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

- **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

- **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

Skills

- **Languages:** Extensive experience with Python, C++, git, and LaTeX. Moderate experience with LLVM.

- **OS:** Experience in programming for GNU/Linux and Windows environments.

- **Teamwork:** Experience working on research and engineering projects in teams of 2-5 individuals.