mspiegel.github.com
[firstname].m.[lastname]@gmail.com

Michael Spiegel

1 Education

Ph.D University of Virginia, Department of Computer Science. May 2011. "Cache-Conscious Concurrent Data Structures." Committee: Andrew Grimshaw (Chair), Paul F. Reynolds (Advisor), Abhi Shelat, Steven Boker, and Doug Lea.

M.C.S. University of Virginia, Department of Computer Science. August 2006. "Model Context For Simulation Composability And Reusability." Research Advisor Paul F. Reynolds.

B.A. Swarthmore College, Bachelor of Arts with Honors. May 2003. Computer Science Major. Religion Minor. Research Advisor Tia Newhall.

2 Work Experience

Post Doc Renaissance Computing Institute (2011-present). Chapel Hill, NC. An interdisciplinary position sponsored by the high performance computing and bioinformatics groups. The objective is the application of doctoral experience on concurrent algorithms and data structures to high performance, high throughput analysis of genetic information. Involved in the implementation of an efficient hierarchical OpenMP runtime, an extension of the Qthreads library (`www.cs.sandia.gov/qthreads`). My contribution is the design and implementation of an array-based lock-free dequeue that supports concurrent modification on both ends of the data structure. Experience with reasoning about the x86 memory model and atomic operations. Also involved in the North Carolina Clinical Genomic Evaluation by NextGen Exome Sequencing project. I am involved in the effort to transform the genomic statistical inference algorithms that are typically applied across 100 kilobase pair regions into efficient implementations that process all 3.2 billion base pairs of the human genome.

Graduate Student Modeling and Simulation Laboratory (2006-2011). Charlottesville, VA. My doctoral research explored novel lock-free cache-conscious data structures, namely lock-free data structures that maintain the abstraction of a linearizable ordered set. I created the dense skip tree as a variation of the skip tree data structure, and proved cache-conscious properties of the dense skip tree. The lock-free dense skip tree has relaxed structural properties that allow atomic operations to modify the tree without invalidating the consistency of the data structure. Available at `www.github.com/mspiegel/lockfreeskiptree`. I show that cache-conscious, linearizable concurrent data structures have advantageous performance that can be measured across multiple architecture platforms on both synthetic and application benchmarks. Experience with reasoning about the Java virtual machine memory model and atomic operations.

Graduate Student Modeling and Simulation Laboratory (2004-2006). Charlottesville, VA. My master's research studied the role model context plays in simulation composability and reusability. I performed a case study in which participants attempted to identify all validation constraints for a relatively simple model. For a simple problem: compute the position and velocity of a falling body, we found that no single study participant was capable of identifying more than three-quarters of all identified constraints. Experience with Modeling and Simulation concepts, including composability, reusability, interoperability, verification and validation, agent-based modeling, quantifying uncertainty, DIS, and HLA (refer to section 3: Teaching Experience).

Lead Developer Human Dynamics Laboratory (2008-2011). Charlottesville, VA. Founding participant in the design and development of the OpenMx library. OpenMx is free and open source software for use with R that allows estimation of a wide variety of advanced multivariate statistical models. The OpenMx website receives approximately 400 download requests per month. My areas of responsibility include the OpenMx library API, the implementation of the front end (transform the model into an intermediate representation), the implementation of the parallel back end (a numerical optimizer), the unit testing framework, and the performance testing framework. The OpenMx website is `openmx.psyc.virginia.edu`. Development can be tracked at `www.unc.edu/~mspiegel/openmx`. This work is funded by NIH grant 5R21DA024304-04.

Summer Intern Sun Microsystems (2008). Burlington, MA. Worked on the Fortress language implementation. Performed concurrent maintenance of the Fortress interpreter while designing a compiler to target Java bytecode instructions. Fortress is a novel programming language designed for high-performance computing with high programmability. Fortress is an open-source project sponsored by the programming languages research group at Sun laboratories. Additionally I wrote a performance testing framework to work with the automated build system, such that code contributions can be assessed on multiple performance metrics.

3 Teaching Experience

Teaching Certificate Participant in the 2011 Training Initiative in Biomedical and Biological Sciences (TIBBS) Summer Teaching Series at the University of North Carolina, Chapel Hill. A series of workshops and panel discussions designed to help graduate students and postdocs learn how to become effective teachers, design a course, manage a classroom, involve undergraduates in research, and get a job at a primarily undergraduate teaching institution.

Twins Workshop Instructor for the 2010 and 2012 International Workshop on Statistical Genetics and Methodology of Twin and Family Studies: the Introductory Course in Boulder, CO. This five day workshop covers topics including causes of variation; univariate twin analysis; between group heterogeneity; path analysis; analysis of raw data; multivariate genetic analysis; and an introduction to quantitative trait loci and association. Assisted in syllabus modifications to introduce emphasis on software decomposition and software testing.

CS451 University of Virginia. Team-taught Advanced Modeling and Simulation with my research advisor as an undergraduate seminar for upper-level students. The course is designed to expose students to the existing capabilities, challenges, and limitations of Modeling and Simulation (M&S) technology. I prepared reading material and class discussion for topics on modeling and simulation in public policy, such as model uncertainty, epidemic prediction, long-term nuclear waste storage, weather prediction and climate modeling. A static snapshot of the course website is available at `www.unc.edu/~mspiegel/wiki`.

CS101 & CS216 University of Virginia. Teaching assistant for one semester of CS101: Introduction to Computer Science. Introduces the basic principles and concepts of object-oriented programming through a study of algorithms, data structures and software development methods in Java. Teaching assistant for two semesters of CS216: Program and Data Representation. Introduces programs and data representation at the machine level. Representations of numbers, arithmetic operations, arrays, records, recursion, hashing, stacks, queues, trees, graphs, and related concepts. TA duties included running lab sessions every week, holding office hours, grading lab assignments, and grading three exams per semester. Lecture experience during professor's absence.

4 Community Activities

Member of ACM and ACM-W organizations. Elected as a graduate student representative for the computer science department, 2006-2007. Attended weekly faculty meetings and spoke on behalf of student opinion on relevant matters.

Organized the graduate town hall meetings with department chair, the orientation weekend for incoming graduate students, and the visitation weekend for prospective graduate students. Graduate student mentor, 2005-2007. Volunteered in the fall of 2008 as a tutor in a departmental pilot program for the retention of women in computer science. Held weekly meeting with individual students from CS 205 to review the course material. Student and mentor assignments were rotated each week.

5 Technical Skills

- Languages: C, C++, Java, Java bytecode, OpenMP, MPI, Perl, Python, Lisp, Scheme, SQL, R
- Tools: GCC, GDB, oprofile, make, autoconf, ant, subversion, git, LaTeX, Eclipse
- Operating Systems: Linux (RH, Debian, Ubuntu), UNIX, Windows, Mac OS X

Publications

Stephen L. Olivier, Allan K. Porterfield, Kyle B. Wheeler, Michael Spiegel, and Jan F. Prins. OpenMP task scheduling strategies for multicore NUMA systems. *International Journal of High Performance Computing Applications*, 26(2): 110–124, May 2012. URL `http://hpc.sagepub.com/content/26/2/110`.

Michael Spiegel. *Cache-conscious concurrent data structures*. PhD thesis, University of Virginia, 2011. URL `http://www.unc.edu/~mspiegel/publications/michael-spiegel-dissertation.pdf`.

Steven Boker, Michael Neale, Hermine Maes, Michael Wilde, Michael Spiegel, Timothy Brick, Jeffrey Spies, Ryne Estabrook, Sarah Kenny, Timothy Bates, Paras Mehta, and John Fox. OpenMx: An open source extended structural equation modeling framework. *Psychometrika*, 76(2):306–317, 2011. URL `http://www.springerlink.com/content/dg37445107026711/`. [60 citations].

Michael Spiegel and Paul F. Reynolds, Jr. Lock-free multiway search trees. In *Proceedings of the 39th Annual International Conference on Parallel Processing (ICPP)*, San Diego, CA, September 13-16 2010. IEEE Computer Society. URL `http://dx.doi.org/10.1109/ICPP.2010.68`.

Michael Spiegel, Ross Gore, and Paul F. Reynolds. Quantifying and analyzing uncertainty in simulations to enable user understanding. In *Proceedings of the Modeling, Simulation, & Gaming Student Capstone Conference*, Suffolk, VA, 2008. The Virginia Modeling, Analysis, & Simulation Center (VMASC). Recipient of best paper award in "Discipline of Modeling & Simulation" track.

Paul F. Reynolds, Jr., Michael Spiegel, Xinyu Liu, and Ross Gore. Validating evolving simulations in COERCE. In *Proceedings of the 2007 International Conference on Computational Science (ICCS)*, pages 1238–1245, May 2007.

Paul F. Reynolds, Jr., David C. Brogan, Joe Carnahan, Yannick Loitiere, and Michael Spiegel. Capturing scientists' insight for DDDAS. In V.N. Alexandrov, G.D. Van Albada, P.M.A. Sloot, and J. Dongarra, editors, *Proceedings of the 2006 International Conference on Computational Science (ICCS)*, Springer Lecture Notes in Computer Science, pages 570–577, Reading, U.K., 2006.

Michael Spiegel, Paul F. Reynolds, and David C. Brogan. Grand challenge case studies in a simulation curriculum. In L.F. Perrone, F.P. Wieland, J. Liu, B.G. Lawson, D.M. Nicol, and R.M. Fujimoto, editors, *Proceedings of the 2006 Winter Simulation Conference (WSC)*, pages 2242–2249, Piscataway, New Jersey, 2006. Institute of Electrical and Electronics Engineers.

Michael Spiegel, Paul F. Reynolds, and David C. Brogan. A case study of model context for simulation composability and reusability. In M.E. Kuhl, N.M. Steiger, F.B. Armstrong, and J.A. Joines, editors, *Proceedings of the 2005 Winter Simulation Conference (WSC)*, pages 437–444, Piscataway, New Jersey, 2005. Institute of Electrical and Electronics Engineers. [32 citations].

Tia Newhall, Sean Finney, Kuzman Ganchev, and Michael Spiegel. Nswap: A network swap module for linux clusters. In H. Kosch, L. Boszormenyi, and H. Hellwagner, editors, *Proceedings of the 9th European Conference on Parallel Processing (Euro-Par)*, Springer Lecture Notes in Computer Science, pages 1160–1169, 2003. [32 citations].