

# Keyur Parag Joshi

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## Education

- **University of Illinois at Urbana-Champaign (UIUC), USA**  
Ph.D in Computer Science advised by Sasa Misailovic  
August 2017 – May 2023 (Expected)
- **Indian Institute of Technology, Hyderabad (IITH), India**  
Bachelor of Technology (Honours) in Computer Science and Engineering  
Valedictorian  
August 2013 – May 2017

## Research Interests

- Testing and analysis of approximate and/or unreliable programs and systems
- Effective and safe application of approximations in emerging domains
- Programming languages and software engineering

## Current Research

I am currently a Research Assistant at UIUC advised by Sasa Misailovic. My current projects include:

- **State uncertainty estimation for autonomous vehicles:** Modern autonomous vehicles use neural networks to perceive their state and/or make control decisions. Consequently, such vehicles operate on approximate data and may make unsafe decisions. Using a novel perception model and generalized polynomial chaos, we estimate the uncertainty in the vehicle state over time, and provide useful safety guarantees.
- **Precise analysis of program uncertainty in the face of SDCs:** Silent Data Corruptions (SDCs) alter program data in an insidious manner. `gem5-Approxilyzer`, a tool for analysis of programs in the presence of SDCs, does not scale to large programs or inputs. We combine `gem5-Approxilyzer` with `Chisel` and `Diamont`, respectively static and dynamic analyses of program uncertainty. This combines the precision of `gem5-Approxilyzer`'s analysis with the scalability of `Chisel` and `Diamont`.

## Publications

Publications are also listed at Google Scholar: [scholar.google.com/citations?user=ewi6R3UAAAAJ](https://scholar.google.com/citations?user=ewi6R3UAAAAJ)

- **Verifying Controllers with Vision-based Perception Using Safe Approximate Abstractions**  
Chiao Hsieh, Yangge Li, Dawei Sun, **Keyur Joshi**, Sasa Misailovic, Sayan Mitra  
*Embedded Software (EMSOFT 2022)*
- **Diamont: Dynamic Monitoring of Uncertainty for Distributed Asynchronous Programs**  
Vimuth Fernando, **Keyur Joshi**, Jacob Laurel, Sasa Misailovic  
*International Conference on Runtime Verification (RV 2021)*
- **ApproxTuner: A Compiler and Runtime System for Adaptive Approximations**  
Hashim Sharif, Maria Kotsifakou, Yifan Zhao, Akash Kothari, Ben Schreiber, Elizabeth Wang, Yasmin Sarita, Nathan Zhao, **Keyur Joshi**, Vikram Adve, Sasa Misailovic, Sarita Adve  
*ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming (PPOPP 2021)*
- **Aloe: Verifying Reliability of Approximate Programs in the Presence of Recovery Mechanisms**  
**Keyur Joshi**, Vimuth Fernando, Sasa Misailovic  
*IEEE/ACM International Symposium on Code Generation and Optimization (CGO 2020)*

- **Statistical Algorithmic Profiling for Randomized Approximate Programs**  
Keyur Joshi, Vimuth Fernando, Sasa Misailovic  
*41st ACM/IEEE International Conference on Software Engineering (ICSE 2019)*
- **Verifying Safety and Accuracy of Approximate Parallel Programs via Canonical Sequentialization**  
Vimuth Fernando, Keyur Joshi, Sasa Misailovic  
*34th ACM SIGPLAN Conference on Object-Oriented Programming, Systems, Languages and Applications (OOPSLA/SPLASH 2019)*
- **ApproxHPVM: A Portable Compiler IR for Accuracy-Aware Optimizations**  
Hashim Sharif, Prakalp Srivastava, Muhammad Huzaifa, Maria Kotsifakou, Keyur Joshi, Yasmin Sarita, Nathan Zhao, Vikram S. Adve, Sasa Misailovic, Sarita Adve  
*34th ACM SIGPLAN Conference on Object-Oriented Programming, Systems, Languages and Applications (OOPSLA/SPLASH 2019)*
- **Identifying Optimal Parameters for Randomized Approximate Algorithms**  
Vimuth Fernando, Keyur Joshi, Darko Marinov, Sasa Misailovic  
*Workshop on Approximate Computing Across the Stack (WAX 2019) (Co-located with PLDI 2019)*

## Professional Experiences

- Summer 2022 – Research Intern at Microsoft Research India
- Spring 2022 – Member of the PLDI 2022 Artifact Evaluation Committee
- Summer 2021 – Member of the OOPSLA 2021 Artifact Evaluation Committee
- Fall 2020 – Teaching Assistant for CS 427 Software Engineering I at UIUC; responsibilities including office hours, class logistics, homework, and projects
- Spring 2018 – Co-organized the Brett Daniel Software Engineering Seminar at UIUC

## Talks and Presentations

- **Conference Talk:** Aloe: Verifying Reliability of Approximate Programs in the Presence of Recovery Mechanisms (*CGO 2020*)
- **Conference Talk:** Statistical Algorithmic Profiling for Randomized Approximate Programs (*ICSE 2019*)
- **Seminar Talk:** Monitor-Based Statistical Model Checking for Weighted Metric Temporal Logic (*Brett Daniel Software Engineering Seminar, UIUC*)
- **Lightning Talk:** Implementation of a Cache Miss Calculator in LLVM/Polly (*LLVM in HPC Workshop, SC 2017*)
- **Seminar Talk:** Triangular inequality for compiler-based strength reduction (*Brett Daniel Software Engineering Seminar, UIUC*)

## Tools

- **Fixed-Point-RNN-Training:** A tool for training RNNs using (almost) exclusively fixed-point arithmetic, available at <https://github.com/KPJoshi/Fixed-Point-RNN-Training>
- **Parallely:** Verifying Safety and Accuracy of Approximate Parallel Programs via Canonical Sequentialization: tool and instructions available at [github.com/uiuc-arc/parallely](https://github.com/uiuc-arc/parallely)
- **AxProf:** Statistical Algorithmic Profiling for Randomized Approximate Programs: tool, examples, and tutorial available at [axprof.org](https://axprof.org)