Linhai Song

FireEye Research Labs
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Research Interests

- Performance Optimization & Tuning for Large Software
- Program Analysis, Security, and Software Testing

Employment

College of Information Sciences and Technology, PSU	PENNSYLVANIA, USA
Assistant Professor	*2017.08 – Present*
FireEye Research Labs, FireEye, Inc.	CALIFORNIA, USA
Staff Research Scientist	*2015.11 – 2017.07*

Education

University of Wisconsin-Madison	WISCONSIN, USA
Ph.D. in Computer Science (M.S. along the way)	*2010.08 – 2015.10*
Advisor: Shan Lu	
Thesis: Understanding, Detecting, and Diagnosing Real-World Performance Bugs	
Institute of Computing Technology, Chinese Academy of Sciences	BEIJING, CHINA
M.S. in Computer Science	*2007.08 – 2010.06*
Advisor: Xueqi Cheng	
Huazhong University of Science and Technology	HUBEI, CHINA
B.E. in Software Engineering	*2003.08 – 2007.06*

Academic Awards

MICRO Best Paper Runner Up, 2014

- "COMP: Compiler Optimizations for Manycore Processors" published in MICRO'2014
- One of five papers selected from 273 MICRO'2014 submissions

ACM SIGPLAN Research Highlights Award, 2011

- "Automated Atomicity-Violation Fixing" published in PLDI'2011
- One of eight papers selected from all papers published in 13 ACM SIGPLAN conferences in 2011

Research Experience

Staff Research Scientist, FireEye Research Labs   2015.11 – Present

- Conduct data mining for the security repository on VirusTotal;
- Design and implement an end-point anti-virus system;
- Design and implement algorithms to calculate similarity between JavaScript programs.

Research Assistant, University of Wisconsin-Madison   2011.01 – 2015.10

- Design and implement a series of static-dynamic hybrid analysis for inefficient loops;
- Study the correlation between features of critical sections and their change histories;
- Explore the design space of applying statistical debugging to performance failure diagnosis;
- Implement a dynamic technique to detect inefficient nested loops for C/C++ programs;

- Design and implement a series of static rule-based detectors for performance bugs;
- Conduct a comprehensive study on 110 real-world performance bugs;
- Implement the deadlock detection module in an atomicity violation concurrency bug fixing project.

Research Intern, FutureWei Technologies Inc. 2014.05 – 2014.09

- Demonstrate a static bug detection technique for inefficient loops with Cond-Break fixes;
- Demonstrate a failure diagnosis technique built on hardware performance counters.

Research Intern, NEC Labs America 2013.05 – 2013.08

- Explore performance bottlenecks for Intel Xeon Phi manycore coprocessors (MIC);
- Design and implement three source-to-source compiler optimizations for parallel loops which offload computation to MIC.

Research Intern, Microsoft Research Asia 2010.05 – 2010.07

- Design and implement a toolkit for graphical model inference based on secondary development on Visio;
- Get **excellent** assessment for this project.

Research Assistant, Institute of Computing Technology, Chinese Academy of Sciences 2007.09 – 2010.05

- Design two separate algorithms to extract news articles and blog posts respectively;
- Implement the web content extraction module in a web retrieve system.

Publications

Refereed Conference and Workshop Publications

1. **Linhai Song**, Ce Zhang, Yiying Zhang, Heqing Huang, Wu Zhou
   Understanding Malwares and Anti-Virus Engines in the Real World, **Under Submission**.
2. **Linhai Song**, Shan Lu
   Program Analysis for Inefficient Loops, **ICSE'2017**.
3. **Linhai Song**, Heqing Huang, Wu Zhou, Wenfei Wu, Yiying Zhang
   Learning from Big Malwares, **APSys'2016**.
4. Rui Gu, Guoliang Jin, **Linhai Song**, Linjie Zhu, Shan Lu
   What Change History Tells Us About Thread Synchronization, **FSE'2015**.
5. **Linhai Song**, Min Feng, Nishkam Ravi, Yi Yang, Srimat Chakradhar
   COMP: Compiler Optimizations for Manycore Processors, **MICRO'2014**.

   Won MICRO'2014 Best Paper Runner Up
6. **Linhai Song**, Shan Lu
   Statistical Debugging for Real-World Performance Problems, **OOPSLA'2014**.
7. Adrian Nistor, **Linhai Song**, Darko Marinov, Shan Lu
   Toddler: Detecting Performance Problems via Similar Memory-Access Patterns, **ICSE'2013**.
8. Guoliang Jin*, **Linhai Song***, Xiaoming Shi, Joel Scherpelz, Shan Lu
   Understanding and Detecting Real-World Performance Bugs, **PLDI'2012**.

   (*: alphabetical order of surnames)
9. Guoliang Jin, **Linhai Song**, Wei Zhang, Shan Lu, Ben Liblit
   Automated Atomicity-Violation Fixing, **PLDI'2011**.

   Won ACM SIGPLAN Research Highlights Award

Other Publications

1. **Linhai Song**, Shan Lu
   Program Analysis for Inefficient Loops, UChicago CS **Technical Report TR-2016-06**.
2. Dongdong Deng, Guoliang Jin, Marc de Kruijf, Ang Li, Ben Liblit, Shan Lu, Shanxiang Qi, Jinglei Ren, Karthikeyan Sankaralingam, **Linhai Song**, Yongwei Wu, Mingxing Zhang, Wei Zhang, Weimin Zheng
   Fixing, Preventing, and Recovering from Concurrency Bugs, **Science China Information Sciences, April 2015**.
3. **Linhai Song**, Shan Lu

Statistical Debugging for Real-World Performance Problems, **GCASR'2015 Poster**.

4. **Linhai Song**, Shan Lu
   Statistical Debugging for Real-World Performance Problems, UW-Madison CS **Technical Report 1803**.

Publications before Ph.D

1. Yan Guo, Huifeng Tang, **Linhai Song**, Yu Wang, Guodong Ding
   ECON: An Approach to Extract Content from Web News Page, **APWeb'2010**.

2. **Linhai Song**, Xueqi Cheng, Yan Guo, Bo Wu, Yu Wang
   Blog Post Extraction Using Title Finding, **CCIR'2009**.

3. Yu Wang, Bingxing Fang, Bo Wu, **Linhai Song**, Yan Guo
   Schema Matching Incorporating with Attribute Distribution Features, **CCIR'2009**.

4. Feng Guan, Xiaoming Yu, Zeying Peng, Hongbo Xu, Yue Liu, **Linhai Song**, Xueqi Cheng
   ICTNET at Web Track 2009 Ad-hoc Task, **TREC'2009**.

5. Xueke Xu, Yue Liu, Hongbo Xu, Xiaoming Yu, **Linhai Song**, Feng Guan, Zeying Peng, Xueqi Cheng
   ICTNET at Blog Track TREC 2009, **TREC'2009**.

6. Bo Wu, Xueqi Cheng, Yu Wang, Yan Guo, **Linhai Song**
   Simultaneous Product Attribute Name and Value Extraction from Web Pages, **WI'2009 workshop**.

7. **Linhai Song**, Xueqi Cheng, Yan Guo, Yue Liu, Guodong Ding
   ContentEx: A framework for automatic content extraction programs, **ISI'2009 short**.

Patents

1. Min Feng, Srimat Chakradhar, **Linhai Song**
   Compiler Optimization for Many Integrated Core Processors, U.S. Patent No. 20150277877, Oct 1st, 2015.

Professional Services

- Reviewer for the Journal of Computer Science and Technology
- PC member of Artifact Evaluation session in PLDI'2015
- PC member of Artifact Evaluation session in ISSTA'2014

Talks

1. Learning from Big Malwares
   Conference Presentation in APSys'2014, August 2016

2. Understanding, Detecting, and Diagnosing Real-World Performance Bugs
   National University of Singapore, March 2016

3. Understanding, Detecting, and Diagnosing Real-World Performance Bugs
   Microsoft Research Asia, December 2015

4. Understanding, Detecting, and Diagnosing Real-World Performance Bugs
   Peking University, June 2015

5. Understanding, Detecting, and Diagnosing Real-World Performance Bugs
   Pivotal Labs, May 2015

6. Statistical Debugging for Real-World Performance Problems
   Conference Presentation in OOPSLA'2014, October 2014

7. Statistical Debugging for Real-World Performance Problems
   WISDOM Workshop II, May 2014

8. Optimizing Memory Performance on Many Integrated Core Coprocessors
   NEC Labs America, August 2013

9. Understanding and Detecting Real-World Performance Bugs
   Conference Presentation in PLDI'2012, June 2012

10. Understanding and Detecting Real-World Performance Bugs
    Programming Languages Seminar, University of Wisconsin-Madison, May 2012

Skills

- **Languages:** C/C++, C#, Java, Python, PHP, SQL, HTML, JavaScript, Bash
- **Instrumentation & Analysis:** LLVM, PIN, GCC, GDB
- **Tools & Libraries:** Pthread, OMP, STL, SVN, GIT, MySQL, SQLite
- **Platforms:** Linux, Windows, Intel MIC

References

- **Shan Lu**
  Associate Professor
  Department of Computer Science, University of Chicago
  Email: shanlu@uchicago.edu

- **Yiying Zhang**
  Assistant Professor
  School of Electrical and Computer Engineering, Purdue University
  Email: yiying@purdue.edu

- **Darko Marinov**
  Associate Professor
  Department of Computer Science, University of Illinois at Urbana-Champaign
  Email: marinov@illinois.edu