Keyur Parag Joshi

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Education

- **University of Illinois at Urbana-Champaign (UIUC), USA**
  Ph.D in Computer Science advised by Associate Professor 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 software and systems
- Effective and safe application of approximations in emerging domains

Current Research

- **Precise and efficient analysis of program uncertainty in the face of SDCs:** Silent Data Corruptions (SDCs) alter program data in an insidious manner. gem5-Approxilyzer, a precise tool for analyzing the effect of bit flips on programs (including SDCs), does not scale to large programs or inputs. We combine gem5-Approxilyzer with Chisel, a more scalable tool for analyzing the propagation of SDCs within programs. The combined approach hits a sweet spot on the precision-scalability trade-off for analysis of SDCs.
- **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 (GPC), we provide useful estimates of the vehicle state distribution over time and conduct safety tests.

Publications

Publications can also be found at scholar.google.com/citations?user=ewi6R3UAAAAJ and kpjoshi.com

- **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)

Open-Source Tools

- **Fixed-Point-RNN-Training**: A tool for training RNNs using (almost) exclusively fixed-point arithmetic, available at `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`
- **AxProf**: Statistical Algorithmic Profiling for Randomized Approximate Programs: tool, examples, and tutorial available at `axprof.org`

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)*

Skills

- **Programming:** Extensive experience in programming with Python and C++. Moderate experience with LLVM.
- **Teamwork:** Experience collaborating on research and engineering projects in teams of 2-5 individuals using tools such as git, Slack, and PowerPoint.