Ian Bertolacci

Software and Performance Graduate Research Engineer

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Education

University of Arizona

Tucson, AZ

- Masters of Science in Computer Science, GPA: 3.8/4.0

May 2020

Colorado State University

Ft. Collins, CS

- Bachelor of Science in Computer Science
- Bachelor of Science in Psychology: Mind, Brain, and Behavior
- Bachelor of Science in Applied Computing Technology: Human Centered Computing

May 2016

Skills

Developer Skills	Git and GitHub, Linux, Parallel programming, Legacy applications, Performance profiling and analysis, Code transformation and generation, Parsers and regular expressions, Agile development
Languages	Python, Bash, C, Chapel, C++, Java, CUDA
Libraries and Frameworks	MultiProcessing, OpenMP, OpenCL, MPI, ROSE, LLVM, ZeroMQ, GTest
Build and Packaging Systems	Make, CMake, AutoTools, Module, Docker
Non-Technical Skills	Public speaking, Technical and scientific writing, Teaching, Statistical analysis

Experience

University of Arizona

Tucson, AZ

Graduate Research Assistant

August 2016 - PRESENT

- Conducted and published research on methods in inter-loop optimization specified using extensions to OpenMP language
- Investigate performance of existing scientific application and propose efficiency changes
- Plan API changes to provide path for shared-memory parallelization and automated inter-loop optimization of existing application
- Collaborated with interdisciplinary and cross-institutional research team
- Worked with team exploring methods of extracting parallelizable loops in Python applications using dynamic analysis
- Mentored undergraduate student in benchmark undergraduate honors thesis

Cray Incorporated

Seattle, WA

Software Engineer Intern

June 2018 - August 2018

- Extended Chapel's compressed sparse-array data structure
- Explored a developer-friendly refactor to Chapel's Domain Standard Interface
- Developed distributed matrix toposorting benchmark exploring distributed work queuing strategies

Colorado State University

Ft. Collins, CO

Undergraduate Research Assistant

May 2014 - August 2016

- Conducted and published research on methods of hiding time-tiling loop-optimizations using existing programming language features
- Conducted performance experiments

Cray Incorporated

Seattle, WA

Software Engineer Intern

June 2015 - August 2015

- Implemented Chapel Linear Algebra Package interface module using custom automated C/Fortran-to-Chapel interface translation tool
- Developed Chapel programming language tutorial (`learnxinyminutes.com/docs/chapel`)

Colorado State University

Ft. Collins, CO

Undergraduate Teaching Assistant

August 2012 - May 2014

- Developed and lead hands-on instructional sessions in computer-lab setting

Projects

LowFlow Mini-App

`github.com/ian-bertolacci/LowFlow_MiniApp`

- Scientific "mini-app" using computationally intensive loops extracted from ParFlow watershed hydrodynamics application
- Explores methods of parallelizing loops using different frameworks, including OpenMP, OpenCL, and CUDA
- Explores methods of hiding details of parallelization using custom preprocessor macro programming language
- Custom CMake framework for integrating different source components and enabling different profiling code at compile-time

LoopChain

`github.com/CompOpt4Apps/LoopChainToolDemo`

`github.com/CompOpt4Apps/LoopChainIR`

`github.com/ian-bertolacci/ISL_To_Sage`

- Source-to-source compiler based on ROSE implementing extensions to OpenMP providing inter-loop optimizations
- C++ library for representing loop sequences and data accesses, potimizing with inter-loop transformations, and generating new C/C++ code
- C++ library for converting from Integer Set Library's C AST format to ROSE's SAGE AST format
- Uses integer linear programming method of determining smallest shift extents to enable legal loop fusion
- Custom test framework for testing legality and correctness of loops generated by the transformation library

Cellular Automata Simulator

`github.com/ian-bertolacci/Cellular-Automata-Simulator`

- Personal summer project in Java diving into compilers, virtual machines, programming languages, graphics, and cellular automata
- Developed programming language and compiler to describe cellular automata rules
- Custom virtual machine and byte-code
- Capable of executing arbitrary cellular automata rules of any dimensionality

Publications

- I. Bertolacci, M. M. Strout, B. R. de Supinski, T. R. W. Scogland, E. C. Davis, and C. Olschanowsky. Extending OpenMP to Facilitate Loop Optimization. In B. R. de Supinski, P. Valero-Lara, X. Martorell, S. Mateo Bellido, and J. Labarta, editors, *Evolving OpenMP for Evolving Architectures*, volume 11128, pages 53–65. Springer International Publishing, 2018.
- I. J. Bertolacci, C. Olschanowsky, B. Harshbarger, B. L. Chamberlain, D. G. Wonnacott, and M. M. Strout. Parameterized Diamond Tiling for Stencil Computations with Chapel Parallel Iterators. In *Proceedings of the 29th ACM on International Conference on Supercomputing*, ICS '15, pages 197–206. ACM, 2015.
- I. J. Bertolacci, M. M. Strout, S. Guzik, J. Riley, and C. Olschanowsky. Identifying and Scheduling Loop Chains Using Directives. In *2016 Third Workshop on Accelerator Programming Using Directives (WACCPD)*, pages 57–67, 2016.
- I. J. Bertolacci, M. M. Strout, J. Riley, S. M. Guzik, E. C. Davis, and C. Olschanowsky. Using the loop chain abstraction to schedule across loops in existing code. *International Journal of High Performance Computing and Networking*, 13(1):86–104, 2018.

Awards

Spring 2019	**Graduate Service Award**, College of Science and Department of Computer Science	*University of Arizona*
Fall 2015	**Deans List**, College of Natural Science	*Colorado State University*
November 2014	**3rd Place Undergraduate Research Poster**, ACM Research Competition	*SuperComputing 2014*
October 2014	**Best Undergraduate Research Poster**	*Rocky Mountain Celebration of Women in Computing*