Erosion and Dilation

November 28, 2020

Introduction

The task consists to implement a couple of basic image processing operations. The erosion and dilation algorithm are a well-known basic morphologic operation, which can be combined for edge detection. For this case, the mask is defined as a squared 5x5 kernel for erosion (table 1) and dilation (table 2). An input signal will be used as switch to select between both filters or the edge detector.

Description

The final code must be able to receive a stream of pixels from an image and to generate an output image with its edge. The data to be processed would be pixels from a BMP file (RGB = 3 bytes/pixel). The image must firstly be converted to grayscale before generating the final output image. The user must select what output to deliver: erosion, dilation or the edge of the input image. The edge is obtained by subtracting the erode and the dilate image. As a result, two designs with optimizations targeting performance or area must be created.Furthermore, at least one optimization at function, loop and I/O level must be applied to each design.

The student will be provided with a reference C/C++ code to manipulate BMP images and to test her/his Vivado HLS code (High-Level test bench).

A final report (up to 10 pages) must be delivered together with all the Vivado HLS code. In the report, you must detail and justify the used optimizations and to provide a complete table comparing the results obtained for each optimization. This table must report the latency, the execution time, the maximum

1	0	1	0	1
0	1	1	1	0
1	1	1	1	1
0	1	1	1	0
1	0	1	0	1

Table 1: Convolutional kernel for Erosion 5x5.

0	1	0	1	0
1	1	1	1	1
0	1	1	1	0
1	1	1	1	1
0	1	0	1	0

Table 2: Convolutional kernel for Dilation 5x5.

frequency and the resource consumption. The report must not contain any source code since the code must be commented, well-structured and be easy to understand.

Erosion and Dilation References

http://homepages.inf.ed.ac.uk/rbf/HIPR2/erode.htm
http://angeljohnsy.blogspot.in/2012/09/image-erosion-without-using-matlab.html
http://homepages.inf.ed.ac.uk/rbf/HIPR2/dilate.htm
http://matlab.izmiran.ru/help/toolbox/images/morph3.html

HELP: General References

http://www.wiki.xilinx.com/HLS+Video+Library
http://en.wikipedia.org/wiki/Kernel_%28image_processing%29
http://beej.us/blog/data/convolution-image-processing/
http://www.roborealm.com/help/Convolution.php
http://www.aishack.in/2010/08/convolutions/
http://www.thebest3d.com/dogwaffle/help/PDHelp/convolvefilters.htm
http://www.aishack.in/2010/08/image-convolution-examples/
http://www.imageprocessingbasics.com/image-convolution-filters/

Your Notes