Machine Learning Intelligent Chip Design

Final Project

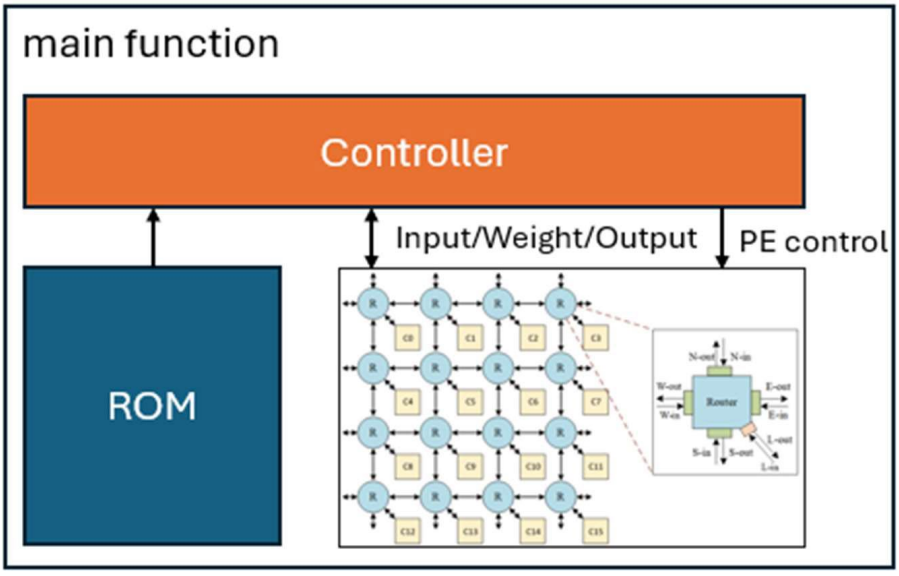
NoC-based CNN architecture with AXI4 DMA architecture & optimized design

Description

In HW1, you build an Alexnet model by SystemC. In HW2, you can partition your neural network model by channel. In HW3, you use the 4x4 mesh-based NoC architecture to transfer packets from PE to PE. In this HW4, you build a NoC-based CNN architecture. In the Final Project, you are required to modify the ROM provided in HW4 and the controller architecture you designed, transforming them into a complete AXI4 DMA architecture.

In addition, you have to propose an optimization method of your own design—this method is not subject to any restrictions. In your report, you should analyze the advantages and disadvantages of your optimization compared to the original architecture.

Implementation Details



Aside from modifying the ROM and controller into an AXI4 DMA architecture, the rest of the architecture remains the same as in HW4. In other words, **you can directly use the files submitted for HW4 as the basis for your modifications.** In the optimized version, you may make any modifications you like; however, communication with memory must still be done through the AXI4 DMA architecture.

Please note that the only files you are not allowed to modify are the parameter files inside the data folder. **The data folder must remain unchanged.**

Implement Notes

You may refer to the provided **AXI_introduction.pptx** for information about AXI4. The closer your implementation is to a complete AXI4 architecture, the higher your score will be.

As for the optimization, you are allowed to optimize any part of the system. However, please ensure that your implementation matches the description in your report. **Any form of falsification will result in a zero score.**

You do not need to download or extract any files; you can directly modify your HW4 files to complete the Final Project.

Output Result Format

After running the make cat、make dog commands, you are required to print the same classification output results as in the previous assignments. However, you may also print any additional information you wish to analyze your optimized architecture, such as the number of execution cycles, etc.

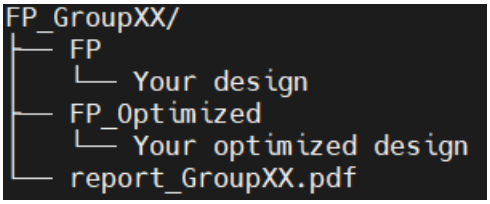
Submission Guidelines & Grading Policy

- **The Final Project can be completed and submitted in groups of up to two people. However, if you complete it individually, you will receive a 5-point bonus.**
- **The grading breakdown for this assignment is as follows:**
  - **Simulation Result: 50%**
    - You need to complete a NoC-based CNN architecture **with AXI4 DMA** similar to Figure 1. After executing the 'make cat' and ‘make dog’ commands, the terminal must **display the correct output on the terminal.** In addition, you may print any extra information to help analyze your optimized architecture.
  - **Report & Optimized design: 50%**
    - You must optimize the original architecture, and this optimization is not subject to any restrictions. However, communication with memory must still be conducted through the AXI4 DMA architecture.
    - The output must include the classification output results, just like in the previous assignments. However, you may print any additional information to help analyze your optimized architecture.
    - As for the report, it must include the following points:
      - Simulation results.

- How did you implement the AXI4 architecture? How did you define its parameters and signals? What problems did you encounter during the process?
- How did you design the optimized architecture, and what impact did it have on simulation or performance?

◆ If the code is not submitted, **no points will be awarded for the report!**

- **For the file submission, you need to upload a zip archive to New E3. The file should be named FP_GroupXX.zip (where XX is your group ID). The zip file must contain two versions of your code and the report. The report file should be named report_GroupXX.pdf (again, XX is your group ID). The internal structure of the zip file should follow the format shown in the figure below.**



- **If the file violates the naming rule and the file format, 10 points will be deducted.**
- **Please be advised that the data folder and all its contents must not be included in your upload.**
- **Ensure that your code is well-commented and organized for clarity and understanding.**
- **The following are rules that must be absolutely adhered to. Any violation will result in 0 points.**
  - **Plagiarism is forbidden.**
  - **You cannot use any Chinese characters in the assignment, including within comments.**