

Significant BITS

Newsletter of the
School of Computer Science

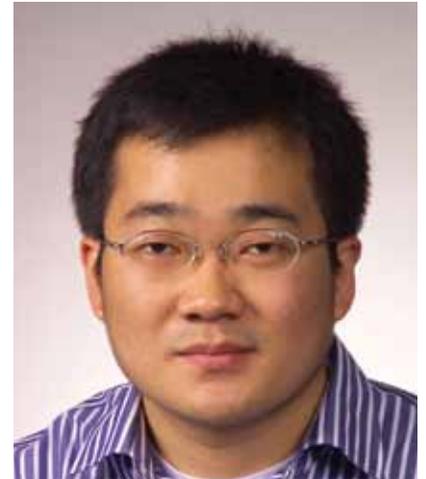


Join us
October 17-19
(during
Homecoming)
for the
School of
Computer
Science
Community
Celebration,
“Broadening
the Impact of
Computing,”
and
50th
Anniversary
Kick-off.

See centerspread for
the schedule of events

Interactive Visual Computing using GPUs

Advances in visual computing, particularly in computer-generated imagery, have profoundly changed the way we express ideas, create content, exchange information, and interact with machines. Today, visual computing is an indispensable component of many fields, including design, prototyping, data analysis, medical imaging, digital preservation, training, e-commerce, and education. Despite the tremendous progress in recent years, generating convincing imagery at interactive rates remains a major challenge in graphics. For example, in the physical world, trillions of photons can simultaneously interact with the scene, leading to an equilibrium state instantly; in the digital world, however, we have to simulate such complex interactions with very limited processing power.



Rui Wang *continued on page 4*

Guha joins CS faculty

Arjun Guha joins the School this fall as an Assistant Professor, where he will co-lead the PLASMA (Programming Languages And Systems at MASSachusetts) group. Guha conducts research in programming languages and enjoys applying his work to other domains.

“A programming language is a medium of expression. It is how programmers communicate their intent to machines and their ideas with each other. That’s what makes research in programming languages so widely applicable,” says Guha. As a student and a postdoc, Guha worked closely with researchers in security and computer networking.

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Alums receive awards at OAA ceremony



CS alums (l. to r.) Aaron St. John, Wayne Duso, Arthur Karshmer, Laura Dillon, Jennifer Neville, Rakesh “Teddy” Kumar, and Richard Sutton receive their awards at the 2013 Outstanding Achievement and Advocacy Award ceremony.



Lori A. Clarke

Save the date! October 17-19 we are planning to celebrate becoming a School and the 50th anniversary of Computer Science at UMass Amherst. Thursday afternoon, October 17th, will be an informal career fair where our alums are invited to meet with our current students to discuss their career experiences and promote their companies. That evening will be a good opportunity to visit the town and your favorite area hangout

(it is probably still there). Friday there will be panels with invited speakers discussing the future of computer science research and education and our future plans for the School of Computer Science. Friday night is an alumni and faculty social and dinner at the top of the Campus Center. Saturday morning there will be hands-on displays that should be fun for visitors of all ages. More information is available on page 10, and we'll be sending more details about the program and registration soon. October is prime leaf peeping season, so plan ahead and make hotel reservations soon. We only turn 50 once, so please plan to join the celebration. As an incentive for early registration, we'll give commemorative 50th anniversary t-shirts to the first 50 alums who register.

For those who graduated with an undergraduate degree, you might be surprised at how much our undergraduate program has changed. Like most programs, we have seen a phenomenal increase in interest in our programs (i.e., BS, BA, and CS minor). In 2008 we had 262 computing students, but today we are almost three times that size. We have a very selective undergraduate program; students with outstanding high school records are admitted directly, while other students must demonstrate competence by performing well in our predictor courses. In a survey, graduating seniors reported that almost 70% of them did at least one internship and 30% worked with faculty on an individual project. Almost a quarter of our graduating seniors did a double major, with half of those also majoring in mathematics. Seventy percent are planning to eventually get a graduate degree, with 15% going to graduate school immediately. The undergraduates now have their own space, called the USpace, for studying and meeting with other students. TAs can hold their office hours in the USpace, and our undergraduate Peer Advisors hold their advising hours there as well. Undergraduate Ambassadors give tours to visiting high school students throughout the year. We have a very active ACM Student Chapter, which under the leadership of Professor Erik Learned-Miller, competes in the ACM programming contest. The undergraduate program committee has monthly information sessions (every first Friday of the month) to discuss issues about the academic programs, internships, job and career planning, and other topics, and hosts fun events such as Wearable Computing Night. Undergraduates have a representative at faculty meetings, helping to assure that faculty understand the issues that concern undergraduates the most.

Our faculty continue to receive outstanding recognitions.

Congratulations to Distinguished Professor Jim Kurose who recently received the 2013 INFOCOM Achievement Award (see the article on page 3). This award is given to one researcher a year to recognize their outstanding contributions throughout their career. Many of the major subareas of computing have such Lifetime Achievement Awards. As a faculty, we have received ten such awards in the areas of Computer Communications, Performance Evaluation, Neural Networking, Software Engineering, Information Retrieval, and Artificial Intelligence. At the junior faculty level, our faculty has garnered eighteen NSF Career Awards. As computer science has matured, many major conferences now look back ten years or more and honor papers that have been extremely influential since their publication. These "Most Influential" or "Test of Time" awards are great honors. To date, seven of our faculty have been recognized with such awards. Conferences also often recognize the current best papers (and sometimes these become the most influential papers of the future). In this arena, our faculty have had an extraordinary year, receiving nine Best or Most Distinguished Paper awards so far in 2013 (see Faculty News, page 18).

I'm pleased to announce that we recently added two new endowed scholarships: the Jim Gray Scholarship in Computer Science and the Sudha and Rajesh Jha Scholarship. Both these scholarships are intended to help support graduate students during their first year of studies. These scholarships are greatly appreciated by the students and help the School attract outstanding students to our program.

The School has had several personnel transitions within the last six months. We are delighted that Professor Arjun Guha, who works in programming languages and software security, is joining the faculty this semester. Tim Richards is now a full-time, permanent lecturer and also serves as the Chief Undergraduate Advisor. Priscilla Scott, a grant administrator, retired after working for CS for 29 years and for the University for 37 years. Keeping up our tradition of having retirees continue to support and participate in the department, Priscilla will continue to help out on a post retirement appointment. On a very sad note, Lecturer Steve Constantine unexpectedly passed away in May (see page 7). Steve taught our undergraduate writing course, focusing on ethical and societal issues of computing. His teaching evaluations were always amazing. Based on student evaluation comments, Steve strongly influenced our students to think about complex societal issues. He will definitely be missed.

Open.CS

The UMass Amherst School of Computer Science is offering open, online courses to anyone interested in learning about computer science topics. Courses are free on a non-credit basis, and run in tandem with on-campus lectures. For Spring 2013, two courses were offered: undergraduate-level Computer Networks by Associate Professor Arun Venkataramani, and graduate-level Distributed Operating Systems by Professor Prashant Shenoy. Learn more at open.cs.umass.edu.

IEEE honors Kurose for career contributions

Distinguished Professor Jim Kurose received the IEEE INFOCOM 2013 Achievement Award “for seminal contributions in the design, analysis, modeling and measurement of computer networks and their protocols, and for impactful service and educational contributions.” This lifetime achievement award is given to someone who has a body of work (or a single paper) that has had a significant impact on the networking community and INFOCOM. It was presented at the 32nd IEEE International Conference on Computer Communications held in Turin, Italy in April, 2013.

Kurose’s research interests include network protocols and architecture, network measurement, sensor networks, multimedia communication, and modeling and performance evaluation. Dr. Kurose has served as Editor-in-Chief of the *IEEE Transactions on Communications* and was the founding Editor-in-Chief of the *IEEE/ACM Transactions on Networking*. He has been active in the program committees for IEEE INFOCOM, ACM SIGCOMM, and ACM SIGMETRICS conferences for a number of years, and has served as Technical Program Co-Chair for these conferences. He has won several conference best paper awards and received the ACM SIGCOMM Test of Time Award.

Kurose is the recipient of the Outstanding Teacher Award from the National Technological University (eight times), the Outstanding Teacher Award from the UMass College of Natural Science and Mathematics, the Outstanding Teaching

Award of the Northeast Association of Graduate Schools, and the IEEE Taylor Booth Education Medal. He was one of the founders of the Commonwealth Information Technology Initiative (CITI). He has twice received an IBM Faculty Development Award, and a Lilly Teaching Fellowship. He currently serves on the Board of Directors of the Computing Research Association, the advisory council of the Computer and Information Science and Engineering (CISE) Directorate at the National Science Foundation. He serves in the scientific advisory boards of Technicolor, IMDEA Networks in Madrid, and Laboratory for Information, Network and Communication Sciences in Paris. He is a Fellow of the IEEE and the ACM.

With Keith Ross, Kurose is the co-author of the textbook, *Computer Networking, A Top-Down Approach* (6th edition), published by Addison-Wesley.

Kurose has previously served in a number of campus administrative roles including Chair of the Department of Computer Science, Interim Dean of the College of Natural Sciences and Mathematics, Executive Associate Dean of the College of Natural Sciences, and senior faculty advisor for science and engineering for the Vice Chancellor for Research and Engagement.



GUHA ----- cont. from page 1

He anticipates many more such collaborations in the future, since both areas are great strengths of UMass Amherst.

Guha received his Ph.D. from Brown University in 2012. As part of his dissertation, he worked on JavaScript, the *lingua franca* of the Web. His JavaScript semantics, dubbed *LambdaJS*, is widely used by other researchers in programming languages and Web security. At UMass Amherst, he is looking forward to continuing research in Web security and tackling scripting languages more broadly.

During the 2012-2013 academic year, Guha was a Postdoctoral Researcher at Cornell University. At Cornell, he worked on *Frenetic*, which is a programming language for software-defined networking (SDN). Guha developed a new compiler and runtime system for *Frenetic* with a computer-verified proof of correctness. “Verification is tremendously important and fruitful, especially when applied to critical infrastructure, such as networks and the Web,” says Guha.

“I truly admire the research conducted at UMass,” says Guha. “And, I’ve found everyone at UMass to be very warm and welcoming. I feel lucky to join this wonderful community.”



Arjun Guha

Microsoft Research SEIF Awards



Associate Professor Emery Berger and CS alums Nilanjan Banerjee (Ph.D. ’09) and Shaun Kane (M.S. ’05) received Microsoft Research Software Engineering Innovation Foundation (SEIF) 2013 Awards. SEIF awards support academic research in software engineering technologies, tools, practices, and teaching methods. Sixteen projects received funding from 2013 SEIF awards from 141 proposals.

Berger’s SEIF award project is “CheckCell: Data Debugging for Spreadsheets.” CheckCell is a data debugging tool that plugs into Microsoft Excel. This work focuses on discovering highly unusual interactions between data and the programs that operate on them, since these are either errors or deserve special attention.

For his SEIF project, Banerjee, an Assistant Professor in the Computer Science and Electrical Engineering Department at the University of Maryland, Baltimore County, is constructing a multi-sensor wearable assistive device that recognizes gestures for paralysis patients.

Kane’s SEIF project is “Wheeltop Interaction: Full-Body Gesture Control for Power Wheelchair Users.” He is an Assistant Professor in the Department of Information Systems at the University of Maryland, Baltimore County.

INTERACTIVE VISUAL COMPUTING – – cont. from page 1

As a result, generating a photorealistic image often takes minutes to hours, severely limiting the user’s productivity.

Associate Professor Rui Wang’s research aims to enable interactive visual computing by exploiting modern graphics processors (GPUs). Today’s GPUs have emerged as low-cost, massively parallel computation platforms with thousands of cores, high computation speed and memory bandwidth, often orders of magnitude higher than the CPU counterpart. Harnessing the GPU’s parallel processing capability can provide an economic solution to tackle computationally expensive tasks. However, making full use of the GPU’s potentials is a non-trivial problem. “One challenge is that many of our algorithms are not naturally expressed in parallel steps,” says Wang. “For example, the simple problem of finding the maximum value in a large set of elements usually requires sequentially comparing every element with a temporary maximum. Since every comparison depends on the outcome of the previous one, the algorithm as is does not allow sharing the workload among multiple processors.

Another challenge is that the best-known algorithms for solving a problem on the CPU are often not optimal on the GPU. For example, quick-sort, one of the best sequential sorting algorithms, is actually quite difficult and inefficient to parallelize on the GPU. Also, while similar to CPU clusters, GPUs impose different resource constraints. For example, data transfer on the GPU is relatively fast, but branching and divergence in computation can be very costly.

“Given these challenges, developing new algorithms to exploit the GPU is no longer a mere engineering practice, but requires fundamentally rethinking our existing models and algorithms,” notes Wang. To this end, Wang’s research is focused on studying new mathematical models and efficient computational algorithms for visual computing, driven by the data-parallel architecture of GPUs. He summarizes his research contributions in three categories:

1. *Precomputed Light Transport.* In image synthesis, precomputed light transport (PLT) is a data-driven approach for interactive rendering with complex lighting. It works by decomposing the lighting domain into a suitable linear basis set, precomputing the scene’s appearance under each basis, then applying the precomputed data at run-time to achieve high-quality rendering at interactive rates. As the users can dynamically modify light sources on the fly, it is particularly useful for lighting design applications, and is increasingly adopted in video games and commercial software. Wang has studied PLT extensively in previous work. His first contribution is to advance the state-of-the-art

by enabling dynamic material effects such as glossy surface reflections and translucency. This allows users to modify not only light sources, but also material properties interactively on the fly. The second contribution is a GPU-based algorithm to speed up PLT by adapting its underlying computations towards data-parallel and GPU-friendly models. This led to 10 to 50 times performance gain over an optimized CPU equivalent with the same rendering accuracy. The third contribution is to propose new lighting basis that employs non-linear approximation methods to preserve rendering fidelity while maximally reducing the precomputed data size. This in turn benefits GPU-based computation because smaller data size leads to coherent memory access and better utilization of the GPU’s cache.

2. *Photorealistic Rendering of Dynamic Scenes.* Although PLT is attractive for visual design and previewing, its pre-computation requirement makes it unsuitable for applications involving dynamic geometry and deformable objects. More recently Wang has focused on new methods that allow users to modify any part of the scene on the fly. Together with his collaborators at Zhejiang University, they presented the first GPU-based algorithm for fully dynamic scenes that integrates a wide range of lighting effects, including multi-bounce indirect lighting, glossy reflections, caustics, and arbitrary specular paths. Their method builds upon the principles of sparse sampling and interpolation, which generally require progressively inserting new samples where the predicted error is high. The progressive insertion step creates data dependencies between every two samples, and disables parallel computation. The key to their method is a clever way to decouple the sample selection and evaluation steps, making both parallelizable on the GPU. The result is one to two orders of magnitude speedup over traditional methods. In addition, some of the components they have developed, including GPU-based kd-tree construction, query, and k-means clustering, are useful for general-purpose computations in other applications as well.

3. *Stochastic Sampling.* Stochastic sampling is a critical component in digital image synthesis. Samples with good spectral distribution properties (such as blue noise) are essential for improving simulation speed, reducing aliasing artifacts, and for producing visually pleasing textures and patterns. Working with graduate student John Bowers, they have proposed the first GPU-based algorithm for computing blue noise samples on the surfaces of arbitrary 3D objects. Not only is their algorithm 10x faster than the previous best-known algorithm, but they have presented a new



Leveraging the GPU for interactive lighting and material designs (top), synthesizing scene elements with desired spectral distributions (middle), and other visual computing applications such as non-photorealistic rendering, 3D scene reconstruction, and creating geometric puzzles (bottom).

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White House names Woolf a Presidential Innovation Fellow

President Barack Obama's office recently named Research Professor Beverly Woolf a Presidential Innovation Fellow (PIF) for 2013, recognizing her leadership in designing software tutors that respond to a student's mood and personal learning pace, for example, to dramatically improve lesson effectiveness.

Woolf's work combines artificial intelligence, computer network technology, and multimedia features in digital tutoring software for teaching mathematics according to individual students' needs. She attended a ceremony at the White House on June 21 to accept the fellowship.

President Obama and his administration launched the PIF program in 2012 to bridge the gap between the private and public sectors and to bring talented innovators into government to solve challenges of national importance, program leaders say. "The program is about improving the way things are done."

PIF projects are selected based on their potential to "save lives, save taxpayer money, and fuel American job growth." Fellows are "doers and change agents" who have shown their ability to accomplish great things in an agile and collaborative way. Each project has its own timeline, but fellowships generally last six to 13 months and involve working in Washington D.C. for at least a few weeks.

Woolf says of her fellowship, "I intend to work towards making education a civil right for all people and to create systemic, broad-based changes in social-educational movements that will be sustained over the long period. I want to provide opportunities for all people, including populations poorly served by the traditional educational system, so they can learn rapidly and form new learning communities. I have been a change agent in education technology for years and am eager

to move our country forward towards groundbreaking activities in education."

In recent years, Woolf, Ivon Arroyo, and colleagues at UMass Amherst have created intelligent and emotionally perceptive teaching software for grade school children, notably one called Wayang Outpost. It features a friendly tutor and other animated characters that interact one-on-one with users like a personal trainer. It uses artificial intelligence to evaluate their skills and knowledge in real time, then adjusts to offer personalized strategies to address knowledge gaps and provide advice for tackling difficult problems.

Wayang Outpost has improved student performance on standardized test scores by an average 10 percent, a critical difference for low-achieving and other students who often struggle with math. It has been used worldwide to improve students' early relationship with mathematics, keeping later career options open.

Woolf says, "Some of my goals for this fellowship are to make education data-rich and to develop Internet-scale experimentation that balances students' learning across all environments as a result of distributed technology. I am committed to quality global instruction, freely available for all students, using educational data mining for formative assessment and immediate feedback about how students can improve their performance."



Priscilla Scott retires

Priscilla Scott retired in May, 2013 after a 37-year career at UMass Amherst, working 29 years in the Department/School of Computer Science. A retirement celebration was held in her honor on May 8, 2013 at the University Club on campus.

In 1974, Scott began her UMass Amherst career in Entomology and, after a year off for the birth of her daughter in 1975, she spent eight additional years in Entomology. She accepted an administrative staff position in Computer Science in 1984, hired on a DARPA grant awarded to Professors Wendy Lehnert, Edwina Rissland, and Beverly Woolf.

Over the years, she has worked as a grant administrator/accountant for a number of research labs in CS and for over a dozen CS faculty, including Emery Berger, Oliver Brock, Mark Corner, Rod Grupen, Neil Immerman and his wife Susan Landau, Evangelos Kalogerakis, Brian Levine, Sridhar Mahadevan, Kathryn McKinley, Eliot Moss, Robin Popplestone, Hava Siegelmann, Paul Utgoff, Chip Weems, and Beverly Woolf. During her years in Computer Science, she has been through two building changes (Lederle low-rise to the current Computer Science Building), three name

changes (COINS to Department of CS to School of CS), and nine department/school chairs.

"I've worked with so many wonderful people here: staff, students, and faculty. It's hardest to leave all of them," notes Scott. "I'm looking forward to traveling, gardening, and spending time with my daughter Melissa and her three beautiful children, Kori, Alex, and Lily."

After spending many weeks at Boston Children's hospital with her granddaughter Lily, Scott plans to volunteer there.

"For years, Priscilla navigated the stormy proposal writing seasons with me—always professional, calm and organized. I really appreciated her expertise, but most of all, she became a close friend and confidant over the course of hundreds of high stress deadlines," says Professor Rod Grupen. "I learned a lot from her about how to deal with people and keep it all in the proper perspective. Priscilla represents the best of UMass to me."



Priscilla Scott, during her retirement party

Industrial Affiliate News

The School of CS has an active industrial affiliates program (IAP). Some IAP activities are highlighted below.

Cisco Systems, Inc.

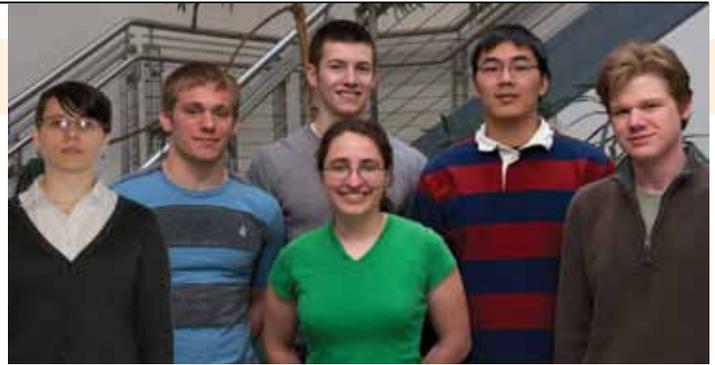
The 2013 Cisco Systems Scholarship for Underrepresented Undergraduate Students at UMass Amherst Computer Science was awarded to Rachel Gordon. The recipients of the 2013 Cisco Systems Awards for Outstanding Achievement as a Junior Undergraduate are Kyle Hughes, David Lowell, Brian Stapleton, Ryan Szeto, and Sofya Vorotnikova. This award, sponsored by Cisco, is given to the top junior year undergraduates in the School as determined by a faculty committee who took into account recommendations by faculty members, GPA, coursework, independent studies or honor projects, and course citations.

The Fourth Annual Programming Competition, held on April 11, 2013, was sponsored by Cisco. Participants from the five colleges competed to solve programming challenges. Khanh Nguyen, Anthony Moh, and Tung Pham won first through third place, respectively.

EMC² Corporation

Along with supporting many undergraduate and graduate student events during the year, EMC² Corporation also helped to fill the sparsely furnished USpace by providing many large beanbag chairs for students to relax on while studying in the room.

UMass Amherst CS alumnae Julie Flannery and Jessica Schneider visited the School to speak to the CS Women's group about their careers as engineers at EMC. Dr. Narayanan ("KK") Krishnakumar, Vice President and Chief IT Architect at EMC, also gave a presentation to students and faculty on "Boldly Transforming IT Like Never Before."



Cisco award recipients (l. to r.): Sofya Vorotnikova, Brian Stapleton, Kyle Hughes, Rachel Gordon, Ryan Szeto, and David Lowell

Yahoo! Inc.

Assistant Professor Benjamin Marlin received a Yahoo! Faculty Research and Engagement Award for his work on "Identifying and Exploiting Temporal Patterns in Online Recommender Systems."

Along with sponsoring the School's outstanding undergraduate and graduate awards presented at the OAA 2013 (see article on OAA), Yahoo! also presented 2013 Accomplishments in Search & Mining Awards to doctoral students David Belanger and Samuel Huston.

On May 2, 2013, the ACM Student Chapter hosted the School's 6th Annual CS Foosball Tournament sponsored by Yahoo!. Students, faculty, and staff participated in the event. CS undergrads Mohamed Elmoutaouakil and Said Mastawi won this year's tournament. Second place went to postdoc Mostafa Keikha and doctoral student Mostafa Dehghan Shirehpaz.

Yahoo! sponsored the technical talks held throughout the academic year as part of the Machine Learning & Friends Lunch Seminar Series and the Computational Social Sciences Initiative Lunch Series. They also sponsored CS Women and ACM chapter events including the popular ACM Jeopardy! Night, and the Fall Hackathon.



Brian Levine

Fighting Internet-based exploitation of children

Professor Brian Levine, Research Scientist Marc Liberatore, and researchers within the Center for Forensics continue their work on forensic analysis to directly assist law enforcement agencies that investigate network trafficking of images of child sexual exploitation. In the 12 months from April 2012 to April 2013, their project with federal and state law enforcement

has resulted in the rescue of more than 100 children from sexually abusive situations, and more than 1,400 arrests for child pornography possession. Since the start of the project in 2009, there have been 4,546 arrests.

The group's work was referenced in a *New York Times*

Magazine article, "The Price of a Stolen Childhood," published in January, 2013. In June, Levine gave a keynote address, "Fighting Internet-based Sexual Exploitation Crimes Against Children," at the 2013 USENIX 6th International Systems and Storage (SYSTOR) Conference in Haifa, Israel. A publication on this research, "Measurement and Analysis of Child Pornography Trafficking on P2P Networks," co-authored by Levine, Liberatore, Ryan Hurley, Swagatika Prusty, Hamed Soroush, Robert Walls, Jeannie Albrecht, Emmanuel Cecchet, Brian Lynn, and Janis Wolak, was chosen as Runner Up for the Best Paper Award at the 22nd International World Wide Web Conference (WWW 2013). In 2012, Levine gave an invited testimony to the U.S. Sentencing Commission hearing in Washington, D.C. on "Federal Child Pornography Offenses." More on their project can be found at forensics.umass.edu.

In Memoriam: Steve Constantine (1955 - 2013)

Dr. Stephen Constantine died suddenly on May 4, 2013 at his home. He was a half-time Senior Lecturer in the School of Computer Science, and also held a half-time appointment in the College of Engineering. He also served as a faculty adviser for the UMass Chapter of Engineers Without Borders.

Professor Lori Clarke, Chair of the School of Computer Science, noted that “Steve was a dedicated teacher who encouraged his students to think about how computing was positively and negatively impacting society. Because of his degrees in English and Mathematics, he was the perfect instructor for our junior writing program. We are saddened that he will no longer be teaching our students, but proud that he was such a valuable member of our faculty while he was with us.”

Dr. Constantine joined UMass Amherst CS in 1997, first with a graduate student teaching assistantship while completing his Ph.D. in English and later as a Lecturer in Computer Science. He was promoted to Senior Lecturer in 2009. Over his years on campus, he also taught courses in the English, Mathematics and Statistics, and Exercise Science departments. From 1981-1991, he was a graduate teaching assistant and later a Lecturer for the Learning Skills Center, both at Cornell University.

Outside of UMass Amherst, Steve also spent time teaching. For the past 12 seasons, Steve coached the Northampton High School Boys Swim team. During his years of coaching, the team moved from B division to A division, won Western Mass. Championships, and received League Sportsmanship Awards. In addition, since 2007, he was a volunteer tutor of English as a Second Language through the International Language Institute in Northampton, MA.

In May 2006, Steve received his Ph.D. in English from the University of Massachusetts Amherst. His dissertation was “By a Gentle Force Compell’d: An Analysis of Rape in Eighteenth-Century English Fact and Fiction.” He received a B.A. in Economics from Harvard University in 1976 and an M.S. in Mathematics from Cornell University in 1985.

Steve was beloved by CS students who consistently raved about his classes. Among many others, he taught the junior-year writing course, Social Issues in Computing.

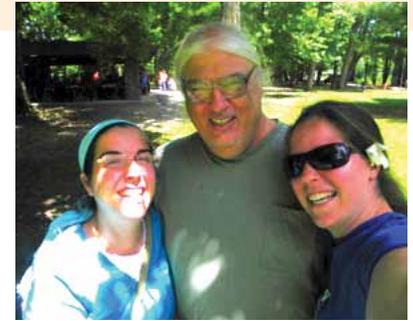
“It was heartbreaking to read the student evaluation comments on Steve for this term, filed before his death,” says

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quantitative method to measure the spectral distribution quality of surface samples. Most recently, Wang has worked with graduate student Yahan Zhou to introduce the first algorithm that can generate samples with any user-specified distribution function. With an efficient GPU-based implementation, the user can interactively synthesize new samples that mimic the distribution property of any exemplar sample set.

In addition to the above, Wang has worked extensively on using GPUs for more general-purpose computations, including solving the Singular Value Decomposition (SVD) of large matrices, building efficient spatial data structures for high-dimensional datasets, creating geometric puzzles, reconstructing 3D scenes, etc.

Professor David Mix Barrington, CS Associate Chair. “Several students said that he was the best Computer Science teacher they had ever had, and many praised the community of free discussion he created in the classroom. Along with the writing course, he taught two different



Steve and his daughters, Alison (left) and Rebecca

discrete mathematics courses for us. It was a pleasure for me to work with him in developing those.”

Steve, in a teaching statement written in 2009, said, “I feel I have succeeded with a course, if, at the end of the semester, I get a student evaluation such as the following (which was from an unhappy student): ‘The teacher tried to make us think too much.’ I want my students to think, and also to enjoy thinking and to realize the value of doing so. For many years now I’ve been encouraging students to think; I hope to continue doing so for many years to come.”

“Steve was a tremendous asset for our undergraduate program - a tech-savvy writing instructor who brought boundless generosity and good-will to all who came in contact with him,” adds Associate Professor Robbert Moll, CS Associate Chair for Academic Programs. “While he was firm when he had to be, he will surely be remembered by students for his kindness and understanding, and for the amazing rapport he was able to establish with all who attended his classes. He will be greatly missed.”

Steve is survived by his two daughters, Rebecca Constantine, a graduate student at Stanford University, and Alison Maayana Miskin, who lives in Haifa, Israel with her family; and by his four granddaughters, mother, two brothers, two sisters, former wife Ruth Constantine, and a large extended family. A celebration of life service for Steve was held in July at Look Park in Northampton.

Donations in Steve’s memory for undergraduate scholarships may be made to the UMass Amherst School of Computer Science, 140 Governors Drive, Amherst, MA 01003-9264.

“The rapid growth in GPU’s computation power will continue to expand the frontiers of visual computing in the future,” says Wang. “For sustained quality and speed improvements, it is essential to develop innovative algorithms and models that can adapt to the massively parallel architecture of the GPU. I hope to contribute new ideas and insights to help tackle some of the challenges in this direction.”

Wang joined UMass Amherst in 2006. He received his Ph.D. in Computer Science from the University of Virginia in 2006 and B.S. in Computer Science from Zhejiang University in 2001. He received an NSF CAREER Award in 2008, an ACM Recognition of Service Award in 2011, and was a program co-chair for ACM Symposium on Interactive 3D Graphics and Games (i3D) in 2012.

Fifth Annual Outstanding Achievement and Advocacy Awards

The School celebrated the accomplishments of this year's Outstanding Achievement and Advocacy (OAA) Award winners along with undergraduate and graduate student award recipients during a banquet held at the Mullins Center on Friday, May 3, 2013. Prior to the banquet, OAA events included building tours, a reception, and a panel discussion in which our alum award recipients spoke about their careers, their experiences as students at UMass Amherst CS, and how those experiences prepared them for their successful careers.

During the banquet, School Chair Lori Clarke and Steve Goodwin, Dean of the College of Natural Sciences, welcomed the attendees. Professor Leon J. Osterweil presented awards to the 2013 OAA award recipients.

The 2013 OAA Award Recipients are:



• Outstanding Achievement in Education: **Laura K. Dillon** (UMass Amherst CS MS '81, Ph.D. '84), Professor in the Department of Computer Science and Engineering at Michigan State University. Dr. Dillon's research interests center on specification and analysis of concurrent software systems, formal methods in software engineering, and programming languages.



• Outstanding Achievement in Management: **Wayne W. Duso** (UMass Amherst CS BS '85), General Manager, AWS New Cloud Initiatives at Amazon.com. He is heading a team developing next generation cloud services as well as opening Amazon.com's AWS (Amazon Web Services) Boston development center.



• Outstanding Contributions to Society: **Arthur I. Karshmer** (UMass Amherst CS MS, '74, PhD '78), a Professor and Department Chair in the School of Management's Department of Analytics and Technology at the University of San Francisco. Dr. Karshmer's research interests are in the system-architecture interface, metropolitan area networking, and computer interfaces for people with disabilities.



• Outstanding Achievement in Technology Development: **Rakesh (Teddy) Kumar** (UMass Amherst CS Ph.D. '92), Director of the Vision Technologies Center at SRI International. Dr. Kumar directs projects in computer vision, augmented reality, robotics, video surveillance, 3D modeling, and medical image analysis. Dr. Kumar pioneered 3D vision in the form of high accuracy localization of mobile cameras. He has led the development of world-class technologies with applications in augmented reality, geolocation, and precision 3D.



• Outstanding Achievement by a Young Alum: **Jennifer Neville** (UMass Amherst CS BS '00, MS '04, Ph.D. '06), Associate Professor of Computer Science and Statistics at Purdue University. Dr. Neville's research focuses on machine learning and data mining, particularly the development and analysis of algorithms for relational domains, including social networks, citation analysis, and fraud detection.



• Outstanding Achievement in Entrepreneurship: **Aaron St. John** (UMass Amherst CS BS '03, MS '05), Co-Founder and Chief Executive Officer of HitPoint Studios. HitPoint Studios is the largest independent game development studio in Massachusetts. Regularly featured in top-ten lists across major gaming portals, HitPoint has in only four years produced over 130 games for over 50 million players.



• Outstanding Achievement in Research: **Richard S. Sutton** (UMass Amherst CS MS '80, Ph.D. '84), Professor and iCORE Chair in the Department of Computing Science at the University of Alberta. Dr. Sutton pioneered the field of reinforcement learning, an approach to artificial and natural intelligence that emphasizes learning and planning from sample experience. Dr. Sutton played a crucial role in the development of the very influential Temporal Difference algorithms.

More details on the careers of the OAA award recipients, along with photos of the event, are posted at www.cs.umass.edu/oa2013.

During the evening's celebration, current students and recent alums were also recognized. The undergraduate and graduate awards were generously sponsored by Yahoo!, a member of the School's Industrial Affiliates Program.



Grad winners (l. to r.): T. Billings, J. Newman, A. Mishra, A. Seetharam, G. Huang, and M. Bendersky

Nominate a fellow alum

Nominations are now being accepted for the 2014 Outstanding Achievement and Advocacy Awards. Nominations should be sent by email to Jean Joyce (jean@cs.umass.edu). The information below would be appreciated with your nomination:

- The name, title, email, phone number and organizational affiliation of the nominee,
- The name(s), email(s), and phone number(s) of the nominator(s),
- A brief biography summarizing the nominee's career (no more than one page),
- A statement of the nominee's outstanding achievements in the award category,
- A very brief (no more than 25 word) suggested citation to be written on the OAA winner's award plaque.

Next year's OAA events are planned for Friday, May 2, 2014. Details will be on www.cs.umass.edu/oa2014.

Professor Sridhar Mahadevan, Graduate Program Director, presented these **Outstanding Graduate Student Awards**:

- Outstanding Dissertation Award: **Michael Bendersky** (Ph.D. '12)
- Outstanding Dissertation Award: **Gary B. Huang** (Ph.D. '12)
- Outstanding Synthesis Award: **Aditya Kumar Mishra**
- Outstanding Synthesis Award: **Anand Seetharam**
- Outstanding Teaching Assistant Award: **William T. Billings**
- Outstanding Teaching Assistant Award: **Jessica Newman**

Professor Roderic Grupen presented the following **Outstanding Undergraduate Awards** to students in this year's graduating class:

- Exemplary Achievement in Computer Science: **Caleb Raitto**
- Achievement in Artificial Intelligence: **Nicolas Ioannou**
- Achievement in Computer Science: **Priscilla Briggs**
- Achievement in Computer Science: **Gal Shenar**
- Achievement in Information Management: **Jeffrey Pezzone**
- Achievement in Interdisciplinary Study: **Anthony Battaglia**
- Achievement in Interdisciplinary Study: **Steven Tenaglia**
- Achievement in Systems: **Andrey Izotov**
- Achievement in Theory: **Alexander Bristol**



Undergrad winners (l. to r.): A. Bristol, A. Izotov, S. Tenaglia, A. Battaglia, J. Pezzone, P. Briggs, N. Ioannou, and C. Raitto; not pictured: G. Shenar



Timothy Wood (Ph.D. '11), Assistant Professor in the Department of Computer Science at The George Washington University, received a 2013 NSF CAREER Award for "Application-Agnostic, Distributed-Aware Cloud Platforms."

The May 1, 2013 issue of *ACM Tech News* highlighted the work of University of Oklahoma Computer Science Associate Professor **Amy McGovern** (Ph.D. '02) on tornado prediction.

Dr. **Akshat Kumar's** (Ph.D. '13) dissertation was selected as a Runner-Up for the IFAAMAS-12 Victor Lesser Distinguished Dissertation Award. The award recognized outstanding dissertations completed in 2012 in the area of Autonomous Agents or Multiagent Systems. Advised by Prof. Shlomo Zilberstein, Kumar's thesis was titled "Exploiting Domain Structure in Multiagent Decision-Theoretic Planning and Reasoning." He is a Research Scientist at IBM Research in India.

Starting in 2014, **Matthew Dwyer** (Ph.D. '95) will be the Editor-in-Chief of the *IEEE Transactions on Software Engineering*. Dwyer is the Interim Department Chair and Henson Professor of Software Engineering at the University of Nebraska Department of Computer Science and Engineering.

Sharad Jaiswal (Ph.D. '05) and his colleagues have developed a mobile radio app, CommunityWeb, that can be used on low-end cellphones to provide region-specific news to people across India. Their development is detailed in an article on livemint.com. Jaiswal is a Researcher at Alcatel-Lucent Bell Labs in India.

Anita Raja (Ph.D. '03) was the moderator and **Hala Mostafa** (Ph.D. '11) was a panelist of a mentoring panel session at the CRA-W/CDC Discipline-specific Workshop during AAMAS '13. Raja is an Associate Professor at UNC Charlotte and Mostafa is a Research Scientist at BBN Technologies. Both were advised by Victor Lesser.

CS Scholarships established

The School is pleased to announce that two endowed scholarships have been established, thanks to generous contributions from our CS alums.

The Jim Gray Scholarship in Computer Science

This scholarship was established in 2013 by CS alum Hanuma Kodavalla to pay tribute to renowned computer scientist, Jim Gray, who was lost at sea in 2007. Hanuma works at Microsoft and received an M.S. in Computer Science at UMass Amherst in 1988. The scholarship will provide support to first year CS graduate students pursuing research in the area of systems.

The Sudha and Rajesh Jha Scholarship

This scholarship was established by Sudha Mishra and Rajesh Jha in 2013. Rajesh graduated from UMass Amherst in 1990 with an M.S. in Computer Science and works at Microsoft. Sudha and Rajesh chose to establish

a scholarship out of appreciation for the support Rajesh received while a CS student. Their scholarship will benefit first year graduate students studying Computer Science.

Donations of any amount are helpful to the CS community and are greatly appreciated. Scholarships not only help students defray the cost of attending, but help attract the very brightest students to study here at UMass Amherst. If you are interested in learning about how you can contribute to the School or to an existing scholarship, or establish one of your own, please contact Jenn Cooper at 413-545-2771 or jcooper@cns.umass.edu. Or, you can make a gift online at www.cs.umass.edu/donate, or by check made out to UMass Amherst Computer Science and mailed to the School of Computer Science, UMass Amherst, 140 Governors Drive, Amherst, MA 01003-9264.

Celebrate the (new!) School of Computer Science: Broadening the Impact of Computing

October 17 - 19, 2013

IN CELEBRATION OF THE CREATION of the new School of Computer Science and the 50th anniversary of the founding of our Department, the School of Computer Science is hosting a series of events, October 17-19, 2013, that will explore the more expansive and outward looking view of the computing discipline and its broadening impact across the campus and state, and in society. The events, aimed at a diverse audience of students (undergrads, grads, majors and non-majors alike), alumni, campus and community members, are open to all. Come and learn about the many exciting directions in which computing is heading!

Highlights:

- Visit with current and former faculty and students
- Talks and panel discussions with distinguished guests, faculty, and alums
- Alum Social and Dinner (50th Anniversary Celebration)
- Career and Internship Fair - CS alums promoting their companies
- BBQ lunch
- Family-friendly Activities
- Campus Homecoming Events (Parade, Concerts, Tours, Sports, and more)

See celebration website www.cs.umass.edu/SCScelebration to register and for more details on the schedule of events

Looking for recruits for your CS-related positions and internships?

As part of the celebration, an informal career/ internship fair and panel session will be held on Thursday, October 17 for our alums to showcase their organizations to UMass Amherst students.

Contact Jean Joyce at jean@cs.umass.edu or 413-545-6310 if you are interested in having a booth in our CS building for the career fair. Limited space is available.

www.cs.umass.edu/SCScelebration

Schedule of Events

Thursday, October 17

1:00- Career and Internship Fair

3:30 Meet informally with UMass-SCS alumni representatives now working in industry who develop or use leading-edge computing technology, applications, and services.

3:30- Careers in Computing Panel

6:00 Alumni reflect on their UMass experience and offer advice on preparing and applying for jobs and internships. Refreshments/networking follow panel.

Friday, October 18

8:15 Registration *Location: Computer Science Building atrium*

9:00 Welcoming Remarks

9:15- Expanding Horizons in Computing

10:30 Join leadership from key federal research agencies, the state, and industry in a discussion of how computing, communications, and information systems increasingly touch our lives, impacting/accelerating discovery and innovation across many disciplines and contributing to economic development and growth in a knowledge-based society.

11:00- Computing as a Core Subject in a 21st Century Education

12:15 Students (K-12 and higher education) from diverse backgrounds should be provided an opportunity to gain the solid grounding in computing and computational thinking required for them to prosper in a 21st century knowledge-based economy. Explore the opportunities and challenges posed as computing becomes a core subject in a 21st century education.

12:15 Lunch: BBQ under the tent

Be our guest for lunch under the tent! Meet friends, faculty, students, and alumni, and find out more about the new School of Computer Science.

2:00 Computing Across the Campus

Computing infuses many disciplines across campus. To encourage and enable UMass Amherst students to employ interdisciplinary uses of computing, the School of Computer Science has been collaborating with other departments across campus to formulate a new, highly interdisciplinary undergraduate program in Informatics. Explore how computing is changing disciplines across the campus and learn about our plans for the Informatics program.

3:45 Panel: Computing Research

This panel focuses on computing research involving faculty, students, alumni, and collaborators in the School of Computer Science, emphasizing the world-class nature of the research and its impact, and showcasing interdisciplinary efforts. Lab tours and posters available throughout the day allow in-depth exploration of a myriad of research topic.

6:00 Computer Science Social and 50th Birthday Party Dinner with Alumni, Faculty, and Friends

Celebrate SCS – past, present and future. *Registration required in advance.*

Saturday, October 19

9:00 Registration and Continental Breakfast

10:00 Hands-on Computing

A family-oriented, hand-on morning of activities in robotics and wearable computing. For kids of all ages! *Registration required in advance.*

www.cs.umass.edu/SCScelebration

Graduate fellowships and scholarships awarded

NSF Graduate Research Fellowships

Tiffany Liu received a 2013 National Science Foundation (NSF) Graduate Research Fellowship. Liu is in her second year in the UMass Amherst CS doctoral program. She graduated from Smith College with a B.S. in Engineering Science and Computer Science in May 2012. David Belanger and Rick Freedman received Honorable Mention in the 2013 NSF Fellowship competition.

The competitive fellowship provides three years of support for graduate study leading to research-based masters or doctoral degrees and is intended for students who are in the early stages of their graduate study

CS Endowed Scholarships

Yunmeng Ban, a first year doctoral student, is the first recipient of the 2013 Jim Gray Scholarship in Computer Science. She is interested in data management, database systems, distributed systems, and data mining. Ban received a B.S. from Shanghai Jiao Tong University (top 3%). Previously she worked in the Software & Solutions Group (Hadoop Team) at Intel Corporation.

Doctoral student **Daniel Garant** is the first recipient of the Victor Lesser Graduate Scholarship in Artificial Intelligence. He is interested in data mining and information retrieval. Garant received a B.S. in Mathematics and one in Applied Computer Science at Keene State College in 2013. He was

vice president of KSC's Computer Science Club and the CS honor society, Upsilon Pi Epsilon.

Li Yang Ku, a first year doctoral student, received the 2013 Robin Popplestone Fellowship in Robotics & Artificial Intelligence. He received an M.S. in Computer Science from the University of California Los Angeles in 2011 and a B.S. in Electrical Engineering from the National Chiao Tung University in 2008. Ku is interested in robotics and vision research. Ku spent the past two years at HRL working in the Information & Systems Sciences Lab which is responsible for NASA Robonaut2's vision module.

Juston Moore received the 2013 Paul Utgoff Memorial Graduate Scholarship in Machine Learning. Prior to joining the Ph.D. program this fall, Moore was an M.S. student in the School. He is a research assistant in the Machine Learning and Data Science Laboratory and is advised by Assistant Professor Hanna Wallach. Moore received a B.S. in Computer Science (with highest honors) from the New Mexico Institute of Mining and Technology.

Tuition Awardees

The School of Computer Science initiated a tuition award program after the International Programs Office discontinued its program. The 2013 tuition award recipients are **Jeffrey Geevarghese, Jisoo Lee, Ashish Jain, Karthik Kannapan, Esver Kishore Kumar, and Vijay Pasikanti.**

CS alum social in Bellevue, WA



On June 13, 2013, the School of CS hosted a social gathering for UMass Amherst CS alums and Washington-based interns at Microsoft's Lincoln Square Café in Bellevue, WA. CS Chair Lori Clarke welcomed guests to the event with an update on the state of the School of CS, and Professor Leon Osterweil gave a presentation on "Definition, Analysis, and Continuous Improvement of Healthcare Systems." Prof. Robert Moll also traveled to Washington to meet with alums. Over 40 guests enjoyed the spectacular views of the Seattle skyline and sunset from the 28th floor location of the Café. The CS alum social organizing committee consisted of Danny Amirault ('10), Victor Bahl ('97), Aruna ('11) and Niranjana Balasubramanian ('11), Tiffany Chao ('10), Rajesh Jha ('90), Hanuma Kodavalla ('88), Micah Kornfield ('04), Michael Krainin ('09), and Stevie Sellers ('10). Special thanks to Rajesh Jha and his staff, Genise Dawson and Rachelle Krawitz, for their tireless efforts in organizing the event.

CS Graduating Senior Luncheon



On May 2nd, the CS undergrad class of '13 gathered with faculty for a luncheon to celebrate becoming a CS alum.



CS Undergraduate Dean's List – Spring 2013

Allman, Timothy
Aquino, Alexander Thomas
Ayoub, Richard George
Bach, Michael Curtis
Beagan, Patrick Daniel
Berman, Zachary Jared
Bieren, John Arthur
Boggs, Kathryn Mackenzie
Boutotte, Jeffrey Ryan
Breitenbach, Lauren Victoria
Briggs, Priscilla E.
Brigham, Alexander Jordan
Brunelle, Matthew Tyler
Bryan, Rebecca Leah
Burkatovskiy, Aleksandr Valeriy
Busch, Rachel Marie
Buxbaum, Aaron Michael
Calderwood, Piers Addison
Carlson, David Sylvernale
Chadowitz, Chaniel
Champagne, Eric Scott
Chau, Peter Son
Cheang, Wai
Cheung, Vincent Yusing
Choi, Jinwoo
Ciollaro, Christopher James
Conlon, Nicholas
Connell, Ryan J
Corey, Cassian Janay
Costigan, Derek James
DeRoy, Michael K
Debenedictis, Dante
Deng, Anna
DiBona, Benjamin Paul

Doucette, Kevin J
Droeske, Trevor Michael
Duggan, Daniel Joseph
Espinosa, Joshua
Feveck, Kevin Kristoff
Finn, Kelly Ann
Gallant, Ryan Kenneth
Godin, Jonathan Mears
Gonda, Peter S
Gonsalves, Nicholas David
Gordon, Rachel Clare
Greenhalge, Zachary Charles
Grossman, Chelsea Jane Gowen
Gutterman, Lucas Rockett
Hebert, Mitchell Ryan
Higgins, Lauren Elizabeth
Hills, Jonathan Eliot
Hoffman, Scott A
Hong, John
Hughes, Kyle Robert
Itkin, David Jonas
Kaufman, Yael
Kim, Jae Il
Krishnamurthy, Vivek
Lai, Jeffrey T
Laizer, Daniel Frank
LeClerc, Joseph G.
Lee, Alexander Pei-Zan
Lei, Rongliang
Levitzy, Yevgeni V
Lewis, Patrick Joseph
Lin, Xuzhang
Lowell, David B.
Luo, Sean

Magliozzi, Cara
Mangini, Mark Christopher
McAvoy, Nicholas Reilly
McClintock, Makai Adam
McMahon, Molly
Mei, Calvin
Meli, Michael Christopher
Montovani, Thomas David
Morris, Connor Terence
Mullens, Ryan John
Murphy, Brendan Edward
Nguyen, Anh Tung
Nguyen, Khanh Xuan
Nolin, Brian J
Noran, Sean Stephen
Novokshonov, Alexey
 Andreyevich
Oh, Chi Heon
Otsuka, Maxwell Sho
Paika, Christopher Blake
Patel, Sahil Alpesh
Peet, Colin Joseph
Pegus, Patrick
Peris, Sahil Loy Joe
Perreault, Jason Edward
Pezzone, Jeffrey Michael
Pham, Tung Thanh
Power, Adam Robert
Power, Conor Charles
Powers, Kenneth Wendell
Rabie, Michael
Radford, Michael Francis
Read, Brandon Scott
Rogers, Kyle T

Rudovol, Ivan
Rutter, James J
Santos, Anthony Joseph
Setzer, Benjamin Stephen
Sherman, Joshua James
Sidhu, Mannat
Silverstein, Katherine F
Sims, Robert J.
Singer, Henry Oskar
Spang, Bruce A
Stanley, Ryan William
Staruk, Elizabeth A.
Stearns, Brett C
Stewart, Ian Ajameian
Stubbs, Daniel M.
Szeto, Ryan Bing-Shue
Tang, Roger Z.
Thea, Kevin H
Tiernan, Carter D
Tobon, Diego A.
Tseytlin, Benjamin Solomon
Tyler, John William
Vachon, Benjamin Michael
Venkatathri, Niharika
Wang, Mingze
Webb, Leonardo Coelho
 Guimaraes
Weng, Swana
Williams, Albert Beckman
Wong, Jay Ming
Yan, Haolan
Yuen, Lit Wa
Zakaria, Adam
Zhang, Simon S

Citations

The following students each are recognized for their outstanding performance in the classroom during the Spring 2013 semester.

Timothy Allman
Noah Saint Souver Bilgrien
Michael R Bjorge
Daniel Philip Bond
Jeffrey Ryan Boutotte
Neil Brazeau
Walter Brown
David Sylvernale Carlson
Chaniel Chadowitz
Nicholas S Combs
Kevin Du Toit
Trevor Glenn Elkins
Stephen Thomas Ferrari
Ian Gardner Fox
Peter S Gonda
Rachel Clare Gordon
Lucas Rockett Gutterman
Mitchell Ryan Hebert
Kyle Robert Hughes

Yael Kaufman
Jae Il Kim
David B. Lowell
Michael Ludwig
Sean Luo
Nicholas Reilly McAvoy
Ryan John Mullens
Anh Tung Nguyen
Sean Stephen Noran
James J Rutter
Mordechai Rynderman
Anthony Joseph Santos
Bruce A Spang
Brian Fitzpatrick Stapleton
Elizabeth A. Staruk
John William Tyler
Jay Ming Wong

Diao receives CRA-W award

The Committee on the Status of Women in Computing Research (CRA-W) announced that Associate Professor Yan-lei Diao is the recipient of the 2013 CRA-W Anita Borg Early Career Award (BECA).

The award was established to recognize a woman in computer science and/or engineering who has made both significant research contributions while also having a positive and significant impact on advancing women in the computing research community.

Diao's research interests include intelligent, real-time data management and big data analytics. She is also involved in broadening the participation of women in computer science. Diao received her award at the CRA-W Grad Cohort Workshop held in April in Boston, MA.





Toby Dragon; *The Impact of Integrated Coaching and Collaboration Within an Inquiry Learning Environment;* (Beverly Woolf, Advisor); May 2013; Assistant Professor, Computer Science, Ithaca College

This thesis explores the design and evaluation of a collaborative, inquiry learning Intelligent Tutoring System for ill-defined problem spaces. The common ground in the fields of Artificial Intelligence in Education and Computer-Supported Collaborative Learning is investigated to identify ways in which tutoring systems can employ both automated coaching and collaborative techniques to support students as they learn. The resulting system, Rashi, offers feedback on student work by using an Expert Knowledge Base to recognize students' work. Evaluation in actual classrooms demonstrated that collaboration significantly improves students' contributions, and some evidence suggests that there is a significant positive correlation between the amount of coaching received and metrics that represent positive inquiry behavior. Finally, this thesis highlights the potential for combining coaching and collaboration such that 1) collaborative work can create more opportunity to provide automated coaching and 2) automated coaching can identify key moments when collaboration should be encouraged.



Mark Floryan; *Evolving Expert Knowledge Bases: Applications of Crowdsourcing and Serious Gaming to Advance Knowledge Development for Intelligent Tutoring Systems;* (Beverly Woolf, Advisor); May 2013; Visiting Lecturer, University of Virginia.

This dissertation presents a novel effort to develop intelligent tutoring system (ITS) technologies that adapt by observing student behavior. We define an evolving expert knowledge base (EEKB) that structures a domain's information and evolves its state over time. An algorithm observes students as they work within our ITS Rashi, and coalesces contributions to form this EEKB. We discover that EEKB models can be constructed accurately, and with significant efficiency compared to human-constructed models. We also examine the impact that game mechanics have on this process. Students who are given additional game mechanics contribute higher amounts of data, while performing higher-quality work. Additionally, we define knowledge-refinement games (KRGs), which motivate subject matter experts (SMEs) to refine an EEKB. Our experiments provide evidence that both the quality and breadth of knowledge within the EEKB are increased when experts use the KRG.



Naomi Fox; *Accurate and Robust Mechanical Modeling of Proteins;* (Ileana Streinu, Advisor); Feb. 2013; Postdoctoral Fellow, Lawrence Berkeley National Laboratory

The focus of this thesis is improving accuracy and robustness of computational protein rigidity analysis systems. One contribution is in new approaches to mechanical modeling of non-covalent interactions, namely hydrogen bonds and hydrophobic interactions. Unlike covalent bonds, the behavior of these interactions varies with their energies. I investigate energy-refined modeling of these interactions. Included is a method to assign a score to a predicted cluster decomposition, adapted from the B-cubed score from information retrieval. Another contribution is

in new approaches to measuring the robustness of rigidity analysis results. The protein's fold is held in place by weak, non-covalent interactions, known to break and form during natural fluctuations. I propose an approach to measure the robustness of rigidity results, by studying how detrimental the loss of a single interaction may be to a cluster's rigidity. The study shows that, when present, highly critical interactions are concentrated around the active site, indicating that nature has designed a very versatile system for transitioning between unique conformations.



Akshat Kumar; *Exploiting Domain Structure in Multiagent Decision Theoretic Planning and Reasoning;* (Shlomo Zilberstein, Advisor); May 2013; Research Scientist, IBM Research, India

This thesis focuses on decision-theoretic reasoning and planning problems that arise when a group of collaborative agents are tasked to achieve a goal that requires collective effort. We examine these decision-theoretic problems within the framework of distributed constraint optimization problems (DCOPs) and decentralized partially observable MDPs (Dec-POMDPs). For DCOPs, a new variational formulation is developed that provides tighter approximation and better quality solutions than previous approaches. For planning under the Dec-POMDP framework, a number of algorithms based on machine learning and mathematical optimization are developed. The main contribution of this thesis is the development of effective, scalable and quality-bounded computational approaches for multiagent planning under uncertainty. This is achieved by a synthesis of techniques from multiple areas of artificial intelligence, machine learning and operations research. Empirically, each algorithmic contribution has been tested rigorously on common benchmark problems and, in many cases, real-world applications from machine learning and operations research literature.



Yariv Levy; *Multiscale Modeling of Human Addiction: a Computational Hypothesis for Allostasis and Healing;* (Andrew Barto and Jerrold Meyer, Advisors); Feb. 2013

I presented a computational multiscale framework for predicting behavioral tendencies related to human addiction. My first contribution is a formal, heuristic, and exploratory framework to conduct interdisciplinary investigations about the neuropsychological, cognitive, behavioral, and recovery constituents of addiction. My second contribution proposes a computational framework to account for real-life recoveries that are not dependent on pharmaceutical, clinical, and counseling support. My third contribution introduces a computational hypothesis about the allostatic theory of addiction and indicates how mechanisms within the brain's reward system may stabilize the functional state of an addict, and how mechanisms within the endocrine system may act as source for possible recoveries. The formal arguments presented in my dissertation are illustrated by simulations which delineate archetypal patterns of human behavior toward drug consumption: escalation of use and influence of conventional and alternative rehabilitation treatments. Results obtained from this computational framework encourage an integrative approach to drug rehabilitation therapies.



Andrés Molina-Markham; *Privacy-Aware Collaboration Among Untrusted Resource Constrained Devices*; (Kevin Fu, Advisor); Feb. 2013; Postdoctoral Researcher, Dartmouth College

Individuals are increasingly encouraged to share private information with service providers. Privacy is relaxed to increase the utility of the data for the provider. This dissertation offers an alternative approach in which raw data stay with individuals and only coarse aggregates are sent to analysts. A challenge is the reliance on constrained devices for data collection. This dissertation demonstrates the practicality of this approach by designing and implementing privacy-aware systems that collect information using low-cost or ultra-low-power microcontrollers. Smart meters can generate certified readings suitable for use in a privacy-preserving system every 10s using a Texas Instruments MSP430 microcontroller. CRFIDs—batteryless devices that operate on harvested energy from radio frequency—can generate encrypted sub-aggregates in 17s to contribute to a privacy-preserving aggregation system that does not rely on a trusted aggregator. A secure communication channel for CRFID tags via untrusted relays achieves a throughput of 18Kbps.



Benjamin Ransford; *Transiently Powered Computers*; (Kevin Fu, Advisor); May 2013; Postdoctoral Fellow, Computer Science & Engineering, University of Washington

My research aims to make energy harvesting a practical way to power small computing systems, and my thesis explores software and hardware techniques to enable this goal. The main challenge for energy-harvesting computers is to compute and communicate opportunistically, completing tasks on small bursts of energy punctuated by power loss. My dissertation presents two systems that respectively insulate computations from power loss and safely outsource storage to more-capable devices. It also demonstrates that a tiny radio-powered computer can endow a safety-critical medical device with improved security properties, and that replacing a medical device's traditional active radio transmitter with a radio-powered computer results in significant energy savings.



Elisha Rosensweig; *On the Analysis and Management of Cache Networks*; (James Kurose, Advisor); Sept. 2012; Software Developer, CloudBand, Alcatel-Lucent

Over the past few years Information-Centric Networking, a networking architecture in which host-to-content communication protocols are introduced, has been gaining much attention. A central component of such an architecture is a large-scale interconnected caching system. To date, the modeling of these cache networks, as well as understanding of how they should be managed, are both in their infancy. This dissertation sets out to consider both of these challenges. We consider approximate and bounding analysis of cache network performance, the convergence of such systems to steady-state, and the manner in which content should be searched for in a cache network. Taken as a whole, the work presented here constitutes an array of fundamental tools for addressing the challenges posed by this new and exciting field.



Mastooreh (Negin) Salajegheh; *Software Techniques to Reduce the Energy Consumption of Low-Power Devices at the Limits of Digital Abstractions*; (Kevin Fu, Advisor); Feb. 2013; Postdoctoral Research Associate, Computer Science, University of Virginia

My thesis explores software techniques that bend digital abstractions in order to allow embedded systems to do more computation with less energy. The capabilities and size of the embedded systems continue to improve dramatically; however, improvements in battery density and energy harvesting have failed to mimic Moore's law. Thus, energy remains a formidable bottleneck for low-power embedded systems. My research considers three methods that unleash energy otherwise squandered on communication, storage, and time keeping: 1) CCCP, which provides an energy-efficient storage alternative to local non-volatile storage by relying on cryptographic backscatter radio communication, 2) Half-Wits, which reduces energy consumption by 30% by allowing operation of embedded systems at below-spec supply voltages and implementing NOR flash memory error recovery in firmware rather than strictly in hardware, 3) TARDIS, which exploits the decay properties of SRAM to estimate the duration of a power failure ranging from seconds to several hours depending on hardware parameters.



Shiraj Sen; *Bridging the Gap between Autonomous Skill Learning and Task Specific Planning*; (Roderic Grupen, Advisor); Feb. 2013; Postdoctoral Research Associate, School of Computer Science, University of Massachusetts Amherst

Skill acquisition and task specific planning are essential components of any robot system, yet they have long been studied in isolation. This, I contend, is due to the lack of a common representational framework. I present a holistic approach to planning robot behavior, using previously acquired skills to represent control knowledge (and objects) directly, and to use this background knowledge to build plans in the space of control actions. Actions in this framework are closed-loop controllers constructed from combinations of sensors, effectors, and potential functions. I will show how robots can use reinforcement learning techniques to acquire sensorimotor programs. The agent then builds a functional model of its interactions with the world as distributions over the acquired skills. In addition, I present two planning algorithms that can reason about a task using the functional models. These algorithms are then applied to a variety of tasks such as object recognition and object manipulation to achieve the objective on two different robot platforms.



Navin Sharma; *Designing Distributed Systems for Intermittent Power*; (Prashant Shenoy, Advisor); May 2013; Postdoctoral Research Associate, School of Computer Science, University of Massachusetts Amherst

The increasing demand for computing infrastructure, such as data centers and storage systems, has increased their energy footprint. As a result of this growth, computing infrastructure today contribute 2-3% of the global carbon emissions. To reduce the financial and environmental impact of growing energy demands, the design of eco-friendly green infrastructure has become an important societal need.

This thesis focuses on designing distributed systems, primarily data centers and storage systems, to run on renewable energy sources such as solar and wind.



Upendra Sharma; *Elastic Resource Management in Cloud Computing Platforms*; (Prashant Shenoy, Advisor); May 2013; Research Staff Member, IBM T. J. Watson Research Center

Enterprise applications are known to observe dynamic workload; provisioning correct capacity for these applications remains an important and challenging problem. Predicting fluctuations in workload or the peak workload is a difficult challenge; erroneous predictions often lead to under-utilized systems or in some situations cause temporary outage of an otherwise well provisioned web-site. Consequently, rather than provisioning server capacity to handle infrequent peak workloads, an alternate approach of dynamically provisioning capacity in response to workload fluctuations has become popular. Cloud platforms are particularly suited for such applications due to their ability to dynamically provision capacity while charge on pay-per-use basis. Consumers enjoy the benefits of resource elasticity but face the challenge of efficient resource management. Administrators of cloud platforms, on the other hand, face the challenge of efficient management/deployment of component-services to support seamless application elasticity. In my thesis I describe solutions to these problems by designing/implementing intelligent systems.



Rahul Singh; *Resource Management for Enterprise Data Center Applications*; (Prashant Shenoy, Advisor); May 2013; Research Staff Member, IBM T. J. Watson Research Center

Today's enterprises depend heavily on their information technology (IT) infrastructure for performing a variety of tasks. The IT infrastructure of a large enterprise comprises of a large number of software applications that utilize various resources including both software and hardware resources. The massive scale of these enterprise applications as well the complicated interactions between their various resources, makes resources management of such enterprise applications extremely challenging. Also, there are dynamics at various time scales that need to be managed effectively. In this thesis we investigate various challenges in resource management of such large-scale distributed enterprise applications and develop systems that solve some of these management tasks arising at multiple time scales. The systems developed in this thesis solve problems arising at the scale of years like IT transformation and "what-if" analysis as well as problems arising at the scale of seconds like dynamic resource provisioning and handling transiency.



Hamed Soroush; *Measurement-Driven Characterization of the Mobile Environment*; (Brian Levine, Advisor); May 2013; Visiting Lecturer, Department of Computer Science, University of Virginia

This dissertation proposes new tools and techniques for the characterization of the environment impact on mobile networks. Novel mechanisms for improving connectivity and throughput in highly mobile scenarios are presented and new privacy challenges for mobile users are demonstrated. This work includes development and evaluation of large-

scale mobile experimentation infrastructures that facilitate longitudinal studies of today's technologically diverse mobile environment. Based on these studies, a mechanism called Spider is presented that efficiently utilizes Wi-Fi deployments in highly mobile scenarios, achieving a 400% improvement in throughput and 54% improvement in connectivity over stock Wi-Fi implementations. Analyzing hundreds of traces gathered over a large geographic area shows that patterns of data transmission between a server on the Internet and a moving cell phone can reveal the geographic travel path of that phone. The presented technique achieves 94.7% accuracy in distinguishing mobile phones from stationary phones. Routes taken by each mobile phone could be distinguished with up to 75.9% accuracy.



Thanh Tran; *High-Performance Processing of Continuous Uncertain Data*; (Yanlei Diao, Advisor); May 2013; Data Scientist, Twitter

Uncertain data has arisen in many sensing and scientific applications. The raw data in these applications is often incomplete, imprecise, and misleading, which has two implications: (i) the raw data is not directly queryable, and (ii) feeding the uncertain data into existing systems produces results of unknown quality. My thesis presents a system for uncertain data processing with two main functionalities, (i) capturing and transforming raw noisy data to queryable tuples with quantified uncertainty, and (ii) performing query processing on such tuples while characterizing the result uncertainty. I propose a probabilistic modeling and inference approach for data capture and transformation, and demonstrate it for RFID data. I then examine query processing for continuous uncertain data by presenting new data models and processing algorithms to compute query answers, either exact or approximate with bounded errors. The experimental results show that the proposed techniques outperform Monte Carlo sampling for many important workloads.



Edward Walters; *Generating Simulators from Multi-level Coordinated Specifications*; (J. Eliot B. Moss, Advisor); May 2013; Senior Software Systems Engineer, MITRE Corporation

Computer system simulations are one of the hardware and software designer's most useful and pervasive tools, but they can be difficult and time consuming to adapt to new requirements and design considerations. This dissertation presents a methodology and toolset for describing and generating a new type of mixed-category simulators we call blended simulators. Blended simulators have two novel features: one specifies them by using multiple semantically related specification languages, each of which describes a computer system at a different level of detail; and we automatically generate the resulting simulators from the set of specifications, using a sophisticated search process to blend behavioral, structural, and timing information at a fine-grained level. This results in a simulator that accurately captures timing metrics, but relies on functional simulation constructs when most appropriate. Other contributions include the CASL language for specifying modern micro-architectures within this system, and CSIP: our methodology for effectively describing the interplay between static and dynamic elements within a micro-architecture.

Faculty News



Professor **Andrew McCallum** was elected as the next President of the International Machine Learning Society (IMLS), the parent organization of the ICML conference. His three-year term will begin in 2014.



Elisha Rosensweig, (CS Ph.D. '12), Daniel Menasche (CS Ph.D. '11), and Distinguished Professor **Jim Kurose** received the IEEE INFOCOM 2013 Best Paper Award (chosen from more than 1600 papers submitted) for their paper, "On the steady state of cache networks."

Jim Kurose was General Co-Chair of the ACM Internet Measurement Conference held in Boston, MA in December, 2012, and Technical Program Co-Chair of the ACM e-Energy Conference held in May in Berkeley, CA.



Co-authors G. Neglia, CS Ph.D. alum Xiaolan Zhang, Distinguished Professors **Jim Kurose** and **Don Towsley**, and H. Wang received the Best Paper Award at the IEEE 77th Vehicular Technology Conference (VTC2013 – Spring) for "On optimal packet routing in deterministic

DTNs."

In July, L. Ma, T. He, K.K. Leung, **Don Towsley**, and A. Swami received the Best Paper Award at the 33rd IEEE International Conference on Distributed Computing Systems (ICDCS 2013) for "Efficient Identification of Additive Link Metrics via Network Tomography." Last Fall, the Best Student Paper Award was presented to N.C. Fofack, P. Nain, G. Neglia, and **Don Towsley** at the 6th International Conference on Performance Evaluation Methodologies and Tools for "Analysis of TTL-based Cache Networks."



Associate Professor **Gerome Miklau**, doctoral student Chao Li, and University of Washington co-authors Daniel Li and Dan Suciu received the Best Paper Award at the 2013 International Conference on Database Theory (ICDT) for their paper "A Theory of Pricing Private Data."



CS grad student Mohamed Musthag and Associate Professor **Deepak Ganesan** received the Best Paper Award at ACM SIGCHI Conference on Human Factors in Computing Systems 2013 (CHI 2013) for "Labor Dynamics in a Mobile Micro-Task Market."



Assistant Professor **Dan Sheldon**, along with co-authors from Cornell and Oregon State, won the Best Paper Award for "Approximate Bayesian Inference for Reconstructing Velocities of Migrating Birds from Weather Radar" at the Computational Sustainability track at the

Twenty-Seventh AAAI Conference on Artificial Intelligence (AAAI 2013).



In June, co-authors Emmanuel Cecchet, Robert Sims, Xin He, and Professor **Prashant Shenoy** received the Best Paper Award at the IEEE/ACM International Symposium on Quality of Service (IWQoS 2013) for "mBenchLab: Measuring QoE of Web Applications using mobile devices." **Shenoy** and co-authors Aditya Mishra, David Irwin, and Ting Zhu received the Best Paper Runner-up for "Scaling Distributed Energy Storage for Grid Peak Reduction" at the 4th ACM International Conference on Future Energy Systems (ACM e-Energy 2013), held in May.

Last year, the paper "Varanus: More-With-Less Fault Localization in Data Centers," co-authored by Vaishali Sadaphal, Maitreya Natu, Harrick Vin, and **Prashant Shenoy** received the Best Paper Award at the IEEE Fourth International Conference on Communication Systems and Networks (COMSNETS 2012). Co-authored by Sean Barker, Aditya Mishra, David Irwin, **Prashant Shenoy**, and Jeannie Albrecht, the paper "SmartCap: Flattening Peak Electricity Demand in Smart Homes" was presented in the Best Papers Session at the 10th IEEE International Conference on Pervasive Computing and Communications (PerCom 2012).

Shenoy and **Kurose** taught a joint semester-long grad seminar class with former CS faculty Krithi Ramamritham (now at IIT Bombay) between UMass Amherst and IIT Bombay as part of a joint research grant funded by the U.S. National Science Foundation and the Indian DIT.

Research Professor **Beverly Woolf** and Mark Floryan (Ph.D. '13) received the Best Poster Award at the 16th International Conference on Artificial Intelligence in Education (AIED 2013) for their short paper, "Authoring Expert Knowledge Bases for Intelligent Tutors through Crowdsourcing."



Associate Professor **Ramesh Sitaraman** received considerable media coverage on the research on video viewer behavior. These included NPR Morning Edition, Boston Globe, CBS, Yahoo! News, CNN, SF Chronicle, Xinhua, and Hindustan Times.



Assistant Professor **Hanna Wallach**'s essay on success, failure, perseverance, and roller derby was published in DerbyLife (the #1 derby website). Her roller derby team played a bout at the UMass Amherst Mullins Center in April.



Associate Professor **Emery Berger** gave an invited keynote address at ETAPS (European Joint Conferences on Theory and Practice of Software) this March in Rome, Italy. Berger also co-chaired the Usenix HotPar (hot topics in parallelism) Workshop in June. In April, Berger gave a talk at Google on "Stabilizer: Statistically Sound Performance Evaluation;" the group's Stabilizer software can be downloaded at stabilizer-tool.org.



The PLASMA lab, co-directed by Professors **Berger, Yuriy Brun**, and **Arjun Guha**, was accepted as a mentoring organization for the Google Summer of Code for students to work on open source projects that are a product of research from their lab.



Emeritus Professor **Andrew Barto** spent eight months in Rome, Italy working with colleagues at the Laboratory of Computational Embodied Neuroscience, a research group at the CNR Institute of Cognitive Sciences and Technologies. CNR is Italy's National Research Council.

The group's "mission" is to use computational and robotic models to investigate how the brain acquires behavior, in a cumulative fashion, by interacting with the body and the environment; and to exploit the knowledge so acquired to build autonomous cumulative-learning humanoid robots.



Emeritus Distinguished University Professor **Arnold Rosenberg** ran the Falmouth, MA Road Race on August 11, 2013 as part of "Run For Dana-Farber Cancer Institute." Rosenberg is pictured on the Run for Dana Farber Falmouth web page.



Hong Yu, Professor in the Department of Quantitative Health Sciences at UMass Medical School, and **David Irwin**, Assistant Professor in the Department of Electrical and Computer Engineering at UMass Amherst, joined the School of CS as Adjunct Faculty.



Irwin received a 2013 NSF CAREER Award for his project "Model-Based Energy Management for Sustainable Buildings." Prior to being named adjunct, he was a Postdoctoral Research Associate in the Laboratory for Advanced System Software at UMass Amherst CS from

2007-2012.

Researcher News

New researchers include CS alum **Shiraj Sen** (Ph.D. '12) as a Postdoctoral Research Associate in the Robotics Lab, **Navin Kumar Sharma** as a Postdoctoral Research Associate working with Prof. Deepak Ganesan, and **Patrick Taylor** as a Research Fellow working with Prof. Hava Siegelmann.

Xucheng Yin is a Visiting Associate Professor from the University of Science and Technology Beijing working with the CIIR.

Working with the Resource-Bounded Reasoning Lab, **Utku Erdogdu** is a Visiting Researcher from the Middle East Technical University, Turkey.

Assistant Professor Yuriy Brun is hosting **Jeanderson Candido**, a Visiting Scholar from Federal University of Campina Grande, Brazil.

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Student News

CIIR doctoral student **Kriste Krstovski** received a Harvard University-Smithsonian Center for Astrophysics SAO Pre-Doctoral Fellowship. This fellowship, which started in February 2013, supports his dissertation work by applying it to NASA's Astrophysics Data System.

Rachel Gordon and **Daniel Stubbs** received Honorable Mention in the 2013 Computing Research Association's (CRA) Outstanding Undergraduate Researcher Award competition.

Graduate students **Elisabeth Baseman**, **Tiffany Liu**, **Dorothee Spitta**, and **Jennie Steshenko** were selected to attend the Computer Research Association on the Status of Women in Computing Research (CRA-W) Graduate Cohort Workshop in Boston, MA in April, 2013. Grad Cohort aims to increase the ranks of senior women in computing by building and mentoring nationwide communities of women through their graduate studies.

The student ACM chapter organized a Jeopardy! Night this spring, with software created by undergrad chapter officer **Ryan McCann**. The first place team included **Rick Freedman**, **Chelsea Grossman**, **Bruce Spang**, and **Ian Stewart**.

The ACM Student Chapter officers for AY 2013-2014 are Chair **Ryan McCann**, Vice Chair **Reed Silverstein**, Treasurer **Kira Revere**, and Secretary **Stephen Donahue**.

CS undergrad **Christopher Scott** was on the team that organized a day-long TEDx conference at UMass Amherst in April.

Staff News

In May, **Michael Zarozinski** joined the CIIR's Multimedia Indexing and Retrieval Group as a Senior Software Engineer.

This spring, CSCF staffer **Paul Sihvonen-Binder**'s photography was exhibited at the gallery of the U.S. Department of Fish and Wildlife Service's Northeast Regional Office in Hadley, MA. His work focuses on capturing the often-overlooked details of the Pioneer Valley.

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