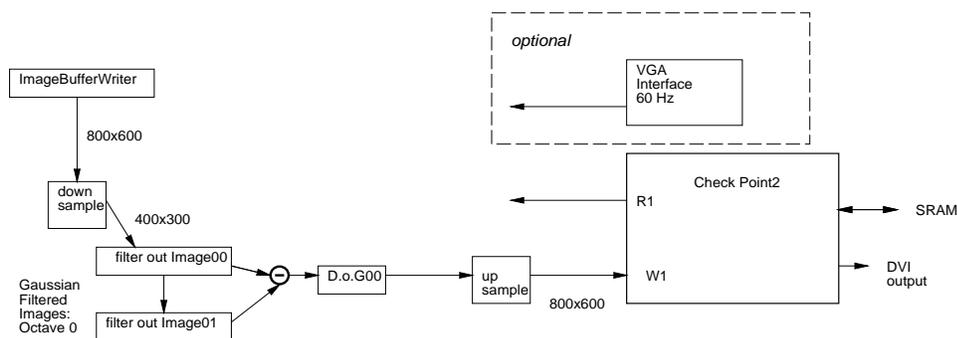


# EECS150 Fall 2013 Final Checkpoint: Difference of Gaussians

Prof. Ronald Fearing, GSIs: Austin Buchan, Stephen Twigg  
Department of Electrical Engineering and Computer Sciences  
College of Engineering, University of California, Berkeley

Due Fri. Dec. 6.  
Draft v1.0 Nov. 23.

For the final checkpoint, you will be implementing and testing one difference of Gaussian filtering operation as shown in the figure below. This is checkpoint 4 with one more Gaussian filtering block and a subtraction of frames. You will read an 800x600 image from ImageBufferWriter, calculate the Difference of Gaussians on the 400x300 down sampled (and filtered images), then write the result into the frame buffer. Set up DIP switches or rotary selector so that you can display either: 1) original ImageBufferWriter image, 2) Image00, 3) Image01, or 4) the difference between Image00 and Image01. (Note that the difference of Gaussians should be scaled to the range 0 to 255.)



## Final Checkpoint Goals

All code should be pushed to GitHub. For the final project checkoff, you should be able to show:

1. The FPGA programmed with the difference of Gaussians calculation on a 400x300 down sampled image. The design should selectively display either the original, Gaussian filtered images, or difference between Gaussian filtered images over the DVI interface. *Report resource utilization and critical path from the Xilinx tools.*
2. Testbench for difference of Gaussians, showing processing of 5 rows, including end-of-row and end-of-frame.

3. Detailed block diagram for final Gaussian filter blocks and difference of Gaussians calculation. Level of detail should be registers, muxes, arithmetic elements, etc. Specify widths of all data paths. (This is updated version of block diagram from Checkpoint4, and will also be needed for the final project report.)
4. Design explanation. Each partner should be able to answer questions on the operation of the system, referring to the block diagram.

Choose a checkoff slot on the Doodle poll for Fri. Dec. 6. Earlier checkoff is encouraged.

### **Optional Extra Credit**

Extra credit is available only if the basic project specification is working completely. (With extra credit maximum project points are 106/100, with 6 points added after grade assignment.)

1. (2 pts) Design and implement the full octave of Gaussian filters and difference of Gaussians for  $\sigma_0, \sigma_1, \sigma_2, \sigma_3, \sigma_4$  and the 4 differences, and selectively display.
2. (2 pts) Design and implement down sampling to 200x150 and the second octave of filtering, and selectively display.
3. (2 pts) Design and implement the VGA input to the DoG pipeline, and display resulting real-time DoG images.