Pritam Gharat
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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, bug finding, etc.

Experience

- **Post-Doctoral Researcher** in Microsoft Research, India *(Sep '21 - Present)*

- **Research Associate** in Department of Computing, Imperial College, London *(Aug '18 - Jul '21)*

- **Invited Speaker** at Summer School for Pointer Analysis, IIT Bombay *(Jul '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 - Jul '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 *(Jul '11 - Jun '13)*

- **B.E.** in Computer Science & Engineering, Mumbai University *(Jun '06 - May '10)*

Publications

- *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.

- *Inference of Resource Management Specifications*. Narges Shadab, Pritam M. Gharat, Shrey Tiwari, Michael Ernst, Martin Kellogg, Akash Lal, Manu Sridharan, Shuvendu Lahiri – Under review.

- *CoS-SSA: SSA for Context-Sensitive Interprocedural Analysis*. Pritam M. Gharat, Uday P. Khedker, Alan Mycroft – Under preparation (target deadline – July).

- *Resource Leak Checker for C# code using CodeQL*. Pritam M. Gharat, Narges Shadab, Shrey Tiwari, Akash Lal, Shuvendu Lahiri – Under review (target deadline – June).

Projects

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

  - 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.

- **Combining Static Analysis Error Traces with Dynamic Symbolic Execution**
  (In Collaboration With Frank Busse, Cristian Cadar, Alistair Donaldson at Imperial College (May '19 - Jul '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 is 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 - Jul '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 is 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.

- **GIS Network Analysis**
  (B.E. Project, 2010)

  - Added features to the Network Analysis module of GRAM++, a GIS based software developed at Bhugol GIS Pvt. Ltd., CSRE, IIT Bombay. The module is used for solving spatial problems such as Transportation, Resource Allocation and Distribution.
  - Implemented efficient algorithms such as Service Area, Closest Facility, Traveling Salesman Problem, Location- Allocation Facility in GRAM++.

Honours and Distinctions

- TCS Research Fellowship *(Jul '13 - Jul '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

- CAV 2023 (Artifact evaluation)

- CGO 2021 (Artifact evaluation)

- ISSTA 2021 (Artifact evaluation)

- PLDI 2020 (External review committee)

- SAS 2020 (Artifact evaluation)

References

Will be provided when required.