EE/CprE/SE 492 BI-WEEKLY REPORT 2

Video Pipeline for Machine Computer Vision

1/28/25 – 2/10/25
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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This week, the team made progress on refining our algorithms, setting up hardware, and generating a bitstream for the Ultra96v2 board. At this point, the team has solidified recurring meetings, updated our advisors, and began ramping up a new ISU team under our client.

Past Week Accomplishments

- ❖ Lindsey's Accomplishments
  - ➢ Continued tracking how algorithm parameters affect speed & accuracy.
  - ➢ Researched and tested how the algorithm responds to low resolution images.
    - RESULTS:
      - ■ The algorithm works as expected till the image gets extremely grainy (beyond a point the human eye can detect the ROI), then lacks the ability to find the ROI, good news.
      - ■ As resolution decreases so does the range that the human can be from the camera, as expected since the image holds less data.
- ❖ James' Accomplishments
  - ➢ Set up hardware to test and run previous team's demo. Running into some issues, but capture of frames from the IMX219 camera is successful.
  - ➢ Worked with Eli to generate a bitstream for the Ultra96v2 ResNet tensil example project which will be used as a base for our design.
- ❖ Eli's Accomplishments
  - ➢ Generated RTL files for Ultra96v2 ResNetProject
  - ➢ Determined that all files needed for our project to be synthesized are ready to be synthesized.
  - ➢ Worked with James to generate bitstream for the ResNet example project. We anticipate that this base bitstream will be used for our project.
- ❖ Mason's Accomplishments
  - ➢ Worked on and researched model fusion for QAT compatibility.
  - ➢ Added pre-calibration before entering the training loop.
- ❖ Team Accomplishments
  - ➢ Set up our recurring meeting times.

Pending Issues

- ❖ Lindsey's Issues
  - ➢ Got the flu and was unable to work for an entire week. Slightly behind in all my classes including this. It will take some time for me to make that week up.
- ❖ James' Issues

- There are still unknowns with using the Ultra96v2's displayport output, particularly with the old team's demo. Frames are being captured but aren't being displayed. Will test a simpler example program to determine where the issue is.
- ❖ Eli's Issues
  - Challenges compiling the .onnx file
  - PyNQ is not consistently running on our hardware. This prevents us from consistently being able to connect the desktop in lab to the Ultra96 via PuTTY.
- ❖ Mason's Issues
  - Debugging QAT is time consuming. Current issue is incompatible parameter types within function calls once the model is fused. More triage needs to be completed to verify what is wrong.
  - Scope creep is growing as many helper scripts in the repository need to be modified for QAT compatibility.
- ❖ Team Issues
  - PynQ is not consistently running as expected on Ultra96.

Individual Contributions

Name	Cumulative Hours	Hours Worked Since Jan 27th
Lindsey	139	10
James	100	5
Eli	112	12
Mason	140	24
Team	491	51

Forward Plan

- ❖ Lindsey's Plan
  - Continue testing the algorithm and making improvements.
  - See if switching from Python to C or C++ will result be less expensive (computation and storage)
  - Find a diverse group of people to test algorithm on (ensure no bias or gaps)
- ❖ James' Plan
  - Debug the displayport output in order to run the previous team's demo.
  - Meet with ComS team under the same client.
  - Continue work on the Ultra96 Resnet tensil project with Eli.
- ❖ Eli's Plan

- ➢ Meet with ComS team to orientate them to our project, hardware, other technology, and goals.
- ➢ Continue attempting to compile .onnx file that Mason has generated
- ➢ Work with James to patch PyNQ overlay on the Ultra96 & "download" the ResNet bitstream, and other needed files onto the FPGA to run the Res Net project.
  - ■ Troubleshoot and debug the system. I expect problems.
- ➢ Maybe begin understanding ResNet example project's data and doing something with it.
- ❖ Mason's Plan
  - ➢ Update/Create a deploy script that will convert the new .pth files into ONNX format.
- ❖ Team Plan
  - ➢ Reschedule instructor meeting due to illness.

Advisor Meeting Notes

We met with our advisor to give updates, receive encouragement, and a bit of technical guidance on our project moving forward. Dr. Zambreno shared that based on our CATME evaluations that we, as a team, are functioning well together. He continues to share and believe our project holds sufficient technical components. The meeting closed with a short discussion on Tensil.AI and various issues that we wanted Dr. Zambreno's help with.

Client Meeting Notes - 2/4/2025

The team provided updates to the client in their respective areas of focus. The client had minimal questions on progress. The client has a new ISU team in the CS department's capstone. He suggested they could work with our team to help with interfacing the video feed in our system. This may ease workload as we become more involved in the FPGA development, but the team will consult with our advisors about this.