

I am currently an Associate Professor in Computer Science at Washington State University, and was previously Assistant Professor at the University of Alabama at Birmingham and a Victor Basili Fellow at the University of Maryland, at College Park.

Education

University of Utah	Ph.D.	2017
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Developed a unified methodology for polyvariant (*e.g.*, flow/call/arg/obj sensitive) program analysis.

I applied this framework to produce a self-reflective form of polyvariance for continuations that avoids all return-flow conflation of values (a long-standing problem for control-flow analyses), guaranteeing ideal stack precision at no cost to average or worst-case model complexity, and at in terms of human labor to implement ($\sim 1\text{LOC}$ in proposed framework). Proved that the precision is equal to an incomputable analysis with an unbounded stack and mechanically verified the proof using the Coq proof assistant. My dissertation is titled “*Introspective Polyvariance for Control-Flow Analyses*”.

University of Utah	M.S.	2012
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University of Oregon	B.S.	2010
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Employment

Associate Professor	Washington State University	2024 - <i>Present</i>
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Working on research into scalable, tunable program analysis, program verification, logic solvers on high performance computers and clusters, and linguistic mechanisms for enforcing correctness, security/privacy, and termination properties of software; regularly teaching undergraduate and graduate-level classes in compilers and programming languages. Won an ARPA-H subaward to investigate private and secure querying for EHR systems, contracting with Galois, inc.

Assistant Professor	U. of Alabama, Birmingham	2018 - 2024
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Developed my research program in high-performance reasoning and program analysis; regularly taught undergraduate and graduate-level classes in automata theory, programming languages, and automated reasoning. Won NSF PPOSS Large, NSF PPOSS Planning, and DARPA VSPILLS grants, bringing a total of \$3.12M in new research money to UAB.

Victor Basili Fellow	U. of Maryland, College Park	2016 - 2018
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Joined UMD’s PLUM lab with Michael W. Hicks, Jeffery Foster, and David Van Horn; worked on various collaborative projects including: soft contract verification, approximating permission-use provenance in Android, accelerating flow analyses in Datalog, and verification of faceted programs, among others. A departmental fellowship granted me great freedom to pursue long-term research.

Instructor	U. of Maryland, College Park	2017 - 2018
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While at UMD, I taught a section of the Intro to Programming Languages course and developed a new Compilers course in which my students built an R⁷RS Scheme Compiler from scratch.

Analysis Developer	HP, inc. (was: Fortify, inc.)	2013 - 2015
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Research Assistant	U. of Utah	2011 - 2016
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Teaching

(WSU) CptS 580: Advanced Programming Languages (Spring 2025)
(WSU) CptS 452: Compilers (Fall 2024)
(UAB) CS 660/760: Artificial Intelligence (Fall 2019–2021, 2023)
(UAB) CS 401/501: Programming Languages (Spring 2019–2024)
(UAB) CS 350/550: Automata and Formal Languages (Fall 2018–2023)
(UMD) CMSC 330: Intro to Programming Languages (Spring 2018)
(UMD) CMSC 430: Compilers (Fall 2017)

Service and Professional Development

ACM and SIGPLAN member; PC member, ICSE 2025; Faculty Search Committee, WSU EECS, 2024; NSF Panelist, SHF CS2 Program, 2024; NSF Panelist, PPOSS Program, 2024; External reviewer, TOPLAS 2023; Curriculum committee member 2018–2022, UAB CS Department; PC member, Dynamic Languages Symposium (DLS) 2021 co-located with SPLASH; Co-organizer, UAB HSPC 2019–2021 (High School Programming Contest); PC member, Symposium On Applied Computing (SAC) 2021; NSF Panelist, PPOSS Program, 2021; External reviewer, POPL 2020; PC chair, Scheme and Functional Programming Workshop, 2019; PC member, IEEE TCBBSI 2019; PC member, MiniKanren Workshop, 2019; Lead a student team in developing an automated grading system for UAB in 2019; External reviewer, POPL 2019; External reviewer, POPL 2018

Selected Conference Papers

1. *Datalog with First-class Facts*. **Thomas Gilray**, Arash Sahebolamri†, Yihao Sun‡, Sowmith Kunapane†, Sidharth Kumar, and Kristopher Micinski. International Conference on Very Large Data Bases.
(VLDB) Sep 2025.
2. *Optimizing Datalog for the GPU*. Yihao Sun‡, Ahmedur Rahman Shovon‡, **Thomas Gilray**, Sidharth Kumar, and Kristopher Micinski. International Conference on Architectural Support for Programming Languages and Operating Systems.
(ASPLOS—12.7% acceptance) Mar 2025. <https://doi.org/10.1145/3669940.3707274>
3. *Column-Oriented Datalog on the GPU*. Yihao Sun‡, Sidharth Kumar, **Thomas Gilray**, and Kristopher Micinski. AAAI Conference on Artificial Intelligence.
(AAAI—23.4% acceptance) Feb 2025.
4. *Optimizing the Bruck Algorithm for Non-uniform All-to-all Communication*. Ke Fan‡, **Thomas Gilray**, Valerio Pascucci, Xuan Huang, Kristopher Micinski, and Sidharth Kumar. International ACM Symposium on High-Performance Parallel and Distributed Computing.
(HPDC—19% acceptance) Jun 2022. <https://doi.org/10.1145/3502181.35314>
5. *Load-balancing Parallel Relational Algebra*. Sidharth Kumar and **Thomas Gilray**. ISC High Performance.
(ISC—31% acceptance) Jun 2020. https://doi.org/10.1007/978-3-030-50743-5_15
Won ISC Hans Meuer Best Paper award.
6. *Distributed Relational Algebra at Scale*. Sidharth Kumar and **Thomas Gilray**. International Conference on High Performance Computing, Data, and Analytics.
(HiPC—23% acceptance) Dec 2019. <https://doi.org/10.1109/HiPC.2019.00014>
Won HiPC Best Paper award.
7. *Size-Change Termination as a Contract*. Phúc C. Nguyễn‡, **Thomas Gilray**, Sam Tobin-Hochstadt, and David Van Horn. Programming Language Design and Implementation.

(PLDI—27% acceptance) Jun 2019. <https://doi.org/10.1145/3314221.3314643>

Invited to the Journal of Functional Programming.

8. *Soft Contract Verification for Higher-order Stateful Programs*. Phúc C. Nguyễn†, **Thomas Gilray**, Sam Tobin-Hochstadt, and David Van Horn. Symposium on Principles of Programming Languages.

(POPL—23% acceptance) Jan 2018. <https://doi.org/10.1145/3158139>

9. *Allocation Characterizes Polyvariance*. **Thomas Gilray**, Michael D. Adams, and Matthew Might. International Conference on Functional Programming.

(ICFP—31% acceptance) Sep 2016. <https://doi.org/https://doi.org/10.1145/3022670.2951936>

10. *Pushdown Control-Flow Analysis for Free*. **Thomas Gilray**, Steven Lyde, Michael D. Adams, Matthew Might, and David Van Horn. Symposium on Principles of Programming Languages.

(POPL—23% acceptance) Jan 2016. <https://doi.org/10.1145/2837614.2837631>

11. *Dynamic Sparse-Matrix Allocation on GPUs*. James King, **Thomas Gilray**, Robert M. Kirby, and Matthew Might. ISC High Performance.

(ISC) 2016. https://doi.org/10.1007/978-3-319-41321-1_4

Won PRACE ISC best paper award.

Invited Talks

- Challenges in High-performance Deductive Programming. AP2S: Automated Program and Proof Synthesis. Vancouver, BC. AAAI Bridge. 2024.
- Formal Methods: Theory and Practice (*invited panel discussion*). Ljubljana, Slovenia. PLMW at ICFP 2022.
- Challenges Scaling Declarative Program Analysis. University of Illinois at Chicago. 2022.
- Declarative Program Analysis at Scale. Syracuse University. 2022.
- Contracts for Correctness (today and tomorrow). Jet, inc. 2019.
- The Best of Both Worlds: Tunable, Correct-by-design Static Analysis. University of Alabama at Birmingham. 2018.
- Static Analysis with Introspective Polyvariance. Indiana University. 2016.
- Static Analysis with Introspective Polyvariance. University of Maryland. 2016.

Contributed Talks

- Load-balancing Parallel Relational Algebra. Frankfurt, Germany (remote). ISC 2020.
- Toward Parallel CFA with Datalog, MPI, and CUDA. Oxford, UK. SW 2017.
- Allocation Characterizes Polyvariance. Nara, Japan. ICFP 2016.
- Pushdown Control-Flow Analysis for Free. St. Petersburg, FL. POPL 2016.
- Partitioning 0-CFA for the GPU. Wittenberg, Germany. WFLP 2014.
- A Unified Approach to Polyvariance in Abstract Interpretations. Alexandria, VA, USA. SW 2013.
- A Survey of Polyvariance in Abstract Interpretations. Provo, UT, USA. TFP 2013.