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William Killian

Education

2011–2017 (est) Ph.D. Computer Science, *University of Delaware*, Newark, DE.
Graph-based Program Characterization Applied to Application Performance and Portability

2011–2013 M.S. Computer Science, *University of Delaware*, Newark, DE.

2007–2011 B.S. Computer Science, *Millersville University of Pennsylvania*, Millersville, PA.

Experience

2012– Research Assistant, *University of Delaware*, Newark, DE.
Researcher in John Cavazos' lab with a focus on employing machine learning to improve compilers.

- Combining high- and low-level graph-based program features targeting performance prediction
- Graph-based program characterization applied to malware classification
- Performance improvement in vectorizable kernels by guiding internal compiler heuristics
- Autotuning polyhedral kernels for energy
- Accelerating and autotuning of financial applications on the GPU

2016 Graduate Student Intern, *Lawrence Livermore National Laboratory*, Livermore, CA.
Developing speedup prediction models targeting various architectures for high-dimensional codes

- Optimize implementations of the Kripke application with RAJA.
- Develop performance prediction models that leverage graph-based program characterization
- Create multi-architecture models for performance prediction of KRIPKE.

2015 Graduate Student Intern, *Lawrence Livermore National Laboratory*, Livermore, CA.
Exploiting heterogeneous massively parallel architectures for large-scale physics simulation

- Optimize implementations of select physics loops.
- Performance evaluation of physics loops running on heterogeneous architectures.
- Investigation and evaluation of strategies and programming models for exascale computing.

2013 MIC Software Performance/Validation Intern, *Intel Corporation*, Hillsboro, OR.
Competitive analysis of applications and micro-architectures

- Competitively analyzed applications from the CORAL benchmark suite
- Understand the underlying mapping of applications to different parallel microarchitectures
- Develop scripts that automate collecting meaningful metrics to simplify competitive analysis

2010–2011 Software Engineer, *Digital Indigo Technologies*, Lancaster, PA.
Helped design and develop an ocular microsurgical simulator

- Develop a generic simulator that will be expandable to several types of surgical procedures
- Design a proprietary suturing algorithm that will work with soft-bodied objects
- Write firmware for custom-built hardware (HID-compatible devices)
- Construct interfaces between custom-built hardware and the software

2009, 2010 Guest Researcher, *NIST–Gaithersburg*, Gaithersburg, MD.
Summer guest researcher during 2009 and 2010 as part of the SURF program

- A Real-time Face Identification System for the NIST SmartSpace Project
- Digital Data Preservation and Metadata-Based Archival System Development

2008–2009 Student Researcher, *Millersville University of Pennsylvania*, Millersville, PA.
Undergraduate researcher for Gary Zoppetti working on various research projects

- Building a Beowulf Cluster and Investigating Parallel Programming
- Extending Microsoft's XNA with Physics, Animation, and Sound
- Efficient Rendering of Binary Space Partitioned Maps

Teaching

2015–2016 Instructor, *University of Delaware*, Newark, DE.
Develop curriculum, labs, and lectures; deliver lectures; hold office hours for students.

- Spring 2016: CISC 360 – Computer Architecture ($n = 42, \bar{x} = 4.51, \sigma = 0.98$)
- Spring 2015: CISC 360 – Computer Architecture ($n = 28, \bar{x} = 4.70, \sigma = 0.54$)

2012–2017 Teaching Assistant, *University of Delaware*, Newark, DE.
Grade labs and assignments; hold office hours for students.
Create labs and additional learning material and resources for CISC 372.

- Spring 2017: CISC 372 – Parallel Computing (J. Atlas)
- Summer 2014: CISC 181 – Introduction to Computer Science II (K. Sabhnani)
- Fall 2012: CISC 260 – Machine Organization and Assembly Language (L. Liao)
- Fall 2012: CISC 367 – Secure Software Design (J. Six)

2009–2011 Computer Science Tutor, *Millersville University*, Millersville, PA.

- Provided both individual and group tutoring to students in the computer science department.
- Courses covered: CSCI 140, CSCI 161, CSCI 162, CSCI 330, CSCI 370, and CSCI 380

2009–2011 Computer Science Lab/Exam Grader, *Millersville University*, Millersville, PA.
Worked with professors to grade labs and exams for undergraduate courses in computer science

- CSCI 161 – Programming I (three semesters) with S. Schwartz and B. Liffick
- CSCI 162 – Programming II (two semesters) with G. Zoppetti

Projects

FinanceBench
`cavazos-lab.github.io/FinanceBench`
Financial benchmarks targeting accelerators

PolyBench/ACC
`cavazos-lab.github.io/PolyBench-ACC`
Polyhedral kernels targeting accelerators

RAJA
`github.com/LLNL/RAJA`
C++ Performance Portability Layer

PolyBench/RAJA
`github.com/willkill07/PolyBench-RAJA`
Polyhedral kernels written in RAJA

Publications

[1] [JOURNAL] A. Ashouri, **W. Killian**, J. Cavazos, G. Palermo, and C. Silvano. "A Survey on Compiler Autotuning using Machine Learning." *ACM Transactions on Computing Survey (CSUR). 2017* **UNDER PEER REVIEW**

[2] [PAPER] R. Searles, L. Xu, **W. Killian**, T. Vanderbruggen, T. Forren, J. Howe, Z. Pearson, C. Shannon, J. Simmons, and J. Cavazos, "Parallelization of Machine Learning Applied to Call Graphs of Binaries for Malware Detection," *25th Euromicro International Conference on Parallel, Distributed, and Network-Based Processing (PDP 2017)*, St. Petersburg, Russia, 2017.

[3] [POSTER] **W. Killian**, A. Kunen, I. Karlin, J. Cavazos, "Discovering Optimal Execution Policies in KRIPKE using RAJA," *ACM Student Poster Competition, 28th International Conference for High Performance Computing, Networking, Storage and Analysis*, Salt Lake City, UT, USA, 2016.

[4] [POSTER] **W. Killian**, G. Zagaris, B. Ryujin, B. Pudliner, J. Cavazos, "Portable Performance of Large-Scale Physics Applications: Toward Targeting Heterogeneous Exascale Architectures Through Application Fitting," *ACM Student Poster Competition, 27th International Conference for High Performance Computing, Networking, Storage and Analysis*, Austin, TX, USA, 2015.

[5] [WHITEPAPER] **W. Killian**, R. Miceli, E. Park, M. Alvarez Vega, J. Cavazos, "Performance Improvement in Kernels by Guiding Compiler Auto-Vectorization Heuristics," *Partnership for Advanced Computing in Europe (PRACE) Performance Prediction*, 2014.

[6] [POSTER] **W. Killian**, W. Wang, E. Park, J. Cavazos, "Energy Tuning of Polyhedral Kernels on Multicore and Many-Core Architectures," at *SEAK: DAC Workshop on Suite of Embedded Applications and Kernels*, SEAK 2014, San Francisco, CA, USA, 2014.

[7] [WORKSHOP] S. Grauer-Gray, **W. Killian**, R. Searles, and J. Cavazos, "Accelerating Financial Applications on the GPU," in *Proceedings of the 6th Workshop on General Purpose Processor Using Graphics Processing Units*, GPGPU-6, (New York, NY, USA), pp. 127–136, ACM, 2013.

Awards and Honors

2017 Invitation to Salishan Conference, *Salishan Conference on High Speed Computing*.
2016 ACM Student Research Competition Travel Grant, *SuperComputing 2016*.
2016 Excellence in Teaching Award, *University of Delaware*.
2015 ACM Student Research Competition Travel Grant, *SuperComputing 2015*.
2011 Second Place PACISE Programming Competition, *Shippensburg University*.
2010 Featured Student for the School of Science and Mathematics, *Millersville University*.
2010 Third Place Mid-Atlantic Regional Collegiate Cyber Defense Competition, *Columbia, MD*.
2009, 2010 Summer Undergraduate Research Fellowship, *NSF and NIST Gaithersburg*.
2009 Upsilon Pi Epsilon Invitation, *Millersville University*.
2007 Brotherhood Member, *Order of the Arrow – Boy Scouts of America*.
2006 Eagle Scout, *Boy Scouts of America*.

Volunteerism and Service

Paper Subreviewer

Varied ICCD 2012, LCTES 2013, PACT 2013, GPGPU7, ACM TACO, ICS 2015, CASES '14, CloudCom 2014, CGO 2015, PLDI 2015, SC '15.

Workshops and Conferences

2017 Student Volunteer Committee Member, *SuperComputing 2017 – Students@SC Program*.
2013–2016 SCinet Volunteer, *SuperComputing 2013 – 2016*.
2016 Oct Mentor, *OLCF GPU Hackathon: OLCFHack*, Knoxville, TN.
2016 May Mentor, *OLCF GPU Hackathon: UDelHack*, Newark, DE.
2014 May Assistant Workshop Organizer, *HIPS 2014*, Phoenix, AZ.
2013 May Workshop Organizer, *Hot Topics in Parallel Computing*, Newark, DE.
2011–2012 Student Volunteer, *SuperComputing 2011 – 2012*.

Other

2015–2016 Presenter, *New CIS Graduate Student Orientation*, University of Delaware.
2015–2016 Graduate Advisor, *Computer Science Mentor Program*, University of Delaware.
2015 Oct Presenter, *UD-ACM Chapter Tech Talk*, University of Delaware.
2015 Mar Panelist, *Women in Engineering: Graduate School Panel for Undergraduates*, University of Delaware.
2014–2015 Panelist, *New Graduate Student Meet-and-Greet*, University of Delaware Computer Science.
2012 Apr Programming Competition Judge, *PACISE 2012*, Millersville, PA.
2007–2011 Assistant Scoutmaster, *Boy Scout Troop 146*, Conestoga, PA.

Computer Skills

Languages C, C++ (expert)
Java (advanced)
C♯, Python (moderate)

Assembly IA32, Intel64, MMX – AVX-512 (advanced)
ARM (moderate)

Parallel OpenMP, OpenACC (expert)
MPI, CUDA (advanced)
OpenCL (moderate)

Libraries, APIs, Tools Build Systems: make, CMake
Graphics: OpenGL, GLSL, glm, freeglut
Other: boost, `git`, LaTeX, bash, CLI