

Ke Bai

CONTACT

INFORMATION **Compiler-Microarchitecture Lab**
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OBJECTIVE

Seeking a research internship position in compiler design/optimization, multi-core/multi-threaded programming, and high performance computing.

RESEARCH

INTERESTS

- Design of cutting edge software for multi-core processors and clusters;
- Computer architecture and compilers design/optimization, for multi-core/graphics processors;
- Interaction of software and hardware;
- Performance evaluation and management on power-efficient systems.

EDUCATION

Ph.D. in Computer Science, [Arizona State University](#), Expected December 2012
B.S. in Electrical Engineering, [University of Science and Technology of China](#), May 2008

PROFESSIONAL EXPERIENCE

Invited Reviewer for Journal of Parallel Programming (IJPP), 2011

Invited Reviewer for Journal of Parallel, Emergent and Distributed Systems (IJPEDS), 2011

Research Assistant, [Compiler-Microarchitecture Lab](#), Tempe, AZ, USA, August 2008 – till now

[Dissertation] *Compiler and runtime support for memory management on Limited Local Memory (LLM) multi-core architectures*

- Designed and developed compiler-level techniques and methodologies for stack data management.
- Designed a framework and developed optimization techniques and methodologies for heap data management.
- Proposed a new data structure-Global Call Control Flow Graph (GCCFG) and developed two heuristics for code mapping.
- Modified the **spu-gcc** to automate the code and data management on the Limited Local Memory multi-core processor.

IN-CLASS DESIGN PROJECTS

Design and implementation of a mini object pascal compiler

- *Front End*: Implemented a translation scheme to check input programs written with an object-oriented language derived from Pascal for semantic errors by utilizing scanner and parse generator tools (*lex* and *yacc*).
- *Middle End*: Generated three-address code and implemented some basic optimizations on the code including evaluation of constant expressions, elimination of redundant expressions using value numbering, and global redundancy elimination.
- *Back End*: Implemented a C backend that transforms three-address code into C programs in a form with support for global, heap variables, methods and arrays.

Implementation of software on high performance cluster (ASU saguaro 5000 processors)

- *OpenMP*: Accelerated the performance of “Poisson Equation Solver” using OpenMP with particular attention to data dependencies.
- *MPI and hybrid MPI-OpenMP*: Implemented the “2-phase simplex method” for a parallel distributed system with MPI and hybrid MPI-OpenMP.
- *CUDA*: Implemented an image manipulation filter called “emboss” on GPU.
- *MPI*: Set up a Singular Value Decomposition on the input image using BLACS and ScaLAPACK ($A = U \times S \times V$), created a new matrix S_2 where S is shrunk by half in each direction, and outputted $A_2 = U_2 \times S_2 \times V_2$ as binary using MPI-IO to a BMP file.

Implementation of a scalable video coding/decoding framework for real-time dynamic channel bandwidth under multi-user scenario, using JSVM (Joint Scalable Video Model) software framework.

Implementation of a Scull Char driver, a parallel port, an interrupt driven parallel port for Linux kernel 2.4.

PUBLICATIONS

Conference Papers

- **C4.** Ke Bai, Di Lu and Aviral Shrivastava, “Vector Class on Limited Local Memory (LLM) Multi-core Processors” in *CASES 2011: Proceedings of the 2011 International Conference on Compilers Architectures and Synthesis of Embedded Systems*.
- **C3.** Ke Bai, Aviral Shrivastava, and Saleel Kudchadker, “Stack Data Management for Limited Local Memory (LLM) Multi-core Processors” in *ASAP 2011: Proceedings of the 2011 International Conference on Application-specific Systems, Architectures and Processors*.
- **C2.** Ke Bai and Aviral Shrivastava, “Heap Data Management for Limited Local Memory (LLM) Multi-core Processors” in *CODES+ISSS 2010: Proceedings of the 2010 International Conference on Hardware/Software Codesign and System Synthesis*.
- **C1.** Seungchul Jung, Aviral Shrivastava, and Ke Bai, “Dynamic Code Mapping for Limited Local Memory Systems” in *ASAP 2010: Proceedings of the 2010 International Conference on Application-specific Systems, Architectures and Processors*.

Journal Articles

- **J3.** Ke Bai and Aviral Shrivastava, “A Pure Software Technique for Stack Data on Limited Local Memory Multi-core Processors”, *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (TCAD)*.
- **J2.** Ke Bai, Seungchul Jung and Aviral Shrivastava, “Efficient Code Placement Techniques for Limited Local Memory Multi-core Processors”, *ACM Transactions on Design Automation of Electronic Systems (TODAES)*.
- **J1.** Ke Bai and Aviral Shrivastava, “A Software-Only Scheme for Managing Heap Data on Limited Local Memory (LLM) Multi-core Processors”, *ACM Transactions in Embedded Computing Systems (TECS)*.

TEACHING EXPERIENCE

Supervisor of a Master Thesis (ASU, 2010 – 2011)
Teaching Assistant of Data Structures and Algorithms (CSE 310, ASU, 2009/2010)
Teaching Assistant of Computer Architecture I (CSE 420, ASU, 2009)

RELEVANT COURSES

Algorithms	Design and Analysis of Algorithms; Combinatorial Algorithms; Optimization Algorithms for Engineering Applications; Statistics Learning for Data Mining;
Applications	Programming for Multi-core Processors; Compiler Construction I; Digital Video Processing; Applied Cryptography; Intro to High Performance Computing;
Systems and Architecture	Real-Time Embedded Systems; Computer Architecture I; Embed Operating System Internals; Low Power Computing;

HONORS AND AWARDS

- Research Assistantship, Arizona State University, August 2008 - present
- University Graduate Grant, Arizona State University, 2008
- GPSA Travel Awards, Arizona State University, 2010/2011
- Scholarship for Excellent Students, University of Science and Technology of China, 2005–2008
- The bronze medal at Robert Game, University of Science and Technology of China, 2006
- Excellent leader, University of Science and Technology of China, 2006/2007

TECHNICAL SKILLS

- Extensive software experience in multi-core/multi-threads programming and debugging
- *Programming:* C, C++, OpenMP, MPI, Perl scripting, GNU make, MIPS assembly language
- *Computer Applications:* MATLAB, SAS, ORIGIN, MSVisio, T_EX (L^AT_EX, B_IB T_EX), Macromedia, most common productivity packages (for Windows, OS X, and Linux platforms), Vim, Emacs
- *Simulators/Tools:* SIMPLESCALAR, Protel, Maxplus, Cadence, SystemSim for Cell/B.E.

REFERENCES

Prof. Aviral Shrivastava, Arizona State University, Aviral.Shrivastava@asu.edu