CHUNGHA SUNG

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Los Angeles, CA, USA

EDUCATION

- **University of Southern California (USC)** *Aug.2017 - May.2021 (expected)*
  Ph.D. Candidate, Computer Science
- **Virginia Polytechnic Institute and State University (Virginia Tech)** *Aug.2014 - Dec.2016*
  Master of Science, Electrical and Computer Engineering
- **Sung Kyun Kwan University (SKKU)** *Mar.2007 - Aug.2013*
  Bachelor of Science in Engineering, Semiconductor Systems Engineering

RESEARCH INTERESTS

- The ultimate goal is to achieve safety, reliability and security of software by better software testing and verification techniques with static/dynamic program analysis and formal methods.
- My dissertation topic is constraint-based program analysis for efficient automated reasoning techniques for multi-threaded programs.
- I am interested in *Program Analysis, Program Languages, Software Testing & Verification, Formal Methods, Program Synthesis, Model Checking, Abstract Interpretation, SMT solver, Datalog, Compiler (e.g., LLVM, Clang), Side Channel, Automatic Repair, AI Safety.*

EXPERIENCE

- **Research Intern** *May.2019 - Aug.2019*
  Microsoft Research, USA
  - Proposed an automatic merge-conflict resolution framework based on AST-based diffing and patching in divergent forks for the Microsoft Edge development (published at ICSE-SEIP 2020).
- **Research Intern** *May.2018 - Aug.2018*
  MediaTek Inc., USA
  - Designed an SMT-based verifier for inconsistent constraints in instruction set architecture.
- **Research Intern** *May.2017 - Aug.2017*
  Microsoft Research, India
  - Achieved an extension of a Scope query optimization tool by static analysis on queries.
- **Participant** *May.2013 - Sep.2013*
  Google Summer of Code 2013
  - Contributed to publishing an interactive graphical open-source package named “RIGHT” in R project.
- **Software Development Intern** *Jul.2012 - Aug.2012*
  Ahn Lab Inc., Korea
  - Advanced server maintenance by modifying a boot loader sequence to support multiple layers of firmware.

RESEARCH PROJECTS

- **Fast and approximate semantic diffing of concurrent programs [Sung et al., ASE 2018]**

- Proposed an interference analysis based on declarative analysis framework to compute synchronization differences in multi-threaded programs.
- Implemented the analysis with Datalog in an LLVM compiler front-end pass.
- Achieved a high accuracy and up to 1000x faster analysis than a model checking based approach.

· **A unified cache analysis framework [Sung et al., ASE 2018]**
- Proposed a unified framework of cache analysis for analyzing cache behavior by various verification tools such as model checkers, abstract interpretation tools and symbolic execution tools.
- Implemented a C/C++ code transformation in an LLVM compiler front-end pass.
- Showed the usefulness of the unified framework with KLEE, SMACK and Crab-llvm.

· **Accurate modular abstract interpretation for interrupt-driven software [Sung et al., ASE 2017]**
- Proposed an interference analysis between interrupts by constraint-based program analysis.
- Applied the analysis to prune infeasible data flows in thread modular abstract interpretation.
- Achieved 18x more proofs in the abstract interpretation by reducing false positives.

· **Optimizing web application testing by DOM-event dependency analysis [Sung et al., FSE 2016]**
- Proposed a constraint-based dependency analysis on DOM objects in web applications.
- Integrated the analysis into a systematic testing tool to prune redundant tests by partial order reduction.
- Achieved 20% higher code coverage in the testing tool with the analysis-based reduction.

· **Power channel analysis and mitigation [Wang et al., FSE 2019]**
- Proposed a constraint-based analysis framework to detect power side channel leaks due to register reuse in compiler.
- Designed a mitigation of power side channel leaks by register reallocation in LLVM.
- Achieved an efficient power side channel mitigation in terms of runtime and transformed code size.

· **Compression side channel analysis and mitigation in web apps [Paulsen et al., ASE 2019]**
- Proposed an automated approach to detect and mitigate compression side channels in web server applications.
- Implemented a taint analysis to collect sensitive data sinks and an enhanced compressor to mitigate the side channel leaks for the sensitive data sinks.

TEACHING

· **Teaching Assistant**
- Software Engineering (CSCI 310, USC) *Fall.2019, Spring.2021*
- Data Structures and Object Oriented Design (CSCI 104, USC) *Spring.2019*
- Microcontroller Programming and Interfacing (ECE 2534, Virginia Tech) *Fall.2014*
- Digital Systems (SKKU) *Spring.2013*
- Digital Logic Design Laboratory (SKKU) *Spring.2011, Spring.2012*

SERVICES

· **Student volunteer**: CAV 2020, ATVA 2018

- **(External) Reviewer**: FMCAD 2020, ASE 2020, IET Software 2020, ICSE 2020, FSE 2019, ICSE 2019, SAS 2018, TSE 2018, ICSE 2017, FORM 2017, FMCAD 2017, RV 2017, ISSTA 2017, ICSE 2016, SETTA 2016, TurstSoft 2016, FMCAD 2016, ATVA 2016, ICECCS 2016, TASE 2016

AWARDS

- LG Electronics industrial scholarship recipient *May.2017*
- ACM SIGSOFT travel grant for FSE *Nov.2016*
- Travel award for CAV *July.2016*
- First prize for graduation thesis and project award in SKKU *June.2013*
- Full Merit-based Awards from SKKU for Full Academic Years *Mar.2007 - Aug.2013*
- Dean's List award in SKKU *Apr.2012*
- Scholarship from Samsung Electronics *Mar.2007 - Feb.2009*

PUBLICATIONS

- **[ICSE 2021] Data-Driven Synthesis of Provably Sound Side Channel Analyses**
  Jingbo Wang, **Chungha Sung**, Mukund Raghothaman and Chao Wang
  Proc. of the ACM/IEEE 43rd International Conference on Software Engineering (To appear).

- **[ICSE-SEIP 2020] Towards Understanding and Fixing Upstream Merge Induced Conflicts in Divergent Forks: An Industrial Case Study**
  [Nominated as a best paper candidate]
  Chungha Sung, Shuvendu Lahiri, Mike Kaufman, Pallavi Choudhury and Chao Wang
  Proc. of the IEEE/ACM 42nd International Conference on Software Engineering: Software Engineering in Practice, pages 172-181.

- **[ASE 2019] Debreach: Mitigating Compression Side Channels via Static Analysis and Transformation**
  Brandon Paulsen, **Chungha Sung**, Peter A.H. Peterson and Chao Wang
  Proc. of the 34th IEEE/ACM International Conference on Automated Software Engineering, pages 899-911.

- **[FSE 2019] Mitigating Power Side Channels during Compilation**
  Jingbo Wang, **Chungha Sung** and Chao Wang
  Proc. of the 27th ACM Joint Meeting on European Software Engineering Conference and Symposium on the Foundations of Software Engineering, pages 590-601.

- **[ASE 2018] Datalog-based Scalable Semantic Diffing of Concurrent Programs**
  Chungha Sung, Shuvendu Lahiri, Constantin Enea and Chao Wang
  Proceedings of the 33rd ACM/IEEE International Conference on Automated Software Engineering, pages 656-666.

- **[ASE 2018] CANAL: A Cache Timing Analysis Framework via LLVM Transformation**
  Chungha Sung, Brandon Paulsen and Chao Wang
  Proceedings of the 33rd ACM/IEEE International Conference on Automated Software Engineering, pages 904-907.

- **[ASE 2017] Modular Verification of Interrupt-driven Software**
  Chungha Sung, Markus Kusano, and Chao Wang
  Proceedings of the 32nd IEEE/ACM International Conference on Automated Software Engineering, pages 206-216.

- **[FSE 2016] Static DOM Event Dependency Analysis for Testing Web Applications**
  Chungha Sung, Markus Kusano, Nishant Sinha and Chao Wang
  Proceedings of the 2016 24th ACM SIGSOFT International Symposium on Foundations of Software Engineering, pages 447-459.

POSTERS

- **[ICSE 2020] Towards Understanding and Fixing Upstream Merge Induced Conflicts in Divergent Forks: An Industrial Case Study**
  Chungha Sung, Shuvendu Lahiri, Mike Kaufman, Pallavi Choudhury, Jessica Wolk and Chao Wang
  IEEE/ACM 42nd International Conference on Software Engineering, Seoul, Korea, July 2020.
- **[UseR 2014] RIGHT: an HTML canvas and JavaScript-based interactive data visualization package for linked graphics**
  ChungHa Sung, TaeJoon Song, Jae W. Lee and Junghoon Lee
  The R User Conference, UCLA, Los Angeles, California, July 2014.