

# Kihong Heo

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## Research Interests

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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

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**Seoul National University** Mar 2009 – Aug 2017  
Ph.D. in Computer Science and Engineering  
*Dissertation*: Selectively Sensitive Static Analysis by Impact Pre-analysis and Machine Learning  
Advisor: Kwangkeun Yi

**Seoul National University** Mar 2005 – Feb 2009  
B.S. in Computer Science and Engineering

## Experience

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**KAIST** Jan 2020 – Present  
Assistant Professor

**University of Pennsylvania** Jul 2017 – Jan 2020  
Post-doctoral Researcher

## Awards

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- ▶ **Best Artifact Award** 2022  
ICSE'22: International Conference of Software Engineering
- ▶ **ACM SIGPLAN Distinguished Paper Award** 2019  
PLDI'19: Programming Language Design and Implementation
- ▶ **ACM SIGSOFT Distinguished Paper Award** 2019  
ICSE'19: International Conference of Software Engineering
- ▶ **Excellent Degree Thesis Award** 2017  
Department of Computer Science and Engineering, Seoul National University

## Research Projects

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

## Publications

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1. Learning Probabilistic Models for Static Analysis Alarms.  
Hyunsu Kim, Mukund Raghothaman, and **Kihong Heo**.  
In *IEEE/ACM International Conference on Software Engineering (ICSE)*, 2022.
2. PacJam: Securing Dependencies Continuously via Package-Oriented Debloating.  
Pardis Pashakhanloo, Aravind Machiry, Hyonyoung Choi, Anthony Canino, **Kihong Heo**, Insup Lee, and Mayur Naik.  
In *ACM ASIA Conference on Computer and Communications Security (ASIACCS)*, 2022.
3. Boosting Static Analysis Accuracy With Instrumented Test Executions.  
Tianyi Chen, **Kihong Heo**, and Mukund Raghothaman.  
In *ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (ESEC/FSE)*, 2021.
4. Synthesizing Datalog Programs using Numerical Relaxation.  
Xujie Si, Mukund Raghothaman, **Kihong Heo**, and Mayur Naik.  
In *International Joint Conference on Artificial Intelligence (IJCAI)*, 2019.
5. Continuously Reasoning about Programs via Differential Bayesian Inference.  
**Kihong Heo**, Mukund Raghothaman, Xujie Si, and Mayur Naik.  
In *ACM Conference on Programming Language Design and Implementation (PLDI)*, 2019.
6. 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.
7. 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.

8. 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.
9. 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.
10. 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.
11. 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.
12. 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.
13. 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.
14. Machine-Learning-Guided Selectively Unsound Static Analysis.  
**Kihong Heo**, Hakjoo Oh, and Kwangkeun Yi.  
*In International Conference on Software Engineering (ICSE)*, 2017.
15. 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.
16. 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.
17. 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.
18. 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.
19. Widening with Thresholds via Binary Search.  
Sol Kim, **Kihong Heo**, Hakjoo Oh, and Kwangkeun Yi.  
*Software—Practice & Experience*, 46(10), 1317–1328, 2016.
20. 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.

21. 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.
22. 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.
23. 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

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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>

## Selected Talks

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- ▶ 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

## Service

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### Program committee member

- ▶ **OOPSLA 2022**: ACM Conference on Object-Oriented Programming, Systems, Languages, and Applications
- ▶ **PLDI 2022**: ACM Conference on Programming Language Design and Implementation
- ▶ **POPL 2022**: ACM Conference on Principles of Programming Languages
- ▶ **SAS 2022**: International Static Analysis Symposium
- ▶ **ECOOP 2022**: European Conference on Object-Oriented Programming (Doctoral Symposium)
- ▶ **ESEC/FSE 2022**: The ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (Student Research Competition)
- ▶ **APLAS 2021**: Asian Symposium on Programming Languages and Systems
- ▶ **SYNT 2021**: Workshop on Synthesis
- ▶ **OCAML 2021**: The OCaml Users and Developers Workshop
- ▶ **ICSE 2020**: ACM International Conference on Software Engineering (Virtualization committee)
- ▶ **TAPAS 2020**: Workshop on Tools for Automatic Program Analysis
- ▶ **PLDI 2019**: ACM Conference on Programming Language Design and Implementation

Last updated: June 20, 2022  
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