

# Cody Rivera

## Curriculum Vitae

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## Education

- 2022–present **Ph.D. in Computer Science**, *University of Illinois Urbana-Champaign*, Urbana, IL  
GPA: 4.0/4.0.  
Advisor: Madhusudan Parthasarathy.  
Expected Completion Date: May 2027.
- 2018–2022 **B.S. in Computer Science and Mathematics**, *University of Alabama*, Tuscaloosa, AL  
GPA: 4.0/4.0. *Summa Cum Laude*.  
Minor: Randall Research Scholars Program.

## Research Experience

- 2022–present **Graduate Research Assistant**, *University of Illinois Urbana-Champaign*, Urbana, IL  
Developing a discipline of predictable verification for heap-manipulating programs using intrinsic definitions of data structures. Applying this discipline to verifying systems software. Supervised by Madhusudan Parthasarathy.
- 2022–present **Graduate Research Assistant**, *University of Illinois Urbana-Champaign*, Urbana, IL  
Developing an “approximate” satisfiability modulo theories (SMT) solver for real arithmetic involving integrals. Using this solver for verification and synthesis tasks in domains such as differential privacy and algorithmic fairness. Supervised by Mahesh Viswanathan.
- 2019–2022 **Undergraduate Research Assistant, High-Performance Computing and Data Analytics Lab**, *University of Alabama/Washington State University*, Tuscaloosa, AL  
Researched parallel GPU algorithms to process vast amounts of data in scientific computation workloads such as large scale simulations more efficiently. Supervised by Dingwen Tao.
- Summer 2021 **Science Undergraduate Laboratory Internship (SULI) Program Intern**, *Argonne National Laboratory*, Virtual Internship  
Improved the performance of lossy decompression for multidimensional scientific datasets by optimizing parallel Huffman decoding for GPUs. Supervised by Sheng Di.

## Publications

### Drafts and Preprints

- C. Rivera, B. Bhusal, R. Chadha, A.P. Sistla, and M. Viswanathan, “Checking  $\delta$ -Satisfiability of Reals with Integrals,” Under Submission, 2024.
- PLDI 2024 A. Murali, C. Rivera, and P. Madhusudan, “Predictable Verification using Intrinsic Definitions,” To appear in *ACM SIGPLAN Conference on Programming Language Design and Implementation*, 2024. Preprint: arXiv:2404.04515.

## Conference Publications

- IPDPS 2022 **C. Rivera**, S. Di, J. Tian, X. Yu, D. Tao, and F. Cappelto, "Optimizing Huffman Decoding for Error-Bounded Lossy Compression on GPUs," *The 36th IEEE International Parallel and Distributed Processing Symposium*, Virtual Event, May 30-June 3, 2022, pp. 717-27. [Acceptance Rate: 25% (123/474)]
- Cluster 2021 J. Tian, S. Di, X. Yu, **C. Rivera**, K. Zhao, S. Jin, Y. Feng, X. Liang, D. Tao, and F. Cappelto, "Optimizing Error-Bounded Lossy Compression for Scientific Data on GPUs," *2021 IEEE International Conference on Cluster Computing*, Virtual Event, September 7-10, 2021, pp. 283-93. [Acceptance Rate: 29% (48/163)]
- IPDPS 2021 J. Tian, **C. Rivera**, S. Di, J. Chen, X. Liang, D. Tao, and F. Cappelto, "Revisiting Huffman Coding: Toward Extreme Performance on Modern GPU Architectures," *The 35th IEEE International Parallel and Distributed Processing Symposium*, Virtual Event, May 17-21, 2021, pp. 881-91. [Acceptance Rate: 22% (105/462)]
- PACT 2020 J. Tian, S. Di, K. Zhao, **C. Rivera**, M. H. Fulp, R. Underwood, S. Jin, X. Liang, J. Calhoun, D. Tao, and F. Cappelto, "cuSZ: An Efficient GPU-Based Error-Bounded Lossy Compression Framework for Scientific Data," *The 29th International Conference on Parallel Architectures and Compilation Techniques*, Atlanta, GA, Oct 3-7, 2020, pp. 3-15. [Acceptance Rate: 25% (35/137)]

## Journal Publications

- JPDC **C. Rivera\***, J. Chen\*, N. Xiong, S. Song, and D. Tao, "TSM2X: High-Performance Tall-and-Skinny Matrix-Matrix Multiplication on GPUs," *Journal of Parallel and Distributed Computing*, Volume 151, 2021, pp. 70-85. [Impact Factor: 3.734]

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## Awards

- October 2023 **Travel Grant**, *Midwest Programming Languages Summit, University of Michigan*
- 2023–2024 **Computer Science Ph.D. Fellowship**, *Department of Computer Science, University of Illinois Urbana-Champaign*
- January 2023 **PLMW Travel Grant**, *POPL 2023, ACM SIGPLAN*
- 2022–2026 **Graduate College Fellowship**, *University of Illinois Urbana-Champaign*
- 2022–2026 **SURGE Fellowship**, *Grainger College of Engineering, University of Illinois Urbana-Champaign*
- 2022–2023 **Wing Kai Cheng Fellowship**, *Department of Computer Science, University of Illinois Urbana-Champaign*
- Summer 2022 **Housing Grant**, *Oregon Programming Languages Summer School, University of Oregon*
- Spring 2022 **Outstanding Undergraduate Award**, *Department of Computer Science, University of Alabama*
- Spring 2022 **H. H. Chapman Outstanding Computer User Award**, *Randall Research Scholars Program, University of Alabama*
- Fall 2021 **R&D 100 Award Winner**, *For "SZ: A Lossy Compression Framework for Scientific Data"*
- Summer 2020 **Outstanding Sophomore Award**, *Randall Research Scholars Program, University of Alabama*
- Spring 2020 **Outstanding Undergraduate Researcher Award**, *Department of Computer Science, University of Alabama*
- 2018–2022 **Fellowship Award**, *Randall Research Scholars Program, University of Alabama*
- 2018–2022 **Engineering Leadership Scholarship**, *College of Engineering, University of Alabama*
- 2018–2022 **Presidential Scholarship**, *University of Alabama*

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\*Equal contribution

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## Software Artifacts

- IDS Artifact A benchmark suite demonstrating predictable verification using intrinsic definitions of data structures. Contains verified implementations of 42 operations over 10 data structures in both Boogie and Dafny. [URL: <https://github.com/codyrivera/ids-artifact>]
- cuSZ A GPU version of SZ, an error-bounded lossy compressor for scientific data, implemented in CUDA C++ for Nvidia GPUs. Compresses data with compression ratios up to 3.48x higher than other state-of-the-art GPU lossy compressors. [URL: <https://szcompressor.org/>]
- TSM2X A collection of two GPU algorithms for multiplying irregular-shaped tall-and-skinny matrices: TSM2L and TSM2R. Implemented in CUDA C++ and tuned to obtain average speedups of 1.9x over the vendor-supplied CUBLAS library. [URL: <https://github.com/codyrivera/tsm2x-imp>]

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## Teaching Experience

- Fall 2020 **Undergraduate Teaching Assistant (CS 100: Computer Science I for Majors)**, *University of Alabama*, Tuscaloosa, AL
- Spring 2020 *Alabama*, Tuscaloosa, AL
- Fall 2019 Tutored students during laboratory sessions and graded student projects.

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## Other Experience

- Summer 2020 **Student Training in Engineering Program (STEP) Intern**, *Google*, Virtual Internship  
Developed GrowPod, a web app that allows users to join, create, and administer community gardens using Google Cloud App Engine and Angular.

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## Workshops and Summer Schools

- October 2023 **Midwest Programming Languages Summit**, *University of Michigan*, Ann Arbor, MI  
Poster: "Predictive Verification using Intrinsic Definitions of Data Structures," with Adithya Murali and P. Madhusudan.
- January 2023 **Programming Languages Mentoring Workshop**, *POPL 2023*, Boston, MA
- Summer 2022 **Oregon Programming Languages Summer School**, *University of Oregon*, Eugene, OR

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## Coursework and Technical Skills

### Relevant Coursework:

- **University of Illinois:** Proof Automation, Compiler Construction, Logic in Computer Science, Formal Software Development Methods, Trustworthy AI Systems, Programming Language Design, Distributed Systems (Current)
- **University of Alabama:** Programming Languages, Compiler Construction, Real Analysis I and II, Abstract Algebra I and II, General Topology, Algebraic Topology

**Programming Languages:** C, C++, Python, Java, Dafny, Boogie, OCaml, Scala, JavaScript, TypeScript

**Platforms and Tools:** Z3, CUDA, OpenMP, Google Cloud, HTML, CSS, LaTeX