

Kihong Heo

Post-doctoral Researcher
Department of Computer and Information Science
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Research Interests

My research aims to develop program reasoning systems for safe and reliable software. In particular, I am working on the following topics:

- ▶ AI-based program analysis system for detecting deep semantic software bugs
- ▶ General-purpose program debloating system for secure and efficient software
- ▶ Scalable program synthesis system for automatic software generation and repair

Education

Seoul National University Ph.D. in Computer Science and Engineering <i>Dissertation:</i> Selectively Sensitive Static Analysis by Impact Pre-analysis and Machine learning Advisor: Kwangkeun Yi	Mar 2009 – Aug 2017
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Seoul National University B.S. in Computer Science and Engineering	Mar 2005 – Feb 2009
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Experience

University of Pennsylvania Post-doctoral Researcher Advisor: Mayur Naik	Jul 2017 – Present
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Facebook Research Scientist (contingent)	Apr 2017 – Jun 2017
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Awards

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| ▶ ACM SIGSOFT Distinguished Paper Award
International Conference of Software Engineering | 2019 |
| ▶ Excellent Degree Thesis Award
Department of Computer Science and Engineering, Seoul National University | 2017 |

Research Projects

<p>► Chisel: A system for Debloating C/C++ Programs https://chisel.cis.upenn.edu</p>	2017 –	Present
<p>► Petablox: Declarative Program Analysis for Big Code http://petablox.org</p>	2017 –	Present
<p>► Sparrow: a static analyzer for C program http://www.github.com/ropas/sparrow</p>	2011 –	Present
<p>► Inferbo: Infer-based buffer overrun analyzer https://github.com/facebook/infer</p>	2016 –	2017
<p>► Selective X-sensitive Analysis http://ropas.snu.ac.kr/sparrow</p>	2013 –	2017
<p>► Global Sparse Analysis Framework http://ropas.snu.ac.kr/sparseanalysis</p>	2011 –	2012

Publications

1. Synthesizing Datalog Programs using Numerical Relaxation.
Xujie Si, Mukund Ragothaman, **Kihong Heo**, and Mayur Naik.
In *International Joint Conference on Artificial Intelligence (IJCAI)*, 2019.
2. Continuously Reasoning about Programs via Differential Bayesian Inference.
Kihong Heo, Mukund Ragothaman, Xujie Si, and Mayur Naik.
In *ACM Conference on Programming Language Design and Implementation (PLDI)*, 2019.
3. Resource-aware Program Analysis via Online Abstraction Coarsening.
Kihong Heo, Hakjoo Oh, and Hongseok Yang.
In *ACM/IEEE International Conference on Software Engineering (ICSE)*, 2019.
4. Effective Program Debloating via Reinforcement Learning.
Kihong Heo, Woosuk Lee, Pardis Pashakhanloo, and Mayur Naik.
In *ACM Conference on Computer and Communications Security (CCS)*, 2018.
5. User-Guided Program Reasoning Using Bayesian Inference.
Mukund Ragothaman, Sulekha Kulkarni, **Kihong Heo**, and Mayur Naik.
In *ACM Conference on Programming Language Design and Implementation (PLDI)*, 2018.
6. Accelerating Search-Based Program Synthesis Using Learned Probabilistic Models.
Woosuk Lee, **Kihong Heo**, Rajeev Alur, and Mayur Naik.
In *ACM Conference on Programming Language Design and Implementation (PLDI)*, 2018.
7. Learning Analysis Strategies for Octagon and Context Sensitivity from Labeled Data Generated by Static Analyses.
Kihong Heo, Hakjoo Oh, and Hongseok Yang.
Formal Methods in System Design, 53(2), 189–220, 2018.
8. Adaptive Static Analysis via Learning with Bayesian Optimization.
Kihong Heo, Hakjoo Oh, Hongseok Yang, and Kwangkeun Yi.
ACM Transactions on Programming Languages and Systems, 40(4), 2018.

9. Difflog: Beyond Deductive Methods in Program Analysis.
Mukund Raghothaman, Sulekha Kulkarni, Richard Zhang, Xujie Si, **Kihong Heo**, Woosuk Lee, and Mayur Naik.
In 1st Workshop on Machine Learning for Programming (ML4P), 2018.
10. Automatically Generating Features for Learning Program Analysis Heuristics.
Kwonsoo Chae, Hakjoo Oh, **Kihong Heo**, and Hongseok Yang.
In ACM Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA), 2017.
11. Machine-Learning-Guided Selectively Unsound Static Analysis.
Kihong Heo, Hakjoo Oh, and Kwangkeun Yi.
In International Conference on Software Engineering (ICSE), 2017.
12. Selective Conjunction of Context-sensitivity and Octagon Domain toward Scalable and Precise Global Static Analysis.
Kihong Heo, Hakjoo Oh, and Kwangkeun Yi.
Software—Practice & Experience, 47(11), 1677–1705, 2017.
13. Sound Non-Statistical Clustering of Static Analysis Alarms.
Woosuk Lee, Wonchan Lee, Dongok Kang, **Kihong Heo**, Hakjoo Oh, and Kwangkeun Yi.
ACM Transactions on Programming Languages and Systems, 39(4), 16:1–16:35, 2017.
14. Learning a Variable-Clustering Strategy for Octagon from Labeled Data Generated by a Static Analysis.
Kihong Heo, Hakjoo Oh, and Hongseok Yang.
In International Static Analysis Symposium (SAS), 2016.
15. Selective X-Sensitive Analysis Guided by Impact Pre-Analysis.
Hakjoo Oh, Wonchan Lee, **Kihong Heo**, Hongseok Yang, and Kwangkeun Yi.
ACM Transactions on Programming Languages and Systems, 38(2), 6:1–6:45, 2016.
16. Widening with Thresholds via Binary Search.
Sol Kim, **Kihong Heo**, Hakjoo Oh, and Kwangkeun Yi.
Software—Practice & Experience, 46(10), 1317–1328, 2016.
17. Selective Context-sensitivity Guided by Impact Pre-analysis.
Hakjoo Oh, Wonchan Lee, **Kihong Heo**, Hongseok Yang, and Kwangkeun Yi.
In ACM Conference on Programming Language Design and Implementation (PLDI), 2014.
18. Global Sparse Analysis Framework.
Hakjoo Oh, **Kihong Heo**, Wonchan Lee, Woosuk Lee, Daejun Park, Jeehoon Kang, and Kwangkeun Yi.
ACM Transactions on Programming Languages and Systems, 36(3), 8:1–8:44, 2014.
19. A Sparse Evaluation Technique for Detailed Semantic Analyses.
Yoonseok Ko, **Kihong Heo**, and Hakjoo Oh.
Computer Languages, Systems & Structures, 40(3-4), 99–111, 2014.
20. Design and Implementation of Sparse Global Analyses for C-like Languages.
Hakjoo Oh, **Kihong Heo**, Wonchan Lee, Woosuk Lee, and Kwangkeun Yi.
In ACM Conference on Programming Language Design and Implementation (PLDI), 2012.

Software

I have contributed to the following open-source software:

- ▶ Chisel: an automated program debloating system
<https://github.com/aspire-project/chisel>
- ▶ Sparrow: a static analyzer for C programs
<https://github.com/ropas/sparrow>
- ▶ Petablox: declarative program analysis framework for Big Code
<https://github.com/petablox-project/petablox>
- ▶ Infer: a static analyzer for Java, C, C++, and Objective-C
<https://github.com/facebook/infer>
- ▶ Euphony: a probabilistic model-guided program synthesizer
<https://github.com/wslee/euphony>

Talks

- ▶ Interactive and Continuous Program Reasoning
Invited talk, Seoul National University. 12/27/2018
- ▶ Chisel: General-Purpose Software Debloating System
Invited talk, KAIST. 12/20/2018
- ▶ Program Transformation for Reducing Software Complexity
Invited talk, Korea University. 07/09/2018
- ▶ User-Guided Program Reasoning using Bayesian Inference
Invited talk, KAIST. 07/06/2018
- ▶ Interactive Alarm Ranking System using Bayesian Inference
Invited talk, Korea University. 01/04/2018
- ▶ Machine-Learning-Guided Selectively Unsound Static Analysis
Invited talk, Naver. 06/26/2017
- ▶ Inferbo: Infer-based buffer-overflow analyzer
Invited talk, Korea University. 04/14/2017
- ▶ Inferbo: Infer-based buffer-overflow analyzer
Invited talk, KAIST. 03/24/2017
- ▶ Selectively Sensitive Static Analysis by Impact Pre-analysis and Machine Learning
Invited talk, Codemind. 02/20/2017

Teaching Experience

- ▶ 4541.664 Program Analysis (Graduate) Teaching Assistant Seoul National University
Spring 2010

- ▶ 4190.210 Programming Languages (Undergrad)
Teaching Assistant

Seoul National University
Spring 2009

Service

- ▶ **ERC Member**, Programming Language Design and Implementation (PLDI), 2019
- ▶ **AEC Member**, Computer Aided Verification (CAV), 2019
- ▶ **AEC Member**, Static Analysis Symposium (SAS), 2019
- ▶ **AEC Member**, Static Analysis Symposium (SAS), 2018

References

Mayur Naik

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