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Research Interests

I am interested in semantic-based static analysis for safe and reliable softwares. In particular,

- ▶ **Sound, Scalable & Precise Static Analysis**

It is challenging to achieve sound, scalable yet precise static analysis in a single analyzer. I have been developing techniques to achieve this goal such as sparse analysis and selective X-sensitive analysis. Currently, I am planning to apply statistical approaches (e.g. machine learning) as well as non-statistical techniques (e.g. pre-analysis).

- ▶ **Data-driven Program Analysis by Machine Learning**

Thanks to the abundance of program code and analysis result, now it is possible to exploit machine learning techniques for improving program analysis. In particular, I am working on inferring effective abstractions using machine learning. For example, I try to infer minimal variable packing for selectively relational analysis and harmless unsoundness for selectively unsound analysis.

Education

Computer Science and Engineering, Seoul National University Ph.D candidate Advisor: Prof. Kwangkeun Yi	Mar 2009 – Present
Computer Science and Engineering, Seoul National University Bachelor of Science in Computer Science	Mar 2005 – Feb 2009

Experience

The Hong Kong University of Science & Technology Visiting Student Advisor: Prof. Sunghun Kim	Sep 2011 – Feb 2012
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Research Project

- ▶ **Sparrow: a static analyzer for C program** 2011 – present
I have been a core developer of Sparrow and mainly involved in its relational analysis engine.

Sparrow is a state-of-the-art static analyzer that aims to verify the absence of fatal bugs in C source. In particular, I have been developing techniques for cost-effective relational analysis enabled by semantic-based pre-analysis and machine learning. (<http://ropas.snu.ac.kr/sparrow>)

- ▶ **Selective X-sensitive Analysis by Impact Pre-analysis** 2013 – 2014
I was involved in the selective X-sensitive analysis framework and mainly developed selective relational analysis. Selective X-sensitive analysis applies certain sensitivity X (e.g. context, flow, or relational analysis) only when and where doing so is likely to improve the precision of the main analysis. The key idea is a pre-analysis that estimates the impact of X on the main analysis's precision. In the project, I designed an impact pre-analysis for the octagon relational analysis.
- ▶ **Global Sparse Analysis Framework** 2011 – 2012
I joined the sparse analysis project and designed the sparse interval analysis engine part. Our sparse analysis framework provides a general method for achieving global static analyzers that are precise, sound, yet also scalable. Based on the framework, we have derived a sparse version of Sparrow which is 175x more scalable than the baseline in terms of lines of code and scales to a million lines of C programs. In the project, I participated in designing a pre-analysis for the interval analysis and implementing the sparse interval analysis. (<http://ropas.snu.ac.kr/sparseanalysis>)
- ▶ **SNEC: Semantic-based Non-Essential Change Detection** 2011 – 2012
I have developed SNEC, a semantic-based non-essential change detector. Non-essential change is a code change that does not alter the semantics such as refactoring. Abundant non-essential changes in software history have negative impacts on software mining tasks. SNEC identifies non-essential changes by observing semantic equivalence using a semantic-aware static analyzer. I designed and implemented SNEC based on a commercial static analysis engine for JAVA programs. (<http://ropas.snu.ac.kr/snec>)

Publications

1. Learning a Variable-Clustering Strategy for Octagon from Labeled Data Generated by a Static Analysis
Kihong Heo, Hakjoo Oh, and Hongseok Yang
SAS 2016: The 23rd Static Analysis Symposium, 2016 (to appear)
2. Selective X-Sensitive Analysis Guided by Impact Pre-Analysis
Hakjoo Oh, Wonchan Lee, **Kihong Heo**, Hongseok Yang, and Kwangkeun Yi
TOPLAS: *ACM Transactions on Programming Languages and Systems*, Vol. 38, Issue 2, Jan. 2016
3. Widening with Thresholds via Binary Search
Sol Kim, **Kihong Heo**, Hakjoo Oh, Kwangkeun Yi
SP&E: *Software-Practice and Experience*, 2016 (to appear)
4. Selective Context-Sensitivity Guided by Impact Pre-Analysis
Hakjoo Oh, Wonchan Lee, **Kihong Heo**, Hongseok Yang, and Kwangkeun Yi
PLDI 2014: *The 35th ACM SIGPLAN Conference of Programming Language Design and Implementation*, 2014

5. Design and Implementation of Sparse Global Analyses for C-like Languages
Hakjoo Oh, **Kihong Heo**, Wonchan Lee, Woosuk Lee, and Kwangkeun Yi
PLDI 2012: The 33rd ACM SIGPLAN Conference of Programming Language Design and Implementation, 2012
6. General Sparse Analysis Framework
Hakjoo Oh, **Kihong Heo**, Wonchan Lee, Woosuk Lee, Daejun Park, Jeehoon Kang, and Kwangkeun Yi
TOPLAS: ACM Transactions on Programming Languages and Systems, Vol. 36, Issue 3, Sept. 2014
7. A Sparse Evaluation Technique for Detailed Semantic Analyses
Yoonseok Ko, **Kihong Heo**, and Hakjoo Oh
Computer Languages, Systems, & Structures, Vol. 40, Issues 3–4, October–December 2014

Teaching Experience

- ▶ **Teaching Assistant** : SNU 4541.664 Program Analysis (grad) Spring 2010
- ▶ **Teaching Assistant** : SNU 4190.210 Programming Languages Spring 2009

References

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Last updated: June 27, 2016

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