

## EE/CprE/SE 491

# HAML: Heterogeneous and Accelerated Computing for Machine Learning

## Week 12 Report

4/9/24 - 4/15/24

Faculty Advisor : Phillip Jones

Client : JR Spidell

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### Team Members:

Jonathan Tan	- DPU Management, Kria Board Manager
Josh Czarniak	- Pupil Center Location Algorithm
Justin Wenzel	- Blink/No-Blink Algorithm, Meeting Leader of the Week
Kai Heng Gan	- OpenCV
Santiago Campoverde	- Data Profile/Model Analytics

### Summary for Progress This Week

This week's objectives were to finish the "4-week plan", by fully implementing the preprocessing, eye tracking model, blink model, and profiling into a single-threaded program. Due to unforeseen difficulties in rebuilding the Petalinux kernel, profiling was not able to be implemented. The group has agreed to extend the "4-week plan" by one week. New deadline is 4/20/2024 during client meeting.

The group plans to use the extra week to refine everyone's parts and implement profiling in the system. Throughout the final week the group was able to narrow down potential issues with profiling and has outlined a plan to rebuild our Petalinux kernel for the Kria board to include necessary dependencies for Vitis AI Profiler.

### This Week's Individual Contributions

- Justin
  - Recompiled xmodel of blink model, using Vitis AI.
    - Documented process for group in case recompiling is needed again.
  - Implemented and tested blink model on the Kria board.
    - Current issues exist with accuracy.
    - Current issues exist with preprocessing data before being input to the model.
    - Addressed issues with group for advice.
  - Started memory isolation techniques presentation to share with client and team members.
- Jonathan
  - Work with Justin to implement the blink model on the board.
  - Attempt to rebuild Petalinux Kernel with required profiling dependencies.
- Josh
  - Met with the team to implement code into the board
  - Finished pupil tracking code for the 4-week plan now including the xmodel.

- Kai
  - Modified the image segmentation code
    - Able to convert 4 channel segmented images to 1 channel segmented images.
  - Tried to code a C++ program for preprocessing to integrate to the Kria board.
- Santiago
  - Got Vaitrace tools set up on the board
  - Determined necessary steps to fully set up all profiling functionality
  - (On-going) Set up necessary profiling tools on the board

Team Member	This Week's Task	Completion Date	Hours Took	This Week's Hours	Total Project Hours
Justin Wenzel	Attended meetings	NA	3	15	83
	Recompiled xmodel for blink inference, using Vitis AI. Document process for group incase recompiling is needed again.	4/8	3		
	Implemented and tested blink model against different inputs.	4/8	7		
	Started memory isolation techniques presentation.	4/11	2		
Jonathan Tan	Attended meetings	NA	3	16	84
	Workday (to rebuild Petalinux)	4/13	4		
	Petalinux kernel rebuilt attempt	4/13	9		
Josh Czarniak	Attended meetings	NA	3	8	71
	Met with group to test blink model on the board	4/13	3		
	Finished the pupil tracking code separate from main	4/11	2		
Kai Heng Gan	Attended meetings	NA	3	14	90.5
	Modified the image segmentation code (Able to convert 4 channel segmented images to 1 channel segmented images)	4/13	8		
	Tried to code a C++ program for preprocessing to integrate to the Kria board.	4/20	3		
Santiago Campoverde	Attended meetings	NA	3	7	56
	Got Vaitrace tools set up on the board	4/6	2		

	Determined necessary steps to fully set up all profiling functionality	4/6	2		
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Note: 1. This is per week hours,  $\Sigma$  "hours taken" = "week hours". 2. Due to multiple meeting times, meetings' "completion date" are "NA".

## Plans for Coming Week

Team Member	Plans for Coming Week	Planned Completion	Planned Hours Required
Justin Wenzel	Compile new blink model provided by client to test the difference in accuracy between the current model and new model provided.	4/18	2
	Re-implement blink inference program to perform different preprocessing steps for the model to address potential accuracy issues, and document results.	4/18	7
	Finish presentation to share different memory isolation techniques the group could use to isolate memory for threads and data on the Kria board.	4/19	2
	Start looking into setting up "ground truth" to test model accuracy. Also compare model results of blink with xmodel and .pb model.	4/20	4
Jonathan Tan	Modify main some values in program to be not hardcoded.	4/20	2
	Assist Santi with working with Petalinux.	4/20	9
	Split test video into test frames, run inference, and compare model prediction vs ground truth.	4/20	3
Josh Czarniak	Work on changing code input from being hard coded	4/19	3
	Make a bounce diagram for the pupil tracking algo	4/17	2
	Testing ground truth to test accuracy of eye tracking code.	4/18	5
Kai Heng Gan	Code a C++ program for preprocessing to integrate to the Kria board.	4/20	10
	Create a slide deck of image segmentation	4/16	4
	Research and learn on PetaLinux	N/A	5
Santiago Campoverde	Adding or setting up XRT on the board	4/12	2
	Running Vitis Analyzer with xclbin.ex.run_summary	4/12	1
	Measure latency of softmax function	4/13	1