

# Kihong Heo

Post-doctoral Researcher  
Department of Computer and Information Science  
University of Pennsylvania  
3330 Walnut St, Philadelphia, PA 19104, USA  
✉ : [kheo@cis.upenn.edu](mailto:kheo@cis.upenn.edu)    🌐 : <http://www.cis.upenn.edu/~kheo>

## 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** 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

**University of Pennsylvania** Jul 2017 – Present  
Post-doctoral Researcher  
Advisor: Mayur Naik

**Facebook** Apr 2017 – Jun 2017  
Research Scientist (contingent)

## Awards

- ▶ **Excellent Degree Thesis Award** 2017  
Department of Computer Science and Engineering, Seoul National University

## Research Projects

- ▶ **Chisel: A system for Debloating C/C++ Programs** 2017 – Present  
<https://chisel.cis.upenn.edu>

► <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

---

- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.

9. 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.
10. Machine-Learning-Guided Selectively Unsound Static Analysis.  
**Kihong Heo**, Hakjoo Oh, and Kwangkeun Yi.  
In *International Conference on Software Engineering (ICSE)*, 2017.
11. 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.
12. 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.
13. 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.
14. 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.
15. Widening with Thresholds via Binary Search.  
Sol Kim, **Kihong Heo**, Hakjoo Oh, and Kwangkeun Yi.  
*Software—Practice & Experience*, 46(10), 1317–1328, 2016.
16. 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.
17. 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.
18. 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.
19. 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<br>Invited talk, Seoul National University.                     | 12/27/2018 |
| ▶ Chisel: General-Purpose Software Debloating System<br>Invited talk, KAIST.                                   | 12/20/2018 |
| ▶ Program Transformation for Reducing Software Complexity<br>Invited talk, Korea University.                   | 07/09/2018 |
| ▶ User-Guided Program Reasoning using Bayesian Inference<br>Invited talk, KAIST.                               | 07/06/2018 |
| ▶ Interactive Alarm Ranking System using Bayesian Inference<br>Invited talk, Korea University.                 | 01/04/2018 |
| ▶ Machine-Learning-Guided Selectively Unsound Static Analysis<br>Invited talk, Naver.                          | 06/26/2017 |
| ▶ Inferbo: Infer-based buffer-overflow analyzer<br>Invited talk, Korea University.                             | 04/14/2017 |
| ▶ Inferbo: Infer-based buffer-overflow analyzer<br>Invited talk, KAIST.  | 03/24/2017 |
| ▶ Selectively Sensitive Static Analysis by Impact Pre-analysis and Machine Learning<br>Invited talk, Codemind. | 02/20/2017 |

## Teaching Experience

---

- |  |  |
|--|--|
| ▶ 4541.664 Program Analysis (Graduate)<br>Teaching Assistant       | Seoul National University<br>Spring 2010 |
| ▶ 4190.210 Programming Languages (Undergrad)<br>Teaching Assistant | Seoul National University<br>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**

Associate Professor  
Dept. of Computer and Information Science  
University of Pennsylvania  
Email: [mhnaik@cis.upenn.edu](mailto:mhnaik@cis.upenn.edu)

### **Kwangkeun Yi**

Professor  
Dept. of Computer Science and Engineering  
Seoul National University  
Email: [kwang@ropas.snu.ac.kr](mailto:kwang@ropas.snu.ac.kr)

### **Hongseok Yang**

Professor  
School of Computing  
KAIST  
Email: [hongseok.yang@kaist.ac.kr](mailto:hongseok.yang@kaist.ac.kr)

Last updated: March 26, 2019  
<http://www.cis.upenn.edu/~kheo>