Matt Staats

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Web Science and Technology
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Research Interests

Broadly: software engineering. Specifically: software testing; model checking; automatic test generation; empirical study of software systems and methods in software engineering; application of statistics to software engineering.

Education

University of Minnesota-Twin Cities ..... Minneapolis, Minnesota

2006-2011 — Ph.D. in Computer Science
Adviser: Dr. Mats P.E. Heimdahl.

University of Missouri-Rolla ..... Rolla, Missouri

2002-2006 — B.S. Computer Science — Minors: Math, Psychology

Professional Experience

Korea Advanced Institute of Science and Technology (KAIST) ..... Daejeon, Republic of Korea

Present — Postdoctoral researcher funded through the Web Science and Technology (WebST) program, under the direction of Dr. Gregg Rothermel. Exploring improvements to automated software testing focused on test oracles. Close collaborations with the Provable Software Lab under the direction of Dr. Moonzoo Kim.

2007–2011 — **University of Minnesota-Twin Cities** ..... Minneapolis, Minnesota
Research assistant and member of Crisys Research Group led by Dr. Mats Heimdahl. Developed tools for automated testing, including tools to measure requirements coverage of tests and conduct automated experiments related to the effectiveness of various test coverage metrics. Developed familiarity with the NuSMV model checker, CBMC model checker, Java Pathfinder execution environment, and R statistical environment.

Summer 2010 — **NASA Ames Research Center** ..... Moffett Field, CA
Summer intern in the Robust Software Engineering group. Continued work on parallelized extensions to the Java Pathfinder execution environment to improve performance of Symbolic Java Pathfinder. Extended framework for parallelizing Java Pathfinder and updated to work within improved Java Pathfinder extension framework, extended symbolic execution environment with additional constraint solvers, worked on improving reliability of symbolic execution framework.

Summer 2009 — **NASA Ames Research Center** ..... Moffett Field, CA
Summer intern in the Robust Software Engineering group. Developed extensions to the Java Pathfinder execution environment to improve performance of Symbolic Java Pathfinder through parallelized execution, with the overall goal of increasing automatic test generation performance. Extensions include a general, extensible framework for parallelizing Java Pathfinder, structural search heuristics for improving Modified Condition/Decision Coverage (MC/DC) test generation performance, and heuristics for partitioning a symbolic execution tree and distributing the partitions across multiple instances of Java Pathfinder.

August 2008 — **NASA Ames Research Center** ..... Moffett Field, CA
Summer intern in the Robust Software Engineering group. Developed extensions to the Java Pathfinder model checker to improve test generation capability. Extensions include an Eclipse plugin to automatically instrument Java code to generate MC/DC tests, functionality to allow generated tests to be run on instrumented code, and functionality to improve the flexibility of test generation when using symbolic execution.

Summer '06, '04 — **Cerner Corporation** ..... Kansas City, Missouri
Worked with a team to develop an Eclipse based Java interface for use in an automated pharmacy system. Extended Eclipse GUI elements to create in-house GUI design. Improved reliability of Visual Basic software by fixing reported software errors.

2004-2006 — **U.S. Geological Survey** ..... Rolla, Missouri
Worked with a three man team to create a interactive browser-based map viewing application for distributed USGS map data. Developed back end server-side code to allow map data to be converted from GML and ESRI map formats. Developed client-side browser based interface using JavaServer Faces and Javascript.

International Publications

12 refereed conference papers.

[1] Michael Whalen, Gregory Gay, Dongjiang You, Mats Heimdahl, and **Matt Staats**. Observable Modified Condition/Decision Coverage. *International Conference on Software Engineering 2013 – ICSE 2013*. San Francisco, California, USA, June, 2012. 10 Pages.

[2] Shin Hong, **Matt Staats**, Jaemin Ahn, Moonzoo Kim and Gregg Rothermel. The Impact of Concurrent Coverage Metrics on Testing Effectiveness. *International Conference on Software Testing, Verification and Validation 2013 – ICST 2013*. Luxembourg, Luxembourg, March, 2013. 10 Pages.

[3] **Matt Staats**, Pablo Loyola, and Gregg Rothermel. Oracle-Centric Test Case Prioritization. *International Symposium on Software Reliability Engineering 2012 – ISSRE 2012*. Dallas, Texas, USA, November, 2012. 10 Pages.

[4] **Matt Staats**, Shin Hong, Moonzoo Kim, and Gregg Rothermel. Understanding User Understanding: Determining Correctness of Generated Program Invariants. *International Symposium on Software Testing and Analysis 2012 – ISSTA 2012*. Minneapolis, Minnesota, USA, July, 2012. 10 Pages.

[5] **Matt Staats**, Gregory Gay, and Mats Heimdahl. Automated Oracle Creation Support, or: How I Learned to Stop Worrying About Fault Propagation and Love Mutation Testing. *International Conference on Software Engineering 2012 – ICSE 2012*. Zurich, Switzerland, June, 2012. 10 Pages.

[6] **Matt Staats**, Gregory Gay, Michael Whalen and Mats Heimdahl. On the Danger of Coverage Directed Test Case Generation. *International Conference on Fundamental Approaches to Software Engineering 2012– FASE 2012*. Tallinn, Estonia, March, 2012. 11 Pages.

[7] **Matt Staats**, Michael Whalen and Mats Heimdahl. Programs, Tests, and Oracles:The Foundations of Testing Revisited. *International Conference on Software Engineering 2011 – ICSE 2011*. Honolulu, Hawaii, May, 2011. *Distinguished Paper Award.* 10 Pages.

[8] **Matt Staats** and Corina Pasareanu. Parallel Symbolic Execution for Structural Test Generation. *International Symposium on Software Testing and Analysis 2010 – ISSTA 2010*. Trento, Italy, July, 2010. 11 Pages.

[9] **Matt Staats**, Michael Whalen, Ajitha Rajan and Mats Heimdahl. Coverage Metrics for Requirements-Based Testing: Evaluation of Effectiveness. *NASA Formal Methods Symposium 2010 – NFM'10*. Washington, D.C., USA, April, 2010. 10 Pages.

[10] **Matthew Staats** and Mats P.E. Heimdahl. Partial Translation Verification for Untrusted Code-Generators. *Proceedings of the 10^{th} International Conference on Formal Engineering Methods – ICFEM'08*. Kitakyushu-City, Japan, October, 2008. 14 Pages.

[11] Ajitha Rajan, Michael W. Whalen, **Matthew Staats** and Mats P.E. Heimdahl. Requirements Coverage as an Adequacy Measure for Conformance Testing. *Proceedings of the 10^{th} International Conference on Formal Engineering Methods – ICFEM'08*. Kitakyushu-City, Japan, October, 2008. 20 Pages.

[12] Erik Shimshock, **Matt Staats** and Nick Hopper. Breaking and Provably Fixing Minx. *Proceedings of the 8^{th} Privacy Enhancing Technologies Symposium – PETS'08*. Leuven, Belgium, July, 2008. 16 Pages.

Short Papers

2 tools paper, 3 short papers.

[13] Seonah Lee, Sungwon Kang, and **Matt Staats**. NavClus: A Graphical Recommender for Assisting Code Exploration. *International Conference on Software Engineering 2012 – ICSE 2013*. San Francisco, California, USA, May, 2013. 4 Pages.

[14] **Matt Staats**, Michael Whalen and Mats Heimdahl. Better Testing Through Oracle Selection (NIER Track). *International Conference on Software Engineering 2011 – ICSE 2011*. Honolulu, Hawaii, May, 2011. September, 2010. 4 Pages.

[15] **Matt Staats**. The Influence of Multiple Artifacts on the Effectiveness of Software Testing. *Proceedings of the 25^{th} International Conference on Automated Software Engineering - ASE'10*. Antwerp, Belgium. September, 2010. 2 Pages.

[16] **Matt Staats**. Towards a Framework for Generating Tests to Satisfy Complex Code Coverage in Java Pathfinder. *NASA Formal Methods Symposium 2009 - NFM'09*. Moffett Field, California, USA, April, 2009. 2 Pages.

[17] **Matt Staats**, Weijia Deng, Ajitha Rajan, Mats P.E. Heimdahl. ReqsCov: A Tool for measuring Test Adequacy over Requirements. *Proceedings of the 23^{rd} International Conference on Automated Software Engineering - ASE'08*. L'Aquila, Italy, September, 2008. 2 Pages.

Other Papers 3 other papers.

[18] Junghyun Kwon, In-Young Ko, **Matt Staats**, and Gregg Rothermel. 동적 슬라이싱과 정보검색을 이용한 서비스 컴포지션의 테스트케이스 우선순위 기법 (Test-case Prioritization of Services Composition by Using Dynamic Slicing and Information Retrieval). *Korea Conference on Software Engineering 2013 – KCSE 2013*. January, 2013. 4 Pages.

[19] Shin Hong, Moonzoo Kim and **Matt Staats**. 기호실행을 통한 자동 생성된 불변식의 검정 (Validating Inferred Invariants using Symbolic Execution). *Korea Conference on Software Engineering 2012 – KCSE 2012*. February, 2012. 4 Pages.

[20] Mats P.E. Heimdahl, Michael W. Whalen, Ajitha Rajan, and **Matt Staats**. On MC/DC and Implementation Structure: An Empirical Study. *Proceedings of the 27th IEEE Digital Avionics Systems Conference*. October, 2008. 10 Pages. ***Selected Best Paper in Software Design Session***.

Presentations 10 conference talks, 1 tool demo, 2 invited talks, 5 visits.

Invited Talks and Visits

May 2012 "Supporting Test Oracle Construction", presented as invited talk at *20th CREST Open Workshop*, University College London, London, United Kingdom.

February 2012 "Programs, Tests and Oracles: The Foundations of Testing Revisited", presented as invited talk at *ISEC 2012*, Indian Institute of Technology Kanpur, Kanpur, India.

January 2012 "Tester-Centric Automated Testing: Bringing Humans Into the Loop", Hong Kong University of Science and Technology, Hong Kong, People's Republic of China.

December 2011 "The Influence of Multiple Artifacts on the Effectiveness of Software Testing", Korea University, Seoul, Republic of Korea.

June 2011 "Programs, Tests and Oracles: The Foundations of Testing Revisited", Kyungpook University, Daegu, Republic of Korea.

August 2010 "Parallel Symbolic Execution in Java Pathfinder", Google, Mountain View, California, USA.

July 2010 "The Influence of Multiple Artifacts on the Effectiveness of Software Testing", Laboratoire d́ Informatique de Grenoble (LIG), Grenoble, France.

Conference

November 2012 [3] presented at *ISSRE 2012*, Dallas, Texas, USA.

July 2012 [4] presented at *ISSTA 2012*, Minneapolis, Minnesota, USA.

March 2012 [6] presented at *FASE 2012*, Tallinn, Estonia.

May 2011 [7] presented at *ICSE 2011*, Honolulu, Hawaii.

May 2011 [14] presented at *ICSE 2011*, Honolulu, Hawaii.

September 2010 [15] presented at *ASE 2010*, Antwerp, Belgium.

July 2010 [8] presented at *ISSTA 2010*, Trento, Italy.

April 2010 [9] presented at *NFM 2010*, Washington, D.C., USA.

April 2009 [16] presented at *NFM 2009*, Moffett Field, California, USA.

November 2008 [10] presented at *ICFEM 2008*, Kitakyushu-City, Japan.

Posters

November 2008 [17] presented at *ASE 2008*, L'Aquila, Italy.

Released Code/Tools **University of Minnesota-Twin Cities** . . . . . Minneapolis, Minnesota

Parallel-SPF `http://babelfish.arc.nasa.gov/trac/jpf/wiki/projects/jpf-parallel-spf` JPF extension adding parallel capabilities to JPF, Symbolic JPF in particular.

Extended-Test-Gen `http://babelfish.arc.nasa.gov/trac/jpf/wiki/projects/jpf-extended-test-gen` JPF extension improving test generation capabilities.

ReqsCov `http://crisys.cs.umn.edu/reqscov.html` Unique First Clause measurement tool/Eclipse plugin.

Teaching Experience **University of Minnesota-Twin Cities** . . . . . Minneapolis, Minnesota

Summer 2008 **Teaching Assistant** CSCI 5801: Software Engineering I. Developed programming assignments around the concepts of system specification, documentation and bug testing. Scored tests and quizzes.

Spring 2007	**Teaching Assistant** CSCI 3081: Program Design and Development. Developed programming assignments around the C++ language to help reinforce the concepts of good program design and development practices from course lectures.
Fall 2006	**Teaching Assistant** CSCI 3081: Program Design and Development. Same as above.

Service Activities

Committee Member	Empirical Software Engineering and Measurement (ESEM) 2013.
Committee Member	Regression 2013.
Committee Member	Testing: Academic & Industrial Conference Practice and Research Techniques (TAIC PART) 2013.
Reviewer	Empirical Software Engineering (ESE) Reviewer, 2012.
Reviewer	Software Testing, Verification and Reliability (STVR) Reviewer, 2012.
Reviewer	Transactions on Software Engineering (TSE) Reviewer, 2012.
Committee Member	Regression 2012.
Reviewer	ACM Transactions on Software Engineering and Methodology (TOSEM) Reviewer, 2012.
Reviewer	Transactions on Software Engineering (TSE) Reviewer, 2011.
Reviewer	Automated Software Engineering Journal Reviewer, 2010.
Reviewer	ACM Transactions on Software Engineering and Methodology (TOSEM) Reviewer, 2010.
Reviewer	International Journal of Software Engineering and Knowledge Engineering (IJSEKE) Reviewer, 2010.
Reviewer	ACM Transactions on Software Engineering and Methodology (TOSEM) Reviewer, 2009.