

Anthony Cabrera

HETEROGENEOUS COMPUTING RESEARCH SCIENTIST

✉ cabreraam AT ornl DOT gov | 🏠 cabreraam.github.io

Summary

Experienced heterogeneous computing researcher and lifelong learner with a penchant for exploring questions around the hardware-software interface. Adept at quickly learning skills, languages, or tools necessary to answer research questions. Strives to communicate complex ideas effectively and accessibly. Previously held DoD-Secret clearance.

Research and Work Experience

Architectures and Performance Group @ Oak Ridge National Laboratory

Oak Ridge, TN (Remote from STL)

RESEARCH SCIENTIST
SOFTWARE ENGINEER

Jan 2021 - Present

Aug 2020 - December 2021

- Developing an LLVM front-end for Fortran
- Leading a multi-institution performance and portability evaluation comparing Intel and Xilinx FPGA OpenCL kernels
- Developing Hexagon DSP kernels for the Qualcomm Snapdragon chip, as part of DARPA's DSSoC project
- Exploring GPU-FPGA collaboration on HPC mini applications as part of the DoE Exascale Compute Project

Stream Based Supercomputing Laboratory @ Washington University in St. Louis

St. Louis, MO

GRADUATE RESEARCH ASSISTANT

July 2016 - July 2020

- Thesis: Domain Specific Computing in Tightly Coupled Heterogeneous Systems
- Evaluated the Intel HARPv2 CPU+FPGA platform as a domain specific compute solution
- Created a benchmark suite of data integration applications (DIBS) to identify opportunities for hardware acceleration
- Ported Needleman-Wunsch OpenCL Kernels to the Intel HARPv2 CPU+FPGA platform to analyze kernel design, performance, and portability
- Architected and optimized hardware for DIBS applications using OpenCL targeting the Intel HARPv2

The MITRE Corporation

Shiloh, IL

GRADUATE PROTOTYPING AND SOFTWARE ENGINEER

May 2019 - August 2019

- Created a neural network to detect cars from wireless iPhone camera stream targeting the NVIDIA Jetson Nano
- Deployed containers on GPU-enabled HPC resources to train convolutional neural networks
- Mentored undergraduate intern project on hyperparameter performance analysis
- Maintained GitLab repository to document work and enable continued development of project
- Selected as one of four interns across all of MITRE's sites to deliver company-wide presentation on project

Arm Holdings

Austin, TX

GRADUATE RESEARCH INTERN

May. 2018 - Aug. 2018

- Quantified spatial and temporal locality by creating a novel technique based on reuse distance
- Developed dynamic binary instrumentation clients to profile memory subsystem characteristics
- Identified strategies around data layout transformations and paging to improve memory subsystem performance

Advanced Sensors Research Laboratory @ Washington University in St. Louis

St. Louis, MO

UNDERGRADUATE AND GRADUATE RESEARCH ASSISTANT

May 2014 - July 2016

- Developed the software/UI for filter alignment of NIR fluorescence imagers
- Assisted medical researchers with NIR fluorescence and polarization imaging studies
- Aided in the design and fabrication of a custom PCB around an ultra low-noise imaging sensor

Education

Washington University in St. Louis

St. Louis, MO

PHD COMPUTER ENGINEERING

August 2020

MS COMPUTER SCIENCE

August 2018

BS COMPUTER ENGINEERING, SECOND MAJOR COMPUTER SCIENCE

May 2015

BSAS ELECTRICAL ENGINEERING

Peer Reviewed Publications

1. AR Young, **AM Cabrera**, JS Vetter, "Design and Analysis of CXL Performance Models for Tightly-Coupled Heterogeneous Computing", *In Review*.
2. NR Miniskar, AR Young, FY Liu, **AM Cabrera**, JS Vetter, "Efficient FPGA Design Environment for Extremely Low Latency Scientific Machine Learning Applications", *In Review*.
3. CJ Faber, T Plano, S Kodali, Z Xiao, A Dwaraki, JD Buhler, RD Chamberlain, **AM Cabrera**, "Platform Agnostic Streaming Data Application Performance Models", (to appear) *ACM/IEEE Redefining Scalability for Diversely Heterogeneous Architectures (RSDHA '21 @ SC '21)*.
4. Zhili Xiao, RD Chamberlain, **AM Cabrera**. "HLS Portability from Intel to Xilinx: A Case Study", *IEEE High Performance Extreme Computing Conference (HPEC '21)*. [[Paper](#)] [[Slides](#)]
5. **AM Cabrera**, S Hitefield, J Kim, S Lee, NR Miniskar, JS Vetter, "Toward Performance Portable Programming for Heterogeneous System-on-Chips: Case Study with Qualcomm Snapdragon SoC", *IEEE High Performance Extreme Computing Conference (HPEC '21)*. [[Paper](#)] [[Slides](#)]
6. **AM Cabrera**, AR Young, J Lambert, Z Xiao, A An, S Lee, Z Jin, J Kim, J Buhler, RD Chamberlain, JS Vetter, "Toward Evaluating High-Level Synthesis Portability and Performance between Intel and Xilinx FPGAs", *ACM International Workshop on OpenCL (IWOCL '21)*. [[Paper](#)] [[Slides](#)] [[Video](#)]
7. **AM Cabrera**, RD Chamberlain, "Design and Performance Evaluation of Optimizations for OpenCL FPGA Kernels", *IEEE High Performance Extreme Computing Conference (HPEC '20)*. [[Paper](#)] [[Slides](#)]
8. **AM Cabrera**, RD Chamberlain, "Designing Domain Specific Computing Systems", *IEEE International Symposium on Field-Programmable Custom Computing Machines (FCCM '20)*. [[Paper](#)] [[Slides](#)] [[Video](#)]
9. **AM Cabrera**, RD Chamberlain, JC Beard, "Multi-spectral Reuse Distance: Divining Spatial Information from Temporal Data", *IEEE High Performance Extreme Computing Conference (HPEC '19)*. [[Paper](#)] [[Slides](#)]
10. **AM Cabrera**, RD Chamberlain, "Exploring Portability and Performance of OpenCL FPGA Kernels on Intel HARPv2", *ACM International Workshop on OpenCL (IWOCL '19)* **Best Presentation Award**. [[Paper](#)] [[Slides](#)]
11. CJ Faber, **AM Cabrera**, O Booker, G Maayan, RD Chamberlain, "Data Integration Tasks on Heterogeneous Systems Using OpenCL", *ACM International Workshop on OpenCL (IWOCL '19)*. [[Paper](#)]
12. **AM Cabrera**, CJ Faber, K Cepeda, R Derber, C Epstein, J Zheng, RK Cytron, RD Chamberlain, "DIBS: A Data Integration Benchmark Suite", *ACM/SPEC International Conference on Performance Engineering (ICPE '18)*. [[Paper](#)] [[Slides](#)]

PhD Dissertation

Domain Specific Computing in Tightly-Coupled Heterogeneous Systems [[Text](#)] [[Slides](#)]

Honors and Awards

2020	SC20 Early Career Program , Supercomputing 2020	Atlanta, GA
2020	Honors Designation for PhD Progress Review (Top 15-20% of students) , CSE Department @ WUSTL	St. Louis, MO
2020	Engineering PhD Student Commencement Marshal , WUSTL	St. Louis, MO
2019	Best Presentation Award , International Workshop on OpenCL	Boston, MA
2019	Graduate Student Ambassador , Intel Corporation	St. Louis, MO
2019	Travel Grant , Supercomputing 2019	Denver, CO
2018	Travel Grant , Supercomputing 2018	Dallas, TX
2017	Travel Grant , Supercomputing 2017	Denver, CO
2015	Graduate Danforth Scholar , WUSTL	St. Louis, MO
2013	Harold P. Brown Engineering Fellowship , McKelvey School of Engineering @ WUSTL	St. Louis, MO
2013	Hendrix College Chamber Orchestra Award , Hendrix College	Conway, AR
2012	Transamerica Employer Solution & Pension Scholarship Award , Transamerica Corporation	Little Rock, AR
2011	Hendrix College Chamber Orchestra Award , Hendrix College	Conway, AR

Teaching Experience

FL17, FL18 **WUSTL CSE 560M Computer Systems Architecture I**, Graduate Teaching Assistant *St. Louis, MO*
SU18 **WUSTL CSE 566S High Performance Computing**, Graduate Teaching Assistant
SP16 **WUSTL CSE {4,5}63M Digital Integrated Circuit Design and Architecture**, Graduate Teaching Assistant
FL14, SP15 **WUSTL CSE 200 Scientific Computing**, Undergraduate Teaching Assistant

Press

2021 **SCTV Interview**, [SC21 Inclusion and Diversity with AJ Lauer and Anthony Cabrera](#) *St. Louis*
2021 **SCTV Interview**, [Promoting the SCALE students program at SC](#) *Virtual*

Professional Service

2021 **SC21 Inclusivity Committee**, Supercomputing 2021 *St. Louis, MO*
2021 **Program Committee**, International Workshop on OpenCL and SYCLcon *Remote*
2019 **Lead Student Volunteer: Communications Committee Press Liaison**, Supercomputing 2019 *Denver, CO*
2019 **Student Volunteer**, Supercomputing 2018 *Dallas, TX*
2017 **Student Volunteer**, Supercomputing 2017 *Denver, CO*

Skills

Languages Bash, C, C++, CMake, Python
Frameworks CMake, DynamoRIO, Git, Intel HLS, OpenCL, Xilinx HLS