Rachit Nigam

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I am a fifth-year PhD student at Cornell University studying programming languages and computer architectures with a focus on building new toolchains to automatically generate efficient hardware accelerators. My research has produced several open-source tools that have been adopted by researchers and engineers.

Education

Cornell University

Doctor of Philosophy in Computer Science — *2018 - Present*

- Committee: Adrian Sampson (chair), Zhiru Zhang, Nate Foster, Chris De Sa

Cornell University

Masters in Computer Science — *2018 - 2021*

- Thesis: *Language-Level Modeling for Hardware Constraints*
- Committee: Adrian Sampson (chair), Zhiru Zhang, Nate Foster, Chris De Sa

University of Massachusetts Amherst

Bachelors in Computer Science | Summa cum laude — *2015 - 2018*

- Thesis: *Execution Control for JavaScript*, Distinction with Highest Honors
- Committee: Arjun Guha (chair), Emery Berger

Refereed Publications

ASPLOS 2023 — **Stepwise Debugging for Hardware Accelerators**

Griffin Berlstein, Rachit Nigam, Chris Gyurgyik, Adrian Sampson

In *Architectural Support for Programming Languages and Operating Systems*.

ASPLOS 2021 — **A Compiler Infrastructure for Accelerator Generators**

Rachit Nigam[†], Samuel Thomas[†], Zhijing Li, Adrian Sampson

([†]*Equally contributing authors*)

In *Architectural Support for Programming Languages and Operating Systems*.

- Calyx has integrated in the LLVM CIRCT project and is being used to design a next-generation high-level synthesis toolchain.
- Calyx has been used as a part of **four research projects** and an industrial toolchain to compile PyTorch programs to customized hardware accelerators

ASPLOS 2021 — **Vectorization for Digital Signal Processors via Equality Saturation**

Alexa VanHattum, Rachit Nigam, Vincent Lee, James Bornholt, Adrian Sampson

In *Architectural Support for Programming Languages and Operating Systems*.

PLDI 2020 — **Predictable Accelerator Design with Time-Sensitive Affine Types**

Rachit Nigam, Sachille Atapattu, Samuel Thomas, Theodore Bauer, Apurva Koti, Zhijing Li, Yuwei Ye, Adrian Sampson, Zhiru Zhang

In *ACM SIGPLAN Conference on Programming Language Design and Implementation*.

PLDI 2018 — **Putting in All the Stops: Execution Control for JavaScript**

Samuel Baxter, Rachit Nigam, Arjun Guha, Joe Gibbs Politz, Shriram Krishnamurthi

In *ACM SIGPLAN Conference on Programming Language Design and Implementation*.

- The next-generation compiler for the Pyret programming language uses Stopify to provide interactive programming features.
- Stopify is the underlying technology for the Ocelot IDE and is used by hundreds of students.

Other Publications

WOSET 2021 **A Toolkit for Designing Hardware DSLs**
Griffin Berlstein, Rachit Nigam, Chris Gyurgyik, Adrian Sampson
In *Workshop on Open-Source EDA Technology*.

LCTES 2020 **A Synthesis-aided Compiler for DSP Architectures (WiP Paper)**
Alexa VanHattum[†], Rachit Nigam[†], Vincent Lee, James Bornholt, Adrian Sampson
([†]*Equally contributing authors*)
In *International Conference on Languages, Compilers, and Tools for Embedded Systems*.

SNAPL 2017 **Fission: Secure Dynamic Code-Splitting for JavaScript**
Arjun Guha, Jean-Baptiste Jeannin, Rachit Nigam, Jane Tangen, Rian Shambaugh
In *Summit oN Advances in Programming Languages*.

Experience

Cornell University
Graduate Research Assistant *08/2018 - Present*
Designing new tools and techniques for compiling high-level languages to hardware designs.

Facebook Reality Labs
Research Intern *05/2019 - 08/2019*
Applied program synthesis techniques to automatically generate correct and efficient hardware for emerging mathematical domains such as log arithmetic.

Google
Software Engineering Intern *05/2018 - 08/2018*
Implemented support for Progressive Web Applications for internal web application framework.

University of Massachusetts Amherst
Research Assistant *05/2016 - 05/2018*
Developed Fission, a compiler for partitioning single-tier JavaScript program while enforcing infromation flow control.

Brown PLT, Brown University
Visiting Researcher *05/2017 - 08/2017*
Developed Stopify, a source to source compiler for JavaScript that provides common debugging abstractions like stopping, stepping and break-pointing, in a browser based IDE for languages that compile to JavaScript.

Awards

Departmental Nominee, Google Fellowship 2020
Finalist, Qualcomm Innovation Fellowship 2020
Outstanding Teaching Assistant, Cornell CIS 2019
Dean's Merit Scholarship, UMass Amherst 2018
Honors Research Fellowship, UMass Amherst 2017
Racket Summer School Scholarship, University of Utah 2017
CMMRS Travel Scholarship, Max Planck Institute 2017
Finalist, Best Project in Public Interest, HackUMass IV 2016
ICFP Travel Scholarship, ICFP 16 2016
Chancellor's Scholarship, UMass Amherst 2015

Presentations

MathWorks Code Generation Forum, Invited Talk 2022
AMD, Invited Talk 2022
Google, Invited Talk 2022
Brown University, Invited Talk 2022
Northeastern University, Invited Talk 2022
Wellesley College, Guest Lecture 2021
University of Washington, A Compiler Infrastructure for Accelerator Generators 2021
ASPLOS, A Compiler Infrastructure for Accelerator Generators 2021
LLVM CIRCT Group, A Compiler Infrastructure for Accelerator Generators 2021
PLDI, Predictable Accelerator Design with Time-Sensitive Affine Types 2020
University of California, Berkeley, Predictable Accelerator Design 2020
University of Washington, Predictable Accelerator Design 2020
Imperial College London, Predictable Accelerator Design 2020
Princeton University, Predictable Accelerator Design 2019
NEPLS, Web-based Debugging for Free 2017

Academic Service

External Review & Artifact Evaluation Committees, OOPSLA 23 2023
Social Chair, PLDI 23 2022
Organizer, 2nd Workshop on Languages, Tools, and Techniques for Accelerator Design 2021
Social Chair, PLDI 22 2021
Organizer, 1st Workshop on Languages, Tools, and Techniques for Accelerator Design 2021
Social Chair, PLDI 21 2021
Sub-reviewer, ISCA 21 2021
Artifact Evaluation Committee, OOPSLA 20 2020
Artifact Evaluation Committee, PLDI 20 2020
Artifact Evaluation Committee, PLDI 19 2019
Volunteer, SPLASH 18 2018

Volunteering

Vice-President of CS Graduate Organization, Cornell CIS 2020
Organizer, CAPRA External Talk Series 2020
Organizer, Programming Languages Retreat 2019
Member of Graduate Admissions Committee, Cornel CIS 2019
Mentor, Expand Your Horizons, Cornell 2019
Mentor, Eureka! Girls Inc. 2016