

# Woosuk Lee

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## Research Interests

I am interested in program analysis techniques for software safety and reliability. In particular, I have focused on general methods for improving usability of static analyzers by combining program analysis, machine learning, and homomorphic cryptography.

I have addressed problems met in developing realistic abstract interpreters for full C. The problems include many false alarms, low scalability, unfriendly user-interface, and copyright concerns of target programs.

## Education

Feb. 2016 (tentative), Ph. D., School of Computer Science and Engineering, Seoul National University.

Mar. 2009 - current, Ph. D. Candidate Student, Programming Research Laboratory, School of Computer Science and Engineering, Seoul National University.

Feb. 2009, B.S. School of Computer Science and Engineering, Seoul National University.

## Research Experiences

Seoul National University  
Ph.D. Student

Mar 2009 - current  
Advisor: Prof. Kwangkeun Yi

### Static Analysis on Encrypted Programs

I have designed and implemented a static analysis on encrypted programs. The motivation was from the users' copy-right concerns in our *static-analysis-as-a-service*<sup>1</sup> system. As a first step, we propose a pointer analysis in secrecy. The technique allows to compute encrypted pointer analysis results for encrypted programs without decryption with the aid of a state-of-the-art homomorphic encryption scheme [3].

### Estimating Static Analysis Progress

I have designed and implemented a progress bar for static analyzers. Static analyzers usually take a long time to analyze real-world software, whereas estimating static analysis progress at real-time is challenging in general. We tackled this problem by integrating semantic-based pre-analysis and machine learning techniques. Our progress bar [5] has been implemented on top of SPARROW<sup>2</sup>, a realistic static analyzer for full C.

### Improving Scalability of Relational Analysis for C-like languages

I have designed and implemented a sparse relational analysis for C-like languages [1, 2]. Sparse analysis technique eliminates redundant computations during static analyses without loss of precision.

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<sup>1</sup>Software Clinic Service, <http://rosaec.snu.ac.kr/clinic>

<sup>2</sup>SPARROW, <http://ropas.snu.ac.kr/sparrow>

We succeeded to perform octagon domain-based analysis on sendmail-8.13.6 (130KLOC), which could not be analyzed even by a commercial analyzer, PolySpace C Verifier, because of scalability problem.

#### **Reducing Alarm Investigation Burden via Sound Clustering of Static Analysis Alarms**

I have designed and implemented a sound method for clustering alarms in the sense that if representative alarms of a cluster turns out to be false, all the other alarms in the same cluster are guaranteed to be false. We have implemented our clustering algorithm on top of a realistic buffer-overflow analyzer and proved that our method reduces 54% of alarm reports [4].

University of California, Berkeley  
Visiting Grad Student

Jul 2012 - Nov 2012  
Host: Prof. Dawn Song

#### **Static Analysis for Detecting Android Malicious Apps**

I have implemented static analyzers for the purpose of detecting malicious behaviours including privacy leaks and sneaking phone calls. The implementation was rewarded with shares of Ensighta Security Inc. founded by Prof. Dawn Song in UC Berkeley. The company was acquired by FireEye.

## Publications

- [1] Hakjoo Oh, Kihong Heo, Wonchan Lee, **Woosuk Lee**, Daejun Park, Jeehoon Kang, and Kwangkeun Yi. Global sparse analysis framework. *ACM Trans. Program. Lang. Syst.*, 36(3):8:1–8:44, September 2014.
- [2] Hakjoo Oh, Kihong Heo, Wonchan Lee, **Woosuk Lee**, and Kwangkeun Yi. Design and implementation of sparse global analyses for c-like languages. In *Proceedings of the 33rd ACM SIGPLAN Conference on Programming Language Design and Implementation, PLDI '12*, pages 229–238, New York, NY, USA, 2012. ACM.
- [3] **Woosuk Lee**, Hyunsook Hong, Kwangkeun Yi, and Jung Hee Chun. Static analysis with set-closure in secrecy. In *Proceedings of the 22nd International Static Analysis Symposium, SAS'15*. Springer International Publishing, 2015. To appear.
- [4] **Woosuk Lee**, Wonchan Lee, and Kwangkeun Yi. Sound non-statistical clustering of static analysis alarms. In *Proceedings of the 13th International Conference on Verification, Model Checking, and Abstract Interpretation, VMCAI'12*, pages 299–314, Berlin, Heidelberg, 2012. Springer-Verlag.
- [5] **Woosuk Lee**, Hakjoo Oh, and Kwangkeun Yi. A progress bar for static analyzers. In Markus Muller-Olm and Helmut Seidl, editors, *Proceedings of the 21st International Static Analysis Symposium, SAS'14*, pages 184–200. Springer International Publishing, 2014.

## Presentations

**Woosuk Lee**, Hakjoo Oh, and Kwangkeun Yi. *A Progress Bar for Static Analyzers*. In 21st International Static Analysis Symposium (SAS 2014). Munich. 11-13 September 2014. [http://ropas.snu.ac.kr/~wslee/sas14\\_talk.pdf](http://ropas.snu.ac.kr/~wslee/sas14_talk.pdf)

**Woosuk Lee**, Hakjoo Oh, and Kwangkeun Yi. *A Progress Bar for Static Analyzers*. In 12th ASIAN Symposium on Programming Languages and Systems (APLAS 2014). Poster Talk. Singapore. 17-19 November 2014. [http://ropas.snu.ac.kr/~wslee/poster/aplas2014\\_poster.pdf](http://ropas.snu.ac.kr/~wslee/poster/aplas2014_poster.pdf)

**Woosuk Lee**, Wonchan Lee, and Kwangkeun Yi. *Sound Non-Statistical Clustering of Static Analysis Alarms*. In 13th International Conference on Verification, Model Checking, and Abstract Interpretation (VMCAI 2012). Philadelphia. 25-27 January 2012. [http://ropas.snu.ac.kr/~wslee/vmcai12\\_talk.pdf](http://ropas.snu.ac.kr/~wslee/vmcai12_talk.pdf)

**Woosuk Lee**, Heejung Kim, and Kwangkeun Yi. *Shape Inference by Parsing and Enumeration* In 7th ASIAN Symposium on Programming Languages and Systems (APLAS 2009). Poster Talk. Seoul. 14-16 December 2009. [http://ropas.snu.ac.kr/~wslee/poster/aplas2009\\_poster.pdf](http://ropas.snu.ac.kr/~wslee/poster/aplas2009_poster.pdf)

## Professional Activities

### *Projects*

Mar 2014 - Feb 2015 Static Analysis in Secrecy (with Samsung Electronics)

Jul - Dec 2012 Droidblaze Project: an extensible framework for automated security analysis of Android apps (with Prof. Dawn Song's group in UC Berkeley)

Feb - Dec 2009 Software Watermarking for C/C++ & JAVA (with Korea Copyright Commission)

### *Patents*

Copyright information inserting system and method

### *Internship*

Jul - Dec 2012, Prof. Dawn Song's group in UC Berkeley

Jun - Aug 2010, PA Division, Fasoo.com

### *Summer School*

Jun 12th - 17th, 2011, Attended First International SAT/SMT Solver Summer School 2011 in MIT, Cambridge, MA, USA.

### *Teaching*

Spring 2014, Teaching Assistant, SNU 4541.664A Program Analysis: Theories and Practices

Fall 2010, Teaching Assistant, SNU 4541.664A Program Analysis: Theories and Practices

Fall 2009, Teaching Assistant, SNU 4190.210 Principle of Programming

### *External Reviewer*

POPL 2013, SAS 2012, SPLASH 2010, PADL 2012, PEPM 2012, etc.

## References

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### **Jung Hee Cheon**

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### **Dawn Song**

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