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Research Interests

Compilers, Program Analysis, Programming languages, Software Engineering.

Objective

Designing new program analyses and applications of program analyses have been the heart of my research pursuit. I wish to explore applications that use program analysis techniques to complement techniques for verification, validation, software engineering.

Experience

- **Senior Researcher** in Microsoft Research, India (*Mar '24 - Present*)
- **Post-Doctoral Researcher** in Microsoft Research, India (*Sep '21 - Feb '24*)
- **Research Associate** in Department of Computing, Imperial College, London (*Aug '18 - July '21*)
- **Invited Speaker** at Summer School for Pointer Analysis, IIT Bombay (*July '22*)
- **Teaching Assistant** in CSE Department, IIT Bombay (*Aug '11 - Aug '18*)
- **Teaching Assistant** in Department of Computing, Imperial College (*Oct '19 - Jan '20*)

Education

- **Ph.D.** in Computer Science & Engineering, IIT Bombay (*Jun '13 - July '18*)
Thesis Title: *Generalized Points-to Graph: A New Abstraction of Memory in Presence of Pointers*
Advisor: Prof. Uday P. Khedker
- **M.Tech.** in Computer Science & Engineering, IIT Bombay (*July '11 - Jun '13*)
- **B.E.** in Computer Science & Engineering, Mumbai University (*Jun '06 - May '10*)

Publications

- *Inference of Resource Management Specifications*. Narges Shadab, Pritam M. Gharat, Shrey Tiwari, Michael Ernst, Martin Kellogg, Akash Lal, Shuvendu Lahiri, Manu Sridharan. Object Oriented Programming Systems Language and Applications (OOPSLA) 2023.
- *Combining Static Analysis Error Traces with Dynamic Symbolic Execution (Experience Paper)*. Frank Busse, Pritam M. Gharat, Cristian Cadar, Alastair Donaldson. ACM SIGSOFT International Symposium on Software Testing and Analysis (ISSTA) 2022.
- *Generalized Points-to Graph: A New Abstraction of Memory in Presence of Pointers*. Pritam M. Gharat, Uday P. Khedker, Alan Mycroft. ACM Transactions on Programming Languages and Systems (TOPLAS) 2020.
- *Flow- and Context-Sensitive Points-to Analysis using Generalized Points-to Graphs*. Pritam M. Gharat, Uday P. Khedker, Alan Mycroft. 23rd Static Analysis Symposium (SAS) 2016.
- *CoS-SSA: SSA for Context-Sensitive Interprocedural Analysis*. Pritam M. Gharat, Uday P. Khedker, Alan Mycroft – Under review.
- *Excursions in Pointer Analysis*. Uday P. Khedker, Pritam M. Gharat – Book under preparation.

Projects

- **Inference of Resource Management Specifications**
(In Collaboration With Narges Shadab (UCR), Manu Sridharan (UCR), Michael Ernst (UW), Martin Kellogg (NJIT), Shrey Tiwari (MSR), Akash Lal (MSR), Shuvendu Lahiri (MSR) (*Sep. '21 - July '23*))

- Developed an annotation-based modular resource leak checker in CodeQL for C# code.
 - Designed a fixed-point algorithm for automatic inference of annotations for the analysis.
 - This work was published in OOPSLA 2023.
- **Combining Static Analysis Error Traces with Dynamic Symbolic Execution**
(In Collaboration With Frank Busse, Cristian Cadar, Alistair Donaldson at Imperial College (May '19 - July '21))
 - The goal of this work was efficient detection of bugs by combining static analysis and dynamic symbolic execution.
 - Worked on Clang Static Analyzer and Infer (static analyzers) and KLEE (dynamic symbolic execution tool).
 - Customized the search strategy of KLEE to explore only paths that agree with the static information, effectively detecting the bugs faster.
 - This work was published in ISSTA 2022.
- **Generalized Points-to Graph: A New Abstraction of Memory in Presence of Pointers**
(Ph.D. Thesis under the guidance of Prof. Uday Khedker at IIT Bombay, Jun '13 - July '18)
 - Designed and developed a summary-based flow- and context-sensitive pointer analysis in GCC.
 - Introduced the concept of Generalized Points-to Graph (GPG) as a new representation of a compact and yet precise procedure summary for scalable pointer analysis.
 - The implementation for GPG-based pointer analysis scaled to 158kLoC for C programs.
 - This work was published in SAS 2016 and TOPLAS 2020.
- **CoS-SSA: Context-Sensitive Interprocedural SSA**
(In Collaboration with Prof. Uday Khedker and Prof. Alan Mycroft (University of Cambridge) (Sep '21 - Present))
 - Proposing an interprocedural SSA form, called the *context-sensitive SSA* (aka CoS-SSA), that overcomes the limitations of traditional intraprocedural SSA by constructing SSA variables for scalars and pointers that may be global or address-taken local.
 - The way traditional SSA brings in flow sensitivity for free for program analysis, CoS-SSA brings both flow and context sensitivity for free for program analysis.
- **Improving Interprocedural Analysis**
(M.Tech + Ph.D. Dual Degree Research Proposal, guided by Prof. Uday Khedker, Oct '12 - Dec '12)
 - Reforming Value Based Call Strings Method by eliminating the re-processing of flow functions and improving the efficiency.
 - Proposed a variant to k -CFA called as Var- k -CFA for higher order languages by building an analogy between Var- k -CFA and Value Based Call Strings Method.

Honours and Distinctions

- TCS Research Fellowship (*July '13 - July '18*).
- Sir Ratan Tata Trust Merit scholarship for two consecutive years - 2008 and 2009 for excellence in academics.
- Best Student Award from Tata Consultancy Services (*2010*).
- Ranked 82 in Gate 2011.

Service

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| • ISEC 2025 (Program committee) | • SAS 2020 (Artifact evaluation) |
| • ISEC 2024 (Program committee) | • TACAS 2024 (Artifact evaluation) |
| • CAV 2023 (Artifact evaluation) | • CGO 2021 (Artifact evaluation) |
| • ISSTA 2021 (Artifact evaluation) | • PLDI 2020 (External review committee) |