

Kihong Heo

Post-doctoral Researcher
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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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Research Projects

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| ▶ ASPIRE: Transformations for Reducing Software Complexity
http://aspire.cis.upenn.edu | 2017 – present |
| ▶ Petablox: Declarative Program Analysis for Big Code
http://petablox.org | 2017 – present |
| ▶ Sparrow: a static analyzer for C program
http://www.github.com/ropas/sparrow | 2011 – present |

► Inferbo: Infer-based buffer overrun analyzer https://github.com/facebook/infer	2016 –	2017
► Selective X-sensitive Analysis http://ropas.snu.ac.kr/sparrow	2013 –	2017
► Global Sparse Analysis Framework http://ropas.snu.ac.kr/sparseanalysis	2011 –	2012

Publications

- Continuously Reasoning about Programs via Differential Bayesian Inference.
Kihong Heo, Mukund Ragothaman, Xujie Si, and Mayur Naik.
In Proceedings of the 40th ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI), 2019.
- Resource-aware Program Analysis via Online Abstraction Coarsening.
Kihong Heo, Hakjoo Oh, and Hongseok Yang.
In 41st ACM/IEEE International Conference on Software Engineering (ICSE), 2019.
- Effective Program Debloating via Reinforcement Learning.
Kihong Heo, Woosuk Lee, Pardis Pashakhanloo, and Mayur Naik.
In Proceedings of the 2018 ACM SIGSAC Conference on Computer and Communications Security (CCS), 2018.
- User-Guided Program Reasoning Using Bayesian Inference.
Mukund Ragothaman, Sulekha Kulkarni, **Kihong Heo**, and Mayur Naik.
In Proceedings of the 39th ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI), 2018.
- Accelerating Search-Based Program Synthesis Using Learned Probabilistic Models.
Woosuk Lee, **Kihong Heo**, Rajeev Alur, and Mayur Naik.
In Proceedings of the 39th ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI), 2018.
- 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.
- Difflog: Beyond Deductive Methods in Program Analysis.
Mukund Ragothaman, Sulekha Kulkarni, Richard Zhang, Xujie Si, **Kihong Heo**, Woosuk Lee, and Mayur Naik.
In 1st Workshop on Machine Learning for Programming (ML4P), 2018.
- 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.
- Machine-Learning-Guided Selectively Unsound Static Analysis.
Kihong Heo, Hakjoo Oh, and Kwangkeun Yi.
In Proceedings of the 39th International Conference on Software Engineering (ICSE), 2017.

10. 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.
11. 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.
12. 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.
13. 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.
14. Widening with Thresholds via Binary Search.
 Sol Kim, **Kihong Heo**, Hakjoo Oh, and Kwangkeun Yi.
Software—Practice & Experience, 46(10), 1317–1328, 2016.
15. Selective Context-sensitivity Guided by Impact Pre-analysis.
 Hakjoo Oh, Wonchan Lee, **Kihong Heo**, Hongseok Yang, and Kwangkeun Yi.
 In *ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI)*, 2014.
16. 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.
17. 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.
18. Design and Implementation of Sparse Global Analyses for C-like Languages.
 Hakjoo Oh, **Kihong Heo**, Wonchan Lee, Woosuk Lee, and Kwangkeun Yi.
 In *ACM SIGPLAN 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

- ▶ 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**, ACM Conference on Programming Language Design and Implementation (PLDI), 2019
- ▶ **AEC Member**, Static Analysis Symposium (SAS), 2018

Last updated: March 19, 2019
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