

Jason Gross

github.com/JasonGross
people.csail.mit.edu/jgross

ADDRESS

258 Prospect Street, Apt # 1L
Cambridge, MA 02139

CONTACT

jgross@mit.edu
(631) 790-8962

RESEARCH INTERESTS

Programming Languages, Formal Verification, Performance of Automation in Interactive Proof Assistants, Homotopy Type Theory, Category Theory, Program Synthesis, Cryptography

KEY CONTRIBUTIONS

Fiat Cryptography

- Collaboratively working on one of the world's first algorithm-level-optimizing compilers
- Collaboratively implemented proven-correct cryptographic code now used by Google Chrome, and in the majority of secure connects from web browsers

Interactive Proof Assistants

- Researching performance issues that impact scalability of automated verification
- Reporting the plurality of bugs in the proof assistant Coq

EDUCATION

Massachusetts Institute of Technology

2013–2021

PhD in Computer Science

Cambridge, MA

Advisor: Adam Chlipala

Thesis: Performance Engineering of Proof-Based Software Systems at Scale

SM Thesis: An Extensible Framework for Synthesizing Efficient, Verified Parsers

Massachusetts Institute of Technology

2009–2013

BS in Mathematics and Physics

Cambridge, MA

GPA: 4.6/5

INTERNSHIPS

Machine Intelligence Research Institute

June 2019–August 2019

Type Theory Intern

Berkeley, CA

- Worked on formalizing type theories and on proving things within proof assistants

Google

June 2018–August 2018

Software Engineering Intern

Cambridge, MA

- Worked with BoringSSL on integration of proven-correct low-level ECC primitives into Chrome

Google

June 2016–September 2016

Software Engineering Intern

Mountain View, CA

- Formalized low-level ECC primitives with proofs of correctness

Microsoft Research

June 2014–August 2014

Intern

Cambridge, United Kingdom

- Created a language for specifying input/output behavior of x86 assembly programs with Andrew Kennedy and Nick Benton; Verified the I/O behavior of a number of simple programs
- Improved automation of the x86proved library

MIT CSAIL

April 2012–June 2014

Researcher

Cambridge, MA

- Entered a significant amount of category theory into the automated proof assistant Coq (<https://github.com/HoTT/HoTT/tree/master/theories/Categories>)
- Made progress towards an interface for databases and database migration on top of category theory in Coq with David Spivak and Adam Chlipala

MIT CSAIL

November 2009–September 2011

Researcher

Cambridge, MA

- Designed from scratch a data collection webpage, collected data for, and helped with research of Brenden Lake, Ruslan Salakhutdinov, and Josh Tenenbaum, on categorical and transfer learning.

Commack High School

Fall 2006–Summer 2009

Independent Researcher

Commack, NY

- Independently researched circuits over sets of natural numbers for three years.
- Won fourth place award in mathematics in ISEF (Intel International Science and Engineering Fair) in 2009, third place award in ISEF 2008.

COMPUTER SKILLS

- Proficient skills – Coq, Mathematica, git, Python, JavaScript, BASIC
- Working knowledge – C, C++, Agda, OCaml, Haskell, Scheme, HTML, CSS, Perl, Java
- Basic knowledge – Matlab, Idris, Ruby, Ur/Web, x86 Assembly

TEACHING

- Instructor at Monsoon Math: Classes on category theory, linear logic, and Löb’s theorem
- TA for 6.172 (Performance Engineering): Led recitations, analyzed and explained assembly output of `gcc -O3` to teach vectorization
- TA for 8.012 (Physics I) and 8.022 (Physics II) in Experimental Study Group
- Volunteer for MIT ESP: Classes on L^AT_EX, philosophy, linear algebra, and quantum mechanics

EXTRACURRICULAR ACTIVITIES

- Co-maintainer of the homotopy type theory Coq repository (HoTT/HoTT on GitHub)
- MIRI Decision Theory Workshop Attendee: Formalized various versions of Löb’s theorem in Agda and Coq
- Committer to the SIPB BarnOwl project (<https://barnowl.mit.edu>)
- SIPB (Student Information and Processing Board) Member
- Canada/USA Mathcamp (Summers 2006–2009)

SELECTED PRESENTATIONS AND PUBLICATIONS

- [Gro21] Jason Gross. *A Limited Case for Reification by Type Inference*. Presented at The Seventh International Workshop on Coq for Programming Languages (CoqPL’21). Jan. 2021. URL: <https://people.csail.mit.edu/jgross/personal-website/papers/2021-reification-by-type-inference-coqpl.pdf>.

- [Pit+20] Clément Pit–Claudel, Peng Wang, Benjamin Delaware, Jason Gross, and Adam Chlipala. “Extensible Extraction of Efficient Imperative Programs with Foreign Functions, Manually Managed Memory, and Proofs”. In: *Proceedings of the 9th International Joint Conference on Automated Reasoning (IJCAR’20)*. Ed. by Nicolas Peltier and Viorica Sofronie-Stokkermans. Paris, France: Springer International Publishing, June 2020, pp. 119–137. ISBN: 978-3-030-51054-1. DOI: 10.1007/978-3-030-51054-1_7.
- [Erb+19] Andres Erbsen, Jade Philipoom, Jason Gross, Robert Sloan, and Adam Chlipala. “Simple High-Level Code For Cryptographic Arithmetic – With Proofs, Without Compromises”. In: *Proceedings of the 40th IEEE Symposium on Security and Privacy (S&P’19)*. May 2019. DOI: 10.1145/3421473.3421477. URL: <https://people.csail.mit.edu/jgross/personal-website/papers/2019-fiat-crypto-ieee-sp.pdf>.
- [Gro18] Jason Gross. *Presentation Proposal for Teaching Your Rooster to Crow in C*. Presented at The Coq Workshop 2018. July 2018. URL: <https://people.csail.mit.edu/jgross/personal-website/presentations/coq-workshop-2018/coq-workshop-proposal-notations.pdf>.
- [GEC18] Jason Gross, Andres Erbsen, and Adam Chlipala. “Reification by Parametricity: Fast Setup for Proof by Reflection, in Two Lines of Ltac”. In: *Proceedings of the 9th International Conference on Interactive Theorem Proving (ITP’18)*. Ed. by Jeremy Avigad and Assia Mahboubi. Cham: Springer International Publishing, July 2018, pp. 289–305. ISBN: 978-3-319-94821-8. DOI: 10.1007/978-3-319-94821-8_17. URL: <https://people.csail.mit.edu/jgross/personal-website/papers/2018-reification-by-parametricity-ity-camera-ready.pdf>.
- [Chl+17] Adam Chlipala, Benjamin Delaware, Samuel Duchovni, Jason Gross, Clément Pit–Claudel, Sorawit Suriyakarn, Peng Wang, and Katherine Ye. “The End of History? Using a Proof Assistant to Replace Language Design with Library Design”. In: *Proceedings of the The 2nd Summit on Advances in Programming Languages (SNAPL’17)*. Ed. by Benjamin S. Lerner, Rastislav Bodík, and Shriram Krishnamurthi. Vol. 71. Leibniz International Proceedings in Informatics (LIPIcs). Asilomar, CA, USA: Schloss Dagstuhl–Leibniz-Zentrum fuer Informatik, May 2017, 3:1–3:15. ISBN: 978-3-95977-032-3. DOI: 10.4230/LIPIcs.SNAPL.2017.3. URL: <https://people.csail.mit.edu/jgross/personal-website/papers/FiatSNAPL17.pdf>.
- [Bau+17] Andrej Bauer, Jason Gross, Peter LeFanu Lumsdaine, Michael Shulman, Matthieu Sozeau, and Bas Spitters. “The HoTT Library: A Formalization of Homotopy Type Theory in Coq”. In: *Proceedings of the 6th ACM SIGPLAN Conference on Certified Programs and Proofs. CPP 2017*. Paris, France: ACM, Jan. 2017, pp. 164–172. ISBN: 978-1-4503-4705-1. DOI: 10.1145/3018610.3018615. eprint: 1610.04591. URL: <https://people.csail.mit.edu/jgross/personal-website/papers/2017-HoTT-formalization.pdf>.
- [Gro16] Jason Gross. *The HoTT/HoTT Library in Coq: Designing for Speed*. Presented at The 5th International Congress on Mathematical Software (ICMS 2016). July 2016. URL: <https://people.csail.mit.edu/jgross/personal-website/presentations/icms-2016/hott-hott-and-category-coq-experience.pdf>.
- [Gro15a] Jason Gross. “An Extensible Framework for Synthesizing Efficient, Verified Parsers”. MA thesis. Massachusetts Institute of Technology, Sept. 2015. URL: <https://people.csail.mit.edu/jgross/personal-website/papers/2015-jgross-thesis.pdf>.
- [Del+15] Ben Delaware, Clément Pit–Claudel, Jason Gross, and Adam Chlipala. “Fiat: Deductive Synthesis of Abstract Data Types in a Proof Assistant”. In: *Proceedings of the 42nd ACM SIGPLAN-SIGACT Symposium on Principles of Programming Languages (POPL’15)*. Jan. 2015. DOI: 10.1145/2775051.2677006. URL: <https://people.csail.mit.edu/jgross/personal-website/papers/2015-adt-synthesis.pdf>.

- [Gro15b] Jason Gross. *Coq Bug Minimizer*. Presented at The First International Workshop on Coq for PL (CoqPL'15). Jan. 2015. URL: <https://people.csail.mit.edu/jgross/personal-website/papers/2015-coq-bug-minimizer.pdf>.
- [TG15] Tobias Tebbi and Jason Gross. *A Profiler for Ltac*. Presented at The First International Workshop on Coq for PL (CoqPL'15). Jan. 2015. URL: <https://people.csail.mit.edu/jgross/personal-website/papers/2015-ltac-profiler.pdf>.
- [Gro14a] Jason Gross. *Presentation: Input, Output, and Automation in x86 Proved*. Presented at Microsoft Research, Cambridge, UK. Aug. 2014. URL: <https://people.csail.mit.edu/jgross/personal-website/presentations/msr-2014-final-talk/input-output-and-automation-in-x86proved.pdf>.
- [GCS14] Jason Gross, Adam Chlipala, and David I. Spivak. "Experience Implementing a Performant Category-Theory Library in Coq". In: *Proceedings of the 5th International Conference on Interactive Theorem Proving (ITP'14)*. Ed. by Gerwin Klein and Ruben Gamboa. Cham: Springer International Publishing, July 2014, pp. 275–291. ISBN: 978-3-319-08970-6. DOI: 10.1007/978-3-319-08970-6_18. eprint: 1401.7694. URL: <https://people.csail.mit.edu/jgross/personal-website/papers/category-coq-experience-ityp-submission-final.pdf>.
- [Gro14b] Jason Gross. *Presentation Proposal for Three Neat Tricks in Coq 8.5*. Presented at the 6th Coq Workshop. Apr. 2014. URL: <https://people.csail.mit.edu/jgross/personal-website/presentations/coq-workshop-2014/coq-workshop-proposal-tactics-in-terms.pdf>.
- [Gro14c] Jason Gross. *Jason Gross' Wishlist for Coq*. Jan. 2014. URL: <https://people.csail.mit.edu/jgross/personal-website/presentations/coq-8.6-wishlist/jgross-coq-8-6-wishlist-no-pause.pdf>.
- [Gro14d] Jason Gross. *POPL: Minute Madness: Category Theory in Coq, and Program Synthesis*. Presented at the 41st ACM SIGPLAN-SIGACT Symposium on Principles of Programming Languages (POPL'14). Jan. 2014. URL: <https://people.csail.mit.edu/jgross/personal-website/presentations/popl-2014-minute-madness/jason-gross-minute-madness.pdf>.
- [Gro13a] Jason Gross. *CSAIL Student Workshop 2013: Computational Higher Inductive Types: Computing with Custom Equalities*. Presented at the 2014 MIT CSAIL Student Workshop. Oct. 2013. URL: <https://people.csail.mit.edu/jgross/personal-website/presentations/csw-2013/jgross-presentation-no-pause.pdf>.
- [Gro13b] Jason Gross. *Building Database Management on top of Category Theory in Coq*. Presented as a student talk at the 40th ACM SIGPLAN-SIGACT Symposium on Principles of Programming Languages (POPL'13). Jan. 2013. URL: <https://people.csail.mit.edu/jgross/personal-website/presentations/popl-2013/jgross-student-talk.pdf>.
- [Gro13c] Jason Gross. *POPL: Minute Madness: Database Management on top of Category Theory in Coq: Category of Relational Schemas = Category of Categories*. Presented at the 40th ACM SIGPLAN-SIGACT Symposium on Principles of Programming Languages (POPL'13). Jan. 2013. URL: <https://people.csail.mit.edu/jgross/personal-website/presentations/popl-2013/minute-madness.pdf>.
- [Lak+11] Brenden M. Lake, Ruslan Salakhutdinov, Jason Gross, and Joshua B. Tenenbaum. "One shot learning of simple visual concepts". In: *Proceedings of the 33rd Annual Conference of the Cognitive Science Society*. 2011. URL: <https://people.csail.mit.edu/jgross/personal-website/papers/LakeEtAl2011CogSci.pdf>.