

Exploring the GPU

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About

GPUs are powerful specialized processors within our computers, unique in its ability for parallel processing, matrix/vector multiplication, and floating point math. However, GPUs are fairly elusive in their actual implementation; unlike CPUs, GPU designs are heavily closed-sourced and are not taught in foundational computer architecture courses.

The goal of this project is three parts. First, we want to understand fundamental GPU architecture and functionality. Second, we want to understand MIAOW, an open-source implementation of a GPU, which follows the instruction set architecture of AMD's Southern Islands GPU. There are several complex parts to this architecture, and through this project it is our goal to understand the purpose of each component and the architecture as a whole. Finally, we want to learn how to write highly-parallelizable programs that can run on the GPU.

Deliverables

Minimum

- A moderate understanding of fundamental GPU architecture, what each part/step does, and demonstrate it on a poster.
- A moderate level understanding of the MIAOW architecture, demonstrated through a poster.

Planned (including above)

- A simple written program that can be run on a GPU.

Stretch (including above)

- A strong understanding of MIAOW and GPUs in general, and the specific decisions made in MIAOW

- A more complex program that takes advantage of a GPU's high parallelizable nature. Likely with multiple examples and scenarios.

Work Plan

- [12/2] Understand the fundamentals of a GPU
- [12/3] Understand MIAOW basics
- [12/4] Create program plan
- [12/5] Midpoint check-in
- [12/9] Program plan check-in
- [12/10] Prep poster material
- [12/12] Poster review & Code complete
- [12/15] Submit project

References

- MIAOW: <https://github.com/VerticalResearchGroup/miaow>
- OpenCL: <https://www.khronos.org/opencl/>