

CHINMAY DESHPANDE

✉ chinmay1dd@gmail.com

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RESEARCH INTERESTS

I am broadly interested in the areas of compilers, security and development of low-level software systems. I enjoy working on problems relating to code performance, source (and binary) program analysis and automating reverse engineering. These days, I am intrigued by challenges and tradeoffs further down the stack, such as in hardware and software co-design.

More generally, I love working with low-level code - be it reverse engineering binaries or writing code generation passes as part of a compiler. I also have experience in the topics of software security – both offensive and defensive, formal analysis, and deep learning.

EDUCATION

University of California Irvine

Ph.D. in Computer Science

Dissertation: Practical Recompilation of Multithreaded Binaries

Advisor: Prof. Dr. Michael Franz

2019 - 2024

GPA: 3.98/4.0

National Institute of Technology Karnataka, Surathkal

B.Tech in Information Technology

Thesis Project: Optimizing Search Strategies in Binary Symbolic Execution

2013 - 2017

GPA: 8.87/10

PUBLICATIONS

- *Chinmay Deshpande*, Fabian Parzefall, Felicitas Hetzelt and Michael Franz. Polynima: Practical Hybrid Recompilation for Multithreaded Binaries. **EuroSys 2024**. (Acceptance: 14.6%)
- Fabian Parzefall, *Chinmay Deshpande*, Felicitas Hetzelt and Michael Franz. What you trace is what you get: dynamic stack-layout recovery for binary recompilation. **ASPLOS 2024**. (Acceptance: 20%)
- *Chinmay Deshpande*, David Gens, and Michael Franz. 2021. StackBERT: Machine Learning Assisted Static Stack Frame Size Recovery on Stripped and Optimized Binaries. **AISeC @ ACM CCS 2021**. (Acceptance: 21%)

EXPERIENCE

AMD

Compilers and Languages Team

Focus: LLVM, GPU compilers, hardware specifics

Member of Technical Staff

Fall '24 - Present

- Working on the LLVM compiler backend that targets AMD GPUs, as part of the ROCm stack - with a focus on compute workloads such as for machine learning and image processing.
- Closely involved in the development of compiler features for upcoming datacenter hardware. Responsibilities also include ensuring and improving compiler compatibility within the ROCm Windows ecosystem.
- Most of my contributions are open-source, as part of upstream LLVM or the AMD fork of the same.

Secure Systems and Software Lab, UC Irvine

Advisor: Prof. Michael Franz

Focus: Binary lifting and translation

Research Assistant

2019 - 2024

- Primarily worked on BinRec, a framework for the lifting and recompilation of x86/x64 binaries using LLVM IR. The project spans around 30 KLOC of C++ and is undisputedly (as of 2024) the most performant and robust recompiler out there.
- We achieved several goals in the context of this project: compatibility for multithreaded binaries, refining generated IR to move away from the “emulator” model, incremental lifting and cross-ISA binary translation. Towards the end, I was investigating fundamental security and correctness issues introduced by the recompilation process and how we can tackle them.
- I also contributed to MCA Daemon (MCAD), a framework that builds on top of llvm-mca and enables precise timing analysis of entire binary programs.

Vuln. Discovery and Mitigations Research, Qualcomm (QPSI)

Engineering Intern

Mentor: Dr. Nilo Redini

Summer '23

Focus: Security, fuzzing, symbolic bug-finding

- Worked on applying symbolic taint analysis to find memory corruption vulnerabilities in kernel-mode driver binaries. The core challenge was to track interesting taint flow from unverified sources.
- Found and reported multiple bugs in critical QC software. Implemented improvements to the underlying engine that include precise handling of global variables, and identifying struct-based object overflows.

Automated Reasoning Group, Amazon

Applied Scientist Intern

Mentor: Dr. Daniel Schwartz-Narbonne

Summer '21

Focus: Formal methods and verification, source analysis, Rust internals

- Worked on a verification-friendly vector stub for the Rust Standard Library in the context of the Kani Verifier project - which performs formal verification of Rust programs.
- Project involved research and implementation of a host of vector abstractions of varying granularity to demonstrate significant improvements in proof performance and scalability.

Binary Ninja, Vector35

Intern

Mentor: Peter LaFosse

Summer '20

Focus: Binary analysis, reverse engineering, dataflow analysis

- Implemented User-informed dataflow (UIDF), a feature which allows users to inform values to identified variables at the Medium-level IL (MLIL) layer. UIDF seeds the analysis with provided variable values and enables constant propagation, dead-code elimination based on the resulting dataflow.
- Was involved in the ideation, design and development of the feature - including core algorithms, API and the user-interface. Also worked on general bug-fixes and product improvement over the summer.

rune/radeco, radare2

Open-source Contributor

Mentor: Anton Kochkov

2016 - 2018

Focus: Decompilers, symbolic execution, Rust

- Implemented an Explorer module for a binary symbolic executor, to allow pre-defined choices at conditional program points in lifted IR. Designed a new memory-module backend to support single-byte symbolic memory accesses.
- Mentored radeco, a decompiler project, which involved implementing control-flow restructuring and IR to AST translation for C-like pseudocode output as a part of Google Summer of Code (GSoC).

Dynamic Windows Sandboxing, McAfee

Software Development Engineer

Manager: Sumit Lohani

2017 - 2019

Focus: Malware detection techniques

- Primarily conducted research on binary sandboxing and reverse engineering of Windows malware - user-mode hooking, process memory analysis, evasion techniques, etc. in a QEMU-based virtual environment to improve their replication and detection.

SKILLS

- **Languages** C, C++, Python, Rust, ASM: x86/64, ARM, AMDGCN ISA
- **Libraries/Software** LLVM, IDA Pro, gdb, OllyDbg, Z3, Intel Pin, qemu, angr

ACTIVITIES

- **Teaching:** CS296P - Capstone Writing & Communication (Spring '23), CS253P - Advanced Programming and Problem Solving (Fall '19), ICS32 - Programming with Software Libraries (Winter '20)
- **Sub-Reviewer:** IEEE S&P, Usenix Security, NDSS, RAID
- **Capture The Flag:** Member of team **No Internet Access**. Peak rank of 2 in India with multiple top 100 placements in major international CTFs. Responsibilities - reverse engineering, forensics
- **Volunteering:** Taught elementary physics and mathematics to underprivileged high school students as part of the Avanti Fellows (NGO) from 2014 - 2017.

ACHIEVEMENTS

Academia

- Deans Scholarship Award for \$10000 - UC Irvine (2019)
- MITACS Globalink Scholarship (Research funding through Summer 2016), Eklavya Scholarship (2015)
- Travel Grant - ACM EuroSys (2024), ACM ASPLOS (2024), ACM CCS (2021)

Industry

- Spotlight Award - AMD (Q3 2025), Letter of Recognition - McAfee (2018)
- GSoC Mentor - radare2 (2018), Radare Summer of Code (2017)
- Invitee - Qualcomm Product Security Summit (2023), Travel Grant - Clojure Conj (2016)

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