EE/CprE/SE 491 WEEKLY REPORT 06

Video Pipeline for Machine Computer Vision

10/17/24 – 10/24/24
Group number: sdmay25-01
Advisors: Dr. Jones and Dr. Zambreno
Client: JR Spidell

Team Members:

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

Table of Contents:

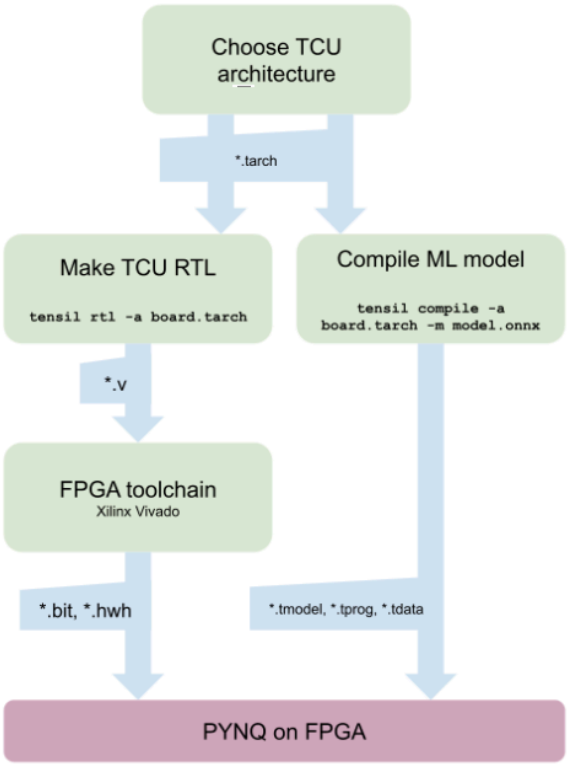
Team Members: 1
Table of Contents: 1
Weekly Summary: 2
Past Week Accomplishments 2
Pending Issues 4
Individual Contributions 4
Forward Plan 4
Advisor Meeting Notes 5
Client Meeting Notes - 10/20 5

Weekly Summary:

This week, our team worked on research, system design, and integrating a few tools. We continued exploring various eye detection algorithms, worked on improving remote access to the FPGA board, and experimented with tools like Tensil's model compiler. We also set up performance tools to better understand the model we are using. The NDA required for our project is now completed and signed, allowing us to work more closely with the existing teams and explore their code base.

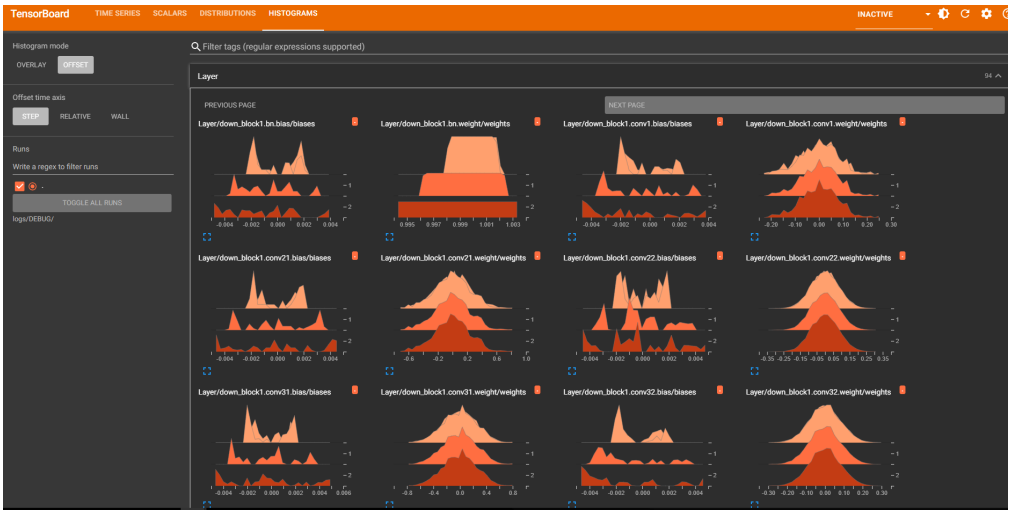
Past Week Accomplishments

- Lindsey's Accomplishments
  - Researched new eye detection algorithms to look into
    - Adaptive Eigen Eye (principal components), Histogram of oriented gradients with vector machine support, Dilb's Facial Landmark Detector, YOLO, Active Shape & Appearance Models, Bright Eye Dark Eye Model
  - Created a notes slide to show team benefits and downsides of each algorithm
- James' Accomplishments
  - Met with V Pipe team and discussed their progress and answered questions about their camera sensor.
  - Accessed pynq console via putty
  - Working on remote access w/ Tera Term 5
- Eli's Accomplishments
  - Met with VPIPE team to better understand their progress, metrics, and current challenges.
  - Researched Tensil, began an experiment (following steps documented on Tensil's website), and delivered a presentation on it. Note that the experiment includes implementing a convolutional neural network ML model on an Ultra96 FPGA Dev board with PYNQ – the same as out system!
  - Conducted some research on integrating Tensil into our project environment. The model below:



- ➢
- ➢ Read and approved NDA.

❖ Mason's Accomplishments

- ➢ In efforts of gathering a deeper understanding of the model based on several of current goals, I set up a TensorBoard gathering and displaying several statistics about the model. This will serve as a tool for understanding the model and provide great visuals to provide in future presentations.
- ■ 

- ➢ Read and approve the NDA.

❖ Team Accomplishments

- ➢ Worked as a team and with the client to build a high-level system diagram.

Pending Issues

- Lindsey's Issues
  - Tired.
- James' Issues
  - Some challenges with full remote access to board, but otherwise no issues.
- Eli's Issues
  - I am having challenges running Tensil in a containerized environment (via Docker) on my local laptop.
- Mason's Issues
  - No issues.
- Team Issues
  - No issues.

Individual Contributions

Name	Cumulative Hours	Week 4
Lindsey	70	8
James	60	8
Eli	60	8
Mason	68	8
Team	258	32

Forward Plan

- Lindsey's Plan
  - Dig into new location algorithms and compare them to each other to find the most relevant algorithm to our project.
- James' Plan
  - Finish up being able to remote access the board. Continue figuring out communication to the FPGA
- Eli's Plan
  - Try to run Tensil on a Linux OS.
  - Make progress on the experiment I mentioned above.
  - Keep learning about Tensil, how to work it, and how different pieces of our solution come together – and document it all.
- Mason's Plan
  - Learn and understand the Dropout and LeakyReLU layers in the Densenet model

- Improve the TensorBoard to display inner-layer statistics such as image size and number of parameters going through convolutions.

- Team Plan
  - Continue research and design based on each team member's responsibilities in the system.
  - Sign the NDA and get the Advisors to sign as well with their approval.

Advisor Meeting Notes

In lieu of another meeting, the advisors and team members read through the NDA provided by the client individually during that scheduled time. In the teams thread, everyone posted their approvals and any changes requested for the NDA. Once everyone approves, everyone will sign and return the signed NDA to the client.

Client Meeting Notes - 10/20

The meeting focused on team updates to the client and a presentation on Tensil.ai about its model compiler for custom accelerator architectures. The client sent SDMay25-01 an NDA that he developed – for the team to review and sign. Key deliverables moving forward include analyzing the NDA, signing the NDA, running ResNet on Ultra96, and providing the client with the ResNet Verilog code if open-source.
Meeting discussions covered drivers in kernel space, the use of ONNX files as input into Tensil ML model compiler, and generating a .tarch file, (which describes ML model parameters).