

Christopher Lupo

Curriculum Vitae

Contact Computer Science and Software Engineering Department
California Polytechnic State University
Frank E. Pilling (Building 14), Room 254
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Research Interests

Applied Parallel Computing, Performance Optimization, Computer Architecture

Education

University of California, Davis

Ph.D., Computer Engineering, September 2008

Dissertation: "Precise Register-Allocation Spill-Code Costing and Placement"

Advisor: Prof. Kent Wilken

M.S., Computer Engineering, June 2007

California State University, Fresno

B.S., Electrical Engineering, Magna Cum Laude, May 1997

Academic Experience

2008–Present

California Polytechnic State University, San Luis Obispo

Department Chair

Sept. 2017–

The Computer Science and Software Engineering (CSSE) Department at Cal Poly serves approximately 1300 undergraduate students in three majors; Computer Science, Software Engineering, and Computer Engineering. The department also serves approximately 100 Masters level students. There are 27 tenure-track faculty, 17 lecturers, and six graduate teaching assistants. There are four full-time staff that help support the department.

Associate Professor

2014–

Assistant Professor

2008–2014

Computer Science and Software Engineering Department

Courses Taught

Fundamentals of Computer Science I, CPE 101

Computer Architecture, CPE 315

Systems Programming, CPE 357

Computer Engineering Capstone I, CPE 350

Computer Engineering Capstone II, CPE 450

Applied Parallel Computing, CPE 419 (Formerly CPE 458)

Distributed Systems, CPE 469

Graduate Computer Architecture, CPE 515 (Formerly CPE 520)

Graduate Distributed Systems, CPE 569

Introduction to Computer Organization and Design, CSC 225

Computers and Society, CSC 302

Interdisciplinary Senior Project Design, ENGR 470, 481, 482, 483

Mar. 2017–July 2017

Hochschule München (Munich University of Applied Sciences), Germany

Visiting Instructor

Department of Computer Science and Mathematics

Courses Taught

Computer Architecture (*course taught in English*)

1997–2008 **University of California, Davis**
Associate Instructor positions
 Instructor of record. Responsible for all aspects of instruction. Designed and delivered syllabus, lectures, laboratory assignments, exams, homework, projects and grading. Held office hours, managed teaching assistants and readers, assigned final grades.
Courses Taught
 Computer Architecture, EEC 170
 Digital Systems I, EEC 180A
 Microcomputer-Based System Design, EEC 172
 Computer Structure and Assembly Language, EEC 70
Teaching Assistant positions
 Assisted instructors with design of laboratory and homework assignments, led laboratory sessions, proctored exams, held office hours, assisted with grading.
 Microcomputer-Based System Design, EEC 172
 Parallel Computer Architecture, EEC 171
 Computer Structure and Assembly Language, EEC 70
Teaching Assistant Consultant, 2003–2004
 Teaching Resources Center, UC Davis. Campus wide graduate fellowship position, mentored and consulted with other teaching assistants to help improve teaching effectiveness. Worked with teams to develop and deliver workshops and presentations on teaching topics and engaged in continuing professional development activities.

Research Experience

2015–Present **Massively Parallel Accelerated Computing**
 Lead in developing Cal Poly's Massively Parallel Accelerated Computing (MPAC) laboratory. Cultivating relationships between domain experts and computer science faculty and students to optimize software performance, with specific emphasis on accelerators including NVIDIA GPUs and Intel Xeon systems. Performance engineering research spans full system, from IO protocols and device selection to algorithm design and software engineering.

2010–Present **Applied Parallel Computing**
 Working with students and faculty in a variety of disciplines on HPC applications that benefit from parallel computing. Work includes computational modeling of scientific codes and algorithms to increase performance and/or increase resolution and accuracy.

2010–2013 **Hard Disk Workload Characterization**
 Working with students and faculty in the Computer Science and Electrical Engineering departments at Cal Poly in conjunction with engineers at Western Digital Corporation to characterize hard disk workloads in enterprise environments to improve performance, reliability, and power efficiency of both the hard disk as well as the workload.

2008–2011 **Code Generation and Computer Architecture**
 Advised students on the design and implementation of algorithms to exploit instruction level parallelism on architectures for server and mobile platforms. Students focus on performance improvement, power consumption and code size.

2000–2008 **Doctoral Research**
 Investigated and developed algorithms to improve code quality for heuristic register allocation that are sensitive to program structure, variable usage patterns, and compiler and operating system register usage conventions. Code quality measured through spill code reduction. Other metrics of interest include performance, code size, and power consumption.

1997–2000 **Research Assistant**
 Performed development and design work on UC Davis's Optimal Register Allocator (ORA), modeling the register allocation problem as a 0-1 integer linear programming problem.

Fall 1993 **Undergraduate Research Semester**

Selected for a Science and Engineering Research Semester at Oak Ridge National Laboratory, Tennessee. Under the direction of Dr. Francois G. Pin.

Funding and Support

- April 2017 **Silicon Mechanics – Equipment Gift**
Research Cluster Grant for High-Performance Computing Research. PI Graham Doig. Co-PIs: Chris Lupo, Maria Pantoja, Andrew Danowitz, Christopher Pascual, Amelia Greig. \$130,000.
- 2015–2016 **Intel Corporation – Equipment Gift**
Development of Massively Parallel Accelerated Computing (MPAC) Laboratory. PI C. Lupo. Approx. value \$300,000.
- September 2015 **Sandia National Laboratories, Livermore**
Development of HPC Resilience Testbed and Capstone Course. PI C. Lupo. \$25,000.
- 2014–2015 **US Department of Agriculture, Agriculture and Food Research Initiative (AFRI)**
Enhanced Bioinformatics to Implement Genomic Selection (E-BIGS). PI D. Garrick (Iowa State). Co-Directors: J. Dekkers, J. Reecy, M. Rothschild, R. Fernando (Iowa State), C. Lupo. \$89,000.
- October 2013 **US Department of Transportation, Research and Innovative Technology Administration (RITA)**
Improved Satellite and Geospatial Tools for Pipeline Operator Decision Support Systems. PI J. Dunning (Cal Poly). Additional investigators: H. Assal, Z. Wood, A. Dekhtyar, C. Lupo, C. Schuldt. 2014-2016. \$799,946 (Cal Poly portion \$250,000).
- October 2013 **Amazon AWS in Education**
Coursework Grant Award. PI C. Lupo. \$3,400.
- September 2013 **CPCconnect**
Supporting Interdisciplinary Distributed Systems Projects and Coursework with Raspberry Pis. PI C. Lupo. co-PI A. Dekhtyar. 2013-2014. \$3,290.
- June 2013 **NVIDIA – Equipment Gift**
CUDA Research Center Award. PI C. Lupo. \$4,000.
- June 2013 **NVIDIA – Equipment Gift**
CUDA Teaching Center Renewal Award. PI C. Lupo. \$15,000.
- Fall 2012 **Extramural Funding Initiative (EFI) Award**
High Performance Ocean Modeling Software Using Massively Parallel GPU Processors. PI C. Lupo. 5 WTU Release Time.
- June 2012 **NVIDIA – Equipment Gift**
CUDA Teaching Center Renewal Award. PI C. Lupo. \$10,000.
- June 2011 **NVIDIA – Equipment Gift**
CUDA Teaching Center Renewal Award. PI C. Lupo. \$10,877.
- June 2010 **NVIDIA – Unrestricted Gift**
CUDA Teaching Center Award. PI C. Lupo. \$9820.
- January 2010 **Lockheed Martin – Unrestricted Gift**
Optimized Code Generation for Reduced Energy Usage. PI C. Lupo. \$5,000.
- July 2009 **Google – Google Research Awards**
Mobile Application Development Course. Co-PIs D. Janzen, C. Lupo. \$20,000.
- June 2009 **Sun Microsystems – Academic Excellence Grant**
Compiler Tuning for Power Efficiency. PI C. Lupo. \$11,900.
- March 2009 **Google – Unrestricted gift**
Equipment gift for Android mobile platform development. Co-PIs D. Janzen, C. Lupo. \$9,600.
- February 2009 **TemperatureAlert – Unrestricted gift**
Equipment gift for temperature sensing and power measurement. PI C. Lupo. \$200.

Publications

Conference Papers

Andrew* Adriance, Maria Pantoja, and **Chris Lupo**. Acceleration of hydrology simulations using DHSVM for multi-thousand runs and uncertainty assessment. In *Proceedings of the 5th Latin American Conference of High Performance Computing, CARLA 2018, Bucaramanga Colombia*. Springer International Publishing, 2018.

Chris Lupo, Maria Pantoja, and Andrew Adriance*. Estudio de aceleración de simulaciones para la industria agraria (a study in accelerating simulations for the agricultural industry). In *Proceedings of the First Congreso Académico Tecnológico Agropecuario (Academic Agricultural Technology Conference)*, Osorno Chile. La Universidad Tecnológica de Chile INACAP, 2018.

Ivan Pachev* and **Chris Lupo**. GPUMap: A transparently GPU-accelerated Python map function. In *Proceedings of the 7th Workshop on Python for High-Performance and Scientific Computing, PyHPC'17*, pages 6:1–6:10, New York, NY, USA, 2017. ACM.

Chris Lupo, Maria Pantoja, and Paul Choboter. Enhancing regional ocean modeling simulation performance with the Xeon Phi architecture. In *OCEANS 2017 - Aberdeen*, pages 1–6, June 2017.

Gavin Baker* and **Chris Lupo**. TARUC: A topology-aware resource usability and contention benchmark. In *Proceedings of the 8th ACM/SPEC on International Conference on Performance Engineering, ICPE '17*, pages 305–316, New York, NY, USA, 2017. ACM.

Trevor DeVore*, Scott Winkleblack*, Bruce Golden, and **Chris Lupo**. A heterogeneous compute solution for optimized genomic selection analysis. In *Proceedings of the IEEE International Conference on Bioinformatics and Biomedicine*. IEEE, 2014.

Doug Gallatin*, Aaron Keen, **Chris Lupo**, and John Oliver. Twill: A hybrid microcontroller-FPGA framework for parallelizing single-threaded C programs. In *IEEE International Symposium on Parallel and Distributed Processing 2014*. IEEE, May 2014.

Ian Panzer*, Spencer Lines*, Jason Mak, Paul Choboter, and **Christopher Lupo**. High performance regional ocean modeling with GPU acceleration. In *OCEANS 2013, MTS/IEEE San Diego - An Ocean in Common*, September 2013.

Kerry Scharfglass*, Darrin Weng*, Joseph White*, and **Chris Lupo**. Breaking weak 1024-bit RSA keys using CUDA. In *Proceedings of the 13th IEEE International Conference on Parallel and Distributed Computing, Applications and Technologies*. IEEE, 2012.

Aldrin Montana*, Douglas Brandt*, Bob Somers*, Alex Dekhtyar, **Chris Lupo**, Michael Black, Anya Goodman, and Chris Kitts. Pyroprinting sensitivity analysis on the GPU, poster. In *Proceedings of the IEEE International Conference on Bioinformatics and Biomedicine*. IEEE, 2012.

Christopher Lupo, Zoë Wood, and Christine Victorino. Cross teaching parallelism and ray tracing: A project-based approach to teaching applied parallel computing. In *Proceedings of the 43rd ACM SIGCSE Technical Symposium on Computer Science Education, SIGCSE '12*, New York, NY, USA, 2012. ACM.

Jason Mak*, Paul Choboter, and **Christopher Lupo**. Numerical ocean modeling and simulation with CUDA. In *OCEANS 2011, MTS/IEEE KONA - Oceans of Opportunity: International cooperation and partnership across the Pacific*, September 2011.

Christopher Lupo and Kent Wilken. Post register allocation spill code optimization. In *CGO '06: Proceedings of the International Symposium on Code Generation and Optimization*, pages 245–255, Washington, DC, USA, 2006. IEEE Computer Society.

Invited Talks

Chris Lupo. The use of high-performance computing in agricultural applications. In *Keynote Presentation for the First Congreso Académico Tecnológico Agropecuario (Academic Agricultural Technology Conference)*, Osorno, Chile, July 2018.

Gavin Baker*, Sean Sheen*, John Oliver, and **Chris Lupo**. Astro: A low-cost, low-power computing cluster, poster. In *NVIDIA GPU Technology Conference*, San Jose, CA, USA, April 2016.

Bruce L. Golden, **Chris Lupo**, and Dorian J. Garrick. High performance gibbs sampler for mixed density generally linear systems, poster. In *NVIDIA GPU Technology Conference*, San Jose, CA, USA, March 2015.

Scott Winkleblack*, Trevor DeVore*, and **Chris Lupo**. GPMoo: Genomic selection related analysis, poster. In *NVIDIA GPU Technology Conference*, San Jose, CA, USA, March 2014.

Chris Lupo. Numerical ocean modeling and simulation with CUDA. In *NVIDIA GPU Technology Conference*, San Jose, CA, USA, March 2013. <http://registration.gputechconf.com/quicklink/baYkLbl>.

Kerry Scharfglass*, Darrin Weng*, Joseph White*, and **Chris Lupo**. Breaking weak 1024-bit RSA keys using CUDA. In *NVIDIA GPU Technology Conference*, San Jose, CA, USA, March 2013.

Chris Lupo. Teaching applied parallel computing with GPUs. In *NVIDIA GPU Technology Conference*, San Jose, CA, USA, May 2012. <http://nvidia.fullviewmedia.com/gtc2012/0516-C-S0311.html>.

Brian Greenwood, Jennifer Becker, and **Christopher Lupo**. College “Kids These Days!” Student and faculty perceptions of the millennial generation. In *12th CSU Regional Symposium on University Teaching*, San Luis Obispo, CA, USA, May 2009.

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Advising

Masters Students

Ivan Pachev. GPUMap: A transparently GPU-accelerated map function. Master’s thesis, California Polytechnic State University, March 2017.

Chris Hunt. CORGI: Compute oriented recumbent generation infrastructure. Master’s thesis, California Polytechnic State University, March 2017.

Vanessa Forney. Encouraging development of mobile applications as a service to the community. Master’s thesis, California Polytechnic State University, November 2016.

Gavin Baker. An emperical study of contention and NUMA effects on heterogeneous computing systems. Master’s thesis, California Polytechnic State University, June 2016.

Jeffrey Forrester. Platforms for teaching distributed computing concepts to undergraduate students. Master’s thesis, California Polytechnic State University, March 2015.

Corey Ford. Lazy fault detection for redundant MPI. Master’s thesis, California Polytechnic State University, June 2016.

Sean Sheen. Astro - a low-cost, low-power cluster for CPU-GPU hybrid computing using the Jetson TK1. Master’s thesis, California Polytechnic State University, June 2016.

Bryan Ching. Optimizing Lempel-Ziv factorization for the GPU architecture. Master’s thesis, California Polytechnic State University, June 2014.

Trevor DeVore. A multi-GPU compute solution for optimized genomic selection analysis. Master’s thesis, California Polytechnic State University, June 2014.

Mike Lady. Towards an automated weight lifting coach: introducing LIFT. Master’s thesis, California Polytechnic State University, June 2014.

*Student authors

Halli Meth. DecaFS: A modular distributed file system to facilitate student learning. Master's thesis, California Polytechnic State University, June 2014.

Scott Winkleblack. ReGen: Optimizing genetic selection algorithms for the heterogeneous computing environment. Master's thesis, California Polytechnic State University, June 2014.

Isaac Asay. Compacting loads and stores for code size reduction. Master's thesis, California Polytechnic State University, March 2014.

Douglas Gallatin. Twill: A hybrid microcontroller-FPGA framework for parallelizing single-threaded C programs. Master's thesis, California Polytechnic State University, March 2014.

Xiaoxi Luo. The accessible user interaction framework for Android applications. Master's thesis, California Polytechnic State University, June 2013.

Darrin Weng. Accurate hardware RAID simulator. Master's thesis, California Polytechnic State University, June 2013.

Joseph White. PARIS: A PARallel RSA-prime InSpection tool. Master's thesis, California Polytechnic State University, June 2013.

Austin Dworaczyk Wiltshire. CUDA enhanced filtering in a pipelined video processing framework. Master's thesis, California Polytechnic State University, June 2013.

Massimo Becker. CUDA web API remote execution of CUDA kernels using web services. Master's thesis, California Polytechnic State University, June 2012.

Adam Miller. Hard drive command capture and sequential stream detection. Master's thesis, California Polytechnic State University, June 2012.

Andrew Hughes. Active pen input and the Android input framework. Master's thesis, California Polytechnic State University, June 2011.

Robert L. Webb. Asynchronous MIPS processors: Educational simulations. Master's thesis, California Polytechnic State University, July 2010.

Graduate Committees

2017–2018 Daniel Kauffman, Andrew Wang, Tram Lai, Andrew Adriance, Kyle Mulligan, Andrew Tran

2016–2017 Sravani Mudduluru, Ian Dunn, Jiewen (Sam) Wu, Eric Yun

2015–2016 James Bilous, Carson Carrol

2014–2015 Alexa Francis, Austin Wylie

2013–2014 Tyler Cassella, Forrest Reiling, Kevin Schapansky

2012–2013 Katherine Blizard, Nick Feeney, Billy McVicker, Aldrin Montana, Richie Steigerwald, Marc Zych

2011–2012 Annie Beug, Sean Fitzsimmons, Stephen Holsapple, Anh Nguyen, Steven Pungdumri, Ryan Schmitt, Bob Somers

2010–2011 Chris Gibson

2009–2010 Harrison McKenzie Chapter, Brian Oppenheim, Emanuel Tarog

Other Related Experience

2004–2008

Systems Administrator

UC Davis Electrical and Computer Engineering Department. Responsible for core services, network infrastructure, software package installation and maintenance.

2000–2002

Consulting Expert

California Department of Justice. Developed software test procedures to prove or disprove manufacturer's technological claims. Measured and analyzed hardware performance.

Service

University Service

Fall 2012–Present Computer Science Faculty Liaison to Computer Science Laboratory Staff
Fall 2012–Present Member of the CENG Faculty Computing Committee
Fall 2011–Present Member of CPConnect college-wide committee dedicated to connecting industry partners with Cal Poly faculty for interdisciplinary projects.
Fall 2011–Present Member Cal Poly Computer Science Curriculum Committee
Fall 2011–Present Member Cal Poly Computer Engineering Curriculum Committee
Fall 2008–Present Member of the Cal Poly Computer Engineering Program Council
2009–Present Advisor for Cal Poly’s Eta Kappa Nu ($\eta\kappa\nu$) Honors Society
2009–Present Advisor for Cal Poly’s Linux Users’ Group (CPLUG)
Fall 2010–June 2011 Chair of the Cal Poly Computer Engineering Curriculum Committee

Professional Affiliation Service

Jan. 2012–Dec. 2013 Program Committee member for the IEEE international conference on *Parallel and Distributed Computing, Applications and Technology*
Winter 2013–Present Reviewer for ACM’s *Computing Reviews*
Winter 2013 Reviewer for Multidisciplinary Digital Publishing Institute’s (MDPI) Journal of *High Performance Computing in Remote Sensing*
December 2012 Session Chair for the IEEE international conference on *Parallel and Distributed Computing, Applications and Technology*
Spring 2010 Reviewer for ACM’s Transactions on Architecture and Code Optimization (TACO)

Professional Memberships

2012–Present Institute of Electrical and Electronics Engineers (IEEE)
2007–Present Association for Computing Machinery (ACM)

Honors and Awards

2011 Computer Science Department Professor of the Year
2003–2004 Teaching Assistant Consultant Fellowship
1998–1999 UC Davis GAANN (Graduate Assistance in Areas of National Need) Fellowship Recipient
1997–1998 UC Davis GAANN Fellowship Recipient