Zachary DeVito

353 Serra Mall #386
Stanford, CA 94305

zdevito@cs.stanford.edu
cs.stanford.edu/~zdevito
(610)-247-7846

EDUCATION

Stanford University, Stanford, CA — January 2015
Ph.D, Computer Science, GPA 4.0
Advised by Pat Hanrahan
Thesis: *Terra: Simplifying High-performance Programming using Multi-stage Programming*

Stanford University, Stanford, CA — September 2011
Masters of Computer Science, GPA 4.0

Princeton University, Princeton, NJ — June 2008
A.B. Computer Science, Summa Cum Laude
GPA 4.0 Departmental 3.95 Overall

RESEARCH INTERESTS

Programming languages, compilers, graphics. Applying techniques from programming languages to make high-performance programming easier and usable by a wider audience.

LANGUAGES

C/C++, Lua, LLVM, Scala, Java, Python, Javascript, ML

PUBLICATIONS

Opt: A Domain Specific Language for Non-linear Least Squares Optimization in Graphics and Imaging.
Zachary DeVito, Michael Mara, Michael Zollhoefer, Gilbert Bernstein, Jonathan Ragan-Kelley, Christian Theobalt, Pat Hanrahan, Matthew Fisher, and Matthias Nießner.
In submission to Transactions on Graphics

Rigel: Flexible Multi-Rate Image Processing Hardware
James Hegarty, Ross Daly, **Zachary DeVito**, Jonathan Ragan-Kelley, Pat Hanrahan.
To appear in SIGGRAPH '16

Ebb: A DSL for Physical Simulation on CPUs and GPUs.
Gilbert Bernstein, Chinmayee Shah, Crystal Lemire, **Zachary DeVito**, Matthew Fisher, Philip Levis, and Pat Hanrahan.
To appear in Transactions on Graphics '16 (Proc. of SIGGRAPH)

The Design of Terra: Harnessing the best features of high-level and low-level languages.
Zachary DeVito and Pat Hanrahan.
In SNAPL '15.

Darkroom: compiling high-level image processing code into hardware pipelines.
James Hegarty, John Brunhaver, **Zachary DeVito**, Jonathan Ragan-Kelley, Noy Cohen, Steven Bell, Artem Vasilyev, Mark Horowitz, and Pat Hanrahan.
In SIGGRAPH '14.

First-class Runtime Generation of High-performance Types using Exotypes.
Zachary DeVito, Daniel Ritchie, Matt Fisher, Alex Aiken, and Pat Hanrahan.
In PLDI '14.

Just-in-time Length Specialization of Dynamic Vector Code.
Justin Talbot, **Zachary DeVito**, and Pat Hanrahan.
In ARRAY '14.

Terra: A Multi-Stage Language for High-Performance Computing.
Zachary DeVito, James Hegarty, Alex Aiken, Pat Hanrahan, and Jan Vitek.
In PLDI '13.

Exploring Traditional and Emerging Parallel Programming Models Using a Proxy Application.
Ian Karlin, Abhinav Bhatele, Jeff Keasler, Bradford L. Chamberlain, Jonathan Cohen, **Zachary DeVito**, Riyaz Haque, Dan Laney, Edward Luke, Felix Wang, David Richards, Martin Schulz, and Charles H. Still.
In IPDPS '13. **Best Paper Award.**

Riposte: a trace-driven compiler and parallel VM for vector code in R.
Justin Talbot, **Zachary DeVito**, and Pat Hanrahan.
In PACT '12.

Designing the Language Liszt for Building Portable Mesh-based PDE Solvers.
Zachary DeVito and Pat Hanrahan.
In SciDac '11.

Liszt: a domain specific language for building portable mesh-based PDE solvers.
Zachary DeVito, Niels Joubert, Francisco Palacios, Stephen Oakley, Montserrat Medina, Mike Barrientos, Erich Elsen, Frank Ham, Alex Aiken, Karthik Duraisamy, Eric Darve, Juan Alonso, and Pat Hanrahan.
In SC '11.

Language virtualization for heterogeneous parallel computing.
Hassan Chafi, **Zachary DeVito**, Adriaan Moors, Tiark Rompf, Arvind K. Sujeeth, Pat Hanrahan, Martin Odersky, and Kunle Olukotun.
In OOPSLA '10.

EMPLOYMENT

Stanford January 2015 – Present
Postdoctoral Researcher in Graphics
Created a domain-specific language for non-linear least-squares optimizations in graphics and imaging on GPUs and advised work on image processing languages for hardware.

Stanford September 2008 – January 2015
Research Assistant in Graphics and Programming Languages advised by Pat Hanrahan.
Created several new high-performance programming languages including Liszt, a language for high-performance physical simulation and Terra, a language that makes it easier to create high-performance domain-specific languages.

Nvidia September 2010 – December 2010
Software Engineering Intern supervised by Ujval Kapasi on the CUDA Driver Team.
Investigated extensions to the current CUDA programming model and developed a framework for distributed FFT computations accelerated using multiple networked GPUs

Amazon.com June 2007 – August 2007
Software Engineering Intern supervised by Peter Cohen on the Mechanical Turk Project.
Developed a system for keeping search results up-to-date with a constantly changing set of available items.
Full-time employment offered in October, 2007.

SOFTWARE PROJECTS

Terra terralang.org Thesis Project
A low-level language which is meta-programmed using Lua. Terra is used to develop high-performance domain-specific languages and libraries that need to generate optimized low-level code at runtime.

Opt optlang.org Wrote the compiler, differentiation transformations, and data-dependency analysis
A language that transforms high-level energy specifications for non-linear least-squares optimizers into high-performance GPU implementations.

Darkroom darkroom-lang.org Assisted with the design and implementation.
A language for designing high-level image processing pipelines that can be compiled into custom hardware designs or efficient CPU implementations. It uses Terra to generate code.

Liszt and Ebb ebblang.org Designed and implemented Liszt, and assisted the design and implementation of Ebb, domain-specific languages for physical simulations such as fluid flow. Liszt transforms portable high-level code into efficient cluster, GPU, and multi-core implementations. Ebb is the second generation of Liszt, which uses Terra for code generation, allowing it to be more flexible and easier to develop.

Riposte github.com/jtalbot/riposte Assisted with the design and creation of the initial JIT compiler.
An implementation of the R programming language that uses a trace-based just-in-time compiler to accelerate vector code written at a high-level.

TEACHING

Co-instructor Fall 2015
Stanford CS448: Domain-specific Language for Graphics, Imaging, and Beyond
Developed lectures and assignments teaching students how to create high-performance domain-specific languages using Terra and other techniques.

Teaching Assistant Spring 2011 and 2013
Stanford CS348b: Image Synthesis Techniques
Developed and evaluated new assignments, and prepared guest lectures.

Instructor Summer 2009
Summer Institute in Computational Science and Engineering at the Army High-Performance Computing Research Center at Stanford
Prepared and presented lectures on multi-core programming techniques and mentored three students developing summer software projects in multi-core programming.

AWARDS AND DISTINCTIONS

Stanford School of Engineering Graduate Fellowship — Stanford Engineering 2008-2009
Phillip Y. Goldman '86 Prize in Computer Science — Princeton Computer Science Dept. 2008
Phi Beta Kappa — Princeton University 2007
Accenture Award for Academic Excellence in Computer Science — Princeton Computer Science Dept. 2007
Shapiro Prize for Academic Excellence — Princeton University 2005-2006 and 2004-2005

REFERENCES

Pat Hanrahan
Professor/PhD Advisor
Stanford University
hanrahan@cs.stanford.edu

Alex Aiken
Professor/Advisor
Stanford University
aiken@cs.stanford.edu

Kunle Olukotun
Professor/Advisor
Stanford University
kunle@stanford.edu