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Research Article

VERIFICATION OF MORPHOLOGICAL OPERATION USING BINARY IMAGE PROCESSING

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ABSTRACT

Binary image processing is a powerful tool in many image and video applications. Discrete cosine transformation is used in this work, as information capability is superior to other transformations. The choice of coding is situation dependant .In general a single coding is employed that may be variable length coding or run length coding. This gives a satisfactory compression ratio up to 50% but still is not very good. The present work employs the combination of both the coding techniques i.e. image is first coded as run length of levels and then run lengths are again coded using variable codes. The outcome of this work is a software system for gray scale image compression which is based on lossy compression. In this paper, we can add image compression using run-length encoding concept . So only we consider the feasible for the operations what we are doing. This technique has the advantage of providing better compression ratio i.e. 10 to 95 times over the other existing techniques which compress images up to 50 times. Further this technique is very flexible as it gives user the choice for selecting compression ratio and retrieved image quality

Keywords: Matlab, Modelsim, Synthesized using XILINX FPGA, Personal computer,

INTRODUCTION

IMAGE PROCESSING is extremely useful in various areas, such as object recognition, tracking, motion detection & machine intelligence, image analysis and understanding video processing, computer vision, and identification and authentication systems[1].

Binary image processing has been commonly implemented using processors such as CPU or DSP. However, it is inefficient and difficult to use such processors for binary image processing. High-speed implementation of binary image processing operations can be efficiently realized by using chips specialized for binary image processing. Therefore, binary image processing chips have attracted much attention in the field of image processing. Application-specific chips and hardware have been reported for various applications. A chip with a 500-dpi cellular-logic processing array was implemented to enhance and verify fingerprint images[2-6].

Multimedia revolution has become possible due to digital signal processing. Digital image Processing is a rapidly evolving field with growing applications in science and engineering. Image processing holds the possibility of developing the ultimate machine that could perform the visual functions of all living beings. In this chapter the background work for image compression has been covered. Problem formulation and organization of the thesis are also discussed. Many theoretical as well as technological breakthroughs in processing techniques and problems have been considered. A few applications viz. remote sensing, image storage for business applications, Medical processing, Robotics and automated inspection etc. are identified. Next chapter focuses on the important issue of data redundancy in image compression[7-11].

ARCHITECTURE

Image Processing is extremely useful in various areas, such as object recognition, tracking, motion detection and machine intelligence ,image analysis and understanding video processing ,computer vision , and identification and authentication systems[12].

A binary image is a digital image that has only two possible values for each different pixel. Typically the two colors used for a binary image are black and white though any two colors can be used. The color used for the object(s) in the image is the foreground color while the rest of the image is the background color. In the document scanning industry this is often referred to as bi-tonal.The reconfigurable processor is given below.

Binary images are also called bi-level or two-level. This means that each pixel is stored as a single bit (0 or 1).The names black & white, B&W, monochrome or monochromatic are often used for this concept, but may also designate any images that have only one sample per pixel, such as grayscale images.In Photoshop parlance, a binary image is the same as an image in Bitmap mode[13].

A. System Design

Reconfigurable binary image processing chips have been designed to generalize the binary image applications of a chip. Chips were presented to perform basic binary morphological operations, such as dilation, erosion, opening, and closing, Programmable analog vision processors based on the cellular neural or nonlinear network universal machine architecture were proposed for a wide range of applications such as motion analysis and texture classification.

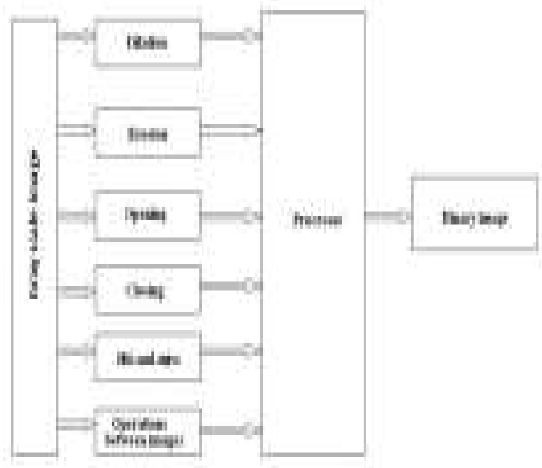

Figure 1: Proposed System

A programmable single instruction multiple data (SIMD) real time vision chip was presented to achieve high-speed target tracking. a programmable binary morphology coprocessor was introduced to the visual content analysis engine of the chip used for visual surveillance. The proposed system is shown in Figure.

B. Limitations

The disadvantages in previous method is its Limited application to various sources.it cannot be extended to 3D especially for multimedia applications. Losing internal details of objects (i.e. in inspection tasks).It is difficult to control the contrast between the background and the objects.

Table 1: Comparison of Fine, Coarse and Mixed grain architecture

	Fine Grained	Coarse-Grained	Mixed-grain
Hardware resource (ALUs)	641	734	641
Flexibility	High	Low	Medium
Reconfiguration Parameters	264	54	116

CIRCUIT IMPLEMENTATION

A. Morphological operation

The morphological operation is verified by considering an input image. Reconfigurable binary image processing chips have been designed to generalize the binary image applications of a chip. Chips were presented to perform basic binary morphological operations, such as dilation, erosion, opening, and closing. Programmable analog vision processors based on the cellular neural or nonlinear network universal machine architecture were proposed for a wide range of applications such as motion analysis and texture classification we are giving two inputs, one is an image and another one is structuring element. Structuring element its differs for different images. Structuring element is like a mask as in different sizes (3*3), (5*5). we are masking the input image with the structuring element, the image pixels are exactly fits with an mask replace the origin with '1' or else '0'.we moving the mask over an image in each row wise and column wise. Finally we get an erosion output[14].

The erosion of the binary image A by the structuring element B is defined by:

$$A \ominus B = \{z \in E | B_z \subseteq A\}, \qquad (1)$$

Dilation is similar to erosion it has slight changes in concept. we are masking the input image with the structuring element, the image pixels anyone hits with an mask replace the origin with '1' or else '0'. Thus we have getting an dilation output

The dilation of A by the structuring element B is defined by:

$$A \oplus B = \bigcup_{b \in B} A_b . \qquad (2)$$

The opening of A by B is obtained by the erosion of A by B, followed by dilation of the resulting image by B:

$$A \circ B = (A \ominus B) \oplus B \qquad (3)$$

The closing of A by B is obtained by the dilation of A by B, followed by erosion of the resulting structure by B:

$$A \bullet B = (A \oplus B) \ominus B \qquad (4)$$

In mathematical morphology, hit-or-miss transform is an operation that detects a given configuration (or pattern) in a binary image, using the morphological erosion operator and a pair of disjoint structuring elements. The result of the hit-or-miss transform is the set of positions, where the firststructuring element fits in the foreground of the input image, and the second structuring element misses it completely[15].

An entire class of operations on binary images operates on a 3×3 window of the image. This contains nine pixels, so 512 possible values. Considering only the central pixel, it is possible to define whether it remains set or unset, based on the surrounding pixels.

B. Synthesis Results

The output from the MATLAB showing morphological operations output. The Figure shows the opening and closing operations.

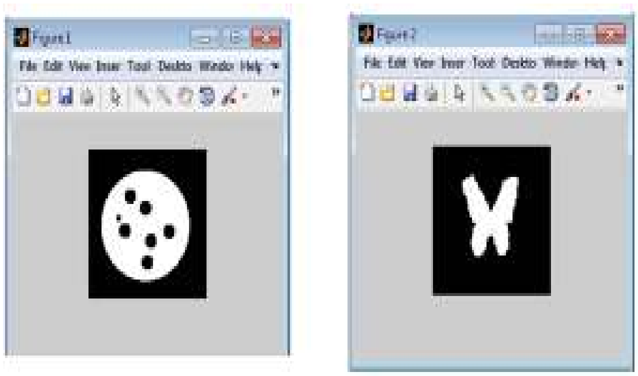

Figure 2: Opening and Closing

C. Comparison

The synthesis results shows the execution times and performances of the morphological operations. The supported operations of the image processors of different morphological operations and also for the proposed system is given in Table

Table 2: Operation On Image Processor

Processor	[10]	[11]	[12]	PROPOSED
Dilation	Y	Y	Y	Y
Erosion	Y	Y	Y	Y
Opening	Y	Y	Y	Y
Closing	Y	Y	Y	Y
Hit and miss	N	N	N	Y
Operation between images	N	N	N	Y

D. Binary Image Processing Applications

Binary Image processing is extremely useful in various areas, such as object recognition, tracking, motion detection and machine intelligence ,image analysis and understanding video processing ,computer vision , and identification and authentication systems . Various general compression model blocks like source encoder, mapper, quantizer and decoder has been covered in this chapter. Two types of compression models i.e. Lossy and lossless have also been discussed. Lossy compression accepts a slight loss of data to facilitate compression which makes two passes; first pass over the data performs a high level signal processing function which transforms the data into the frequency domain.Transformed data in second pass is smoothed, rounding off high and low points contributing to loss of signal. The more the data is massaged, the greater the signal loss and more compression will occur. Lossless compression is applied where image quality is more important than storage saving. In the next chapter, Image compression by implementing lossy DCT model has been discussed.

SYSTEM ENHANCEMENT

A. Dct Compression Model

In transform coding a reversible, linear transform is used to map the image into a set of' transformed co-efficient, which are then quantized and ceded. Various transformation techniques are Karhunen-Loeve [KLT]. Discrete Cosine (DCT), Walsh-Hadamard (WHT) etc. In this chapter Discrete Cosine Transformations have been chosen among the various ether transformations have been chosen as its information packing ability is superior te ethers and it provides a geed compromise between information packing and computational complexity.

Dct Encoder And Decoder

As shown in fig 4 (a), encoder performs fear relatively straight forward operations i.e.Sub-image decomposition, Transformation, Quantization and Coding. The decoder implements the inverse sequence of steps with the exception of the quantization function of the encoder shown in fig 4.l [b].An N x N input image is first subdivided into sub-images et` size n it n, which are then transformed to generate $(N/n)^2$,n x n sub image transform arrays. The goal of transformation process is to decorrelate the pixels at each sub image, or the pack as much information as possible into smallest number of transform co-efficient The quantization stage selectively eliminates or more coarsely quantizes the co-efficient that carry the least information. These co-efficient have the smallest impact en reconstructed sub image quality. The encoding process terminates by ceding the quantized co-efficient.Any or all of the transform ceding steps can be adapted in local image content, called adaptive transform ceding, or fixed for all sub-images, called non-adaptive transform coding.

In the present implementation non-adaptive transform coding has been chosen.

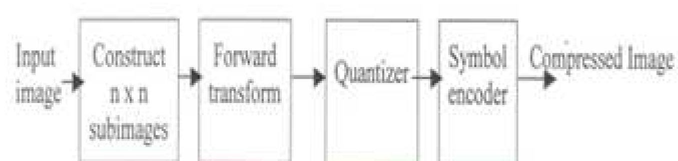

Figure 4(a): Encoding process of the system

Figure 4(b): Decoding process of the system

B. Run Length Encoding

Run-length encoding (RLE) is a very simple form of data compression in which *runs* of data (that is, sequences in which the same data value occurs in many consecutive data elements) are stored as a single data value and count, rather than as the original run. This is most useful on data that

contains many such runs: for example, simple graphic images such as icons, line drawings, and animations. It is not useful with files that don't have many runs as it could greatly increase the file size.The RLE concept is described below.
Let us take a hypothetical single scan line, with B representing a black pixel and W representing white. If we apply the run-length encoding (RLE) data compression algorithm to the above hypothetical scan line,

C. RLE Concept

The RLE concept is a simple algorithm in which an input image is get.The next one is to check the given input image is to be checked that it is binary sequentially or not.Then to find the number of zeros and ones in a binary image and the stored count values is single memory.At last the compressed output is derived.

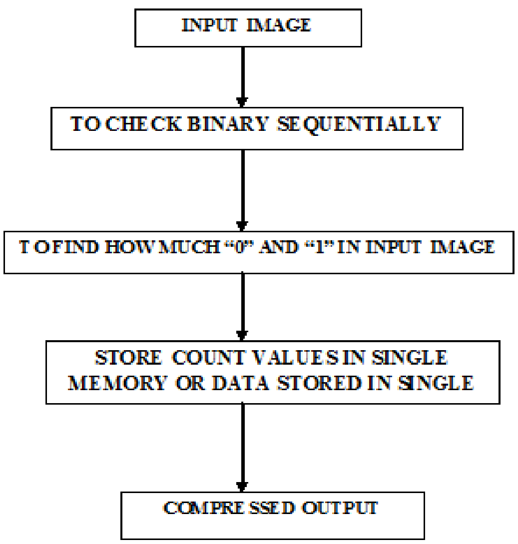

Fig.3.Operation of RLE

D. Subimage Size Selection

A significant factor affecting transform coding, error and computational complexity is function of sub image size. In most application images are subdivided so that the correlation (redundancy) between adjacent sub-images is reduced to some acceptable level so that n can be expressed as an integral power of 2, where n is the sub image dimension. The latter condition simplifies the computation of the sub image transformation. In general both the levels of compression and computational complexity increase as the sub image size increases. The most popular sub-image sizes are 8 x 8 and 16 x 16 and sub image size of 3 x 3 have been chosen in the present work for analysis of compression algorithm.

CONCLUSION

In this project, a reconfigurable binary image processor was proposed to perform real-time binary image processing. The dynamic reconfiguration approach was used to increase the processor performance. Basic mathematical morphology operations and complicated algorithms can easily be implemented on it because of its simple structure and it is verified. The processor, featured by high speed, simple structure, and wide application range, is suitable for binary image processing, such as object recognition, object tracking and motion detection, computer vision, identification, and authentication.
Present technique for compression has been tested and found successful to compress gray scale images. For most of the images quality factor of 5 or less produce s slight loss resolution, but without significant loss of picture quality. Once the quality factor gets above 15 blocking affect of compression starts and become visible. The images with quality factor of EU or higher show graceful degradation in the image quality. In most cases images can be compressed up to 85% without much loss in picture quality. The future scope of work in this present work, images with one color component have been considered. But compression of colored images can also be analyzed using this technique. Here only still images are analyzed. Further this technique explored for moving images. This technique can be further explored to compress audio files.

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