

CSE 291 Assignment 2: Implementation of Convolution Kernel on an FPGA

Due date: 04/25/2017

Instructions

In this assignment, you will learn two different ways of designing a convolution kernel on an FPGA. Please assume your input is 480 by 640 grayscale image (each pixel is 8-bit). For both tasks, you are required to create your own testbench. You can use any image format (jpeg, png, or binary file) as an input. Your testbench must be self-checking (checks the output of HLS against the software version of the same function).

Task 1: 40% of Assignment 2

Design and implement Sobel filter in HLS. Sobel filter has two 3x3 kernels. In this part of assignment 2, you need to use line buffers and window buffers to implement the Sobel filter. You are free to use Lecture 2 notes and parallel programming for FPGAs book [2], and Xilinx resources [3].

Task 2: 60% of Assignment 2

Design and implement Sobel filter in HLS using the technique presented in [1]. This reduces the convolution into a matrix multiplication problem. You are free to use the same testbench from Task 1.

Submission

Follow the same procedure as Assignment 1.

References

- [1] Chellapilla, Kumar, Sidd Puri, and Patrice Simard. "High performance convolutional neural networks for document processing." *Tenth International Workshop on Frontiers in Handwriting Recognition*. Suvisoft, 2006.
- [2] <https://sites.google.com/site/sneuendorffer/publications>
- [3] https://www.xilinx.com/support/documentation/application_notes/xapp793-memory-structures-video-vivado-hls.pdf