IMPLEMENTATION OF MORPHOLOGICAL OPERATORS FOR IMAGE SEGMENTATION

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ABSTRACT: Morphological operators are widely used in binary image processing for several purposes, such as removing noise, detecting contours or particular structures, regularizing shapes. Image Segmentation plays vital role in Computer Vision and Digital Image Processing. It is the process of separating the digital image into distinct region(s) possessing homogeneous properties. The main objective of image segmentation is to extract various features of the image that are used for analyzing, interpretation and understanding of images. Image segmentation is applied in various applications like medical imaging, shape detection, content-based image retrieval, robot vision, etc. Several techniques have been developed for image segmentation such as pixel-based segmentation, edge based segmentation and region based segmentation. This proposed work deals with image processing usually can't address real time image calculation. Here I use M4K blocks instead of normal registers to store pixels which might exceeds the total number of registers on board, I also utilize shift registers to address data in pipeline so that we can fasten the speed when it's processing. The realization of dilation, erosion, opening, closing and edge detection using Cyclone II FPFGA with Verilog HDL. The user is able to select both binary threshold, exposure threshold and also the sobel threshold by using the external inputs. There are also options to display in grayscale image, binary.

1. INTRODUCTION

Image analysis usually starts with a pre-processing stage, which includes operations such as noise reduction. For the actual recognition stage, segmentation should be done before it to extract out only the part that has useful information. Image segmentation is a primary and critical component of image analysis. The quality of the final results of an image analysis could depend on the segmentation step. On the other hand, segmentation is one of the most difficult tasks in

image processing, especially automatic image segmentation. The goal of the segmentation process is to define areas within the image that have some properties that make them homogeneous. The definition of those properties should satisfy the general condition that the union of neighboring regions should not be homogeneous if we consider the same set of properties. After segmentation, we can usually establish that the discontinuities in the image correspond to boundaries between regions. In general, morphological operators transform the original image into another image through the interaction with the other image of a certain shape and size, which is known as the structuring element. Geometric features of the images that are similar in shape and size to the structuring element are preserved, while other features are suppressed. Therefore, morphological operations can simplify the image data, preserving their shape characteristics and eliminate irrelevancies. In view of applications, morphological operations can be employed for many purposes, including edge detection, segmentation, and enhancement of images.

II. LITERATURE WORKS

Digital image processing[1] deals with system that perform various operation on digital image to improve the quality of the image by removing noise and unwanted pixels and to obtain intentional information from an image. Image segmentation is a key step in digital image processing that subdivides an image into its constituent region or object that share homogeneous attributes [2]. The main purpose of the segmentation process is to get more information in the region of interest in an image which helps in annotation of the object scene [3]. An edge is defined as boundaries of objects or sudden change in an image which is not in a continuous form that helps to detect and identify the objects in a given image [4]. Region Based segmentation methods divide an image into region having similar characteristic like color, texture etc. Region Growing algorithm performs a segmentation of an image with examine the neighboring pixels of a set of points, known as seed points, and determine whether the pixels could be classified to the cluster of seed point or not [5]. In method of region Split-merge [6] whole Image which is considered as a seed region splitting out into quadrant until the homogenous sub region is obtained, after the process of Splitting Merging process merge two adjacent regions according to similar characteristic.

III EXISTING SYSTEM

Morphological Operations based Segmentation

Binary images may contain countless defects. In some circumstances binary regions constructed by simple thresholding are buckled by noise and textures. Morphology is a vast extent of image processing operations that modifies the images based on shapes. It is considered to be one of the data processing methods useful in image processing. It has many applications like texture analysis, noise elimination, boundary extraction etc [7]. Morphological image processing follows the goal of eliminating all these defects and maintaining structure of image. Morphological operations are confident only on the associated ordering of pixel values, rather than their numerical values, so they are focused more on binary images, but it can also be applied to grayscale images such that their light transfer functions are unknown and thus their absolute pixel values are not taken into consideration [8]. Morphological techniques verify the image with a small template called structuring element. This structuring element is applied to all possible locations of the input image and generates the same size output. In this technique the output image pixel values are based on similar pixels of input image with is neighbors. This operation produces a new binary image in which if test is successful it will have non-zero pixel value at that location in the input image. There are various structuring element like diamond shaped, square shaped, cross shaped etc.

The base of the morphological operation is dilation, erosion, opening, closing expressed in logical AND, OR notation and described by set analysis. Among them in this paper only two operations are used dilation and erosion. Dilation adds pixels while erosion removes the pixels at boundaries of the objects. This removal or adding of pixels depends on the structuring element used for processing the image.

Binary Dilation

Dilation is found by placing the center of the template over each of the foreground pixels of the original image and then taking the union of all the resulting copies of the structuring element, produced by using the translation.

Erosion

Erosion, it is to erode away the boundaries of regions of foreground pixels (In our experiment, black pixels). Thus areas of foreground pixels shrink in size, and holes within those areas become larger.

Opening

Opening consists of an erosion followed by a dilation and is used to eradicate all pixels in regions that are too tiny to include the structuring element. Here the structuring element is often called a query, because it is inquiring the image looking for small objects to strain out of the image.

Closing

Closing comprises of a dilation followed by erosion and can be used to fill in holes and small gaps.

IV PROPOSED SYSTEM

The basic operators of Mathematical Morphology include: Edge Detection, Binary Dilation and Erosion, Binary Opening and Closing, Skeleton Extraction, Ultimate Erosion, Top-hat Transform, Morphological Gradient, Watershed, etc.

Dilation and Erosion

Dilation and Erosion are two basic operators in Mathematical Morphology. They are typically applied to binary images. However, sometimes they can also be extended to grayscale images. For dilation, the effect would be gradually enlargement of the boundaries of the regions of foreground pixels. Thus areas of foreground pixels grow in size while holes within those regions become smaller. For Erosion, it is to erode away the boundaries of regions of foreground pixels (In our experiment, black pixels). Thus areas of foreground pixels shrink in size, and holes within those areas become larger. The two figures below show the different effects of Dilation and Erosion.

Opening and Closing

Opening and Closing are another two important operators in Mathematical Morphology. They are usually applied to binary images. However there are grayscale versions as well. The basic effect of an Opening is somewhat like erosion in that it tends to remove some of the foreground pixels from the edges of regions of foreground pixels. However it is less destructive than erosion in general. Similarly, the basic effect of a Closing is similar to dilation in that it tends to enlarge the boundaries of foreground regions in an image and shrink background color holes in such regions, but it is less destructive of the original boundary shape.

The definition of Opening and Closing are both very simple. For Opening, it is defined as an erosion followed by a dilation, but using the same structuring element for both operations. For Closing, it is Opening performed in reverse, which is a dilation followed by an erosion using the same structuring element for both operations. Simply speaking, the Opening is to break the small connections of different image parts, while Closing is to connect the small gap between different image parts.

V RESULT

We got mathematical morphology function on the FPGA but In fact, the total resource we use on the FPGA board is quite small. When looking through the report generated after compiling the code, we saw we use 9% of the total logic elements, which includes 7% of total combinational functions and 6% Dedicated logic registers.

Modelsim & Matlab Result

Figure : a) Original Image b) Dilation output

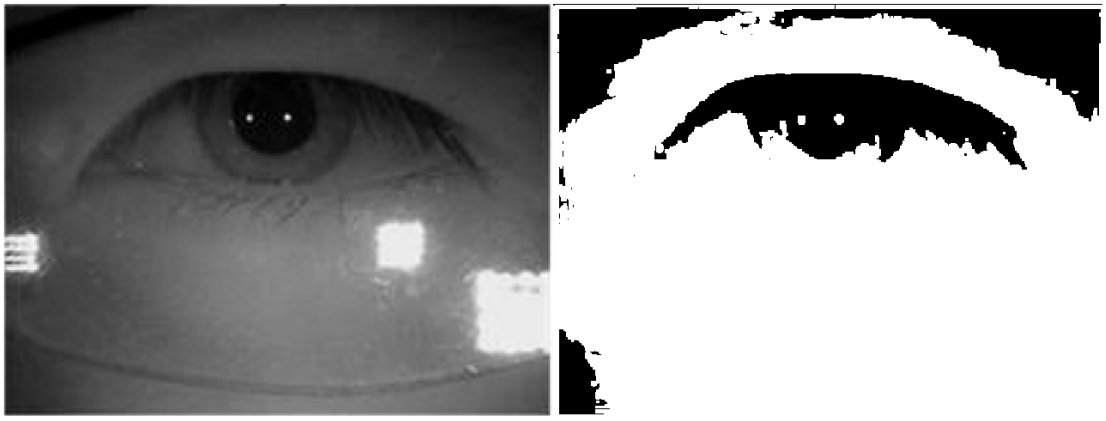

Figure : a) Original Image b) Erosion output

Figure : a) Opening output b) Closing output

VI CONCLUSION

The basic theory of morphological filters has been reviewed, focusing on fundamental properties of the basic operators, erosion and dilation, and deriving some theoretical consequences that could be exploited to find the traces of the filters. Finally, the results of an extensive testing are presented, showing that the proposed approach is highly effective, as well as robust to the typical manipulations of binary image documents, including splicing. Future directions of this work could lead to the detection of multiple filterings (e.g., open and close operators and filter chains). Furthermore, the possibility of using the proposed technique as a basis for a statistical analysis of filtering traces may open the possibility of dealing with more severe attacks such as large

rotations and scaling, as well as extending the technique to graylevel image morphology, where compression may become a critical issue.

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