

Stephen Chou

32 Vassar Street, 32-G778
Cambridge, MA 02139
✉ s3chou@csail.mit.edu
🌐 stephenchou.net
📍 stephenchouca

Summary

- 7+ years of experience with developing programming systems and optimizing compilers that help users easily implement high-performance applications. In particular, I am a primary contributor to the **TACO tensor algebra compiler**, which generates fast code to perform sparse tensor algebra computations given high-level specifications of the desired computation and input/output data structures.
- Multiple first-authored and co-authored publications at top programming language and compiler conferences, including a distinguished paper award.
- Proficient in **C++ and C** and have significant working experience with **Python, JavaScript, MATLAB, Java, SQL, and Bash**.

Education

- 02/2018–09/2022 **PhD, Computer Science**, *Massachusetts Institute of Technology*.
(expected) Thesis: Format Abstractions for Compilation of Sparse Tensor Algebra.
Advisor: Prof. Saman Amarasinghe.
Cumulative GPA: 5.0/5.0.
- 09/2015–02/2018 **SM, Computer Science**, *Massachusetts Institute of Technology*.
Thesis: Unified Sparse Formats for Tensor Algebra Compilers.
Advisor: Prof. Saman Amarasinghe.
Cumulative GPA: 5.0/5.0.
- 09/2010–06/2015 **BASc, Computer Engineering**, *University of Waterloo*.
Cumulative GPA: 94%. (Graduated on Dean's Honours List with distinction.)

Research and Industry Experience

- 09/2015–present **Research Assistant**, *Massachusetts Institute of Technology*, Cambridge, MA.
- Generalized the TACO tensor algebra compiler theory to support efficiently computing with sparse tensors that are stored in a wide range of disparate data structures. These generalizations speed up real-world sparse tensor algebra computations by letting users store their data in specialized data structures that are optimized for the data.
 - Developed a more user-friendly compiler front end for Simit, a programming language for computing on sparse systems using linear algebra. This new front end was later also adapted for use in the compiler for GraphIt, a graph programming language.
 - Developed a web interface for TACO (<http://tensor-compiler.org/codegen>) that lets users try out the tool online without having to install it on their own machines.
- 06/2018–08/2018 **Research Intern**, *Microsoft*, Redmond, WA.
- Designed and implemented a prototype Python framework that can be used to improve the performance of deep learning models by automatically applying user-defined, high-level architectural optimizations. Worked with Drs. Minjia Zhang and Yuxiong He.
- 01/2015–08/2015 **Research Assistant**, *University of Waterloo*, Waterloo, ON, Canada.
- Prototyped mathematical (SMT) models that can be used to automatically synthesize designs for capillary electrophoresis devices given user-specified requirements and constraints. Worked with Prof. Derek Rayside.

- 09/2014–12/2014 **Compiler Optimization Developer Co-op**, IBM Canada, Markham, ON, Canada.
 01/2014–04/2014
 - Extended IBM XL C/C++/Fortran compiler’s high-level optimizer to vectorize type conversions (yielding up to ~30% performance gain on some SPEC benchmarks) and prototyped alternative cost models for the auto-SIMDizer.
 - Investigated and fixed defects in the XL compiler’s optimizer.
- 05/2013–08/2013 **Software Engineering Intern**, OptumSoft, Menlo Park, CA.
 - Designed and implemented prototype for a GraphLab-inspired distributed graph processing framework in the TACC programming language.
- 08/2012–12/2012 **Software Developer Co-op**, Sybase, Waterloo, ON, Canada.
 01/2012–04/2012
 - Developed tools and investigated techniques for improving the performance and optimality of Sybase SQL Anywhere’s join optimizer. Worked with Dr. Anisoara Nica.
 - Developed a replacement system for aggregating Sybase product crash reports and usage statistics. System was implemented entirely in Sybase SQL.

Publications

Preprints

- arXiv 2021 Stephen Chou and Saman Amarasinghe. Dynamic Sparse Tensor Algebra Compilation. arXiv:2112.01394 [cs.MS].

Conference Publications

- CGO 2022 Daniel Donenfeld, Stephen Chou, Saman Amarasinghe. Unified Compilation for Lossless Compression and Sparse Computing. To appear in *Proceedings of the 2022 IEEE/ACM International Symposium on Code Generation and Optimization*, 2022.
- OOPSLA 2021 Rawn Henry, Olivia Hsu, Rohan Yadav, Stephen Chou, Kunle Olukotun, Saman Amarasinghe, Fredrik Kjolstad. Compilation of Sparse Array Programming Models. In *Proceedings of the ACM on Programming Languages, Volume 5, Issue OOPSLA*, 2021.
- OOPSLA 2020 Ryan Senanayake, Changwon Hong, Ziheng Wang, Amalee Wilson, Stephen Chou, Shoaib Kamil, Saman Amarasinghe, Fredrik Kjolstad. A Sparse Iteration Space Transformation Framework for Sparse Tensor Algebra. In *Proceedings of the ACM on Programming Languages, Volume 4, Issue OOPSLA*, 2020.
- PLDI 2020 Stephen Chou, Fredrik Kjolstad, Saman Amarasinghe. Automatic Generation of Efficient Sparse Tensor Format Conversion Routines. In *Proceedings of the 41st ACM SIGPLAN International Conference on Programming Language Design and Implementation*, 2020.
- OOPSLA 2018 Stephen Chou, Fredrik Kjolstad, Saman Amarasinghe. Format Abstraction for Sparse Tensor Algebra Compilers. In *Proceedings of the ACM on Programming Languages, Volume 2, Issue OOPSLA*, 2018.
- OOPSLA 2017 Fredrik Kjolstad, Shoaib Kamil, Stephen Chou, David Lugato, Saman Amarasinghe. The Tensor Algebra Compiler. In *Proceedings of the ACM on Programming Languages, Volume 1, Issue OOPSLA*, 2017. [**Distinguished Paper Award**]

Peer-Reviewed Short/Workshop Publications

- SPAA 2020 Suzanne Mueller, Peter Ahrens, Stephen Chou, Fredrik Kjolstad, Saman Amarasinghe. Sparse Tensor Transpositions. In *Proceedings of the 32nd ACM Symposium on Parallelism in Algorithms and Architectures (brief announcement)*, 2020.
- Chocs Avancées David Lugato, Fredrik Kjolstad, Stephen Chou, Saman Amarasinghe, Shoaib Kamil. Taco: compilation et génération de code d’expressions tensorielles. In *Chocs Avancées*, No. 12, 2018.

ASE 2017 Fredrik Kjolstad, Stephen Chou, David Lugato, Shoaib Kamil, Saman Amarasinghe. *taco: A Tool to Generate Tensor Algebra Kernels*. In *Proceedings of the 32nd IEEE/ACM International Conference on Automated Software Engineering (tools paper and demo)*, 2017.

DBTest 2013 Anisoara Nica and Stephen Chou. Using Similarity Distance for Performance Prediction of the Query Optimization Process. In *Proceedings of the Sixth International Workshop on Testing Database Systems*, 2013.

Patents

01/2013 **Resource Estimation For A Query Optimization Process**.
Anisoara Nica and Stephen Chou.
Application number: US 13/754,596. Publication number: US9298771 B2.

Teaching Experience

- 10/2021 **Instructor for Intro to Unix Shell Workshop**, *Boston College*, Chestnut Hill, MA.
◦ Prepared and delivered a two-hour workshop, designed for undergraduate computer science and engineering students, that covered the basics of Bash and Vim.
- 09/2020–12/2020 **Teaching Assistant for Dynamic Computer Language Engineering Course (6.818)**, *Massachusetts Institute of Technology*, Cambridge, MA.
◦ Handled logistics associated with running the course (which had 30+ students), including keeping course website up to date, answering student questions on Piazza, and preparing and grading mini-quizzes that are given after every lecture.
◦ Prepared and graded semester-long course project, which required students to implement an optimized virtual machine for a dynamic programming language.
◦ Prepared and delivered nine recitations over the semester that were designed to aid students with their project. Also held weekly office hours to assist students one-on-one.

Awards & Honors

- 10/2017 **Distinguished Paper Award**, *OOPSLA 2017*.
- 06/2015 **Albert Sherwood Barber Medal for Best Overall Work Term and Academic Performance**, *University of Waterloo*.
- 02/2015 **First in Class Engineering Scholarship for 4A term**, *University of Waterloo*.
- 06/2014 **First in Class Engineering Scholarship for 3B term**, *University of Waterloo*.
- 10/2013 **First in Class Engineering Scholarship for 3A term**, *University of Waterloo*.
- 07/2012 **iAnywhere Solutions Inc. Scholarship**, *University of Waterloo*.

Talks

Format Abstractions for Compilation of Sparse Tensor Algebra

- 07/2021 Google Compiler ML Reading Group
- 07/2020 MIT Fast Code Seminar
- 06/2020 Programming Language Design and Implementation (PLDI)
- 02/2019 ADA Liaison Meeting Talk
- 01/2019 Invited Workshop on Compiler Techniques for Sparse Tensor Algebra, MIT
- 11/2018 Object-Oriented Programming, Systems, Languages, and Analysis (OOPSLA)

Professional Service

- Journal Review **IEEE TC:** Transactions on Computers (2019)
- Conference **MLSys:** Conference on Machine Learning and Systems (2022)
- Review **Euro-Par:** European Conference on Parallel and Distributed Computing (2020)
- SPAA:** Symposium on Parallelism in Algorithms and Architectures (2019, 2021)
- PLDI:** Programming Language Design and Implementation (2019)
- CGO:** Symposium on Code Generation and Optimization (2017, 2018, 2022)
- Committees **CGO 2020** Artifact Evaluation Committee