EE/CprE/SE 492 BI-WEEKLY REPORT 4

Video Pipeline for Machine Computer Vision

2/24/25 - 3/10/25
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 ran into a few roadblocks the past two weeks: arising Tensil issues and a lack of support from the development team, issues integrating the algorithm and U96 board, and an exam paced week. Continuing forward the team plans on trying to reach out to the Tensil development team for help getting the semantic segmentation algorithm compiled on the U96 board. Additionally, the team will continue debugging and testing out libraries to get the eye detection algorithm compiled on the board.

Past Week Accomplishments

- Lindsey's Accomplishments
  - Started working on getting the algorithm running on the U96 board.
- James' Accomplishments
  - Set up Tensil and Pytorch environment to test compiling models using tensil.
  - Help bring Eli up to speed on board
  - Help research alternatives to Tensil
- Eli's Accomplishments
  - Learned more about Tensil's supported operations.
  - Attempted to debug compilation errors that Tensil.
  - Communicated with one of Tensil's founder's about Tensil's website domain expiring – Tensil has no plan to get it back up and running.
  - Learned how to set up the FPGA board and connect desktop computer to PyNQ on the board.
  - Learned some base knowledge about Vitis AI (including VART) toolchain to compile and run our U-Net model.
  - Drove conversation to determine who (on our team) does what next.
- Mason's Accomplishments
  - Coordinated and had a knowledge transfer/handoff meeting with the new ISU team.
  - Researched alternatives to Tensil.ai after the domain was not renewed and the documentation site went down.
  - Generated an XModel file (an alternative to ONNX) that we can possibly use Vitis AI Runtime (VART) to run the model on the Ultra96v2.
- Team Accomplishments
  - Held several meetings (client, advisor, team, and handoff meetings)
  - Quickly highlighted issues with Tensil.AI when discovered.

Pending Issues

- Lindsey's Issues
  - Had a week full of midterm projects and exams, and a weekend spent running a basketball tournament. This impacted the amount of time I 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
  - Tensil is no longer supported – it will no longer be developed moving forward, and it does not support the "operations" that our U-Net model needs it to support.
- Mason's Issues
  - Forward plan may shift due to integration issues, it is unknown at this point in time.
- Team Issues
  - Tensil.AI documentation domain did not renew. After contacting the creator of Tensil.AI we have been notified it will not be coming back up. Additionally, the board and the eye detection algorithm do not like using the same libraries, and have many small bugs due to software differences.

Individual Contributions

Name	Cumulative Hours	Hours Worked Since Feb. 25th
Lindsey	166	15
James	136	13
Eli	140	10
Mason	172	15
Team	614	53

Forward Plan

- Lindsey's Plan
  - Work on getting the algorithm properly running on the board
  - Beguin testing the algorithm & making improvements
- James' Plan
  - Support Eli & Lindsey with ROI on board
  - Work with Mason to run model in SW on board
  - Continue exploring alternatives
- Eli's Plan
  - Research Vitis AI, VART, and the compatible PYNQ operating system .
  - Verify the data on an SD card is backed up
  - Import VART to one of the Ultra 96 FPGAs.

        - Begin playing with it: see what it does, what it needs, and how it likes our environment.
    - ➢ Research the next steps to compile and run our currently trained U-Net model.
- ❖ Mason's Plan
    - ➢ Work in parallel on exploring new options to integrate while the front-end of the pipeline is integrated and run on the board.
- ❖ Team Plan
    - ➢ Continue working on integrating all of our individual work

Advisor Meeting Notes

We held our scheduled bi-weekly meeting with Dr. Zambreno as scheduled. This meeting happened after we discovered the Tensil.AI documentation went down and we shared our, and our client's, thoughts about next steps. Ultimately, we all shared a similar opinion in focusing on running the ROI algorithm on the board first before focusing on a possible software solution to running the model. We additionally discussed modifying the core U-NET framework backing the model to be compatible with Tensil.AI, however there are many concerns discussed: the core functionality is likely to change if we removed unsupported operations and possibly losing time if we continue looking into a non-functional Tensil.AI framework.

Client Meeting Notes - 2/25/2025 & 3/4/2025

Regarding our client meeting on February 25th, Mason gave the fusion presentation to the team and client. Our client asked a lot of questions about fusion and specific roadblocks to our project. We shared our knowledge with our client in as good detail as we could. Our client recommended a change in our workflow to more strategically accomplish our goals.

For our meeting on March 4th, our client shared with us that the Computer Science team dropped him as a client; therefore, we should dedicate a large majority of our focus to our deliverables. We updated our client on the state of Tensil – that it is no longer supported and will not fulfill our needs. Our team then drove the conversation with our client on the next steps, ensuring that each party receives value added from our next steps.