

BUCKEYE BLOG

A Newsletter of the Computer Science and Engineering Department

Autumn 2012

Volume 5 Issue 2

Celebrating Alumni in...



Photo: "Lord of the Rings," Courtesy Digital Domain



Photo: "Brave," Courtesy Pixar Animation Studios

Industry, Research, Education and
Hollywood.



Dear CSE Alumni, Parents, Friends and Colleagues,

I welcome you to the 2012 Autumn newsletter! We are in the beginning of the first semester after the transition from the quarters, and everything is going very well in the new academic system thanks to the best preparation and the support of our faculty and staff members. I am glad to report that the external advisory committee has added a new member from Ohio: Jim Escoe from the Procter & Gamble Company (see his introduction in page 7). Since the department was established in 1969, the CSE faculty across several generations has had a strong consensus to emphasize the quality of education and value the impact of research. This issue again presents you several stories of our faculty and alumni and how their work has advanced their fields to improve the quality of our life by their innovative computing research and development.

Due to the rapid growth of the department in both teaching and research, we have been authorized to hire five new tenure-track faculty of open ranks in the coming year. We expect an even more exciting CSE family after increase of the faculty size.

Please keep us informed about your progress and accomplishments. This newsletter has always been an inspiring source for the CSE family.

Xiaodong Zhang
Chair and Robert M. Critchfield Professor
Computer Science and Engineering

Bachelor of Science Program Accreditation is Renewed

The BS-CSE program recently went through its periodic accreditation evaluation by the Engineering and the Computing Accreditation Commissions of ABET, Inc. (www.abet.org). As part of the evaluation, we prepared a detailed self-study documenting all aspects of the program including our curriculum, faculty and facilities, and our assessment, evaluation and continuous improvement processes and their results. The evaluation included a three-day site visit by an ABET team. During the visit, the team met with faculty, students, advising staff, as well university and college administration officials. Based on their careful evaluation, the team found that the program fully satisfied the accreditation criteria.

The department thanks Neelam Soundarajan, CSE Associate Professor, who made a strong and effective effort to prepare the evaluation and Bruce Weide, CSE Professor and Associate Chair who played an important role in the process of evaluation.



The Department: By the Numbers

Faculty

36 Regular Faculty
2 Clinical / Research Faculty
1 Adjunct Faculty

Undergraduate Enrollment

480 Computer Science and Engineering Majors
441 Computer Science and Engineering Pre-Majors
168 Computer and Information Science Majors
257 Computer and Information Science Pre-Majors

Graduate Enrollment

138 MS Students
201 PhD Students

Research Expenditures

2012 \$8.3 million
2011 \$7.3 million
2010 \$6.2 million
2009 \$5.6 million

Alumni

5,757 BS Alumni
307 BA Alumni
2,167 MS Alumni
488 PhD Alumni

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Celebrating Alumni in the Movies

CSE Grads Masterminding Oscar-Worthy Effects

By Candi Clevenger



Photo: "Brave," Courtesy Pixar Animation Studios

A giant blue monster with silky fur. An enormous tower of water that floods New York City and pulverizes skyscrapers. A conflicted villain made of sand who disappears and reappears like magic.

These scenes might sound like a nightmare in the making, but they're just a few of the design challenges faced by Jeff Wolverton, Doug Roble and Steve May—three Ohio State CSE alumni who work in the film industry.



Jeff Wolverton

As a visual effects artist, **Jeff Wolverton** ('91, '94 MS CIS) represents the more artistic side of the animation industry. He got his start in computer graphics at The Ohio State University where he created animations for the old, dot

matrix scoreboards in Ohio Stadium and St. John Arena.

The idea that experience in computer graphics could lead to a career in movies was a revelation. "I wanted to work in movies, but for some reason it didn't occur to me that you could do computer stuff and work in movies until a guy named Doug Roble, who is also an Ohio State graduate, came back and gave a talk," says Wolverton. "I was like, 'Holy cow! You can work on movies with a computer engineering degree?' That is what started me on the path to doing it."

Wolverton's work as a scoreboard animator provided fodder for a demo reel and led to a job at Walt Disney Feature Animation, where he was a digital artist on *Hercules* and *Tarzan*. Since then, Wolverton has worked as a visual effects artist for numerous films, including six that were nominated for Academy Awards in visual effects.

The challenge of finding solutions for new problems with each film is what helps keep the job fresh, says Wolverton, who just finished work on *The Amazing Spider-Man* and is now busy with *Iron Man 3*.

"Even things we do the same are different every time. This is the third Spider-Man movie I worked on, but the way we do Spider-Man's webs is different than every other movie," says Wolverton. "That happens a lot, actually, because [studios] usually don't want something you've seen before."

The man who inspired Wolverton to consider the movie industry, **Doug Roble** ('87 MS, '92 PhD CIS), works on the technical end of the animation spectrum, creating the tools artists use.



Doug Roble

concepts from his PhD thesis.

"[It] is a program that allows people to figure out where the camera was when a photograph was taken or where things are in the scene," says Roble. "That makes it a lot easier to integrate computer graphics with a picture that was taken by a film camera."

That program, called "track," earned Roble a Scientific and Technical Achievement Academy Award in 1999. Next, he created Digital Domain's first fluid simulation, which was used on *Lord of the Rings*, and received a Scientific and Engineering Academy Award in 2007 for that work.

"It's fun playing with the physics and the mathematics behind how liquids move," says Roble.

As chief technology officer and supervising technical director at Pixar Animation Studios, **Steve May's** work spans the gap between art and technology. May ('90 BS, '92 MS, '98 PhD CIS) was drawn to the field of computer animation out of a love of art and science, and an article in *Science* magazine in 1984 that highlighted,

Ohio State's reputation as a computer graphics powerhouse helped solidify May's decision to attend the university.

among others, Charles Csurí, an Ohio State professor emeritus who is considered to be the first computer artist. Ohio State's reputation as a computer graphics powerhouse helped solidify May's decision to attend the university. His education provided a solid understanding of the field of computer graphics, something he says he uses daily.

"As we make decisions about how to animate the films at Pixar, we're always challenging ourselves to find either something we've never animated before like, in the case of *Monsters, Inc.* we had never animated fur, and in our new movie, called *Brave*, we had never animated a character with really long, curly hair. Actually, it turns out that is really hard," explains May. "We have a continuous number of new animation challenges and all of those things rely on computer graphics."

Since joining Pixar in 1993, May has worked directly on five films. He is perhaps best known for his work as simulation and effects sequence supervisor for "Monsters, Inc.," where he helped pioneer the fur technology and overall look for the character "Sully."

May, Roble and Wolverton all agree that the best parts of their jobs are the ever-changing challenges with each film, working on projects the whole world sees and working in an industry they love.

"When you're sitting in the back of a movie theater and something that you've worked on comes on the screen and the audience reacts in the appropriate way, whether they're startled or they laugh, that is a huge thrill," says Roble. "That is an amazing feedback loop where you go



Steve May

'Wow, they like what I did.' It's fun."

James Hahn

Founding Director of The Institute for Biomedical Engineering at George Washington University.

As I approached my graduation in the spring of 1989, I was apprehensive as to where my career should be heading. I had received job offers from both industry and academia. While I wanted to continue conducting research and teaching in an academic environment, having a successful academic career seemed to be a daunting task. Rick Parent, my advisor put things in perspective. His advice was that I should pursue what I loved instead of worrying too much about the different scenarios. "You are not going to starve. You need to do what you enjoy doing." This simple advice led me to the start of my academic career in the Department of Computer Science at George Washington University (GW).

When I first arrived at GW, my thoughts were to construct the interdisciplinary environment that Charles Csuris was so successful in creating at OSU. As a research assistant in his CGRG/ACCAD group, I experienced the joys of working in a creative environment composed of people from all different backgrounds. Even though my dissertation research was on the use of dynamics in computer animation, I soon learned that the same technology could be used to great effect in the biomedical domain.

For the last 15 years, I have been doing research in medical simulation and visualization in collaboration with the medical faculty. I have a joint faculty appointment in the medical school, and this led me to create the Institute for Biomedical Engineering (IBE). The IBE is composed of a couple dozen faculty members from both the School of Engineering and Applied Science and the School of Medicine and Health Sciences. As the founding director, one of my primary jobs is to foster a sense of collaborative community in biomedical engineering at GW. The research funding for our institute comes mainly from the National Institutes of Health. In between running the institute, teaching and conducting my own research, I was also serving as Chair of the Department of Computer Science.

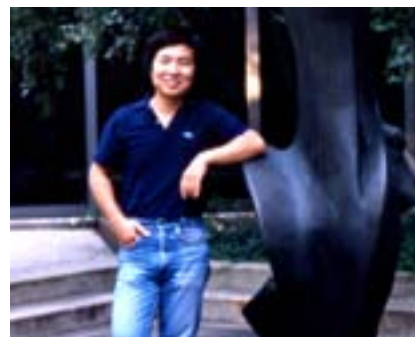
My own research in image-guided surgery is based on registration of a pre-operative imaging modality (typically Computed Tomography (CT) and Magnetic Resonance Imaging (MR)) to the intra-operative patient. I have worked on a number of projects in urology,



otolaryngology and maxillofacial reconstructive surgery. My group has also been involved in surgical simulations designed to train surgeons to perform minimally-invasive procedures in virtual reality before they perform them on a real patient. It is a rewarding feeling to know that what we are doing has the potential to make a real difference in the lives of real patients.

In the midst of all my responsibilities, I had not given up on my original love of computer animation. I have been teaching student computer graphics and computer animation for the past 23 years. One of my former students, Bill Westenhofer, received the 2008 Academy Award® for Achievement in Visual Effects for his work on the movie *The Golden Compass*. Many of my other students ended up in the gaming and graphics industry and academia.

My graduate student years at OSU were some of the most creative, exciting and satisfying times of my life. The "first generation" doctoral students under Rick Parent included some of the most talented and driven people I ever worked with. I still remember running the two Symbolics® machines in the lab 24 hours a day, often sitting in front of the terminal for the graveyard shift...going home at dawn to sleep. I don't think any of us fully realized how big the graphics field would become. Or that we were living through the dawn of the "Golden Age" of computer graphics. I am thankful for the opportunity of having been at the center of it all.



On the left is a picture of Hahn taken in 1988 in front of the Cranston Center where the Computer Graphics Research Group used to be located.

Jim Escoe

Product Lifecycle Management Business Architect for the Procter & Gamble Company.

Jim Escoe, MS '91, Computer and Information Science, has recently joined the Industry Advisory Board for the Department of Computer Science and Engineering. He is currently the Product Lifecycle Management (PLM) Business Architect for the Procter & Gamble Company. Jim has been with P&G for fourteen years and has held a variety of positions in the R&D and engineering spaces for information technology. In his first position, Jim served as the Chemoinformatics Architect for the Pharmaceuticals business unit. There he delivered a state-of-the-art drug discovery infrastructure based upon robotics technology to automate the biological screening of hundreds of thousands of chemical tests. Jim then joined the Engineering IT Organization and delivered the global plant drawing control system in 2000. This system is still in service and manages P&G plant information in over forty countries. From there, Jim led the global High Performance Computing infrastructure. He managed the transition from shared memory computing to P&G's current Linux cluster based HPC systems. He worked closely with the Ohio Supercomputing Center during this transition. This infrastructure manages all of the modeling and simulation globally for use in virtual product/package and process design. During this period (2000-2007) Jim co-lead the development of P&G's first high resolution power wall. The design of which was based upon (and extended) the visualization capabilities at the Sandia National Laboratory. This system and subsequent systems are the basis of P&G's virtual consumer learning. In the last several years, Jim's focus has turned to transforming product development processes through the use of virtual design leveraging PLM technologies. He developed the technical vision for the transformation of P&G's package development process and is currently leading the architecture of the overall global PLM infrastructure for R&D's product and package development.

Jim worked at Structural Dynamics Research Corporation (SDRC) after leaving OSU and prior to joining P&G in CAD/CAE/PLM software development. Jim led the transformation of SDRC's CAD Assembly Modeling Systems that allowed the company to deliver virtual design capability automotive and aerospace manufacturers (e.g.



Ford Motor Company, Honda, etc.). This capability, along with the associated part modeling capability, won *Design News*' "New Product of the Year" award in 1998. Jim's last position at SDRC was a program manager for all product development in the computer aided engineering business unit.

Jim lives in Cincinnati with his wife (Professor Gigi Escoe) and two daughters. Gigi is the Vice Provost for Undergraduate Education at the University of Cincinnati. Gigi received her PhD in Economics from Ohio State at the same time Jim earned his master's degree. Jim's eldest daughter is a Buckeye! She is a freshman in OSU's neuroscience program. The family enjoys boating in the summer and college football in the fall. Gigi's brother, Urban Meyer, is the new football coach at OSU.

Jim attributes much of his success to the involvement in computer science research while at OSU. He has a love of challenging the norm and taking calculated risk to achieve step change results. He contends that the breadth of understanding provided by his OSU education is essential to his ability to impact the business world.

Jim's favorite memories of Ohio State are standing on the sideline for the Buckeye's victory over the school up north while Urban was a graduate assistant at Ohio State, dinners out on High Street with computer science and economics graduate students and with Gigi, and playing the Scarlet & Gray golf course. Jim was thrilled to introduce his daughters to Script Ohio and to be able to play the Scarlet & Gray course again this spring when Urban came back to town as the new coach.



Jim and his wife Gigi on graduation day in front of the "Shoe" in 1991. In the picture above, they attend a recent Buckeye football game.

Ohio State Honors Computer Science Alumni



Matt Desch, BS '80, was a recipient of the Ohio State 2012 Alumni Association Award for Professional Achievement. CEO of Iridium Communications, his company uses low-Earth-orbiting satellites to help people communicate in some of the most remote locations on the planet.

As an undergraduate, Matt was an Evans Scholar who co-founded the Student Alumni Council. After graduating, he began his career as a software developer with Bell Laboratories, earning an MBA from the University of Chicago after a few years as young technology manager. He then spent 30 years rapidly advancing in telecommunications management, when cell phones were in their infancy. In his current role as chairman and CEO at Iridium, he has led extraordinary growth, taking it public and completing financing for its 2015 launch of the Iridium NEXT satellite network.

Based on his telecom expertise, Matt was appointed by President Obama to the National Security Telecommunications Advisory Committee, which advises the president on U.S. telecom security matters. He has testified on Capitol Hill regarding U.S. telecommunications security and emergency communications.

In 2011, he was named a "Tech Titan" by The Washingtonian magazine. That same year, he was the Ernst & Young Entrepreneur of the Year, and Via Satellite magazine named him Executive of the Year for making "a lasting business impact on the global satellite market."

The Professional Achievement Award is presented to alumni who have superb records of distinguished career accomplishments and who have made outstanding contributions to their professions.



Soumitra Sarkar, PhD '89, is a Senior Technical Staff Member at IBM Research. He has been with IBM since he graduated and his work there has spanned many technology areas including networking, automated rejuvenation of legacy applications, storage systems and Cloud Computing. He has also worked on semantic search systems and is currently investigating practical applications of IBM's Jeopardy-playing "Watson" technology.



Xiaoning Ding, PhD '10, has joined the College of Computer Science in the New Jersey Institute of Technology as an assistant professor this year after two years' CI Fellow work at Intel Labs and CMU. His research is in operating systems and computer architecture.



Michael Fortin, PhD '91, was awarded The College of Engineering Distinguished Alumni Award. Mike is a distinguished engineer in the Windows Core Operating Systems Division at Microsoft, he has management and architectural oversight responsibilities

for disciplines such as performance, reliability, feedback, application compatibility and diagnosis. He began his career at Microsoft in 1997, where he worked on Windows 2000 doing development on tools to aid in improving system and application performance. Later, as a performance analyst, he took a more active role in overall systems performance and fundamentals. He is a 2011 recipient of the Outstanding Technical Leadership Award, one of the highest recognitions from Microsoft.

Prior to joining Microsoft, Mike was employed at IBM where he worked primarily as a performance analyst and architect on a variety of operating systems. He received a doctorate in computer science from The Ohio State University in 1991, and a master's degree in 1987. He also holds an undergraduate computer science degree from Xavier University ('85). Mike currently serves on the Computer Science and Engineering Advisory Committee.

The faculty of the College of Engineering established The Distinguished Alumni Awards to recognize distinguished achievement on the part of alumni in the field of engineering or architecture by reason of significant inventions, important research or design, administrative leadership or genius in production.



Charles Armbruster, MS '72, is an Application Systems Engineer for Wells Fargo.



Joshua Levine, PhD '09, is joining the Computer Science Department of Clemson University as a tenure-track assistant professor. Levine is currently a Postdoctoral Research Associate at the Scientific Computing and Imaging Institute at the University of Utah. His research interests include geometric modeling, scientific visualization, mesh generation, topological methods, medical imaging, and computational geometry, and the process of scientific discovery that these areas are relevant.



Detecting Depression Through Internet Use

Dr. Sriram Chellappan, PhD '07, is an Assistant Professor of Computer Science at Missouri S&T and the lead researcher in a study on the connections between internet usage and depression among college students. This study shows that students with signs of depression use the internet differently than those without symptoms. By using actual internet usage data acquired from university networks, instead of data collected from surveys, researchers were able to identify nine patterns that can indicate symptoms of depression. Students that showed symptoms of depression tend to use file-sharing services more than their counterparts, and also use the Internet in a more random manner, frequently switching among several applications. This new data offers new insight to the connection between computer usage and mental health, compared to existing studies. "The study is believed to be the first that uses actual Internet data, collected unobtrusively and anonymously, to associate Internet usage with signs of depression," Chellappan says.



Ahmed Elmagarmid MS '81, Computer and Information graduate, and '85 PhD, is the newly named Executive Director of the QCRI in the Qatar Foundation.



Steve Balmert, BS '92, is currently an Automation Engineer for Republic Steel.



Mark A. Hanna BS. '87, is now the founder and president of RealTime Fantasy Sports (www.rtsports.com), a website devoted to the fantasy sports enthusiast.



Bruce Flinchbaugh, PhD 1980, Distinguished Alumnus 2003, retired in September after a thirty-year R&D career at Texas Instruments in Dallas.



Pawandeep Lamba BS '01, is an IT Manager for the CIA.

Alumni's Research Group Garner Top Honors



Weikuan Yu (left) and Yuan Tian (right) while at the 2012 ACM Awards Ceremony.

CSE Alumnus **Weikuan Yu**, PhD '06, is an Assistant Professor in the Department of Computer Science and Software Engineering at Auburn University. He founded the Parallel Architecture and System Laboratory at Auburn in 2009. Working with a group of talented students, Yu's research has garnered a stream of top research honors from international conferences and industry. These include the First Prize in the ICS 2011 Student Research Competition, the George Michael HPC Fellowship at the ACM/IEEE SC'11 conference, the 2011 Outstanding Research Contribution from Mellanox Technologies Inc, and most notably, First Prize in the 2012 ACM Grand Finals of Student Research Competition. Yu and his PhD student, Yuan Tian, were invited to receive the award at the 2012 ACM Awards Ceremony. Their work has been sponsored by grants and contracts from DOE/ORNL, NSF, NASA, Mellanox and NVIDIA.



Michael Collier BS '03, is the Windows Azure National Architect for Neudestic.



Eric Kilby, BS '75, started working at what started as The First National Bank of Chicago, and eventually through mergers and acquisitions became JP Morgan Chase retired in July 2008 after 33 years of service.



Terrance L. Dick, BS '87, is the Assistant Chief Information Officer for the Ohio Secretary of State. He has been with the Ohio Secretary of State for the past 25 years.

Rebecca Vallera, BS '10, is the Assistant Technical Director for Walt Disney Animation Studios.

Daniel Nye, BS '11, is a video engineer working in rotational program for Robert Bosch LLC.

Michael Hecht, MS '90, is a Senior RTS Systems Analyst for NiSource.

Samuel Mburu, CSE '09, is currently employed as a Senior Web Developer for LinkedIn in San Jose California.

Andrew Griffith, MS '73, is a Senior Systems Engineer for ING North America Insurance Corporation.

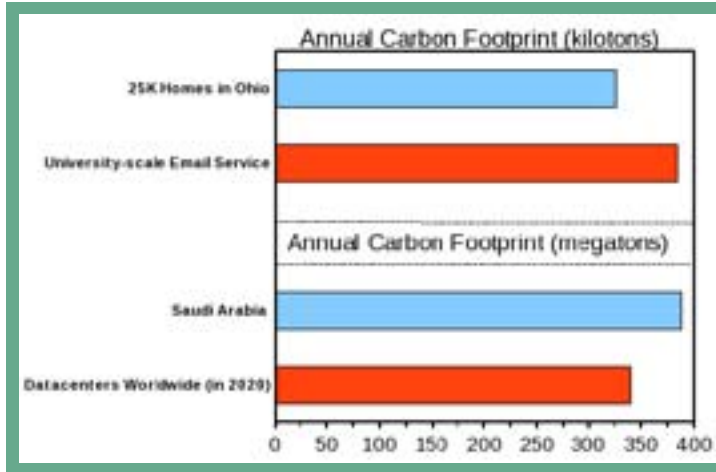
Jeffri Frontz, BS '87, is a Senior Software Engineer for Pocared Diagnostics.

Christopher Stewart

Scalable and Sustainable Internet Services



Have you ever thought about the carbon footprint of mundane daily tasks? Do computers reduce or increase these carbon footprints? You may be surprised to find that computing, especially in large datacenters, is not always an environmentally friendly chore. For instance, some of you that are reading the print version of this newsletter may be making a sustainability statement compared to those reading a digital version that was downloaded from a distant, coal powered datacenter. The figure below highlights the large footprint of Internet services.



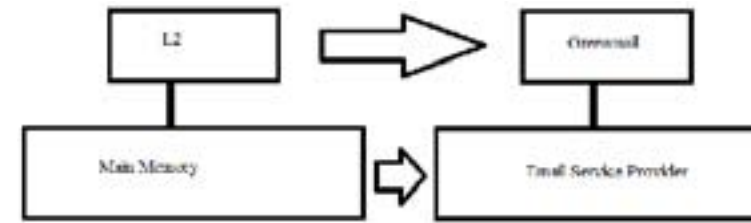
The email service for a university, like Ohio State, may support over 1 million accounts in a centralized enterprise datacenter. This would include accounts for students, alumni, staff, and visitors. Under this setup, each account would average about 4.7kWh a year [Google's Green Computing Efficiency at Scale, 2011], translating to an aggregate carbon footprint of 3 Gigatons—more than a small Ohio township. Looking across the whole world, the combined footprint of the world's datacenters is on scale with the emission rates of entire countries.

As the world becomes increasingly aware of the effects of global climate change, there is growing demand to reduce carbon emissions. Businesses all over the world, from auto makers to paper mills, are rethinking their business models, embracing sustainability, and looking for ways to ensure that their industry will flourish today and 50 years from now. Like any industry, Internet services are also under pressure to reduce their carbon footprint, much of which stems from the operation of large buildings that house thousands of computers, called datacenters.

Unlike many other industries, Internet services face these challenges in the midst of a boom. Social networking, big data analysis, and smart phones—fast growing segments in today's economy—rely on Internet services. The number of datacenters world wide will quadruple over the next 8 years. One open and important research challenge asks, how do we design software and hardware to supply enough computing power for tomorrow's workloads? At the same time, with a nod toward the environment, we must acknowledge that today's computing solutions dump a lot of carbon into the atmosphere. Thus another open research question is, can we transparently retrofit these systems, providing customers the same high-performance services while making datacenters more sustainable?

Professor Christopher Stewart looks for sustainable ways to scale up Internet services. In the context of his research, the word sustainable should be construed broadly to describe services with the following properties. First, they can adapt their server infrastructure so that they profit when customers use the service heavily, more than heavily, and at Facebook scale. Second, they use a small, fixed amount of energy per customer regardless of usage patterns, and finally, they get energy from clean sources. Professor Stewart's holistic approach balances sustainability for the environment and for business, acknowledging that sustainability cannot come at the expense of profits. In his own words, "Often sustainability and scalability are viewed through different lenses, but to influence decision makers, solutions that improve sustainability must be translated into the language of business. For Internet services, that means sustainable solutions must scale up to millions of customers cost effectively."

Professor Stewart's recent work (to be presented at this year's ACM International Conference on Autonomic Computing) offers a concrete example of sustainable scaling. The focus is carbon offsets, a currency for the environment. Carbon offsets allow companies to invest in programs that pull carbon from the atmosphere, like planting trees in the rainforest. These investments lower, eliminate, or even reverse a company's net carbon footprint. For instance, Google and Microsoft purchase enough carbon offsets to zero out the carbon footprints of their datacenters (and other operations), i.e., they are carbon neutral. While Google and Microsoft's pledges are



nice gestures, they lack a key ingredient for sustainability: profit. After all carbon offsets can be pricey, especially in competitive markets, few companies can afford to invest in offsets without any return.

The key idea underlying Professor Stewart's work (co-authored with his students Nan Deng and Jaimie Kelley and collaborators at HP Labs Daniel Gmach and Martin Arlitt) is that investing in carbon offsets can increase profits when the investment attracts new customers. Consider the companies that run Apache and Python servers for small- to medium-sized web sites, called web hosts. Web hosts profit when customers lease their servers, but competition is stiff and often subtle technical issues sway customers one way or another. Recently, a small cadre of web hosts have used carbon offsets to gain a qualitative edge on their competition. These green hosts buy carbon offsets to replace any dirty energy used by their servers, but instead of raising their prices, they recoup their investment by using their environmentally friendly status to recruit customers. The strategy works because study after study shows that most CIOs, system administrators, and even people worldwide would prefer green products when they are priced competitively with traditional products.

Even though green hosts have carved out a profitable niche, there are still many open problems on how to maximize profit within the niche. In other words, how many carbon offsets should a green host buy? Professor Stewart's research shows that carbon offsetting should be dynamic, adapting to the changes in the request arrival rates of hosted web sites. By purchasing carbon offsets in a rigorous, model-driven fashion, green hosts can increase their profits by more than 150%.

The next step in Professor Stewart's research is to implement the green hosting model here at Ohio State. Specifically, he and his students, Chen Li, Nan Deng, and Xi Qiu, are building GreenMail, a web-based email caching system that achieves a less-than-zero carbon footprint (shown in the figure). GreenMail interacts with email servers through IMAP, caching hot data on its local renewable-powered servers. The system monitors email



access and tracks the daily carbon footprint of each user. If the aggregate carbon footprint of GreenMail users exceeds a target goal, carbon offsets are purchased. From a research perspective, GreenMail presents a new twist on cache management.

Traditional caches (shown in the figure above) trade money for performance. GreenMail trades money for sustainability. Traditional caches typically have a fixed miss penalty. GreenMail may incur different carbon-footprint penalties on misses depending on the IMAP provider and its datacenter locations. An early prototype of GreenMail has already been demoed as a part of Alex Bunch's (BS, '12) undergraduate thesis. This project was demoed at the Denman Undergraduate Poster Forum.

“Serious people recognize the long-term consequences of computing’s growing carbon footprint, but we must be realistic too. Making our field sustainable will require a sustained effort and practical, economic solutions.”- Christopher Stewart

Professor Stewart also serves as the chief editor for the IEEE Sustainable Computing Register, the monthly publication of the IEEE Special Technical Committee on Sustainable Computing. “The STC on Sustainable Computing has very talented people that are committed to its mission, giving it an opportunity to really impact the field,” he said. In this position, Professor Stewart started the Pick of the Month series to highlight excellent research in sustainable computing. Already, this is being recognized as a prestigious award in the field. Visit <http://stc-sustainable-computing.ieee.net/> or <https://www.facebook.com/#!/groups/STC.Sustainable.Computing/> to find out more about this group.



Rick Parent Retires

CSE Professor Rick Parent, a highly respected computer animation expert, retired this past June after a career that saw expansive change and innovation in the field of graphics, and Rick was in the middle of it all. Rick received his PhD in 1977 from Ohio State under the direction of Charles Csurí, in the Computer Graphics Research Group (CGRG). For the next three years, Rick worked at CGRG first as a research associate and then as associate director. In 1980 he co-founded The Computer Animation Company. In 1985, he joined the faculty of the Ohio State CIS Department (now CSE).

Rick has published several seminal papers on layered animation, on anatomical modeling, and on facial animation. Several of his papers have been heavily cited by peers in the field, specifically his work on generation of articulated skeletons from surfaces, facial animation and automated lip sync. His SIGGRAPH paper published in 1990 was selected in a list of "Seminal Graphics: Pioneering Efforts that Shaped the Field." He has also been named as Computer Graphics Pioneer by the Association of Computing Machinery (ACM).

Rick Parent authored an influential and widely used computer animation textbook, *Computer Animation: Algorithms and Techniques*. The book has made a strong impact in computer science education. The book was published by Morgan Kaufmann in 2001, and its

second edition published in 2007 by the same publisher. This book is the first, and only, to focus entirely on computer animation from the technical point of view. It collects the various algorithms and techniques that are used in computer animation and presents them in a straightforward, accessible manner. With 590 pages, almost 400 diagrams, and over 450 equations it explains the field more thoroughly than previously available. In addition to foundational material, it provides descriptions of the state-of-the-art technology with pointers to current research being addressed in the literature. This book has been adopted as the required text book or a main reference in many animation classrooms in many US academic institutions and in other countries.

The other impact Rick has made is that of an educator. Many of his former PhD students have made significant research and industry impacts, including several distinguished leaders in the field: David Ebert (Professor, Purdue University), James Hahn (Professor and former Chair, George Washington University), Dave Haumann (Senior Member of Technical Staff, Pixar), Doug Roble (Creative Director of Software, Digital Domain) and Karan Singh (Professor, University of Toronto). The impact and contributions that Rick's former students are making in the field of computer graphics is a testament to Rick's passion for his research and his devotion to educating and preparing the next generation of computer leaders.



P. Sadayappan and **Nasko Rountev** were awarded a three year grant from the Department of Energy entitled *Domain Specific Language Support for Exascale*.



NSF awarded **Srinivasan Parthasarathy** two new research awards entitled *CCF: EAGER: Scalable Graph Mining and Clustering on Desktop Supercomputers* and *SHF: Small: Collaborative Research: Elastic Fidelity: Trading off Computational Accuracy for Energy Efficiency*.



Srinivasan Parthasarathy and **Arnab Nandi** were awarded a Google Research Award to explore *Guided and Interactive Exploration of Large Data Sets*.



Ness Shroff will serve as part of a team funded by the Army Research Office Multidisciplinary University Research Initiative to explore *Multivariate Heavy-Tail Phenomena: Modeling and Diagnostics*. In addition, he received the following new grants: *Theory Enabled Secure Wireless Networking: Scaling Laws, Network Control, and Implementation* funded by the Qatar National Research Fund - National Priorities Research Program entitled *Toward Efficient and Distributed Cyber-Physical Systems Design for the Smart Electric Power Grid*, funded by NSF with Cathy Xia, ISE and CSE faculty member. Ness also gave invited talks at distinguished colloquia at the University of Maryland, Texas A&M and Rutgers entitled *Low-Complexity Scheduling Policies for Achieving Throughput and Delay Optimality in OFDM Downlink Systems*. He also now serves as a Technical Editor for the IEEE Network Magazine.



Chris Stewart received an NSF award entitled *EAGER: Design and Implementation of a Renewable Adaptive Cluster*.



NSF awarded **Bruce Weide** a three year grant entitled *SHF: Medium: Collaborative Research: Specification and Mathematics Engineering for the Verified Software End-Game*. The work is in collaboration with Harvey Friedman, OSU Professor of Mathematics.



NSF awarded **Prasad Sinha** a new research grant entitled *NeTS: Medium: Collaborative Research: Enabling Cellular Services over Unplanned Femto-cell Deployments: Theory to Implementation*.



Eric Fosler-Lussier received an NSF grant entitled *Speech Recognition Virtual Kitchen by the National Science Foundation*. In addition, he is part of a collaborative team led by the International Computer Science Institute at Berkeley exploring *SWORDFISH: Spoken Wordsearch with Rapid Development and Frugal Variant Subword Hierarchies*, funded by Intelligence Advanced Research Projects Activity.



NSF awarded **Xiaodong Zhang** two new research grants entitled *Unified Software Environment to Best Utilize Cache and Memory Systems on Multicores* and *CSR: Collaborative Research: On Closed-Loop and Cross-Layer Design and Implementation of Data Storage Systems Utilizing Extremely Scaled NAND Flash Memory Technologies*.



Roger Crawfis was invited to Portugal to give the keynote at the IADIS International Conference on Computer Graphics, Visualization Computer Vision and Image Processing. He has also received a two year grant in collaboration with the OSU Wexner Medical Center entitled *A Low-cost Virtual Reality Gaming Platform for Neurorehabilitation of Hemiparesis* funded by the Patient Centered Outcomes Research Institute Pilot Grants Program.



Raghu Machiraju received the 2012 College of Engineering Lumley Research Award at the 15th Annual College of Engineering Faculty Awards Banquet in May; he was also promoted to full professor and was general chair of the IEEE BioVis Symposium. In addition, Raghu and Kun Huang, OSU Department of Biomedical Informatics, received a new grant entitled *Cloud Computing and Visualization Tools for KBase* with Kitware, Inc.



Radu Teodorescu will collaborate with University of Illinois Urbana-Champaign on a new Defense Advanced Research Agency award to study *Parameter Variation at Near Threshold Voltage: The Power Efficiency versus Resilience Tradeoff*.



Dong Xuan received a research grant from NSF on the topic of *Integrating Electronic and Visual Signals for Accurate Localization*. In addition, he led the NSF funded *U.S.-China Workshop on Environmental Monitoring for Public Health and Disaster Recovery*. The workshop involves researchers from the US and China and will promote and sustain mutually beneficial research and education in the area of environmental monitoring.



Dhabaleswar K. (DK) Panda, received 2012 IBM Collaborative Faculty Award. This was awarded to DK for designing high-performance and scalable cloud computing environment on InfiniBand. In addition, he received two new grants from NSF entitled *SHF: Large: Collaborative Research: Unified Runtime for Supporting Hybrid Programming Models on Heterogeneous Architecture* and *SI2-SSI: Collaborative Research: A Comprehensive Performance Tuning Framework for the MPI Stack*.



Leon Wang was awarded a four year grant by The Air Force Office of Scientific Research entitled *Speech Segregation Based on Binary Classification*.



The National Security Agency awarded **Kannan Srinivasan** a four year grant entitled *Building a Practical Wireless In-Band Full Duplex System Existing Awards*.



NSF awarded **Mike Bond** a grant entitled *CSR: Small: Making Software Transactional Memory More than a Research Toy*.



Brian Kulis received a three year grant from the National Science Foundation entitled *RI: Small: Hard Clustering via Bayesian Nonparametrics*.



Han-Wei Shen was promoted to full professor.

Graduate Associate Teaching Award

Joshua Eckroth, PhD student was awarded the University Graduate Associate Teaching Award (GATA) at a surprise visit during one of his classes. This award is the highest honor awarded to a graduate student at The Ohio State University and is given to ten grad students annually.

The university recognized Eckroth for his dedication to the education and development of his students. Eckroth's students are happy to recognize him as a great teacher. On the website, RateMyProfessors.com, a student commended Eckroth saying, "Very helpful, and sincerely interested in helping his students. Probably the best teacher I've had at OSU."

Eckroth was also recognized by university faculty for his dedication to teaching. A nominating professor said, "I rarely get an excuse to go see the most outstanding [GTAs] in action. I have learned a few new tricks myself from sitting in on Josh's class and from examining his on-line materials... We are lucky to have such a dedicated and impressive young teacher among our graduate teaching associates." Eckroth's outstanding contributions to the department and the university as an educator are truly impressive and the respect that he earned from his students shows his skill and dedication as a teacher. Another faculty stated, "Josh has a great rapport with his students. They



pay attention, ask and answer questions, and respond to the material in a way any instructor would relish... I visited his class on a random day some two weeks into the quarter... [and] the respect he had already earned was impressive.

In addition to receiving this year's GATA, Eckroth has received the Humboldt State University Computing Science Department Student of the Year Award in 2008, as well as OSU's Computer Science and Engineering Department 2012 Eleanor Quinlan Memorial Award for Teaching. At Ohio State, Eckroth has taught CSE 630, 230, 202 and 201. At his undergraduate alma mater, Humboldt State University, he co-taught an undergraduate capstone course in software engineering.

Josh's research is in the area of artificial intelligence, with his advisors Dr. John R. Josephson and Dr. Chandrasekaran. Josh's research aims to develop strategies that improve the ability of an intelligent agent (such as a robot) to perform challenging reasoning tasks even when the agent's knowledge about the world is significantly limited or the sensors that provide information about its domain (e.g., video cameras, and microphones) are sometimes inaccurate, misreporting, or otherwise malfunctioning.



In the top right photo Josh is receiving his Graduate Associate Teaching Award from Patrick S. Osmer, Vice Provost of Graduate Studies and Dean of the Graduate School. (Bottom right) Josh is sitting among his students after receiving his award.

Best Paper Awards



Oleg Mishchenko was awarded a best paper award for his paper entitled, *Effective Texture Models for Three Dimensional Flow Visualization* at The 1st International Workshop on Soft Computing Techniques in Cluster Grid Computing Systems, (SCCG) 2012.

In collaboration with his advisor, Roger Crawfis, Mishchenko's paper tackles the problem of occlusion in three dimensional flow visualization by using semi-transparent geometry. Because using semi-transparency can make visualizations blurry and vague, the authors investigate limits of perception of semi-transparency with a user study. Based on the user study results, a set of guidelines for visualizing flow with semi-transparent geometry is proposed.



Sreeram Potluri and his co-authors were awarded the Best Student Paper award at the recent Texas Advanced Computing Center (TACC) - Intel Highly Parallel Computing Symposium for their work entitled *Intra-MIC MPI Communication using MVAPICH2: Early Experience*. The effort, guided by Professor DK Panda and in collaboration with fellow team members Karen Tomko and Devendar Bureddy, describes the team's early experience using MVAPICH2, a popular open-source implementation of MPI, on the Intel Many Integrated Core architecture.

Exascale computing (one quintillion or 10^{18} computer operations per second) is the next grand challenge in the field of supercomputing. It will help scientists tackle several fundamental problems in a wide range of fields like aerospace, automotive, energy, health care and others.



Wenzhuo Ouyang, won the Best Student Paper Award for his paper *Low-complexity Optimal Scheduling Over Correlated Fading Channels with ARQ Feedback* at IEEE International Symposium on Modeling and Optimization in Mobile, Ad Hoc Wireless Networks (WiOPT) 2012.

Ouyang is a PhD student working in information processing systems with CSE Professor Ness Shroff and ECE Professor Atilla Eryilmaz.

The paper investigates the downlink scheduling problem under Markovian ON/OFF fading channels, where the instantaneous channel state information is not directly accessible, but is revealed via ARQ-type feedback. Ouyang's research shows that under an average number of transmissions constraint, a low-complexity index policy is throughput-optimal.



Vignesh Ravi received a Best Student Paper Award at The 12th IEEE/ACM International Symposium on Cluster, Cloud and Grid Computing for his paper *Scheduling Concurrent Applications on a cluster of CPU-GPU Nodes*.

The paper, in collaboration with his advisor Gagan Agrawal and fellow PhD student David Chiu and alumnus Wenjing Ma, tackles the problem that supercomputers and cloud environments commonly employ a combination of multi-core CPUs and GPUs, and are concurrently used by various users. State of the art practical schedulers for independent jobs lack features and policies that are desirable today and in the future. Exploiting portability offered by OpenCL, our novel scheduling policies significantly improve the throughput by allowing dynamic mapping of jobs to resources and minimizing the resource idle times.

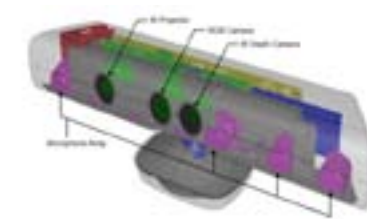
ACM-W Cookout



The OSU Association of Computing Machinery committee on Women (ACM-W) hosted a cookout for CSE students. The mission of ACM-W is to engage women in activities and projects that aim to improve the working and learning environments for women in computing by mentoring and role modeling, volunteering and teaching others and encouraging other women to get involved in computer science.

CSE Team Brings Brutus to Life

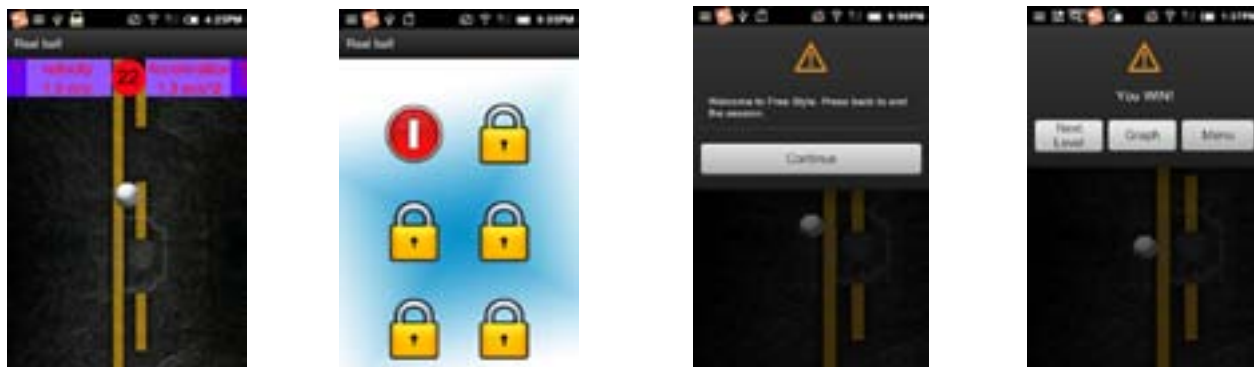
CSE undergraduate Seth Darbyshire is working with Associate Professor Rajiv Ramanth and PhD student Thomas Lynch on a spoken-dialog interface to the iShoe website that will provide information to fans in the 'Shoe during football games via a video display. iBrutus is a verbal interface with applications beyond the stadium and can change how information is disseminated in any real world setting, like hospitals. iBrutus's spoken-dialog interface is created using advanced audio filtering, conversation analyzing and visual processing algorithms. The project brings student researchers at the undergraduate, master's and PhD levels from several disciplines to realize this cutting-edge project.



Above left is the Microsoft Kinetic Cutaway. This hardware is comprised of a four microphone array, an IR camera and a RGB camera. Above right is the iBrutus animation.

Students Win STEM App Challenge with Mobile Application, “Real Ball”

By Kari Fox



A group of three students received first place in the STEM App Challenge with their application that helps learners overcome common physics misconceptions. Yu Qiao, Martin Keegan and Lingchen Xiong developed the winning Android application, “Real Ball-” in Rajiv Ramnath’s Advanced Mobile Application Development class.

The competition, hosted by the Advanced Distributed Learning Center, challenged students to develop an application that can be used as a learning tool to help learners overcome common misconceptions they may have in the areas of science, technology, engineering and math. Real Ball targets misconceptions about physics, such as velocity and acceleration.

“For example, one misconception is that acceleration always occurs in the direction of the objects motion,” says Martin Keegan, an undergraduate student majoring in computer and information science. “In one level, this misconception is challenged as the goal is to have the ball be accelerating in one direction as it is moving in the opposite direction.”

Real Ball users can roll a digital ball by tilting the phone screen and try to reach a goal on each of the six levels, which the designers hope will eliminate users’ sometimes false conceptions about velocity and acceleration by experiencing it themselves. And after completing a level, the user can view a graph of both the ball’s velocity and its acceleration over time.

To form the idea, the group looked at a list of problems people commonly have with understanding various areas of science. “We brainstormed and tossed ideas back and forth and decided which one could translate into a game or app,” says Keegan. “After seeing the misconceptions having to do with physics, we decided a physics based game would work best.” Prior to the project, the students had never worked with Android development. “Not only are we learning this technology from scratch, but we are creating this app simultaneously,” says Keegan. “There were many alterations that had to be done and many tweaks that had to be made.”

Another challenge the students faced concerned programming. “I am sure all programmers know what I am talking about when I say things never go completely smoothly,” says Keegan. “Parts of code will just randomly not work or break and you need to figure out why and there were a lot of small details to tweak to get things running well, especially considering we were making a game and it had to feel like it was responsive and working smoothly.” But through their hard work and dedication, the team was able to complete the application in just ten short weeks. The teammates credit a lot of their success to

professors, Rajiv Ramnath, associate professor of computer science and engineering; Dean Cristol, associate professor of education; and Andrew Heckler, associate professor of physics.

“All groups performed admirably,” says Ramnath. “They were motivated and engaged throughout the whole term.”

CSE 16th Annual Awards Banquet

The Computer Science and Engineering Department held their 16th Annual Awards Banquet on May 10th, 2012 at the OSU Faculty Club. This is a departmental event to honor our students’ academic achievements and the successes of our faculty and staff.

The department wishes to thank those alumni and industry donors who helped make this event possible – either by contributing to the undergraduate scholarship awards or by sponsoring a table.



Chirantan Eckbote and Rephael Wenger



Nikki Strader and Peg Steele



Xiaodong Zhang



David Albert and Wayne Heym

- Scholarships**
- Central Ohio Chapter of Association of Computing Machinery**
Zachary Boerger
 - Cisco Systems, Inc.**
Tiffany Bogantz
 - Crowe Horwath, LLP**
Andrew Buelow
 - Harris Corporation**
Christopher Powers
 - Ernest William Leggett, Jr. Scholarship**
Joshua Glick
Michelle Rush
David Albert
Carrie Scono
 - Matt J. Desch & Ann M. Murphy Award**
Albert Kyle
Nathaniel Dikeman
 - The O’Connell Family Award**
Jay Hines
 - Steve R. and Sarah O’Donnell Computer and Information Science Fund**
Evan deLaubenfels
Simeon Georgiev
Richard Hutcheson
Kevin Landers
Ryan McGowan
 - Raytheon Corporation**
Brad Hartshorn
Jeremy LeDonne
 - CSE Undergraduate Scholarship**
Joseph Pedicini
Anthony Zuccarelli
 - Department Founders Scholarship**
Rachel McIlrath

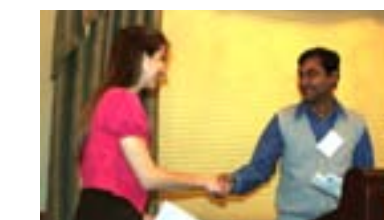
- Department Awards**
- Faculty Teaching Award**
Wayne Heym
Raphael Wenger
 - B. Chandrasekaran & Sandra Mamrak Fellowship**
John Woodruff
 - Mike Liu Graduate Scholarship Fund**
Vignesh Trichy Ravi
Timothy Miller
 - Eleanor Quinlan Memorial Award**
Josh Eckroth
 - Service Award**
Neelam Soundarajan
Nikola (Nikki) Strader
David Kneisly
 - Undergraduate Research Award**
Chirantan Eckbote



A group of attendees smiling for the camera.



Zachary Boerger and Clint Foulk



Rachel McIlrath and Tamal Dey



Tiffany Bogantz and Merv Mueller



John Woodruff and Leon Wang

Cornell Emeritus Professor Makes Continuous Contributions to A CSE Graduate Scholarship Fund



(From left to right) Mike and Lily Liu & Bung-Fung and H.C. Torng

The Mike Liu Graduate Scholarship Fund was established in November 2008 to celebrate Professor Liu's 40 year outstanding career in our department at Ohio State. Most donors to the fund are Professor Liu's former students, Colleagues and family members. However, a unique and continuous donor to this fund is Professor Liu's old friend, Professor H. C. Torng. Torng is an emeritus professor of electrical and computer engineering at Cornell University. This Graduate Scholarship has awarded 6 excellent Ph.D. students since 2009. Professor Torng retired from Cornell in 1999, and moved to California with his wife in 2000. The department is grateful to Professor Torng's continuous contribution to this graduate scholarship fund, and would like to acknowledge him by presenting a story of his technical innovation in the Buckeye Blog.

Instruction-level parallelism (ILP) is a standard processor design concept today we study in computer

architecture classes. ILP can best utilize the opportunities of executing instructions without dependencies concurrently, which is also called out-of-order execution. With ILP, the execution speed is significantly raised because it avoids the CPU to stall while waiting for fetching data from cache or memory. ILP is considered as a technological innovation milestone for processor design in 1980s. However, the logic complexity of out-of-order designs was a main barrier to turn this concept into a reality in mainstream processor design.

Professor Torng is best known for his pioneer work in the design and implementation of ILP in hardware. As early as in 1982, Professor developed an out of order hardware device, where instructions without dependencies are determined for concurrent execution, significantly reducing program execution times. In 1989, a US patent of this invention called "Instruction issuing mechanism for processors with multiple functional units" was granted to Cornell University and Professor Torng.

Professor Torng's invention has made a huge impact in processor chip industries. Intel Corporation adopted this hardware design in their Pentium II and Pentium Pro processors by licensing the patent. His invention has also been adopted by several other major CPU chip vendors, including HP. In December 1997, Intel hosted an official ceremony on Cornell campus to recognize Professor Torng "for his contributions to the state-of-the-art high speed instruction decoding and execution." Professor Torng was also named as the first Intel Academic Research Fellow in the ceremony. Professor Torng's inspiring story shows how research in academia makes a critical impact on products, and how updated technology can benefit so many people.

Homecoming Lecture Series

The CSE Department would like to thank these OSU alumni who participated in our department's 2011 - 2012 Homecoming Seminars.

Bryan Pardo, MS '93
(PhD '05 University of Michigan)
Associate Professor,
Northwestern University
Audio Production Interfaces that Enhance Musical Creativity

Min-Te (Peter) Sun, PhD '02
Associate Professor, Computer Science & Information Engineering, National Central University, Taiwan
Dynamic Bit Encoding for Privacy Protection Against Correlation Attacks in RFID Backward Channel

Jun (Jim) Xu, PhD '00
Professor, Georgia Institute of Technology
Worst-Case Large Deviation, Theory and Applications

Doug Roble, PhD '92
Creative Director of Software, Digital Domain
VFX Case Studies: 2012, Benjamin Button, Tron, Real Steal Behind the Scenes From a Software & Math Perspective

Many Thanks to Our Alumni and Friends!

We appreciate the following alumni, faculty, staff and friends who directed their Ohio State gifts to the Computer Science and Engineering Department. Listed below are our benefactors over the past 6 months. These donations are making a difference. Private support can help us to attract outstanding students and promising young faculty. We have used gift dollars to improve research and teaching labs, as well.

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Matthew Desch
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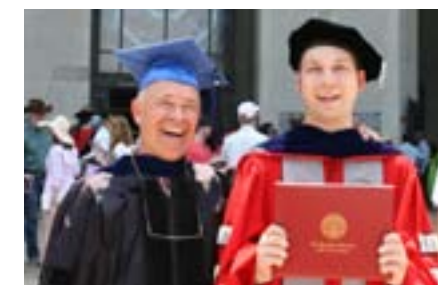
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Telcordia Technologies
The Torng-Lee Family Fund

You may direct your CSE giving to specific uses or specific research online:

www.cse.ohio-state.edu/giving or by mail with the attached envelope. For more information about various means of giving, contact: Xiaodong Zhang, Professor and Chair at (614) 292-2770 or zhang@cse.ohio-state.edu.

Celebrating our Graduates



From left to right, Mark Khoury (left), Bruce Weide and Derek Bronish (middle), and Venu Satuluri (right).



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Phone: 614-292-5813 fax: 614-292-2911

Congratulations to CSE Autumn and Spring Quarter Graduates!

The Department wishes you the best of luck in your future endeavors.

Bachelor's CSI

Parik Arulalan
Allen Aston
Jonathan Barker
Alexander Bartlow
Scott Bennington
Joel Burget
Jawad Butt
Matthew Caimi
Jonathan Dailey
David Dehne
Anthony Depassio
Benjamin Doughtry
Matthew Eberts
Chirantan Ekbote
Moustafa Eid
Marius Fekete
Robert Ferguson
Justin Frye
Kathleen Gannon
Samuel Glockner
Andrew Griffin
Andrew Groot
Tyler Hess
Timothy James
Martin Keegan
Miguel Ibarra
David Lashock, Jr.
Kai Li
Jenna McAuley
Allison Mitsui
Christopher Myers

Sandhyarani Natarajan
Miles Oldenburg
Kenneth Pascoe
Joseph Pompeani
Steven Reasor
Brett Brett
Jeffrey Stuecher
Peter Tefft
Nicholas Tyo
Christopher Theobald
Michael Van Baalen
Guhan Venguswamy
Daniel Vogel
Benjamin Wilkins
Bai Nong Yuan

Bachelor's CSE

Anuj Agrawal
Abdulwahab Alkharashi
James Austrow
Travis Bagley
Andrew Balderas
Spencer Balogh
Ritu Biala
Zoe Blevins
Brian Block
Derek Boytim
Rachel Brickley
Ronak Buch

Alexander Bunch
Daniel Burnett
Erkan Cetinkaya
Brian Claus
Logan Coulson
Dillon Courts
Christopher Crawford
Grant Curell
Kevin Daines
James Devine
Charles Dickens
Michael Dickema
Jonathan Diekema
Andrew Edwards
Benjamin Elliot
Craig Farler
Daniel Fischer
Jerod Fritz
Stephen Glancy
Eric Gottschalk
Daniel Haaser
Michael Hall
Maxwell Hallum
Stephen Halter
Sean Hanrahan
Stephen Hanson
Christopher Hofer
Sandra Horwitz
Jessica Hummer
Xiaolong Jia
Amanda Kauppila

Rakaan Kayali
James Kendle
Yaman Khan
Marc Khoury
Abraham Kim
Ethan Klein
David Kronk
Michael Kusold
Jason Lee
Chao Lin
Thomas Loh
Nasser Lopez
Andrea Machemehl
Mohammad Mandourah
Christopher Mayer
Robert McCann
Jason Monroe
Sean Moreno
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Shane Myers
Nathan Newman
Natalie O'Connell
Mathew Olinger
Simone Perry
Zachary Quinn
Dorian Rahamin
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Daniel Saunders
Robert Schmidt
Michael Schoenberg
Mohammed Shareef

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Grant Siefker
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Marko Skugor
David Smelser
Malory Spicer
Alex Street
Matthew Stvartak
Timothy Suffel
Brian Swinehart
Preston Tamkin
Steven Tatz
Andrew Thayer
Mark Vlcek
Jeffrey Walsh
Jonathan Wilber
Jeffrey Wolfe
Naila Zaman
Jie Zhang
Adam Zink

Master's

Praseeda Badami
Subha Balaraman
Deepan Balasubramanian
Da Cai
Adam Champion
Abon Chaudhuri
Zhezhe Chen
Keith Chima

Jie Cui
Manojprasad
Dhanapalan
Vijay Dhanraj
Ruolin Duan
Eric Dye
Kemal Eren
Aravind Gopalakrishnan
Matthew Goyder
Kun Han
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Laura Housley
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thalingam
Ashish Singh
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Aditi Tagore
Shuai Tang
Jin Teng
Aishwarya Venkataraman
Min Wang
Chenjie Wei
Hans Winterhalter
Xiaojia Zhao
Da Zhang
Yuwen Zhuang

Doctorates

Matthew Boggus
Derek Bronish
William Hartmann
William Harvey
Ke Hu
Wei Jiang
Taewoo Kwon
Tantan Liu
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