Most common methods of edge detection, innovative procedures that have a strong mathematical basis. Noise reduction algorithm is the first steps in a two-dimensional image with a Gaussian window apply. After the noise, the initial approximation of points that could be considered as the edge is pressed. At this stage, the gradient image and the points at which the maximum gradient in (locally) is selected as the edge. One of the most important steps in image pre-processing is processing of the form. In this section we will only consider the form of the binary images. In this study, we hypothesized that the morphological operators acting white pixels. Wear operator is defined as follows in various articles:

$$A \oplus B = \left\{ z \mid \left(\hat{B}\right)_z \cap A \neq \emptyset \right\} \quad (1)$$

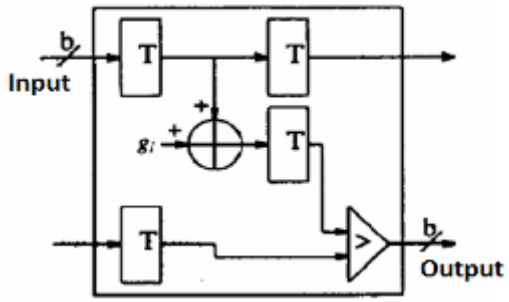

Fig1. Structural unit operators wear gray level for VLSI implementation

b number of bits per pixel of the image T symbol transmission stability and <icon comparator which is reflected in the set B is the set B and (B) _z transmitted set point B with z = (z_1, z_2) is.

FPGA circuit to measure the morphology of wear and will be expanding in Figure 2. Because the morphology operation is a binary operation should structure its design as well as the operator needed to be applied on the bits.

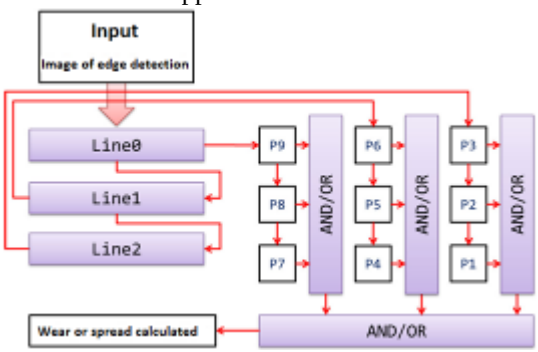

Fig2. Morphology computing architecture with FPGA

Circuit operation to calculate the wear morphology is that the AND operator and the OR operator uses to calculate the expansion. Figure 3 architecture abrasion operator individually displayed. In this structure, the buffer lines Line0, Line1 and Line2 for input bits and applying the OR operator is used on them. Units P1 to P9 for storing bits are used.

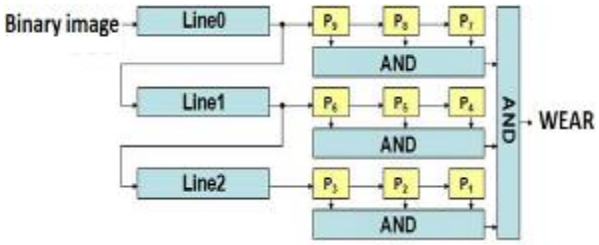

Fig3. Computing architecture with FPGA wear

The structure of each pixel of the binary image as bits, bit by lines line0, line1 and line2 rolled up into the first clock pulse is entered. Bit by Line and arrive at the next clock pulse per bit into one unit will shift to the left, so that the input bit of line0 to p9, p9 to p8, p8 to p7 and input from line1 to p6, p6 to p5, p5 p4 and the entrance to line2 to p3, p3 to p2, p2 to p1 is shifted. Finally, it is calculated by applying the AND operator wear.

III. Results and Discussion

In this chapter the results of the simulation are examined. HDL code was written by Matlab 2014 and tool HDL Coder. Top features of the final images are then processed using the PCA can be extracted. The images used in the simulation, the size of 300 x 300 pixels, which is faster to perform calculations were resized to 100 × 100. The image recognition using neural network was performed. To evaluate the proposed method, the results of artificial neural network and fuzzy neural network is compared.

a) The original image b) Image by applying of histogram

Fig 4. Normalized image sample image shows images taken from the bank

Figure 5 CANNY images of the edge detection algorithm displays. Then, convert the image into a binary structure, and the final processing stage wear or apply to be placed.

a) The original image b) Image by applying of histogram

Fig5. Edge detection algorithm using image CANNY

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Feature extraction by PCA

The proposed criteria obtain the center of the neighborhood. The method is described below. In this method, image width and height of some area is divided. In each region, taking into account the center pixels, horizontally and vertically neighboring pixel density is calculated. Each region will have two characteristics. For example, according to Figure 6, if the image is 45 by 45 pixels, it can be in the region of 9* 9 pixels spacers. 25 districts, each with 2 parameters are obtained and then the image feature vector has 50 elements.

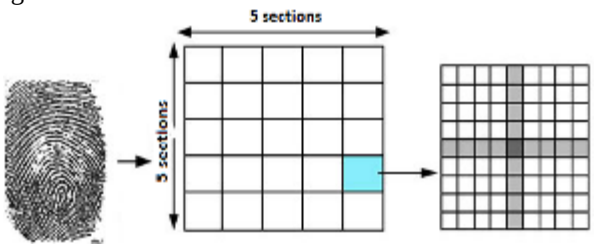

Fig6. Structure of the Center neighbors

Then, important characteristics obtained using PCA. Figure 7 charts shows a graph of the effect features. Properties located in the red-to-white groups have a higher impact and better quality for image recognition.

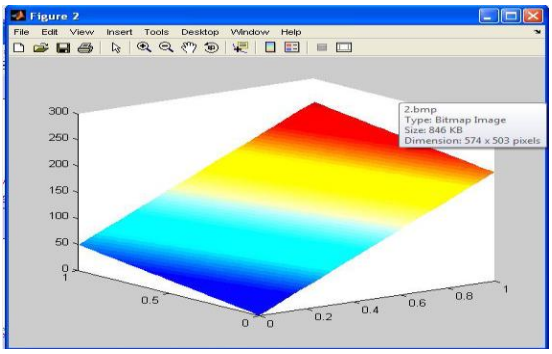

Fig7. The impact of structural features using PCA

Figure 8 and Figure 9, KNN algorithm validation features important to both linear and curved displays.

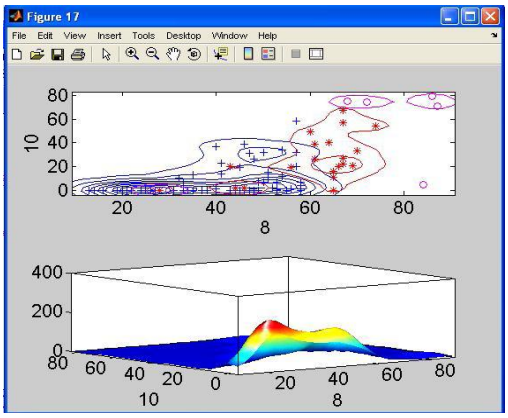

Fig8. Features important validation using KNN algorithm for curves

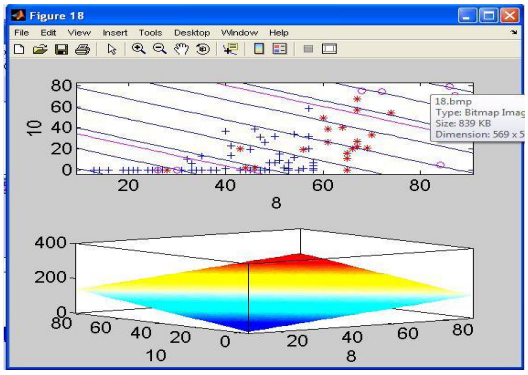

Fig9. Features important validation using KNN algorithm for linear

In order to increase the accuracy in the calculation of the detection system with a 10-fold Cross Validation technique is used. The above operation is repeated with three different upstream of data for training and testing was done.

These ratios are as follows.

30% of the training data and 70% of test data

50% of the training data and 50% of test data

80% of the training data and 20% of test data

The proposed method based on FPGA

In the third case 80% of the training data and 20% of test data have used. Table1 Test results of this simulation are shown.

Table 1. Results of FPGA for 80% of the training data and 20% of test data

Fold	Train Recog.	Test Recog.	Performance
1	96.5667	98.0721	0.0548093
2	96.9333	98.6767	0.0475693
3	97.5779	99.2927	0.0353977
4	96.3611	97.7981	0.0545302
5	97.7389	99.441	0.0319495
6	97.1278	98.9392	0.0442737
7	95.5889	96.9313	0.0610085
8	95.0719	96.3499	0.0796161
9	96.7056	98.46	0.0526094
10	95.6278	96.7716	0.0620987
Avg	96.5300	98.0733	0.0523862

Using artificial neural network without operator wear (ANN)

Table 2 the results of this simulation are shown for 80% of the training data and 20% of test data.

Table 2. Results of ANN for 80% of the training data and 20% of test data

Fold	Recog. Rate	Train Perf.	Test Perf.	Best Perf.
1	94.8382	0.0736995	0.0770575	0.0698826
2	90.75043	0.0795446	0.0687049	0.0765225
3	93.89815	0.070612	0.0645287	0.0808067
4	94.14325	0.072055	0.078246	0.080514

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		7	4	8
5	92.94014	0.0646763	0.0673979	0.0780069
6	90.77315	0.0711216	0.0830356	0.080713
7	93.93953	0.0735867	0.0766177	0.0780278
8	93.40247	0.08388	0.080521	0.0815644
9	94.12064	0.0842734	0.0750724	0.0837079
10	94.11547	0.0733371	0.0773223	0.0832555
avg	93.29214	0.0746787	0.0748504	0.0793002

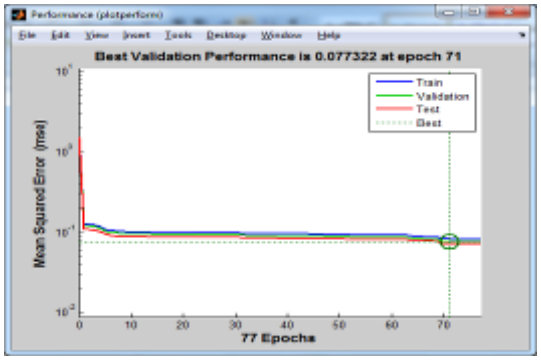

Fig 10. The efficiency of ANN mode for 80% of the training data and 20% of test data

Using Fuzzy Neural Network (ANFIS)

Table 3 the results of this simulation are shown for 80% of the training data and 20% of test data.

Table 3. Results of ANFIS for 80% of the training data and 20% of test data

Fold	Train Recog.	Test Recog.	Performance
1	97.3054	99.1678	0.0532053
2	91.6987	92.1603	0.165174
3	89.5967	90.7472	0.200811
4	89.6435	90.8422	0.200537
5	98.1297	99.3226	0.0352642
6	89.6533	90.7648	0.197974
7	95.6435	96.8829	0.0769523
8	95.727	97.2319	0.0716879
9	91.7458	92.2184	0.163711
10	96.0322	97.5808	0.0658103
avg	93.5176	94.6919	0.1231127

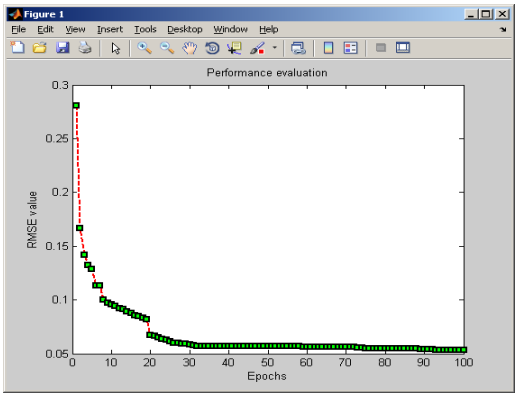

Fig 11. The efficiency of ANFIS mode for 80% of the training data and 20% of test data

Finally, the chart below shows the total average efficiency of each of the three methods shown together.

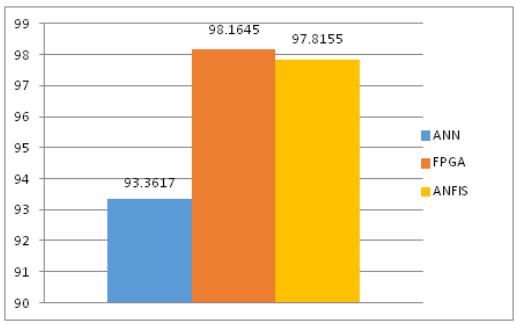

Fig12. Comparison of methods FPGA, ANN and ANFIS

Figure 12 shows the efficiency of the pre-processing method with FPGA does wear compared to other methods that are commonly used for face recognition is better.

The results of the simulation for operator expansion, suggests that these structures are faster than the P.

IV. Conclusion

This study examines the results of implementation of the deterioration in the level of HDL function in image processing payments. The results show that by increasing the size of the structural elements, different structures can be seen significant differences between the hardware complexities. The minimum hardware complexity of the structure OFOC - M because the cells forming the structure of the cells that form the structure of the lower gate. The maximum speed of this structure with P is equal, i.e. the speed is not improved. The structure OFOC P is faster than the hardware complexity is the highest. The compromise between hardware complexity and speed of the structures is 1.

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