EE/CprE/SE 492

HAML: Heterogeneous and Accelerated Computing for Machine Learning
Semester 2 Week 9-10 Report

10/18/24 - 10/31/24

Faculty Advisor   *Phillip Jones*
Client   *JR Spidell*

Team Members:

Jonathan Tan	- Memory Affinity, Kria Board Manager
Josh Czarniak	- DPU Control Developer
Justin Wenzel	- Multi-threaded Developer
Kai Heng Gan	- Image Processing/Semantic Segmentation Developer
Santiago Campoverde	- Model Analytics

Summary for Progress These Two Weeks

During these two weeks, we worked towards "Milestone 3." That is, mainly, creating the multithreaded approach for our Blink, Eye-tracking, and semantic segmentation inference. We are also working on setting up the Vitis-AI profiling tool for performance analysis. Finally, we worked on optimizing the semantic segmentation model by modifying negative slope value of Leaky ReLu Activation function to ensure that DPU could support the converted semantic segmentation model.

These Two Weeks' Individual Contributions

- Justin
    - Implemented eye track model in the defined model class format for the multi-threaded program
    - Met with Josh to finish multiple tasks involving the multi-threaded program:
        - Finishing the DPU handler code
        - Merging all the classes into a single program and began testing the multi-threaded program
    - Built a draw.io schematic outlining the entire program application
        - Outlining the structure and declaration of each function and class
        - A flowchart visually showing the function implementation
    - Broke down testing for each thread to monitor performance and resolve run time errors in the current program
- Jonathan
    - Switching integration of DPU to Vitis flow. Which consists of these steps:
        - Remaking Vivado block design.
        - Creating Vitis platform for the new hardware.
        - Integrate DPU into hardware via Vitis

- Josh
  - Met with Justin to finish the DPU handler code implementation
    - Discussed how the new DPU functions will be interacting with the code as a whole
  - Finished implementing DPU handler code but now need to bug fix the interactions with the DPU code
    - DPU handler wasn't holding onto the subgraph after it releases the runner.
  - Made Dpu slides based on DPU implementation
- Kai
  - Updated the SS cpp code to align with the model class format
  - Wrote script to test the quantized model and validated the output from the quantized model
    - The accuracy of the quantized model is 98.43%
  - Continued work on semantic segmentation cpp code and encountered the xmodel output was giving wrong classes score for each pixel.
- Santiago
  - Finished individual Semantic Segmentation accuracy testing script.
    - Added a visualization component of the prediction and ground truth using matplotlib
    - Added RGB to the visualization component for clear representation of model prediction and false positives\negatives within it.
  - Created a second Semantic Segmentation testing script for image sets
    - Provides average accuracy within a set
    - Returns a list of prediction files that have a accuracy under 97% (adjustable)

Team Member	These Two Weeks' Task	Completion Date	Hours Took	These Two Weeks' Hours	Total Project Hours
Justin Wenzel	Attended meetings	NA	3	31	158
	Implemented eye track model in model class format for our program	10/20	5		
	Met with josh to finalize DPU handler program and setup multi-threaded program	10/2 & 10/27	3		
	Created a draw.io schematic or the entire program	10/23	10		
	Broke down testing for each thread, for performance and runtime errors	10/9	10		
Jonathan Tan	Attended meetings	NA	6	23	171.5
	Change Vivado flow to Vitis flow	On-going	17		

Josh Czarniak	Attended meetings	NA	1	8	114
	Implemented the DPU handler code	10/23	5		
	Worked on trying to fix DPU code	10/26	2		
Kai Heng Gan	Attended meetings	NA	5	17	168
	Updated the SS cpp code to align with the model class format	10/22	1		
	Wrote script to test the quantized model and validated the output from the quantized model	10/22	3		
	Continued work on semantic segmentation cpp code and encountered the xmodel output was giving wrong classes score for each pixel.	On-going	8		
			1		
Santiago Campoverde	Attended meetings	NA	3	9	103
	Finished Individual Semantic Segmentation testing script	10/26	4		
	Created and finished Semantic Segmentation testing script for images sets.	10/29	2		

Note: 1. This is per week hours, Σ "hours taken" = "week hours". 2. Due to multiple meeting times, meetings' "completion date" are "NA".

Plans for Coming Two Weeks

Team Member	Plans for Coming Week	Planned Completion	Planned Hours Required
Justin Wenzel	Begin Profiling critical sections, e.g. using gettimeofday() to start	11/7	4
	Debug runtime errors and reoutline multple functions in the multi-threaded program	11/2	8
	Create bounce diagrams for documentation	11/3-11/7	6
Jonathan Tan	Continue working to set up DPU using Vitis flow	11/5	6
	Figure out difference between Vivado flow and Vitis flow	11/5	3

Josh Czarniak	Adjust slide deck on DPU implementation based on current fixes and suggestions made	11/1	1
	Fix anymore errors in the DPU code	11/3	5
Kai Heng Gan	Continue working and testing on semantic segmentation cpp code that will run on the Kria KV260. Resolve the invalid output from the xmodel.	ongoing	10
	Continue working with Justin to implement semantic segmentation in the model class format defined in the multi-threaded application to interact with the semantic segmentation model, and perform inference with the DPU	NA	3
Santiago Campoverde	Test larger Semantic Segmentation image sets to provide feedback on pc model	11/2	2
	Begin working on Blink Algorithm testing	11/3	3