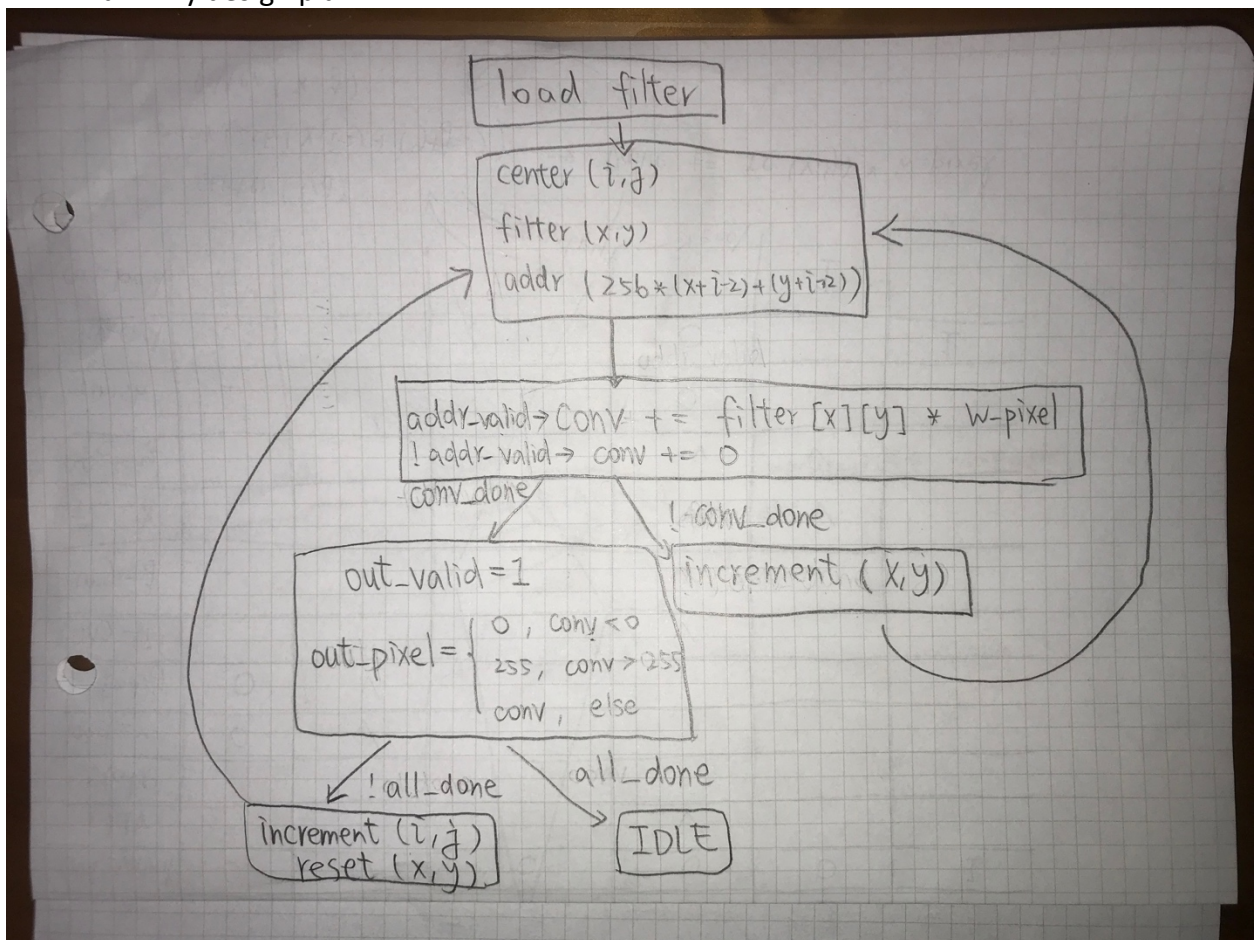


106062202_final_report

- 1.
2. In practice, the file will be converted into .tar file when downloaded for Macs. Thus, if the .tar file is uploaded to the workstations, the command should be "tar -xvf conv_engine2018_v1.tar".
3. The original image is loaded into a 1D register by a function "fread". A nested for loop then iterates through the new bitmap and gets bitmap data for every new pixel. By applying the RGB to gray scale formula, every new pixel is turned into gray scale. The new bitmap is written into a text file, which is then loaded into the sram.
- 4.
- 5.
- 6.

a. My design plan:



b. My finite state machine:

- i. IDLE: Wait for the outputting filter coefficients to start.
- ii. LOADFC: Load the filter coefficients.
- iii. SETADDR: Set the address for working pixel and check if the address is valid.
- iv. CONVOL: Perform the convolution.
- v. SETCNTR: Increment counters.
- vi. OUTPUT: Set the output pixel and set signal "out_valid" as 1.

- c. Problems encountered: I had problem determining the counter for the filter, the center of filter, and the corresponding pixel for convolution. In the end, I used three sets of counters, the corresponding pixel's counters are functions of the former two. Since there may not be a corresponding pixel for convolution, the counters may be negative, and it took me an hour to realize the registers must be unsigned.
- d. Problems encountered: I always thought that all blocks could be combinational other than the flip-flop. However, too many problems occurred in my combinational block and almost no calculations are performed ideally. Therefore, I set the block for calculation as negative-edge triggered, which solved many difficulties. I only left my finite state machine as a combinational block.
- e. Problems encountered: I downloaded the bitmap file and find it be pitch black. To solve the problem, I corrected three things. First, I examined if the signal "addr" is properly functioning by directing outputting the signal got from sram. If the bitmap is a normal gray scale bitmap, then the address is good. Second, I checked if the filter coefficient is in match with the address by printing the counters and checking the first 25 to 30 cycles. Lastly, I checked if the convolution result is calculated and stored properly, which turned out overflowed before my examination.
- f. The moment I compared the log_out file with the golden one by command "diff" and got no results, I literally screamed for five straight minutes. Seeing the bitmap converted into a harmonic black-and-white rather than those previously strange lines, I felt proud of myself. The experience was a tough but rewarding one.
- g. I would like to thank one of my friend, 詹振宏, who discussed the problems with me and taught me many useful Linux commands. Please consider give him some extra points, even if he may not need any.