Cody Rivera

Curriculum Vitae
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Education

2022–present **Ph.D. in Computer Science**, *University of Illinois Urbana-Champaign*, Urbana, IL
GPA: 3.98/4.0. *Advisor: Tianyin Xu.*

2022–2024 **M.S. in Computer Science**, *University of Illinois Urbana-Champaign*, Urbana, IL
GPA: 3.97/4.0. *Advisor: Madhusudan Parthasarathy.*

2018–2022 **B.S. in Computer Science and Mathematics**, *University of Alabama*, Tuscaloosa, AL
GPA: 4.0/4.0. *Summa Cum Laude, University Honors.*

Research Experience

2024–present **Graduate Research Assistant, XLab**, *University of Illinois Urbana-Champaign*, Urbana, IL
Advisor: Tianyin Xu.
Verify liveness properties of interacting Kubernetes cloud cluster controllers. Extend the Anvil verification framework to support compositional verification and verify example controller interactions.

2022–2024 **Graduate Research Assistant**, *University of Illinois Urbana-Champaign*, Urbana, IL
Advisor: Madhusudan Parthasarathy.
Developed a discipline for predictable automated verification on top of intrinsic, or local, definitions. Demonstrated this discipline by verifying functional correctness of a suite of data structure operations.

2022–2024 **Graduate Research Assistant**, *University of Illinois Urbana-Champaign*, Urbana, IL
Advisor: Mahesh Viswanathan.
Extended dReal, an approximate SMT solver on the Reals, with integration. Evaluated the extended solver on verification and synthesis queries in domains such as differential privacy and algorithmic fairness.

2019–2022 **Undergraduate Research Assistant, High-Performance Data Analytics and Computing (HiPDAC) Lab**, *University of Alabama*, Tuscaloosa, AL
Advisor: Dingwen Tao.
Researched parallel algorithms and engineered GPU kernels for tasks including compression and linear algebra operations to improve the performance of scientific computing codes.

Summer 2021 **Science Undergraduate Laboratory Internship (SULI) Program Intern**, *Argonne National Laboratory*, Virtual Internship
Advisor: Sheng Di.
Improved the performance of custom lossy decompression on multidimensional floating-point datasets by implementing optimized parallel Huffman decoding on GPUs.

Publications

Drafts and Preprints

OOPSLA 2025 **C. Rivera**, B. Bhusal, R. Chadha, A.P. Sistla, and M. Viswanathan, "Checking δ-Satisfiability of Reals with Integrals," To appear in *Proceedings of the ACM on Programming Languages,* Volume 9, Issue OOPSLA1, 2025.

Conference Publications

PLDI 2024 A. Murali, **C. Rivera**, and P. Madhusudan, "Predictable Verification using Intrinsic Definitions," *Proceedings of the ACM on Programming Languages,* Volume 8, Issue PLDI, 2024, pp. 1804-29. **ACM Europe Best Paper Award**.

IPDPS 2022 **C. Rivera**, S. Di, J. Tian, X. Yu, D. Tao, and F. Cappello, "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.

Cluster 2021 J. Tian, S. Di, X. Yu, **C. Rivera**, K. Zhao, S. Jin, Y. Feng, X. Liang, D. Tao, and F. Cappello, "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.

IPDPS 2021 J. Tian, **C. Rivera**, S. Di, J. Chen, X. Liang, D. Tao, and F. Cappello, "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.

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. Cappello, "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.

Other Publications

;login: X. Sun, J. Gu, **C. Rivera**, T. Chajed, J. Howell, A. Lattuada, O. Padon, L. Suresh, A. Szekeres, T. Xu, "Anvil: Building Kubernetes Controllers That Do Not Break," *USENIX ;login:*, 2024.

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.

Awards

June 2024 **ACM Europe Best Paper Award**, *PLDI 2024, For "Predictable Verification Using Intrinsic Definitions"*

October 2023 **Travel Grant**, *Midwest Programming Languages Summit, University of Michigan*

January 2023 **PLMW Travel Grant**, *POPL 2023, ACM SIGPLAN*

2022–2027 **Graduate College Fellowship**, *University of Illinois Urbana-Champaign*

2022–2027 **SURGE Fellowship**, *Grainger College of Engineering, University of Illinois Urbana-Champaign*

2022–2023 **Wing Kai Cheng Fellowship**, *Siebel School of Computing and Data Science, University of Illinois Urbana-Champaign*

June 2022 **Travel Grant**, *Oregon Programming Languages Summer School, University of Oregon*

May 2022 **Outstanding Undergraduate Award**, *Department of Computer Science, University of Alabama*

Fall 2021 **R&D 100 Award**, *For "SZ: A Lossy Compression Framework for Scientific Data"*

2018–2022 **Fellowship Award**, *Randall Research Scholars Program, University of Alabama*

2018–2022 **Presidential Scholarship**, *University of Alabama*

[*]Equal contribution

Software

Anvil A framework for implementing Kubernetes controllers and verifying liveness properties in Verus, a Rust verification tool. Verified implementations of builtin controllers and features supporting compositional verification are under development. [URL: `https://github.com/anvil-verifier/anvil`]

IDS Artifact A suite of 42 operations over 10 data structures verified for functional correctness in Boogie to demonstrate intrinsic definitions. Data structures include lists, trees, and a List/BST overlay similar to that in the Linux I/O scheduler. [URL: `https://github.com/codyjrivera/ids-artifact`]

cuSZ A GPU version of SZ, an error-bounded lossy compressor for scientific data, implemented in CUDA C++. Incorporates optimized kernels for custom Huffman codebook construction and decoding. [URL: `https://szcompressor.org/`]

TSM2X A collection of two GPU algorithms for multiplying irregular-shaped tall-and-skinny matrices: `TSM2L` and `TSM2R`. The CUDA C++ implementations obtain average speedups of 1.9x over the vendor-supplied CUBLAS library. [URL: `https://github.com/codyjrivera/tsm2x-imp`]

Mentoring Experience

Spring 2025 **Cathy Cai**, *University of Illinois Urbana-Champaign*, Ph.D. Student

Technical Skills

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

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

Teaching Experience

Spring 2025
Fall 2024 **Graduate Teaching Assistant (CS 421: Programming Languages and Compilers)**, *University of Illinois Urbana-Champaign*, Urbana, IL

Fall 2020
Spring 2020
Fall 2019 **Undergraduate Teaching Assistant (CS 100: Computer Science I for Majors)**, *University of Alabama*, Tuscaloosa, AL

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.

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."

January 2023 **Programming Languages Mentoring Workshop**, *POPL 2023*, Boston, MA

June 2022 **Oregon Programming Languages Summer School**, *University of Oregon*, Eugene, OR