Homework#3

Due in Two Weeks (12/16)

Problem:

The Convolution Neural Network (CNN) is a kind of neural network to do image recognition. The convolution layer of CNN is used to extract the feature of image. Please design a convolution layer with 3x3 kernel size and the stride is 1. (No padding) The convolution operation is shown in Fig.1. After the convolution operation the feature need to go through an activation function - ReLU to calculate the output. The ReLU formula is shown in Fig. 2.

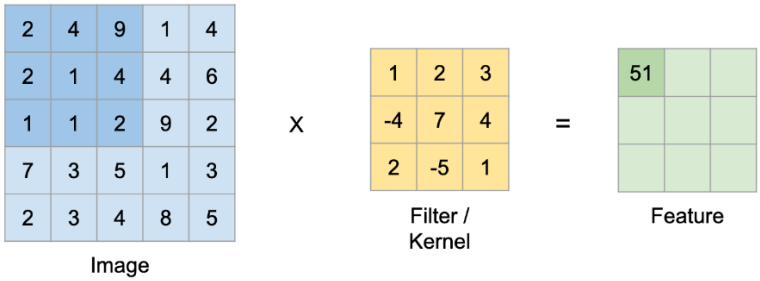
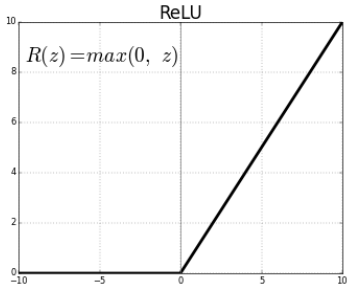


Fig.1 Convolution operation



$$f(x) = \begin{cases} x, & x > 0 \\ 0, & x \leq 0 \end{cases}$$

Fig.2 ReLU function

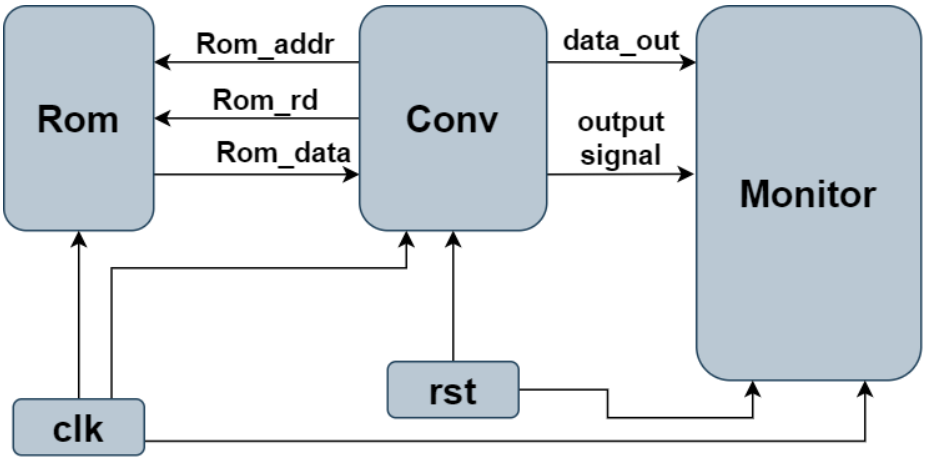


Fig.3 Block diagram

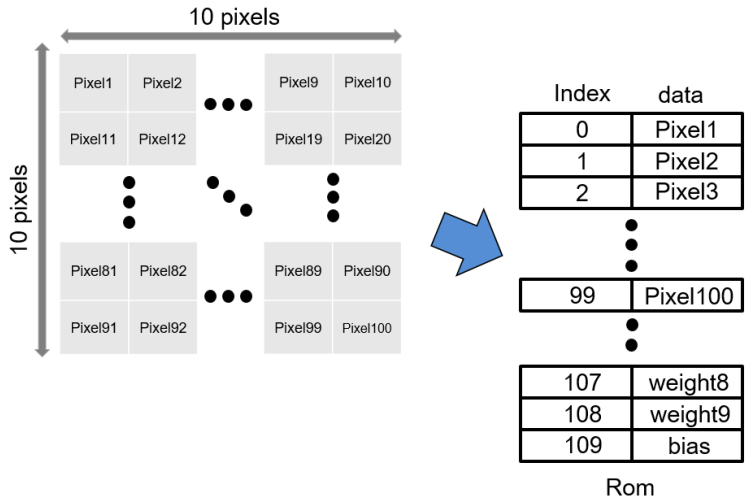


Fig.3 ROM

Requirement:

Complete the convolution block, as shown in Fig. 3. Rom_addr is the address for ROM reading, Rom_rd is the signal for ROM reading (high: valid, low: not valid), and Rom_data is the data output by ROM. Data_out is the data output by Conv, and output_signal is the output signal (high: valid, low: not valid). The ROM is used to store the input data and weight. The size of ROM is 110(10x10 input data and 10 weight data) and the specification of ROM is shown in Fig.3. The Monitor block is used to print your convolution output result on the screen, as shown in Fig. 4. Please use the Platform Architect (PA) to simulate the system and show the simulation result.

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Result:
0       174     0       103     0       92      22      102
22      0       0       61      0       22      0       0
11      106     36      0       71      13      66      55
0       23      0       0       18      0       66      0
44      8       93      94      10      76      0       0
0       14      94      11      0       0       0       197
53      171     0       0       78      52      80      0
108     0       93      0       141     0       67      0
```

Fig.4 8x8 output result (Example)

Please upload the compressed file (.zip or .rar) which including following files to Cyber University (Compressed File Name: Student ID_HW3)

1. Source code
2. Report (Word file Include design ideas, block diagram, and simulation result of PA)