Ian Jacob Bertolacci

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Research Interests

The development of programming languages, compilers, and other related tools, particularly domain specific languages, and source-to-source transformation tools, to enable and implement optimizations for high-performance computing applications.

Education

Master of Science degree in Computer Science University of Arizona GPA: 3.8 / 4.0	May 2020
Bachelor of Science degree in Computer Science Colorado State University GPA: 3.337 / 4.0	May 2016
Bachelor of Science degree in Psychology Colorado State University GPA: 3.337 / 4.0	May 2016
Bachelor of Science degree in Applied Computing Technology: Human Centered Computing Colorado State University GPA: 3.337 / 4.0	May 2016

Selected Courses

Software Development Methods	(CS 314)	Advanced Operating Systems	(CSc 552)
Algorithms: Theory and Practice	(CS 320)	Algorithmic Language Compilers	(CSc 553)
Systems Security	(CS 356)	Database Systems Implementation	(CSc 560)
Introduction to Computer Graphics	(CS 410)	Human-Computer Interaction	(PSY 354)
Introduction to Artificial Intelligence	(CS 440)	Cognitive Psychology	(PSY 452)
Principles of Programming Languages	(CSc 520)	Sensation and Perception	(PSY 456)
Parallel and Distributed Programming	(CSc 522)	Cognitive Neuroscience	(PSY 458)
Principles of Computer Networking	(CSc 525)	Pharmacology	(BMS 450)
Design and Analysis of Algorithms	(CSc 545)		

Awards and Honors

College of Science Graduate Service Award, University of Arizona	Spring Semester 2019
Dean's List, Colorado State University	Fall Semester 2015
3rd place, ACM Student Research Competition (Undergraduate), SuperComputing	November 2014
Best Undergraduate Poster, Rocky Mountain Celebration of Women In Computing	October 2014

Professional Experience

Graduate Research Assistant at University of Arizona   August 2016—Present

Under the direction of my PhD advisor Dr. Michelle M. Strout, currently work on developing high performance loop optimization targeting memory bound applications, such as stencil computations. This work is done in conjunction with developing code annotation systems and compilers plugins that enable the automatic application of these optimizations, and exploring mechanisms for deploying inter-loop optimizations via an legacy scientific application's API to reduce refactoring requirements.

Intern at Cray Incorporated   June 2018—August 2018

Extended Chapel's compressed sparse-array data structure and explored a developer-friendly refactor to Chapel's Domain Standard Interface. Developed a Chapel implementation of a distributed matrix topological-sorting benchmark, exploring multiple work-queuing strategies, and illustrated challenges in developing distributed Chapel applications in the context of that benchmark.

Undergraduate Research Assistant at Colorado State University   May 2014—August 2016

Under the direction of Dr. Michelle M. Strout and Dr. Catherine Olschanowsky, worked on developing high performance iteration schedules for stencil computations using the polyhedral model, and developing tools and frameworks to generate these schedules and transform existing code to use them. Previous work has included investigating using language features as software engineering techniques to simplify the development and modification of high performance loop-nests.

Intern at Cray Incorporated   May 2015—August 2015

Developed the Chapel interface to the LAPACK linear algebra package and its 3122 procedures using automated techniques to understand the semantics laid out by the original Fortran code and the human written documentation.

Undergraduate Teaching Assistant at Colorado State University   August 2012—May 2014

Assisted faculty in multiple classes where my role was to develop and modify portions of the laboratory curriculum, lead and present material in lab sessions, and generally assist students.

Undergraduate Research Assistant at Colorado State University   January 2012—August 2012

Under the direction of Dr. Benjamin Clegg within his cognitive psychology lab, participated in conducting psychological experiments during research on automation in learning, and participated in group discussion related to research topics in automation in learning.

Teaching Experience

Undergraduate Teaching Assistant at Colorado State University

First Year Seminar - Computer Science, CS192   Fall 2012

In this seminar, first year students are introduced to what computer science is, the ways of thinking like a computer scientist, and are given an opportunity to decide if computer science is the right major for them. My role was to develop and modify small portions of the laboratory curriculum, occasionally lead and present material in lab sessions, and assist students both in the lab sessions and during office hours.

Foundations in Programming, CS160   Spring 2013—Spring 2014

This class is the first requirement for the computer science degree at CSU. It introduces the Java programming language to students who have likely never programmed before, and introduces Boolean logic and simple proofs. My role was to develop, modify, and overhaul large portions of the laboratory curriculum, lead and present material in lab sessions, and assist students both in the lab session and during office hours.

Math In Action In Computer Science Summer Camp at Colorado State University

Assistant Instructor   Summer 2014, 2016

In this summer camp for middle school students, we demonstrated the applications of math to students and engaged them in related programming exercises. My role was to develop and modify small portions of the curriculum, present material, lead sessions, and assist students.

Internal Service Activities

President of the Computer Science Graduate Student Council   September 2018—May 2020
Tea Master of University of Arizona Computer Science Graduate Tea Party   August 2016—May 2020
Undergraduate Representative for Computer Science Undergraduate Committee August 2013—May 2016

Journal Papers

J-1 Ian J. Bertolacci, Michelle Mills Strout, Stephen Guzik, Jordan Riley, Eddie C. Davis, and Catherine Olschanowsky, "Using the Loop Chain Abstraction to Schedule Across Loops in Existing Code." in the *International Journal of High Performance Computing and Networking*, vol. 13, no. 1, pp. 86 – 104, Dec. 2018.

Refereed Conference and Workshop Papers

C-4 Ian Bertolacci, Michelle Mills Strout, Bronis R. de Supinski, Thomas R. W. Scogland, Eddie C. Davis, and Catherine Olschanowsky. "Extending OpenMP to Facilitate Loop Optimization" To the *14th International Workshop on OpenMP*, September, 2018. Presentation given by Ian J. Bertolacci.

C-3 Michelle Mills Strout, Saumya Debray, Kate Isaacs, Barbara Kreaseck, Julio Cárdenas-Rodríguez, Bonnie Hurwitz, Kat Volk, Sam Badger, Jesse Bartels, Ian Bertolacci, Sabin Devkota, Anthony Encinas, Ben Gaska, Brandon Neth, Theo Sackos, Jon Stephens, Sarah Willer, and Babak Yadegari. "Language agnostic optimization and parallelization for interpreted languages." To the *30th International Workshop on Languages and Compilers for Parallel Computing*. Presentation given by Michelle Mills Strout.

C-2 Ian J. Bertolacci, Michelle Mills Strout, Stephen Guzik, Jordan Riley, and Catherine Olschanowsky, "Identifying and Scheduling Loop Chains Using Directives". In the *3rd Workshop on Accelerator Programming Using Directives at SuperComputing2016*, November 2016 (47% acceptance rate). Presentation given by Ian J. Bertolacci.

C-1 Ian J. Bertolacci, Catherine Olschanowsky, Ben Harshbarger, Bradford L. Chamberlain, David G. Wonnacott, and Michelle Mills Strout. "Parameterized Diamond Tiling for Stencil Computations with Chapel Parallel Iterators." In the *Proceedings of the 29th International Conference on Supercomputing*, June 2015. (25% acceptance rate). Presentation given by Ian J. Bertolacci.

Refereed Talks and Posters

RP-3 Ian J. Bertolacci, advised by Michelle Mills Strout and Catherine Olschanowsky. "Orthogonal Scheduling of Stencil Computations." Talk and poster presentation given by Ian J. Bertolacci at SuperComputing, November 2014.

RP-2 Ian Bertolacci, Catherine Olschanowsky, Michelle Mills Strout, and David G. Wonnacott, in collaboration with Bradford L. Chamberlain, and Ben Harshbarger. "Chapel Iterators: Providing Tiling for the Rest of us." Talk presentation given by Ian J. Bertolacci at SuperComputing, November 2014.

RP-1 Ian J. Bertolacci, advised by Michelle Mills Strout and Catherine Olschanowsky. "Orthogonal Scheduling of Stencil Computations." Talk and poster presentation given by Ian J. Bertolacci at Rocky Mountain Celebration of Women In Computing, October 2014.

Posters and Other Talks

O-2 "Procuring Performance in Python." Talk presented to the Tucson Python Meetup, August 2017.

O-1 "Chapel + LAPACK: New dog, meet old dog." Talk presented to the Melange research group at Colorado State University, September 2015.

Software Development Skills

Proficient in C, Chapel, Python, Bash.
Experience in Java, C++, CUDA, Javascript, and PHP
Experience using MPI, OpenMP, OpenCL, CUDA, ROSE, LLVM, GTest.
Experience in developing build processes using Make, CMake, Autotools, and Docker.
Experience in using Linux and command line, PBS job scheduler.
Experience in developing compiler tools and code optimization techniques.