Erdal Mutlu

2894 Salk Ave. Apt. 228
Richland, WA, 99534

erdal.mutlu@pnnl.gov
www.erdalmutlu.com
+1 (509) 460-2869

Research Interests

Software Engineering and Reliability: runtime systems, dynamic/static verification techniques and tools for asynchronous, parallel and distributed programming models.

Programming Languages: compiler design and implementation, domain specific languages, typed systems for anomaly detection.

Education

Koç University, İstanbul, TURKEY

Ph.D. in Computer Science and Engineering, September 2016

Dissertation title: Race Detection Techniques for Applications using Asynchronous Programming Models

Advisor: Serdar Taşıran

Description: We worked on developing race detection techniques for parallel programming models specifically asynchronous JavaScript applications and task based high performance computing (HPC) applications using dataflow constructs along with shared memory programming models. For testing our detection techniques, we manually instrumented Firefox web browser for collecting execution information from real-world applications. We also implemented a randomized exploration scheduler for Atomic DataFlow framework from Barcelona Supercomputing Center.

Sabancı University, İstanbul, TURKEY

M.Sc. in Computer Science and Engineering, February 2011

Thesis title: High Level Rule Modeling Language for Airline Crew Pairing

Advisor: Hüsnü Yenigün

Description: We designed a domain specific programming language (DSL) for representing rule based feasibility controls and cost calculations in crew pairing systems. Later, we designed and implemented a compiler for this DSL using Flex(scanner), Bison(parser) and C++ programming language as the backend code generation. Our framework generates C++ libraries for each rule specified with our DSL which then used by crew scheduling optimization framework at runtime.

B.Sc. in Computer Science and Engineering, June 2008

Research Experience

Tensor Algebra for many-body methods (TAMM)   **Winter 2018–present**

We are developing a runtime system specialized for efficient tensor operations heavily used in computational chemistry applications for exascale high performance computing (HPC) systems. Framework is developed as part of NWChemEx project which focuses on tackling the challenges in methods developed for exascale systems.

Race Detection for Hybrid HPC Applications   **Fall 2015–2016**

We developed race detection techniques for applications using hybrid programming models combining data-flow constructs with shared memory programming models. We implemented a prototype tool for Atomic Dataflow programming model by instrumenting the framework using C++ programming language.

Race Detection for JavaScript Web Applications   Fall 2014–2016

We introduced a race detection technique for JavaScript web applications using asynchronous constructs(user interaction, server requests). We instrumented Firefox web browser (over 20M lines of codes) for collecting traces using C++ programming language and applied our race detection technique on real world web applications detecting various harmful races.

Behavior Exploration Techniques
for Distributed Data Types   Spring 2014

We investigated different data types used in distributed systems (Conflict-free Replicated Data Types (CRDTs), Cloud Types etc.) and formalized techniques for exploring s possible behaviors of different interactions between client and server systematically.

Randomized Schedule Exploration
for Hybrid Applications   Fall 2013

We presented a dynamic verification technique for a class of concurrent programming models that combine data-flow and shared memory programming models. We identified and illustrated a novel category of bugs in these hybrid concurrency programming models and provide a technique for randomized exploration of program behaviors in this setting. Implemented a randomized exploration technique into ADF framework using C++ programming language.

Face Detection Optimization for System-on-Chip   Fall 2012

We developed and implemented an optimized scheme for calculating the integral image and applying the face detection which optimizes the memory usage so that it can be used in SecSoC, which targets to achieve video surveillance application on energy optimized microprocessors.

High Level Rule Modeling Language
for Airline Crew Pairing   Fall 2009–2010

We designed a domain specific language and implemented a compiler generating C++ libraries for rule based feasibility controls and cost calculations in crew pairing systems. We generate run time methods for the crew pairing systems where end-users are able to change the feasibility rules without interacting with the crew pairing engine itself.

Work Experience	**Post Doctorate Research Associate**	Pacific Northwest National Laboratory
	Richland, WA, USA	Jan 2018–present

Visiting Researcher   Barcelona Supercomputing Center

Barcelona, SPAIN   Sept 2013–Dec 2013

Developed behavior exploration techniques for a hybrid programming model "Atomic DataFlow(ADF)" which combines "Transactional Memory" concurrent programming models with data-flow constructs. Implemented a testing scheduler into ADF framework using C++ programming language.

Ph.D. Intern   ST-Microelectronics

Milan, ITALY   Aug 2012–Dec 2012
Worked on optimizing and parallelizing Viola-Jones face detection algorithm for a new prototype system-on-chip, SecSoC, which targets to achieve video surveillance application on energy optimized microprocessors. Implemented the algorithm using C programming language over FPGA simulator.

Researcher - Software Engineer   The Scientific and Technological
                                                  Research Council of Turkey
Kocaeli, TURKEY   May 2010–Sept 2011
Worked in IYON (Forensic Image Enhancement and Restoration Software) project on developing plug-in manager and custom filter generator modules. Implemented various modules using C++ programming language with Qt and Boost libraries.

GSM/UMTS Global Product   Nortel-Netas
Support Engineer
İstanbul, TURKEY   Feb 2008–Aug 2008
Worked as part time product support engineer for Nortel's GSM/UMTS products on investigating and solving reported issues on the software stack.

Computer Skills	**Languages**: Advanced knowledge of C/C++(11-14-1z)/C#, Java, JavaScript; Basic knowledge of OCaml, Python.
	Parallel Programming Models: OpenMP, MPI, CUDA, Intel - TBB, Microsoft-TPL
	Development Tools: Eclipse, Visual Studio, WebStorm, Git

Honors and Awards

Microsoft Research invitation to Summer School in Cambridge, UK	**2015**
EuroTM Short Term Scientific Mission (STSM) Scholarship	**2013**
EuroTM travel award to attend DMTM	**2013**
EuroTM financial support award to attend HTDC Winter School	**2013**
HiPEAC Industrial Ph.D. Internship Scholarship	**2012**

Teaching Experience

Teaching Assistant: Software Reliability, Koç University   **Spring'15**
- Preparing weekly assignments for different analysis and verification tools
- Conducting weekly recitations/tutorials on tools used in the assignments
- Grading assignment, projects and exams

Teaching Assistant: Software Engineering, Koç University   **Fall'11-14**
- Preparing homework and term projects for all software engineering groups
- Conducting weekly meetings for the software engineering groups on the term project
- Grading exams and evaluating weekly progress on the term projects

Teaching Assistant: Advanced Programming, Koç University **Spring'12-14**
- Preparing and conducting weekly coding quizzes for all students
- Grading coding quizzes and exams
- Conducting recitations/tutorials on Java programming language

Publications

Correctness'18 – E. Mutlu, A. Panyala, and S. Krishnamoorthy. HPC software verification in action: A case study with tensor transposition. In *2018 IEEE/ACM 2nd International Workshop on Software Correctness for HPC Applications (Correctness)*, pages 9–16, Nov 2018

PARCO'18 – Hassan Salehe Matar, Erdal Mutlu, Serdar Tasiran, and Didem Unat. Output nondeterminism detection for programming models combining dataflow with shared memory. *Parallel Computing*, 71:42 – 57, 2018

JPF'17 – Maryam Dabaghchian, Zvonimir Rakamarić, Burcu K. Ozkan, Erdal Mutlu, and Serdar Tasiran. Consistency-aware scheduling for weakly consistent programs. *ACM SIGSOFT Software Engineering Notes*, 42(4):1–5, October 2017. Proceedings of the 2017 Java Pathfinder Workshop (JPF)

FSE'15 – **Erdal Mutlu**, Serdar Tasiran, and Benjamin Livshits. Detecting JavaScript races that matter. In *Proceedings of the 2015 10th Joint Meeting on Foundations of Software Engineering*, ESEC/FSE 2015, pages 381–392, New York, NY, USA, 2015. ACM

RV'14 – **Erdal Mutlu**, Vladimir Gajinov, Adrián Cristal, Serdar Tasiran, and Osman S. Unsal. *Runtime Verification: 5th International Conference, RV 2014, Toronto, ON, Canada, September 22-25, 2014. Proceedings*, chapter Dynamic Verification for Hybrid Concurrent Programming Models, pages 156–161. Springer International Publishing, Cham, 2014

DYLA@PLDI'14 – **Erdal Mutlu**, Serdar Tasiran, and Benjamin Livshits. I know it when I see it: Observable races in javascript applications. In *Proceedings of the Workshop on Dynamic Languages and Applications*, Dyla'14, pages 1:1–1:7, New York, NY, USA, 2014. ACM

PaPEC'14 – Burcu Kulahcioglu Ozkan, **Erdal Mutlu**, and Serdar Tasiran. Towards verifying eventually consistent applications. In *Proceedings of the First Workshop on Principles and Practice of Eventual Consistency*, PaPEC '14, pages 11:1–11:4, New York, NY, USA, 2014. ACM

SCLIT'11 – **Erdal Mutlu**, Ilker Birbil, Kerem Bulbul, and Husnu Yenigun. High level rule modeling language for airline crew pairing. In *International Conference on Numerical Analysis and Applied Mathematics*, pages 798–801, 2011