EE/CprE/SE 492 BI-WEEKLY REPORT 3

Video Pipeline for Machine Computer Vision

2/11/25 – 2/24/25
Group number: sdmay25-01
Advisors: Dr. Zambreno and Dr. Jones
Client: JR Spidell

Team Members:

Lindsey Wessel — *ML Face & Eye Detection*
James Minardi — *Hardware*
Eli Ripperda — *Embedded Systems*
Mason Inman — *Semantic Segmentation Optimization*

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Bi-Weekly Summary:

The team spent the last two weeks preparing for integration. Lindsey and Mason got running copies of their algorithms and shared them with the group. Eli and James ran a demo model on the board and have been working to compile custom models using Tensil. The team also discussed a scope change with the addition of a ComS team and a CprE team. The team plans to work alongside with the ComS team, and plans to begin the project handoff for the CprE team. The handoff will be conducted throughout the semester as we incrementally mentor the CprE team in regards to our current project status.

Past Week Accomplishments

- Lindsey's Accomplishments
  - Continued tracking how algorithm parameters affect speed & accuracy.
  - Got the algorithm ready to be compiled and run on the Ultra96. It now accepts one image, rather than a video, and returns the coordinates of the eye, rather than drawing on it and displaying it.
- James' Accomplishments
  - Successfully ran previous team's demo with display port output
  - Met with current COM S team to explain our progress and give our extra hardware to.
  - Continued work on debugging tensil compilation with Eli
- Eli's Accomplishments
  - Worked with James to successfully:
    - "Patch" PyNQ Contiguous Memory Allocation (CMA) – by increasing the CMA.
    - Got Ultra96v2 ResNet (Residual Network) "demo" running on our FPGA.
  - When attempting to compile custom .onnx file, I overcame the missing key exception by editing the model output name in the command.
  - Invested a handful of hours attempting to reconfigure my environment to allow more memory to the process. This has not been successful.
  - Met with ComS team to help orientate them.
  - Researched Tensil, its founders, its GitHub, and support history.
- Mason's Accomplishments
  - Got an initial QAT demo model working with epoch 10. It contains DSC and custom fusion methods quantized into int8 format.
  - Collaborated with the team to research ONNX formats and versioning that is compatible with Tensil.AI.
  - Coordinated with a client to talk to a new incoming team of his.
  - The client requested a demo model.

- Team Accomplishments
  - Held first instructor review meeting.
  - Communicating with other client SR Design teams.

Pending Issues

- Lindsey's Issues
  - Midterms projects and exams are coming up, and I will spend all of next weekend running a basketball tournament. This may impact the amount of time I can put towards the project.
- James' Issues
  - Compiling custom model with tensil
  - Docker isn't available on lab computers for getting tensil compiler running
  - Unknowns regarding tensil compiler compatibility with our model
- Eli's Issues
  - Challenges compiling the .onnx file:
    - Now, I am getting a "java.lang.OutOfMemoryError: Java heap space"
- Mason's Issues
  - An unknown/potential blocker is Tensil.AI may need fp16 format.
- Team Issues
  - PynQ is not consistently running as expected on Ultra96.

Individual Contributions

Name	Cumulative Hours	Hours Worked Since Feb. 11th
Lindsey	151	12
James	118	18
Eli	124	16
Mason	156	16
Team	549	62

Forward Plan

- Lindsey's Plan
  - Continue testing the algorithm and making improvements.
  - Find a diverse group of people to test algorithm on (ensure no bias or gaps)
- James' Plan
  - Help debug tensil compilation with Mason and Eli
  - Bring Lindsey up to speed on hardware
- Eli's Plan

- Continue researching and implementing solutions for "java.lang.OutOfMemoryError: Java heap space."

- Mason's Plan
  - Provide the team with updated ONNX files.
  - Implement Up-Block Fusion methods
  - Continue to coordinate with client to knowledge-share with other teams
- Team Plan
  - Reschedule instructor meeting due to illness.

Advisor Meeting Notes

We held our scheduled bi-weekly meeting with Dr. Zambreno. The main highlight of this meeting was the discussion of a new Iowa State Computer Science Senior Design Team working with our client. Since our client wanted to "merge" the teams we wanted to discuss options to minimize project scope overlap between the teams. Ultimately, they will be using the same hardware, but working on different software for the client.

Client Meeting Notes - 2/11/2025 & 2/18/2025

Regarding our client meeting on February 11th, 2025, our team provided updates, our client listened, gave guidance, and shared the options he gave the ComS team.

During our client meeting on February 18th, 2025, we updated our client on our status, and he provided several questions for us to explore regarding our research areas. Specifically, he wanted to know how Quantization Aware Training increased accuracy and performance over other methods, and how the hardware dataflow works when Tensil is successfully integrated. We are working to solidify our understanding of these topics to discuss during our next client meeting. Our client wants to see more of our team's documentation.