

# NEW ARCHITECTURES

*alumni newsletter / SPRING 2009*

Parallel Computing from Supercomputers to PDAs

Sustainable Petaflop Computing and Beyond

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# NEW ARCHITECTURES

CS at Illinois is world renowned for the advances to new computing architectures made by our alumni, faculty, and students. From the world's first academic parallel computer (ILLIAC IV), to the world's first sustained petascale computer (Blue Waters, page 22), Illinois advances in new architectures have defined the computing landscape of today.

And Illinois continues to lead with discoveries in new computing models – like bringing supercomputing concepts to handheld devices (page 16), our pioneering work in cloud computing management and systems needs (page 20), or planning for computing beyond the petascale.

Preparing for the challenges in computing and information technology that lie ahead requires a coordinated and multi-faceted approach — from our faculty, our alumni, and our staff. At Illinois, a focus on collaborative approaches, holistic solutions, and adaptive thinking have been the hallmark of our strength.

With a new Advancement team, we are building new models for engagement with our alumni, students, and partners as well. Alumni programs, like the re-launched Engineer in Residence program, bring new and better opportunities to connect students and alumni. Corporate partnership programs, like the new CS-ECE Corporate Connection, introduce new models for collaborating with industry on research and recruitment. Expanded student programs, like a new mentorship program, help our students tap into a larger network of support. And our continuing outreach programs are helping to attract new populations to the field.

As alumni who are the leaders of transformation in the industry, your perspectives and inputs on new directions in engagement and education are important to us. We encourage you to share your thoughts by contacting us at [alumni@cs.illinois.edu](mailto:alumni@cs.illinois.edu), or through our Always Illinois, Facebook, or Twitter platforms.



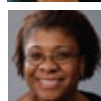
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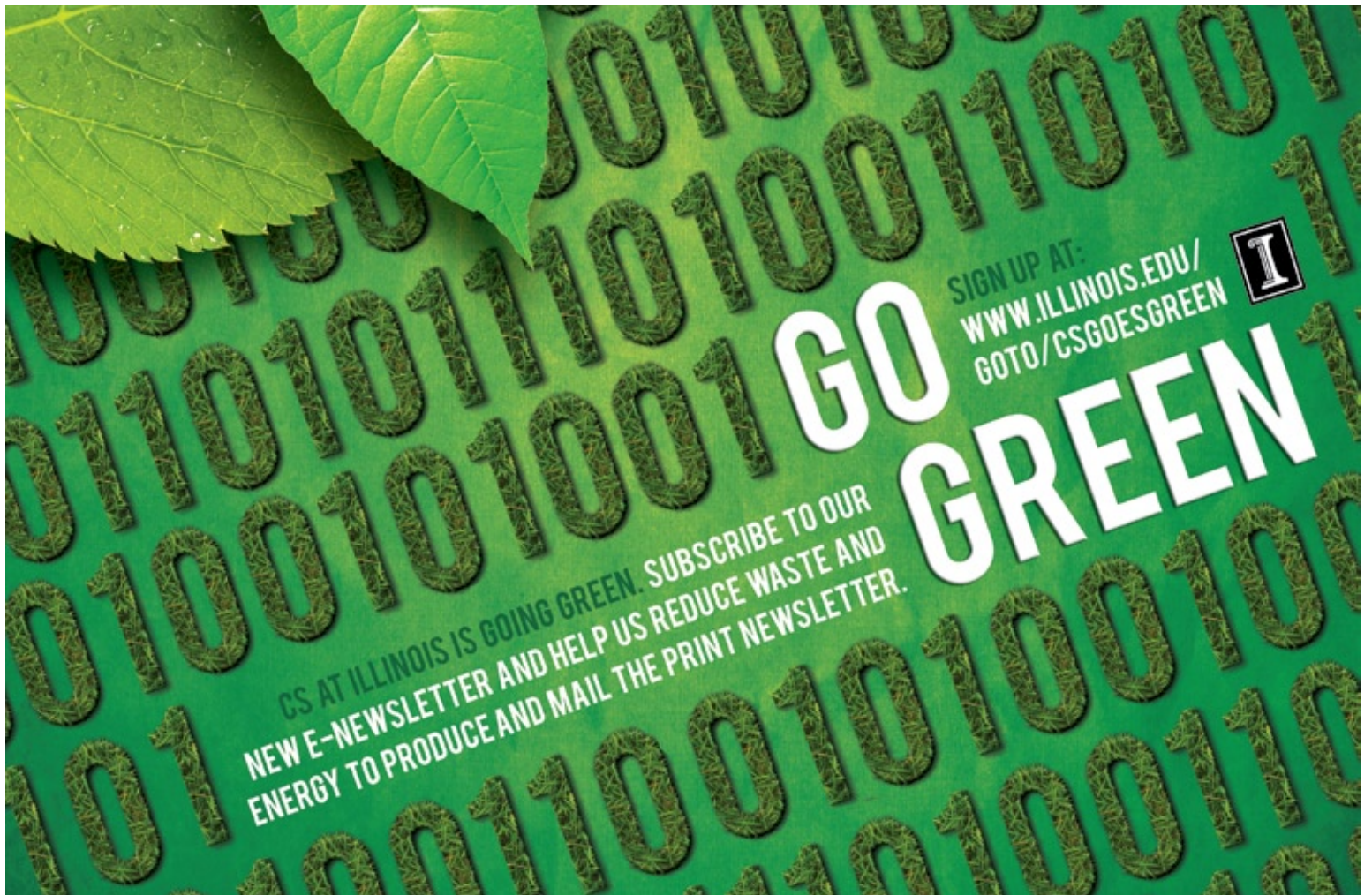
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Spring 2009 at Thomas M. Siebel Center for Computer Science

PHOTO / KURT BIELEMA



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# SLAYIN

## Illinois Computer Science Students to Compete in ACM World Finals

# SEVEN

Once again the University of Illinois at Urbana-Champaign has a team of three students competing in the world finals of the ACM International Collegiate Programming Competition —this is the sixth time in seven years. The Illinois team will test its skills against 100 teams of the most talented and creative information technology (IT) students from around the world in what is known as the “Battle of the Brains” on April 18–22, 2009 in Stockholm, Sweden.



The Illinois ACM-ICPC world qualifying team (from left to right): CS sophomore Pichayoot Ouppaphan, CS PhD students Yintao Yu and Mianwei Zhou.

The Illinois team includes computer science PhD students Yintao Yu and Mianwei Zhou, and sophomore Pichayoot Ouppaphan. Ouppaphan was a member of last year’s world qualifying team. The team is coached by mathematics graduate student Jesse Beder, a member of CS’s 2007 qualifying team. The team is led by computer science lecturer Dr. Marsha Woodbury.

This year’s Regional Contest was a nail-biter. Due to an erroneous data set affecting the judge’s scoring on one problem, this year’s team was forced to wait in agony to see if they advanced to the finals. Their appeal was upheld, and they emerged as the first place winner in the Regional competition, advancing them to the finals.

The ACM-ICPC World Finals brings qualifying teams from around the world together to solve eight to ten highly-complex computer programming problems, modeled after real-world business challenges. The problems are designed to test students’ knowledge, endurance, and business acumen.

### *Do You Have What it Takes?*

The 2003 27th Annual ACM International Collegiate Programming Contest World Finals sponsored by IBM, Problem E Covering Whole Holes:

- ❓ **Can you cover a round hole with a square cover?**
- A. You can, as long as the square cover is big enough. It obviously will not be an exact fit, but it is still possible to cover the hole completely.**

The Association of Cover Manufacturers (ACM) is a group of companies that produce covers for all kinds of holes — manholes, holes on streets, wells, ditches, cave entrances, holes in backyards dug by dogs to bury bones, to name only a few. ACM wants a program that determines whether a given cover can be used to completely cover a specified hole. At this time, they are interested only in covers and holes that are rectangular polygons (that is, polygons with interior angles of only 90 or 270 degrees). Moreover, both cover and hole are aligned along the same coordinate axes, and are not supposed to be rotated against each other — just translated relative to each other.

#### **Input**

The input consists of several descriptions of covers and holes. The first line of each description contains two integers  $h$  and  $c$  ( $4 \leq h \leq 50$  and  $4 \leq c \leq 50$ ), the number of points of the polygon describing the hole and the cover respectively.

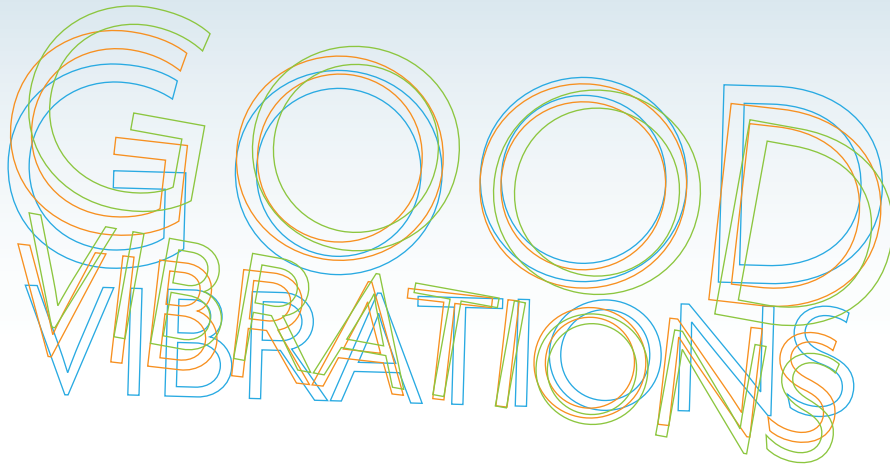
Each of the following  $h$  lines contains two integers  $x$  and  $y$ , which are the vertices of the hole’s polygon in the order they would be visited in a trip around the polygon.

The next  $c$  lines give a corresponding description of the cover. Both polygons are rectangular, and the sides of the polygons are aligned with the coordinate axes. The polygons have positive area and do not intersect themselves.

The last description is followed by a line containing two zeros.

#### **Output**

For each problem description, print its number in the sequence of descriptions. If the hole can be completely covered by moving the cover (without rotating it), print “Yes” otherwise print “No”. Recall that the cover may extend beyond the boundaries of the hole as long as no part of the hole is uncovered.



## Students Develop Sensor Network to Study Structural Health of Bridge

Computer science students working with Professor Gul Agha are working with students and faculty in Civil & Environmental Engineering to study a new approach to civil infrastructure monitoring.

The goal of the project is to develop scalable and robust algorithms for structural health monitoring (SHM) over a wireless smart sensor network. The ability to continuously monitor the integrity of civil infrastructure in real time could lead to a reduction in maintenance and inspection costs, while providing increased safety to the public.

According to the research team, the work is of particular importance because limited resources on sensor nodes preclude the direct application of traditional monitoring strategies in smart sensor networks. The group's approach uses concurrent and distributed real-time processing to make dense arrays of low-cost wireless sensors a viable and more effective approach to the SHM problem.

PhD student Kirill Mechitov has been working on the wireless sensor network that supports the research for several years. Using the Intel Imote2 sensor platform, Mechitov and his colleagues have developed a sensing platform that not only is more effective at detecting and processing vibrations of the structure, but also provides a low cost and robust framework for future SHM application development.

Already, the project has released an open source toolkit containing a library of services for, and examples of, SHM applications. The group is now testing their system at full-scale, using the wireless sensor network they developed in the lab to monitor the state of a local pedestrian bridge.

If the full-scale test is successful, the group will have developed a first of its kind autonomous sensor network system for monitoring civil infrastructure, and will bring us one step closer to a safer, lower cost mechanism to keep tabs on the overall health of the nation's estimated \$20 trillion civil infrastructure.

## PhD Student Wins Award at Supercomputing 08

University of Illinois Ph.D. candidate, Abhinav Sudarshan Bhatele received an award in the ACM Graduate Student Poster Competition at the Supercomputing Conference (SC08, [sc08.supercomputing.org/](http://sc08.supercomputing.org/)) in Austin, Texas. The poster was titled "Effects of Contention on Message Latencies in Large Supercomputers," and was awarded third place. The poster competition at SC08 was organized by ACM as a part of the Student Research Competition sponsored by Microsoft. As a finalist, Bhatele's poster will also be considered during the ACM Student Research Competition to be held in Spring 2009.



SC08 is an international conference for high performance computing, networking, storage and analysis sponsored by the Association for Computing Machinery (ACM) and the IEEE Computer Society Technical Committee on Scalable Computing and the IEEE Computer Society Technical Committee on Computer Architecture.

## Engineering Open House March 13th–14th, 2009

A sample of some of the CS projects on display at this year's Engineering Open House:

### **SigBot: Swarming Cars**

A swarm of four independently thinking cars! As a mass they can follow a moving target, very similar to a school of fish or a swarm of hornets.

### **SigGraph: Moonbeam**

This 3D-animated short film follows our characters through the Solar System in a showcase of modern animation and other computer graphics techniques. The project sums up 7 months of effort from a mixed group of programmers, artists, and musicians in a collaboration characteristic of the film industry. Watch Moonbeam on the CS YouTube channel at [www.youtube.com/IllinoisCS](http://www.youtube.com/IllinoisCS).

### **!BANG: !Multiplicity**

A network protocol and client which work together to distribute processing-intensive problems among multiple computers, speeding up the process considerably. Our implementation gives the ad-hoc flexibility and range that most common clusters lack.

### **SIGSoft: Crescendo**

Crescendo is a distributed democratic music library and player. It allows many people to share music and vote for what they'd like to hear. Crescendo is distributed, so it's possible to use more than one database of music and/or more than one player.

### **Gamebuilders: In Darkness**

Navigate the gathering blackness using all your senses and fight back against the undead menace in this 3D game! Gamebuilders and SIGGRAPH jointly present a new way to visualize three-dimensional games in this unique project.



## Undergraduate Students Get Hands-On with Research in New Lab

A new course is helping student leverage the unique research opportunities available in the department. The Undergraduate Research Lab, launched in Fall 2008, is helping prepare undergraduate students who are interested in graduate studies, as well as students who are seeking more exposure to cutting-edge and path-breaking research underway in computer science.

In the class, which is taught as an apprenticeship-style, hands-on laboratory, students learn to:

- » Pose testable research questions
- » Write competitive grant proposals
- » Create novel solutions using software and/or hardware
- » Draw valid scientific conclusions
- » Present and publish results, conclusions and other materials.

Students in the class are able to select from proposals submitted by faculty and grad students who are willing to serve as mentors to the undergraduates, or to pursue an independent project by finding a mentor within the department.

CS instructor Lawrence Angrave proposed and designed the new course as a way to encourage more students to involve themselves in research and to ensure that students interested in pursuing graduate studies are as well-prepared for that future as for a future in industry.

“The course provides students with a chance to apply principles learned in the classroom to original, complex problems,” said Angrave. “In addition to the hands-on skills cultivated, the students also obtain demonstrable, verifiable experience that appeals to graduate schools as well as potential employers.”

The course has had an additional benefit as well: fostering a greater sense of community between undergraduate and graduate students. Graduate students serving as mentors for the project in the first semester were as excited about the results as the undergraduate students who took the course. Research proposals, hard to come by the first semester, are now plentiful.

“The word is getting out, and graduate students are approaching us with proposals, instead of us having to seek them out,” said Brittany Smith, the PhD student who helps lead the course.

Undergraduate work in the class is presented as part of a new Undergraduate Research Symposium created by professor Vikram Adve and published in the new student-produced peer-reviewed Undergraduate Research Journal.

“Not only will the students have experience in proposing and conducting research, but also in presenting research to peers and faculty,” said Smith. The Symposium takes place in the Spring and includes poster sessions, presentations, and an award for best project.

# SPECIAL

**How did you become interested in the field of computer graphics and visual effects?**

Well, I've always loved movies, particularly Science Fiction, so I guess it was natural to be curious about how I could leverage my computer science degree into working on films. Fortunately the timing was good — computers were well-poised to become a dominant force in the moviemaking process.

**How has the field evolved since your 1st edition?**

The availability of lower-cost and higher-power computers means that we don't need to make nearly as many compromises. It used to be that we'd be very concerned about not using higher resolution or bit-depth if we could avoid it — nowadays it's much easier to throw around large files.

**What new challenges and opportunities lie ahead in the next 3–5 years?**

Generally we're at the point now where movie FX can do pretty much anything, so the real challenge is figuring out how to do it within a reasonable budget. Timeframes for postproduction on movies is getting shorter and shorter, so there's that to contend with as well.

**What new insights are available in the 2nd edition of the book?**

My original goal was to simply update the chapter that contains the case studies — to cover a number of more recent works and thus have the opportunity to discuss newer tools and techniques within the context of those case studies.

But as I was dealing with the acquisition of those various properties (a process that ultimately took well over a year, all told — traversing the bureaucracies of major movie studios is definitely not recommended for the impatient!) I found myself continually coming across areas that I felt could use a bit of an update in the main body of the text as well. Although the book was originally written in a fashion that I'd hoped would be reasonably obsolescence-proof (concentrating on core compositing concepts rather than their use within a specific application), technology doesn't stand still and there were a number of areas that I realized could use further elaboration and some updating.

The new subtitle — Techniques for Visual Effects, Animation and Motion Graphics — is of course partially an aid to help people find this book a little easier when they're searching for information on the web. But it also reflects the fact that this edition is even more focused on providing a set of practical, real-world concepts for working with images. Technology continues to advance but ultimately one needs to be able to apply that technology to solve a problem. And technology is ultimately (and even etymologically) all about knowledge of techniques.

Computer science alumnus Ron Brinkmann published the 2nd edition of his text on digital compositing for visual effects. His book, *The Art and Science of Digital Compositing, Second Edition: Techniques for Visual Effects, Animation and Motion Graphics*, provides a complete guide to the technical and artistic elements of this process and is the leading book in the field.

The book is available for purchase at Amazon.com.

**Why did you choose to focus your text on concepts versus tools?**

The best artists understand the concepts behind what they're doing. Knowing what buttons you can push isn't nearly as important as knowing why you'd push them. Plus it means that the book doesn't go out-of-date nearly as quickly.

**Was there anything about your experiences as a student in CS at Illinois that you feel particularly prepared you for the career path that you chose?**

It's always handy to have a strong background in a variety of CS-related disciplines. Equally important is the general engineering background I received there — physics, mechanical engineering, etc... they all end up getting used at one time or another.

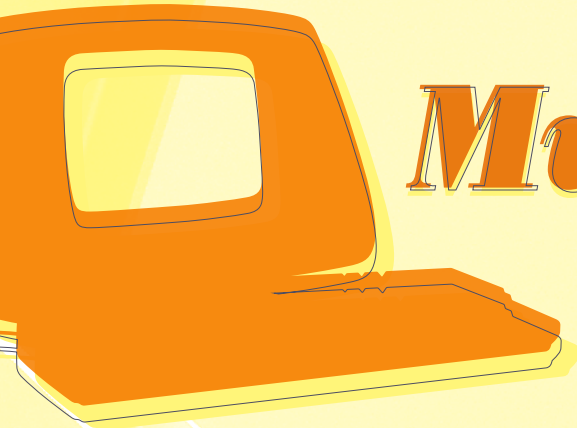
**Can you tell us a little about one of the most interesting or challenging visual effects projects you've worked on recently?**

I'm mostly working on the software side of things lately, and we're concentrating on some of the various challenges that working on Stereoscopic movies will bring. I'm doing a lot of stuff with a company called The Foundry and their compositing software 'Nuke'... and there's a lot of Stereo workflow stuff that we're focusing on.



Brinkmann received his BS in computer science from Illinois in 1986 and has been working in the field of computer graphics for over a decade. He has been involved with both hardware and software design, development, and use. He was one of the founding employees of Sony Pictures Imageworks. He later co-founded Nothing Real, a software company that produced the digital compositing application Shake. Nothing Real was acquired in 2002 by Apple. He is now working with The Foundry on their Nuke compositing application. His primary field of expertise is in visual effects for feature films, and his personal feature-film credits include: *Contact, The Ghost and the Darkness, James and the Giant Peach, Die Hard with a Vengeance, Speed, Hideaway, Tall Tale, Last Action Hero, and In the Line of Fire*. Brinkmann is a frequent speaker at seminars on the topics of visual effects, digital filmmaking and general technology.





# Music Machine

## Alumnus Releases CD of PLATO-Created Music

University of Illinois computer science alumnus Bill Schaeffer has released a new CD recording of music he composed and created on the PLATO system in the late 1970s and early 1980s.

The CD, *PLATO Music*, was created using the Gooch Synthetic Woodwind box and the Gooch Cybernetic Synthesizer invented by computer engineering alumnus Sherwin Gooch for the PLATO system.

“Somehow I arranged an interview with Sherwin,” says Schaeffer, “and he introduced me to the PLATO system. He gave me a sign-on, and I learned to use notes, term-talk, and all the rest of the system features. Eventually, I wrote some simple programs, but mostly I wrote music.”

“For many months, I would go to CERL, when I was done studying at night. I checked out a GSW box and tried little experiments. I felt like an explorer in an alien musical universe where no man had yet travelled... To me, this was the future of music.”

The Gooch Cybernetic Synthesizer used by Schaeffer in these recordings was a sixteen voice programmable waveform synthesizer. Each voice had a 256 point waveform and an ASR envelope. There was no filtering or post processing of the sound. Each song was composed by Schaeffer in a special music language code called OPAL and then compiled on PLATO for performance on the GCS.

## Alumnus Tom Siebel Named to Top “Green” Leader List

The Sunday Times has named University of Illinois computer science alumnus Thomas M. Siebel to its list of the most eco-friendly business magnates. Siebel was ranked #38.

Siebel, who has pledged \$100 million to establish the Siebel Fund for Excellence in Science and Engineering for the University of Illinois to use on research in areas such as alternative energy, was also recognized for his \$20 million green building prize. Siebel also donated \$32 million towards the construction of the Thomas M. Siebel Center for Computer Science in 2001.

To read the complete list of the world’s most eco-friendly investors, view: [www.bdcnetwork.com/articleXml/LN934262971.html](http://www.bdcnetwork.com/articleXml/LN934262971.html).

“I loved working on the GCS. I loved the opportunity to make music on PLATO. I am very happy that the music was able to be salvaged and digitally restored from old audio recordings,” said Schaeffer.

**“I never would have had this opportunity unless I was a student at University of Illinois.”**

The recordings are available at [www.cdbaby.com/all/was57](http://www.cdbaby.com/all/was57).

## Alumnus Named Director of IIIT Delhi

University of Illinois computer science alumnus Pankaj Jalote was recently named director of IIIT Delhi, a new center established to act as a global centre of excellence in Information Technology education, training and research. The center aims to encourage innovation and entrepreneurship in specified domain areas of IT.

Jalote received his PhD in computer science from the University of Illinois in 1985. He is the author of “CMM in Practice”; “Software Project Management in Practice”; the highly popular textbook “An Integrated Approach to Software Engineering”; and the graduate-level book “Fault Tolerance in Distributed Systems”. His research interest is in software engineering (software quality, software process improvement, software architecture analysis), and fault tolerant systems and reliability. He is a Fellow of the IEEE.

## CS PhD Alumnus Awarded SIGKDD Dissertation Award

CS alumnus Xiaoxin Yin has been awarded the SIGKDD Doctoral Dissertation award by the ACM Special Interest Group on Knowledge Discovery and Data Mining for his work while a PhD student at the University of Illinois. This annual award recognizes excellent research by doctoral candidates in the field of data mining and knowledge discovery.

Yin’s dissertation titled “Scalable Mining and Link Analysis Across Multiple Database Relations” describes his work to develop scalable and accurate approaches for data mining tasks such as classification, clustering, and duplicate detection. His approach utilizes novel techniques for virtually joining different relations, single-scan algorithms, and multi-resolutional data structures to dramatically reduce computational costs. His experiments have shown that the approaches he proposes in his thesis are not only highly efficient and scalable, but also achieve high accuracies in multi-relational data mining.



## **Forsyth and Han Receive IEEE Honors**

Two University of Illinois computer science faculty members have been selected as IEEE Fellows for the class of 2008. CS Professor David Forsyth was honored for his contributions to human motion computing and object recognition in computer vision, and CS Professor Jiawei Han was honored for his for contributions to data mining and knowledge discovery.

The grade of Fellow recognizes unusual distinction in the profession and is conferred by the IEEE Board of Directors upon those with an extraordinary record of accomplishments in any of the IEEE fields of interest. The accomplishments that are honored have contributed importantly to the advancement or application of engineering, science and technology, bringing the realization of significant value to society.

“This well warranted recognition of two of our senior faculty members by the one of the most prestigious professional societies in our field affirms the consistent record of excellence they have exhibited in their research, as well as the great respect they command among their peers,” said Michael Heath, interim head of department and Fulton Watson Copp Chair in computer science.

### **David Forsyth**

#### **Human Motion Computing & Object Recognition**

Professor Forsyth’s research interests lie in computer vision, artificial intelligence, and machine learning. He is particularly interested in problems relating to human motion computing and object recognition.

“Understanding what people are doing is one of the great unsolved problems of computer vision,” says Forsyth. In that area, Forsyth has recently been working on transfer learning, a body of procedures that allow information obtained learning one task to be transferred to another, related, task. This work has led to demonstrated methods to learn models of activity in one domain and recognize those activities in a different domain.

“Object recognition is a topic of ongoing interest to me. An attraction is that we don’t really know what it means to be doing object recognition, and the collective view of what the problem is has changed rather sharply on several occasions,” says Forsyth.

His recent work aims to train object recognizers and language parsers jointly to reveal how representations of the visual world line up with semantic interpretations of sentences. The effort combines both computer vision and natural language processing techniques to better understand the link between image and caption. Forsyth believes that this link provides the key to the next generation of object recognition systems.

### **Jiawei Han**

#### **Data Mining & Knowledge Discovery**

Professor Han has done groundbreaking work in the area of data mining, and is an expert in bio-data mining, data mining, data warehousing, database systems, spatiotemporal data mining, stream data mining, and Web mining.

“The rise of data mining reflects the imminent needs of today’s computerized, data-intensive society,” says Han. “Data mining is an exciting scientific discipline since it requires us to integrate and advance the knowledge produced in multiple disciplines, including database systems, statistics, machine learning, algorithms, information theory, spatial and multimedia databases, bioinformatics, Web technology, and high performance computing, among others.”

Han’s recent work includes the development of new techniques for information quality management and validation, information search and integration, and information discovery and analysis. He and his research team are also investigating new data mining techniques for analyzing flight safety data. The project aims to find computing methods to better understand anomalous flight events and improve airline safety. To reach this goal, the team will employ data mining and contextual text mining techniques, among others, to classify, cluster, and build links between data elements.

## Professor William Gropp has been named the 2008 winner of the IEEE Computer Society's Sidney Fernbach Award.



The Sidney Fernbach Memorial Award honors innovative uses of high performance computing in problem solving. It acknowledges outstanding contributions in developing numerical algorithms and mathematical software that are important for computational modeling and simulation, or for using high-performance computers to solve large computational problems.

Gropp played a major role in creating the MPI, the standard interprocessor

communication interface for large-scale parallel computers. Gropp is also co-author of MPICH, one of the most influential MPI implementations to date, and co-wrote two books on MPI: *Using MPI* and *Using MPI2*. He also co-authored the Portable Extensible Toolkit for Scientific Computation (PETSc), one of the leading packages for scientific computing on highly parallel computers.

Among his other accomplishments, Gropp developed adaptive mesh refinement and domain decomposition methods with a focus on scalable parallel algorithms, and discussed these algorithms and their application in *Parallel Multilevel Methods for Elliptic Partial Differential Equations*.

## Gropp takes key role with Institute for Advanced Computing Applications and Technologies

William Gropp, the Paul and Cynthia Saylor Professor of Computer Science, has been appointed the new deputy director for research for the University's Institute for Advanced Computing Applications and Technologies (IACAT).

"Bill is an extraordinary scientist with a deep knowledge of computing technology. More important, he has a track record of working with researchers who are seeking to use computing to tackle the most pressing issues in their disciplines," says IACAT Director Thom Dunning, who also leads the National Center for Supercomputing Applications (NCSA). "His energy and leadership experience will be great assets in advancing the Institute's mission to transfer computer science and engineering innovation to a broad range of disciplines."

"IACAT's three research themes, embracing advanced information systems, computing and creativity, and petascale computing, are an example of the tremendous strength of Illinois in all areas of advanced computing," Gropp says. "I am excited by this opportunity to take part in building on these strengths to make Illinois a leader in advanced computing."

Gropp is an ACM Fellow and a Gordon Bell Award winner. His research interests are in high-performance scientific computing, with particular emphasis on parallel computing, and he is a co-principal investigator on the Blue Waters project to build the first sustained-petascale resource for open scientific computing.

## Sarita Adve Honored for Work on Memory Consistency Models

Computer science professor Sarita Adve has been honored with the Maurice Wilkes Award for her work on memory consistency models. The award is given annually by the ACM special interest group SIGARCH to honor outstanding contributions in the field of computer architecture by a researcher in the first 20 years of their career.

The memory consistency model lies at the heart of the semantics of a threaded parallel program. It defines what values a memory read should return and affects the programmability and performance of a parallel system. It has been one of the most challenging areas in concurrent hardware and software specification, with a plethora of incompatible and ambiguous models defined by different software systems and hardware vendors.



Adve's work over almost 20 years has provided the foundation for a recent convergence in this area — finally mainstream languages have embraced a largely common model and hardware vendors have announced specifications compatible with the language models. Adve's approach drove this convergence by addressing both programmability and performance together.

"Sarita's early work departed from the prevalent hardware-centric view

of consistency to a combined hardware/software view," said Marc Snir, director of the Universal Parallel Computer Research Center and Faiman Muroga professor of computer science at the University of Illinois. "She observed that for common, well-synchronized programs — which she formalized as data-race-free — we can provide both programmability of sequential consistency and high performance."

This observation ultimately led to a comprehensive framework to specify models as "sequential consistency for data-race-free programs" and a formalization of the optimizations the models allowed. This work forms the foundation for the Java and C++ memory consistency models, which she recently co-developed.

Adve is currently working to develop a comprehensive concurrent hardware/software interface to achieve the promise of ubiquitous parallelism as part of the Universal Parallel Computing Research Center at the University of Illinois, where she serves as the director of research.

# TRANS-NATIONAL COLLABORATION

## Illinois Launches First International Research Center in Singapore

By Kim Gudeman, Coordinated Science Laboratory

The University of Illinois at Urbana-Champaign announced that it has opened its first research center outside the U.S. The Advanced Digital Sciences Centre (ADSC), is located at Singapore's Fusionopolis, in a landmark collaboration with the Asian nation's Agency for Science, Technology and Research (A\*STAR).

"A world-class university should be open and engaged with the world," explained Illinois Chancellor Richard Herman. "Our research centre at Singapore will allow us to deliver University of Illinois education and degrees to a whole new contingent of students.

"We live in very exciting times, with unprecedented opportunities for new partnerships among government, academia and industry," he added. "Singapore, with its proactive government, modern infrastructure, investment in research and higher education, and a talented and diverse population is the perfect nation to enter into such a partnership. This Illinois-Singapore collaboration is a bold commitment to building a better future, and is most striking especially at a time when the current global financial crisis might cause others to retreat or scale back their intentions."

ADSC is an extension of Illinois' top-ranked computer engineering, computer science and supercomputing application programs that are responsible for such innovations as Mosaic, the web browser credited with popularizing the World Wide Web, and many famous alumni including YouTube co-founders Jawed Karim and Steve Chen; Microsoft's Chief Software Architect Ray Ozzie, who also created Lotus Notes; Max Levchin, co-founder and CTO for PayPal; Tom Siebel, founder of Siebel Systems (now Oracle's Siebel CRM, the premier customer relationship software); and Jerry Sanders, co-founder and long-time CEO of semi-conductor manufacturer Advanced Micro Devices.

ADSC builds upon the multidisciplinary excellence of the university's Coordinated Science Laboratory and Information Trust Institute, and top faculty from the computer science and electrical and computer engineering departments.

Nineteen full-time and visiting Illinois' faculty will staff the center. They include the world-renowned researchers in information technology Benjamin Wah, the center's first director in Singapore, and professors Ravi Iyer, and William Sanders. Forty A\*STAR Ph.D. scholars are expected to be trained at ADSC.

Twenty-five post-doctoral students will be based at ADSC, and 40 Illinois graduate students will be attached to the center for part of their PhD projects. In addition, the program is expected to nurture research collaborations between Illinois and A\*STAR researchers.

In mid-February, about 150 researchers from Illinois, A\*STAR, universities and industry attended a two-day workshop to encourage exchange of ideas and research collaborations in digital sciences.



The ADSC is located at Fusionopolis in Singapore.



A\*STAR Chairman Lim Chuan Poh and Chancellor Richard Herman at a ceremony for the opening of the new center.

### The Human Sixth Sense Program

The Advanced Digital Sciences Center's showcase project will be the Human Sixth Sense Program (HSSP). HSSP will develop information technology infrastructure and human-machine interfaces that will enable humans to interact naturally with the digital world, giving them the information they want, when, where and how they need it.

The projects seeks to overcome existing limitations of information access across different modalities and devices. Instead, researchers at ADSC aim to provide computers with a "sixth sense", enabling computers to provide users only the information relevant to them, delivered in a high-resolution, multimedia format on any device, anytime and anywhere, and across a secure setting.

#### Applications of HSSP

- » Ability to send timely information directly to the mobile devices of fire fighters and first responders, such as escape routes derived by "sixth sense" from analyzing the existing blueprints and infrastructure.
- » Providing doctors across continents simultaneous access to vast amounts of multimedia and textual medical database to treat diseases
- » Providing investors timely access to financial information to help them make prime investment decisions.

# BEYOND



## Teaching Computers to Understand Images from Sentences

Researchers Tackling Grand Challenge Linking Images & Text

By Jennifer LaMontagne

A team of computer scientists at the University of Illinois is taking a new approach to a core problem in computer vision. Professors David Forsyth and Julia Hockenmaier are combining their expertise in computer vision and natural language processing to use knowledge contained in image captions to create richer object recognition systems. Their work aims to train object recognizers and language parsers jointly to reveal how representations of the visual world line up with semantic interpretations of sentences.

“The last ten years have seen astonishing advances in our understanding of methods to build object detectors,” says Forsyth. “However, very little is known about what to say about an image. We’re not good at describing the attributes of objects — are they furry, or wooden, or metal — or at identifying relations between objects — on top of, next to, bigger than, or similar to.”

However, knowledge about image attributes and relations can often easily be discovered in image captions.

“Captions seem to be quite special,” says Forsyth. “People talk about pictures differently than they might talk about other things. They use special words to describe what the image depicts.”

“People use object-oriented words [to describe an image],” continues Hockenmaier. “But it’s not a word salad. It’s also about grammar.”

Of particular importance is the relationship that caption writers assume about the reader of the caption and the image — most captions assume that the reader is also looking at the image. It is therefore possible to resolve ambiguities in language by looking at the image it’s describing (think, “chasing a dog with a stick”), and to resolve questions of saliency, attribute, or relationship in an image by reading the words describing it (think, “this man died in a house” versus “a man died in this house”).



Forsyth and Hockenmaier believe that within this link between image and caption lies the key to the next generation of object recognition systems.

The challenge is twofold. Advances must be made in building a semantic parser that is able to expose an appropriate linguistically expressive grammar structure to discover the knowledge embedded in captions. The second challenge is in building an image understanding system that can recover salient entities depicted in an image together with their attributes and relations.

In their lab, captioned images will be used to train both parser and object recognizer. The object recognizer will be able to train the parser with information like who has the stick in an image captioned “chasing a dog with a stick”; for instance, and can train the parser to learn what is in an image and what is not. The parser will be used to train the object recognizer with information like what is blue, what is worth mentioning and what is not, and what is likely to be in the picture.

The work has significant practical implications in a variety of areas. From new applications like automatic captioning systems that could enable better search and organization of visual artifacts to efficient management of surveillance data, this research will open up key directions in computer vision and natural language processing.

“This really gets at some profound questions about perception,” comments Forsyth. “The world outside has a meaning, and how people come to understand that meaning is one of the most exciting mysteries in science.”

## WRITTEN BY ROBOTS

### Building an Automated Writing Assistant

By Jennifer LaMontagne



“I think a peace of cake would make me fill better.” Who hasn’t lamented the limited capabilities of today’s spell checkers — unable to check for context or most grammatical mistakes, or to offer suggestions for alternative word usage or even placing adjectives and adverbs?

With the ubiquity of computing devices making authoring simple — think blogs, wikis, and Twitter — document production is at a higher rate than ever. Document quality however has not kept pace with document quantity, due to the speed with which the written word can now be distributed and to the wide audience of non-native English speakers who are now authoring in English in order to communicate on the web.

Yet today, the only tool available to assist is essentially a computerized version of that reference tool used for decades — the dictionary. Current authoring platforms offer minimal guidance with regard to the “correctness” of a document — context sensitive mistakes, word selection and usage, sentence structure and readability, use of connectives, etc.

Enter University of Illinois computer science professor Dan Roth. He and his team are currently working on a novel Automated Writing Assistant tool that aims to incorporate context-sensitive technologies at multiple levels of writing. His work was recently selected by the College of Engineering to receive funding from the Grainger Program in Emerging Technologies.

“We suggest that current natural language processing technologies allow us to develop a tool that can actually help writers — native speakers of English, non-native speakers, as well as a considerable population of writers with disabilities (e.g., dyslexics) — to produce better, more professional looking English documents, email messages and reports,” says Roth.

The tool will rely on natural language processing techniques to identify and correct grammatical mistakes and context sensitive word usage mistakes (it’s vs. its, peace vs. piece), identify missing or superfluous words, identify word usage errors, guide writers to select the right prepositions and determiners. In addition, Roth plans to support enriching the text by proposing to the writer the use of adjectives and adverbs.

# MINING THE FRIENDLY SKIES?

Aided by a \$1.1 million grant from NASA, computer science researchers at the University of Illinois are investigating new data mining techniques for analyzing flight safety data. The project aims to find computing methods to better understand anomalous flight events and improve airline safety.

## Researchers Develop Techniques to Analyze Flight Safety Data

By Jennifer LaMontagne and Jenny Applequist, Information Trust Institute

A new research project in data mining at Illinois focuses on more than three decades of what are called “anomalous aviation events,” or incidents that deviated from normal flight operations. The variety of such events — airspace violations, in-flight encounters with birds, and miscommunication between pilots and flight controllers, to name a few — the complexity of the aviation systems involved, the heterogeneity of data sources, and the variety of people who report such events all contribute to the difficulty of discovering trends and correlations in the data.

Computer science professor and Information Trust Institute (ITI) member Jiawei Han is leading the effort to develop new tools and algorithms to make sense of this jumble of information. The research team also includes Illinois CS professor Cheng Zhai, an expert in information retrieval, natural language processing, machine learning, and text mining, and researchers from UT-Dallas and Boeing Corporation.

“Since the root causes of such events can be complicated and the reporters’ opinions may vary or are inconsistent, we believe that an effective way to help analysts is to provide a software environment that can be used to interactively mine the reports to obtain interesting patterns,” says Han. “We want to create a system that enables users to flexibly navigate through the event and pattern space to understand the linkages among different events and patterns.”

Ultimately, says Han, the team wants to enable analysts to go beyond the raw text information in the reports to interact more directly with the knowledge buried in the reports. To reach this goal, the team will employ data mining and contextual text mining techniques, among others, to classify, cluster, and build links between data elements.

Researchers hope that their system enables another crucial task beyond the detection of anomalous events: the prevention of similar incidents in the future.

The new collaboration emerged in part of a project Han leads in ITI’s Boeing Trusted Software Center, addressing online mining of anomalous moving objects for security protection.



# Talking in Color

## Prof. Karahalios Tests Speech Visualization for Autistic Children

From Reuters, March 31, 2009.

[Karahalios'] tool, called a Conversation Clock, visualizes conversations on a computer terminal as vibrant colors — red, yellow, blue, green — the image growing in size if the voice gets louder, overlapping another color as it interrupts or abruptly narrowing with silence.

Karahalios says her method provides feedback in real time and can act as a type of social mirror, allowing people to adjust their speech in the same way they adjust their appearance before a glass mirror.

“You look into a mirror and you change your dress, your expression, because you see exactly how it’s happening in real time,” she said.

The colors linger so people can see the progression of an entire conversation, not only the present moment.

Karahalios will begin work on a trial of the technology to see if children with Asperger’s Syndrome might be able to learn new conversational patterns of speech, and to help them overcome the monologuing or lecturing behaviors associated with the disorder.

Karahalios describes a test of a previous version of her Conversation Clock in which four people sat at a table, each fitted with a lapel microphone matched to a color and attached to a computer. The conversation clock charts a colorful, real-time record of their conversation that is projected on the table, instead of on a wall or a computer screen.

The “clock” shows the progress of the talk. Three times a second, a color bar pops up showing who was speaking. The louder the speech, the longer the bar. Interruptions are shown as overlapping color bars. Every minute, a new circle of bars is rendered in a visual record akin to the rings of tree trunk.

Karahalios found that once it was turned on, people tried to balance their conversation.

Prof. Karrie Karahalios has devised a way to digitize conversations and spit them back as images that let people “see” their own conversations on computer monitors. The computer program, which she calls a “conversation clock,” has been tested with low-functioning autistic children and in marriage counseling and is being prepared for use with Asperger’s Syndrome.

“Everyone sees the exact same thing and people almost felt like it had to be a balance of color,” Karahalios said. “I’m not saying that balanced conversation is good conversation. It’s fascinating how people behaved.”

Once she had established her techniques, Karahalios worked to apply them to children with autism.

Research has shown computers can teach in ways that reduce human-to-human interaction, which tends to be a source of anxiety to people with autism. That came into play in an experiment Karahalios did with some low-functioning autistic children, age 3 and 7, who did not talk.

The idea was to help children “vocalize,” using sounds that are the basis of speech instead of screams or grunts.

When a child watching the computer monitor vocalized, a cartoon character would spin, or a cone would erupt in fireworks. The longer the vocalization the greater the reaction: the cartoon character spun more quickly, or more fireworks appeared.

As for audio, the computer would give the child an “echo,” a short sound for a short sound, a longer one for a longer sound.

“We got him to say 10 words, which his mother had never gotten him to say,” said Joshua Hailpern, a doctoral candidate working with Karahalios and two other professors.

Karahalios hopes for the day her work can become widely available to help children and families, through iPhone programs and as toys for children. A toy for autistic children who have trouble working with doctors, or who are far away from specialized help, could give “rewards” to kids as they play with the toy and make sounds.

“We don’t want it to look like a small computer,” she said. “It needs to be inviting ... fun and engaging.”

# STARTUPS



Cazoodle provides software and internet services for Web search, integration, and mining, with a central objective to “deepen” search on the Web — to access the vast amount of data beyond the reach of current search engines. The company is co-founded by Prof. Kevin C. Chang and his research team, with the support of the University and technology transfer from the MetaQuerier research at Illinois.

Cazoodle’s innovative approach involves analyzing and learning both the navigational characteristics of an data site and the HTML content of its web pages to generate a specialized “intelligent crawler” for that site. The result is a customized “crawler” that retrieves information from all web sources and displays a comprehensive listing of source listings that match your specifications.

The technology can be applied to a variety of specialized domains; apartment listings, job listings, flight information, and other real estate listings are common examples of searches where users need access to both structured and unstructured data on the web.

[www.cazoodle.com](http://www.cazoodle.com)



Professor YY Zhou and 3 of her researchers — Zhenmin Li, Spiros Xanthos, and Qingbo Zhu — launched PatternInsight based on technologies they developed in their labs. PatternInsight brings powerful data mining technology to the advanced, real-time analysis of every type of system data—code, logs, scripts, and more. The company’s solutions help companies analyze system data at every stage of the lifecycle, and are changing how software-intensive products are developed, tested, and supported. Now shipping, Code Insight, a search and analysis suite for source code, helps development teams with the challenges of managing large code bases.

The company’s products fit a gaping industry need. Most current solutions rely on simple search to search and analyze system data. However, simple search isn’t good enough for many problems within the system lifecycle, like root cause analysis of system faults, or finding all functions in a code base that need refactoring. In situations like these, you don’t know exactly what you’re looking for, so you can’t just supply a keyword to match.

Effective analysis of system data requires a solution that can do fuzzy search, discover patterns in real-time, and scale to massive volumes of data. Pattern Insight’s products do just that and support advanced, real-time analysis of every type of system data.

[www.patterninsight.com](http://www.patterninsight.com)



Professor Cheng Zhai’s “real-time implicit personalization” technology, which improves relevancy by re-ranking search results “on the fly” based on a user model generated from real-time selections, was recently licensed by start-up Surf Canyon. The tool is a browser extension that personalizes search engine results as you search! Available for download as an add-on for Firefox and Internet Explorer (IE6 and IE7), the software figures out what you want and then automatically recommends relevant search results. So far, more than 500,000 people have used the technology to enhance their search.

[www.surfcanyon.com](http://www.surfcanyon.com)

## iVentures10

For the second year in a row, Illinois computer science students launched their start-up companies as part of a unique internship program called iVentures10. The program provides guidance, resources, and \$25k in funding to students with the next big idea for a web-based technology or service.

Companies launched by computer science students last year include:

- » Athena Advertising — Topic recognition for news and advertising targeting.
- » Socolio — Connecting your social life.
- » Fashion Latte — Machine vision for fashion.

## Illini Entrepreneurship Network

A new student group on campus is working to assist all Illinois students launch start-up companies. Working with the campus’ Academy for Entrepreneurial Leadership and the college’s Technology Entrepreneur Center, IEN offers seminars, workshops, brainstorming, and networking sessions, and also helps facilitate the 3 student start-up incubators on campus. More than 8 groups of computer science students are currently working on their start-ups through the group.



# IN MEMORIAM

## CS Student Corey Nielsen

By Jennifer LaMontagne

Computer science student Corey Nielsen died August 25, 2008 from complications due to paraplegia and diabetes.

Corey was a unique presence in the department, and those who had the pleasure of teaching him will remember him well for his active and curious mind. He was well-known for his engaging style in class and with fellow students and for his friendly and affable nature. It was not uncommon to see him sitting in the coffee shop with friends, poring over a homework assignment.

“Corey was always an active contributor in his classes, sharing his expertise with other students cheerfully and with a comfortable ease. His classmates clearly benefited from his openness and inquisitiveness,” said Cinda Heeren, lecturer in computer science.

“Corey was always fun, alive, alert, and caring. He knew the names of every member of our class,” said Marsha Woodbury, lecturer in computer science. “What I particularly enjoyed about Corey was how he inserted liveliness into each class. We cherish students who are smiling and giving like Corey was.”

Corey will be greatly missed by all of us in computer science. He had often said he was proud to be able to study computer science at Illinois. We are equally proud to have been able to call him one of our own.

Contributions in Corey’s memory may be made to the Three Fires Council of the Boy Scouts of America or to the LDS Humanitarian Relief Fund.

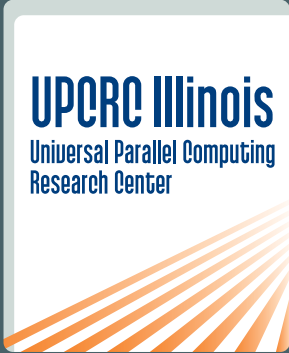


# FROM SUPERCOMPUTERS TO PDAs

## Illinois Researchers Bring Parallel Computing Concepts to the Mass Market

By Jennifer LaMontagne

Last spring, the University of Illinois at Urbana-Champaign launched a joint research endeavor with Microsoft Corporation and Intel Corporation that aims to enable commodity systems to make use of parallel computing techniques previously relegated to the realm of supercomputers. As a pioneer in parallel computing advances, Illinois is uniquely positioned to help usher in a new era of parallel computing for consumer systems that will enable drastically new applications for human-centric and environment-aware computing.



**UPCRC Illinois**  
Universal Parallel Computing  
Research Center

The 5-year, \$18 million Universal Parallel Computing Research Center at the University of Illinois brings together researchers in computer science and computer engineering to discover easy and accessible methods for enabling the multicore computing systems increasingly in use today to take better advantage of their processing capabilities.

“Multi- and many-core computing is becoming pervasive; client-focused mass market applications are now driving parallel programming,” said Marc Snir, professor of computer science and co-director of the center. “We face a new challenge: one that places emphasis on productivity over high performance; and one that addresses the needs of the broad community of application developers. In such an environment, parallel programming must be accessible to all programmers.”

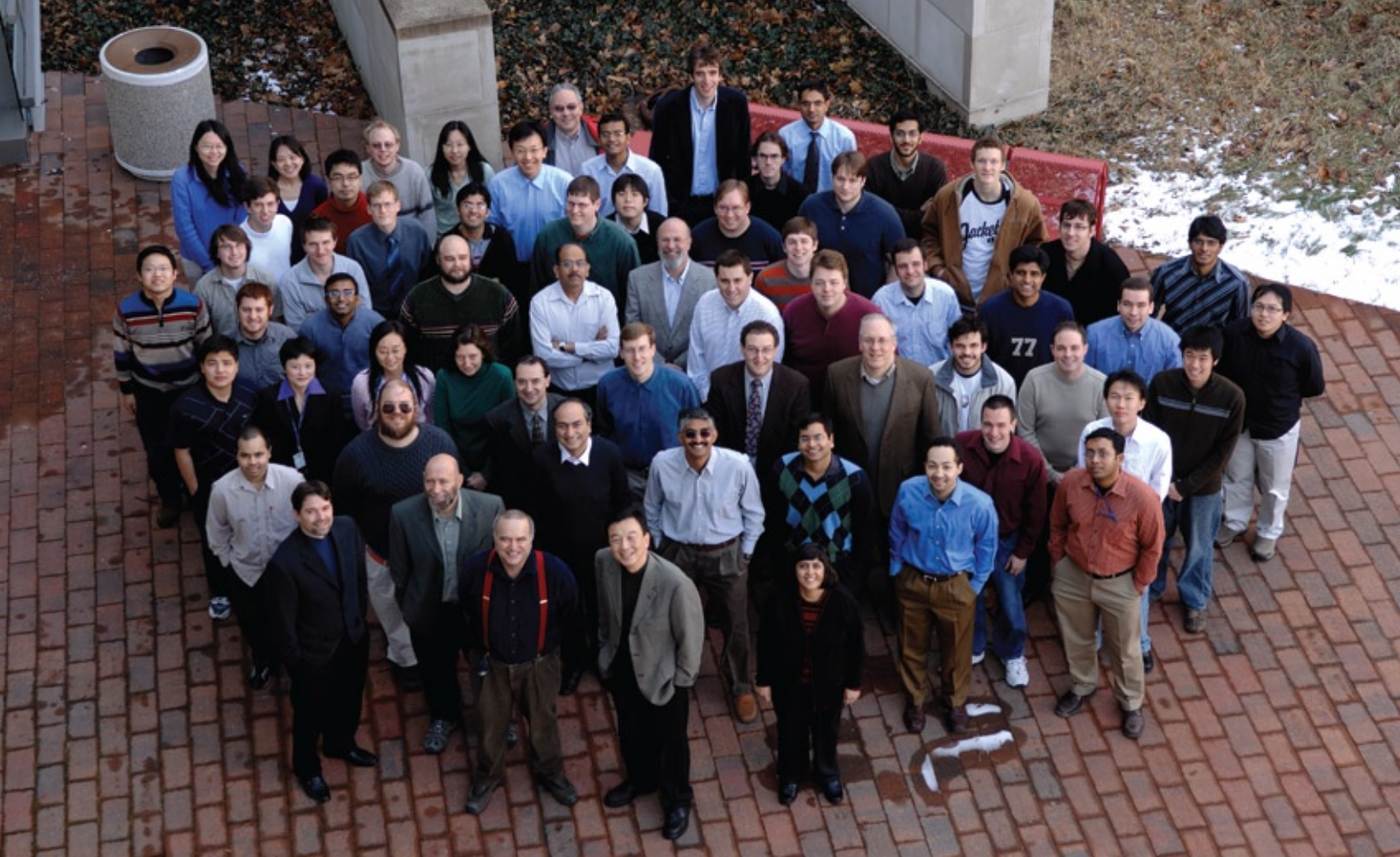
A central research thrust will be the development of new applications that aim to dramatically improve the quality of life for the end user, but are not feasible with the computing power available on today’s clients. For example, future systems should not only assist with computational tasks, but also enhance our ability to interact with each other and with our environment using natural communication and visual interfaces. The center’s research will be driven by and will eventually enable such applications.

“We believe that most parallel programmers should be able to use simple, intuitive ways of expressing parallelism,” said Wen-mei Hwu, professor of electrical and computer engineering and co-director of the center. “Future microprocessors will contain hundreds, and perhaps thousands of cores. While parallel languages must become simpler, hardware is becoming more complex. We will be researching ways to bridge this enlarging gap to enable client-focused applications of the future.”

The center’s research activities are founded on the premise that advances in multicore computing will require a coordinated, multi-disciplinary effort that encompasses all components of the multicore system. The center brings together 22 faculty members in computer science and computer engineering to focus on several areas of research, ranging from new applications for multicore processors to new languages, programming environments, and architectures.

“We have a new opportunity and a new challenge for parallel computing today,” said Sarita Adve, professor of computer science and director of research for the center. “The market is larger, so there is an opportunity to provide different programming solutions for different applications. The challenge is that these solutions must be supported by one, flexible hardware architecture and a few software system architectures. Our multi-disciplinary approach will be critical to provide this diversity for programmers and convergence for the system.”

The Universal Parallel Computing Research Center at the University of Illinois is one of two such centers funded by Microsoft and Intel. The other center will be located at the University of California Berkeley. This research alliance is the first joint industry and university research center of this magnitude in the United States focused on mainstream parallel computing. Twenty-five top tier institutions in the field of parallel computing research were evaluated for this program, with Illinois and UC Berkeley being selected to host.



The UPCRC Research Team.

Faculty and students in the departments of computer science and electrical and computer engineering contribute to UPCRC:

**Marc Snir**, *co-director*

**Wen-mei Hwu**, *co-director*

**Sarita Adve**, *director of research*

**Sanjay Patel**, *application coordinator*

**Vikram Adve**

**Gul Agha**

**Minh Do**

**Matthew Frank**

**Maria Garzaran**

**John Hart**

**Ralph Johnson**

**Laxmikant Kale**

**Rakesh Kumar**

**Darko Marinov**

**Klara Nahrstedt**

**David Padua**

**Madhu Parthasarathy**

**Grigore Rosu**

**Dan Roth**

**Josep Torrellas**

**YuanYuan Zhou**

**Craig Zilles**

## SUMMER SCHOOL 2009

UPCRC Illinois Summer Schools bring together researchers and developers interested in learning state-of-the-art, multicore programming and gaining hands-on experience with parallel programming environments.

**When:** June 22–26, 2009

**What:** Multicore Programming

**Where:** Thomas M. Siebel Center  
for Computer Science  
University of Illinois  
at Urbana-Champaign

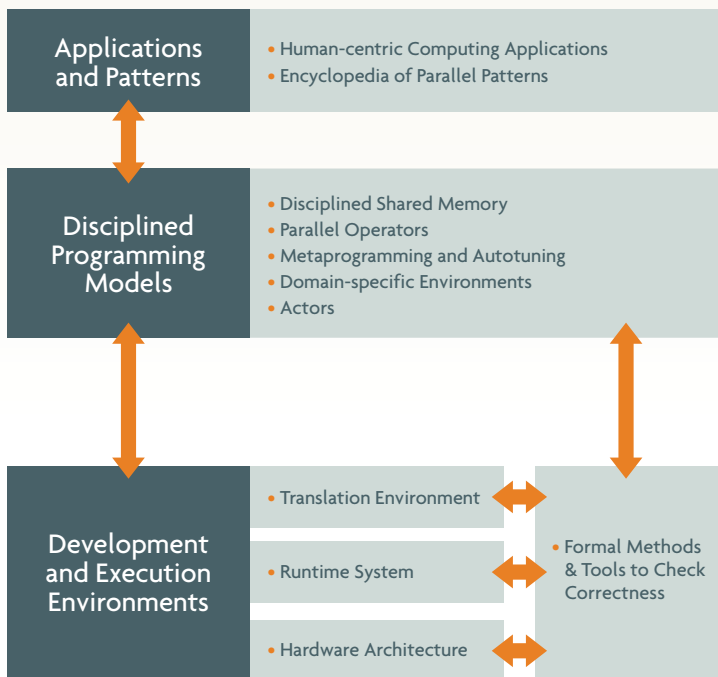
The 2009 UPCRC Illinois Summer School for Multicore Programming offers programmers with little or no exposure to parallelism an opportunity to learn about multicore programming. The program will provide a solid foundation in the fundamentals of multicore programming, offer hands-on experience with the use of multicore languages and libraries, and introduce emerging research topics. Upon completion, participants will be equipped to choose the best multicore programming model for current and future projects.

# UNIVERSITY OF ILLINOIS PARALLEL COMPUTING RESEARCH CENTER

By Cheri Helregel, Universal Parallel Computing Research Center, Computer Science

A human-centric future for consumer computing — where mobile devices, virtual environments, and anthropomorphic communication interfaces allow humans to seamlessly move between cyber- and physical-spaces — is possible with the power of multicore parallel computing. A major impediment to this vision is that parallel programming today is remarkably difficult and the domain of a few experts.

The UPCRC is taking a multi-disciplinary approach to addressing these challenges. Their agenda to bring parallel computing to mainstream consumer applications and make multicore parallel programming synonymous with programming includes work in three areas.



## Human-Centric Vision of Future Consumer Applications

Driving the UPCRC Illinois agenda is a human-centric vision of future consumer applications, backed up by research on application technologies to enable quantum-leaps in immersive visual realism, reliable natural-language processing, and robust telepresence. Investigating these applications reveals new parallel patterns and serves as a testbed for evaluating, refining, and ultimately proving our ideas on multicore programming.

## Focus on Disciplined Parallel Programming

Sequential languages have evolved to support well-structured programming, and provide safety and modularity. Mechanisms for parallel control, synchronization, and communication have not yet undergone a similar evolution. UPCRC Illinois takes the optimistic view that parallelism can be tamed for all to use by providing disciplined parallel programming models, supported by sophisticated development and execution environments. The UPCRC Illinois agenda includes bringing to parallel programming the analogs of the tenets underlying modern sequential programming such as safety, modularity, and separation of concerns.

## Multi-Front Attack on Multicore Programming

The center is taking an integrated broad-based attack on parallelism at all levels of the system stack from applications down to hardware, using every weapon in the arsenal to enable performance, scalability, and programmability. This includes investigating disciplined parallel languages, metaprogramming and autotuners, and domain-specific environments; developing a powerful translation environment to exploit information from multiple sources at different times in the life of a program; developing an adaptive runtime to handle heterogeneity and automate resource management; developing new hardware mechanisms to enhance performance, scalability and programmability; and rethinking the customary division of labor among the layers of the system stack. Refactoring tools will help move existing code to new environments and formal methods-based techniques and tools will help ensure correctness.

The complete UPCRC Agenda is available online at: [www.upcrc.illinois.edu/whitepaper.php](http://www.upcrc.illinois.edu/whitepaper.php)



# Need for Speed

Emerging Applications for Parallel Computing

A Parallel@Illinois Seminar Series

The University of Illinois at Urbana-Champaign launched a 13-week seminar series on emerging applications for parallel computing, bringing together hardware engineers with the software developers who require parallel processing to create faster and superior applications.

*The Need for Speed Series*, which began Jan. 28, will feature world-class application experts from industry and academia who will discuss how increased computing performance will revolutionize their fields.

Speakers such as Tim Sweeney, founder and president of Epic Games, Sam Blackman, CEO of Elemental Technologies, and Mark Johns, an Illinois alum and iPhone application developer, will help forecast breakthroughs enabled by the rapid advances in computing performance per dollar, performance per watt, or storage capacity provided by Moore's Law.

"Understanding computing from an applications perspective has become even more important as we cruise along the trend lines forecast by Moore's Law into the multi-core era," said Sanjay Patel, associate professor of electrical and computer engineering at Illinois. Patel is a co-organizer of the event with Illinois Professor and parallel computing pioneer Wen-mei Hwu.

"This seminar series will exhibit how parallel processing will enable us to continue building better imaging techniques for medical applications, more impressive cell phone software, and ultra-realistic video gaming capabilities, among other applications," he says.

## Illinois IMPACT Parallel computing is in our blood.



Illinois history in parallel computing stretches more than 40 years. From the first academic parallel supercomputer, the ILLIAC IV started in 1964, to today's work to install the first petascale computer, Blue Waters, Illinois has defined the landscape of parallel computing.

Today, parallel computing at Illinois spans mobile and desktop client computing, cloud computing, GPUs, and petascale supercomputing. The work includes long-term research, education, and one-of-a-kind testbed installation, including the world's largest academic supercomputer.

### Impact of Illinois on Parallel Computing Advances

**ILLIAC IV:** The ILLIAC IV, designed at the University of Illinois by Daniel Slotnick, was the world's first supercomputer and the first to use parallel computation. A key part of the ILLIAC IV design was its fairly high parallelism for that time. The machine worked on large data sets in what would later be known as SIMD processing. ILLIAC IV was for many years the most powerful machine in existence and is one of the most influential systems in the history of parallel computing. The parallel programming languages IVTRAN, TRANQUIL, and Glypnir were developed at Illinois for the ILLIAC IV.

**CEDAR:** This experimental shared-memory multiprocessor prototype was built by a team of Illinois researchers led by David Kuck, Edward Davidson, Duncan Lawrie, and Ahmed Sameh. The project made seminal contributions to parallel system design. CEDAR embodied advances in interconnection networks, multiprocessor memory hierarchies, control unit support of parallelism, optimizing compilers, and parallel algorithms and applications.

**Cedar Fortran:** David Padua developed this predecessor to OpenMP for the CEDAR multiprocessor.

**OpenMP:** Efforts led by David Kuck to consolidate parallel programming directives used by supercomputer vendors culminated in the design of OpenMP, the most widely used shared memory API.

**PATH Pascal:** Developed by Roy Campbell in 1977, an early language for expressing concurrency in a disciplined manner.

**Illinois Cache Coherence Protocol (MESI):** The Illinois protocol, developed by Janak Patel in 1983, became the IEEE MESI standard and is used today by virtually all cache coherent shared memory multi-processors.

**Autoparallelization:** David Kuck and his students pioneered techniques to translate conventional code into parallel code. Autoparallelization systems such as the Analyzer (ca. 1970), Paraphrase (ca. 1976), Paraphrase 2 (led by Constantine Polychronopolous, ca. 1988), and Polaris (led by David Padua, ca. 1992) were instrumental in the development of dependence analysis, vectorization, parallelization, and locality enhancement techniques which are incorporated today in all widely-used compilers.

**IMPACT:** Wen-Mei Hwu's "superblock" and "hyperblock" structures enable compilers to parallelize code across complex control structures. His work has become part of the technology base of new compilers in major corporations.

**MPI:** Co-developed by Marc Snir and Bill Gropp, MPI (Message Passing Interface) became the leading paradigm for distributed memory computing. ParaGraph: Michael Heath developed this graphical display tool for visualizing the behavior and performance of parallel systems that use MPI.

**Chare Kernel:** This message-driven parallel programming system developed by Laxmikant Kale is used for state-space search and other applications. It has been acknowledged as one of the influences on Intel's Thread Building Blocks (TBB).

**CHARM++ and AMPI:** CHARM++ is a parallel programming system developed by Laxmikant Kale that allows expression of parallel programs without reference to processors, and automates resource management. It has been used by several scalable parallel Computational Science and Engineering applications. 15% and 20% of the cycles in one year at NCSA and the Pittsburgh Supercomputing Center respectively ran applications (including NAMD) using Charm++. It also supports an Adaptive MPI implementation called AMPI. Charisma and MSA are new deterministic parallel languages developed by Kale that work with CHARM++'s automatic resource management.

**Race Detection Techniques:** David Padua developed these pioneering strategies to find programming defects and synchronization errors.

**Thread-Level Speculation:** Josep Torrellas' work on this architectural technology for parallelization and programmability has helped ensure that it is used in commercial systems, such as those from SUN and Azul Systems, and in a prototype from IBM.

**IBM/DARPA PERCS:** Josep Torrellas, David Padua, and Marc Snir made contributions from 2002 to 2006 to this DARPA-funded IBM multiprocessor. This design has evolved into IBM's Power 7. A petascale-level Power 7 multiprocessor will be installed at NCSA in 2010.

**AVIO:** Yuan Yuan Zhou's innovative approach to detecting atomicity violations in parallel programs is based on a novel observation called access interleaving invariant that detects atomicity violations without requiring programmers' annotations and specifications on synchronizations. Currently this technology is in the process of being transferred to Intel.

**LLVM:** Vikram Adve's group developed LLVM, a novel system for "lifelong compilation" of programs from any source language. LLVM is a versatile compiler infrastructure used to build diverse tools including static compilers, JIT optimizers of graphics shaders, hardware synthesis tools, bug finding tools, and many others. It is in active use by numerous groups across academia and industry for both research and teaching. It is also being used in commercial products by Apple, Adobe, Cray, and several other companies.

**Java and C++ Memory Consistency Models:** Sarita Adve co-developed the memory consistency models for the Java and C++ languages, building on the foundation of data-race-free models proposed in her PhD thesis. **High-speed Switching Networks:** Janak Patel's 1981 paper on performance of interconnections for multiprocessors, and Marc Snir's papers on this topic from 1982 to 1984, are considered "foundation" papers for the entire field on the performance of high-speed switching networks. A large body of research on multiprocessor interconnections is based on the techniques presented in these papers.

**Actors:** Gul Agha's paradigm of concurrent computation, with rigorously defined formal semantics, has been realized in a number of parallel programming languages such as Erlang, E, Ptolemy, Thal, Scala and SALSA.

# cloud computing

## CS Researchers to Study Internet-Scale Computing Systems with New 1,024-Core Cloud Computing Testbed

Building on a long history of innovation in large-scale systems and parallel computing, the Illinois department of computer science recently launched a joint research endeavor to investigate Internet-scale cloud computing systems.

In collaboration with Hewlett-Packard, Intel, and Yahoo!, Illinois is developing an experimental testbed for data-intensive applications using distributed “cloud” computational resources.

The global partnership, which also includes the National Science Foundation (NSF), the Infocomm Development Authority of Singapore (IDA), and the Karlsruhe Institute of Technology in Germany, has resulted in the establishment of a globally distributed, Internet-scale testing environment for advanced research in cloud computing infrastructure and services.

“We live in a world populated with enormous amounts of data from a wide variety of sources such as satellite telemetry, medical and agricultural sensors, and billions of web pages,” said computer science professor Michael Heath, Fulton Watson Copp chair in computer science, and one of the three Illinois researchers leading the project. “There is a compelling human need to represent, analyze, query, manage, understand, and respond to such data for knowledge extraction and decision making.”

Responding to these needs, the Cloud Computing Testbed (CCT) at Illinois will enable researchers to explore systems-level research issues such as:

- » automatic resource allocation,
- » scheduling,
- » monitoring,
- » and management tasks that arise in processing and responding to large amounts of data.

“This effort will differ markedly from existing experimental clusters,” said Heath. “With previous efforts focused on networking or user-level applications, the gaping need to process and respond to large amounts of data has been inadequately addressed. Our effort will go deep into the system software stack to explore new and better ways to provide system-level support for data-intensive computing.”

Illinois researchers are bringing their characteristic multi-disciplinary approach to the project. The effort involves multiple computer science faculty members spanning several disciplines and will be targeted at critical cloud computing systems needs such as: analyzing network logs, querying application logs, semantic web systems, search navigation maps, crawling online social networks, tele-immersive applications, and system management and monitoring. Computer science professors Roy Campbell and Indranil Gupta, well known for their systems and networking research for distributed computing, will serve as co-leads on the project.

“To realize the full potential of cloud computing, the technology industry must think about the cloud as a platform for creating new services and experiences. This requires an entirely new approach to the way we design, deploy and manage cloud infrastructure and services,” said Prith Banerjee, senior vice president of Research at HP and director of HP Labs.

# Computing

## Project Builds on Illinois History of Innovation in Large-Scale Systems and Parallel Computing

The CCT effort will build on recent Illinois efforts to advance parallel computing across the entire computing spectrum, from the Blue Waters project, which is building the world's first sustained petascale computing system, to the Universal Parallel Computing Research Center, which is bringing parallel computing concepts and performance to mainstream systems and applications.

"Creating large-scale testbeds is important because they lower barriers to innovation and provide the opportunity to experiment and learn at scale," said Andrew A. Chien, Vice President and Director of Intel Research.

"With this test bed, not only can researchers test applications at Internet scale, they will also have access to the underlying computing systems to advance understanding of how systems software and hardware function in a cloud environment."

"Illinois is thrilled to be a part of this groundbreaking effort," said Heath. "It will accelerate research for data-intensive, Internet-scale computing and drive innovation for future systems. It will enable a better understanding of Internet characteristics, especially emerging online social networks. It will also enable development of open-source tools for network analysis, fast querying, and transfer of distributed logs, search engines yielding navigation maps, semantic Web tools, and configuration for multimedia environments."

Research on the CCT covers a breadth of research areas including:

- » networking,
- » operating systems,
- » virtual machines,
- » distributed systems,
- » data-mining,
- » Web search,
- » network measurement,
- » and multimedia.

The CCT is located in the Thomas M. Siebel Center for Computer Science on the Illinois campus. It includes:

- » a 1,024-core HP system
- » 200 TB of disk space
- » Apache Hadoop
- » Pig parallel programming language developed at Yahoo! Research.

# blue water

Illinois to Deliver Sustained Petaflop Computing

“Blue Waters will be an unrivaled national asset that will have a powerful impact on both science and society”

Illinois Petascale Computing Facility.  
Photo courtesy of NCSA.

## NCSA Petascale Computing Facility overview



88,000 square feet total space. At approximately 126 feet by 360 feet, the two-story building's footprint will be just shy of the size of a European football field.

20,000-square-foot machine room with 6-foot raised floor. This will be large enough to house Blue Waters (and its follow-on system) and other compute, archive storage, and internal infrastructure systems.



Command center, system administration center, and office space for 50 staff.



24 MW electrical capacity. Blue Waters will not need this much power, but the capacity is being provided to accommodate future growth.



5,400 tons of water cooling capacity from the University's chilled water distribution loop.

### LEED Silver or Gold Certification

Energy efficiency is an integral part of the project; because the Blue Waters system will be directly cooled by water, rather than air, IBM estimates a 40% reduction in energy consumption.



# ers



#### About NCSA

The University of Illinois' National Center for Supercomputing Applications (NCSA) provides powerful computers and expert support that help thousands of scientists and engineers across the country better understand our world. For more than 20 years, NCSA has helped researchers simulate how galaxies collide and merge, how proteins fold and how molecules move through the wall of a cell, how tornadoes and hurricanes form, and other complex natural and engineered phenomena with real-world impact.

## In 2011, a supercomputer of unprecedented power

will be deployed by the National Center for Supercomputing Applications (NCSA) on the campus of the University of Illinois at Urbana-Champaign. Called Blue Waters, this IBM system will have greater computing capacity than all the current Top 500 supercomputers combined. This resource, which is funded by the National Science Foundation, will be capable of sustained performance of at least 1 petaflop when running the real codes and applications used by scientists and engineers.

To put it another way, if you could multiply two 14 digit numbers every second, it would take about 31 million years to complete the 1 quadrillion calculations Blue Waters will complete every second. This leadership-class project, is supported by a \$208 million grant from the National Science Foundation.

This computing power will enable scientists at universities and research centers across the United States to make extraordinary leaps in knowledge and scientific discovery: predicting the structure of complex biological systems, designing new materials atom by atom, predicting climate and ecosystem changes, and improving intricate engineering systems such as chemical plants and airplanes. Such breakthroughs will dramatically advance our understanding of the world around us and create enormous benefits for society—better healthcare and emergency response, less dependence on oil, increased sustainability of the environment—as well as renewed economic competitiveness of U.S. industries in a global economy that is fueled by innovation.

“Blue Waters will be an unrivaled national asset that will have a powerful impact on both science and society,” said Thom Dunning NCSA director and a professor of chemistry at Illinois. “Scientists around the country—simulating new medicines or materials, the weather, disease outbreaks, or complex engineered systems like power plants and aircraft—are poised to make discoveries that we can only begin to imagine.”

“With this collaboration and investment, researchers may tackle previously unimaginable questions and realize unparalleled discoveries, generating new understanding about the Earth’s climate, the functioning of national and global economies, nanoscale engineering, the design of advanced materials, the evolution of the early universe, the molecular processes that sustain life ... possibilities abound,” said Arden L. Bement, director of the National Science Foundation.

The system will deliver sustained performance of more than one petaflop on many real-world scientific and engineering applications. A petaflop is computing parlance for 1 quadrillion calculations per second.

“Our community traditionally uses peak performance to measure the output of a system based on simple benchmarks. It’s a measure that’s never achieved in real life,” Dunning said. “With Blue Waters, we’re focused intently on sustained performance—genuine performance on codes that scientists and engineers use every day instead of unattainable benchmark figures.”

More than 200,000 processor cores will make that performance possible. They will be coupled to more than a petabyte of memory and more than 10 petabytes of disk storage. All of that memory and storage will be globally addressable, meaning that processors will be able to share data from a single pool exceptionally quickly.

“A system with a large amount of globally addressable memory might come in at two terabytes of memory. Blue Waters will have 500 times that. This configuration makes Blue Waters a unique resource for the most compute-, memory-, and data-intensive applications. Handling data in this way means a broad range of researchers can get all of their work done in one place and don’t have to move among different machines with specialized architectures,” said Rob Pennington, NCSA’s deputy director.

Helping to make Blue Waters possible are co-principal investigators William H. Gropp, the Paul and Cynthia Saylor Professor of computer science and Marc Snir, the Michael Faiman and Saburo Muroga Professor of computer science.

# the best things constantly change



Wen-mei Hwu, professor of electrical and computer engineering, and Marc Snir, professor of computer science.  
Photo courtesy of NCSA.

By Barbara Jewett, National Center for Supercomputing Applications

With the National Science Foundation's funding of a sustained-petascale computer system at the University of Illinois, called Blue Waters, the high-performance computing community embraces on new challenges. NCSA Access' Barbara Jewett discussed some of the hardware and software issues with the University of Illinois at Urbana-Champaign's Wen-mei Hwu, professor of electrical and computer engineering, and Marc Snir, co-director of the Universal Parallel Computing Research Center and professor and former head of computer science.

The complete interview can be found on the NCSA website at [www.ncsa.uiuc.edu/News/Stories/HwuSnir/](http://www.ncsa.uiuc.edu/News/Stories/HwuSnir/).

**Q: A report, Dr. Snir, that you co-edited a few years ago on the future of supercomputing in the United States [Getting Up to Speed: The Future of Supercomputing, National Academies Press], indicated the country was falling behind in supercomputing. With the Blue Waters award, do you feel like we are now getting back to where we need to be?**

**SNIR:** It certainly is an improvement. The part that is still weak is that there has been no significant investment in research on supercomputing technologies, and that is really the main thing we emphasized—you get continuous improvement in computer technology when you have continuous research.

**Q: Let's talk about the software for a petascale machine. What is the biggest challenge?**

**S:** Scalability is first and foremost. You want to run and be able to leverage hundreds of thousands of processors. Wen-mei can explain it even better than I. Technology now is evolving in the direction where we can get an increasing number of cores on a chip, and therefore an increasing number of parallel processors in the machine. To be able to increase the performance over the coming years, the answer has to be that we will increase the level of parallelism one uses. And that really affects everything—applications that have to find algorithms that can use a higher level of parallelism, the run times, the operating systems, the services, the file systems. Everything has to run not on thousands, not on tens of thousands of processors, but on hundreds of thousands of cores. I expect to see millions before I retire. It's a problem.

**Q: What other expertise will your respective departments contribute to this project?**

**HWU:** One of the aspects of this machine is that we are going to build this massive interconnect. Marc actually has a lot of experience building this kind of machine, although probably on a smaller scale, when he was working at IBM. And people that make up the electrical and computer engineering department (ECE) have a lot of experience building this kind of machine. Another aspect of this

reliability facet that we talked about is that Ravi Iyer with ECE has more than 20 years' experience working with IBM measuring their mainframe failure rate and their component versus systems reliability. I personally focus much more on the microprocessors. I have worked with numerous companies on various microprocessors, and one of the things I specialize in is how do you actually build these microprocessors so that the compilers can use the parallel execution resources on that chip.

**S:** We have a lot of experience at Illinois on developing parallel run-times, programming languages, and software for high performance. The computer science department has been involved in parallel applications, and large scale applications, assisting in developing the NAMD code just a few years ago. [Editor's note: NAMD is a molecular dynamics simulation code designed for high-performance simulation of large biomolecular systems (millions of atoms). It was developed through a collaboration of Illinois Theoretical and Computational Biophysics Group and Parallel Programming Laboratory.] We've done a lot of work on multicore systems. We certainly have a strong applications team on our campus whose efforts I think we can use, as well as all sorts of professors and graduate students as we are one of the few places that teach scientific computing and teach high-performance computing. So we have the breadth.

**Q: A process like this changes the state of affairs for everybody. What are some of the likely candidates for those disruptive moments we are going to encounter?**

**S:** They are likely to be while working on new programs, new programming languages, and new programming models. The big impediment to these changes is: "Will my program run everywhere? Am I willing to invest in order to write my program in languages that will not be supported everywhere?" But if it is supported by several of the topmost machines in academia they will probably make that investment, so we'll need to work with the Track 2 teams.

# GRADUATED PHD STUDENTS

## MAY 2008

- Chakravorty, Sayantan – L. Kalé  
*A Fault Tolerance Protocol for Fast Recovery*
- Chitsaz, Hamid Reza – S. LaValle  
*Geodesic Problems for Mobile Robots*
- Furukawa, Yasutaka – J. Ponce  
*High-Fidelity Image-Based Modeling*
- Gonzalez, Hector – J. Han  
*Mining Massive Moving Object Datasets from RFID Data Flow Analysis to Traffic Mining*
- Kim, Sun-IL – S. Lumetta  
*Efficient Design and Management of Reliable Optical Networks*
- Kloder, Stephen – S. Hutchinson  
*Barrier Coverage: Deploying Robot Guards to Prevent Intrusion*
- Li, Xiaodong – S. Adve  
*Soft Error Modeling and Analysis for Microprocessors*
- Li, Xiaolei – J. Han  
*Multidimensional Analysis of Moving Object Data*
- McHenry, Kenton Guadron – J. Ponce  
*Learning to Segment Images into Material and Object Classes*
- Myagmar, Suvda – R. Campbell  
*Secure Configuration for Software Defined Radio*
- Oezer, Tuna – S. Ray  
*Discovering Audio-Visual Associations in Narrated Videos of Human Activities*
- Salverda, Pierre – C. Zilles  
*Principles of Instruction-Level Distributed Processing*
- Shakery, Azadeh – C. Zhai  
*Probabilistic Score Propagation in Information Retrieval*

## OCTOBER 2008

- Bell, William N – L. Olson  
*Algebraic Multigrid for Discrete Differential Forms*
- Bhandari, Vartika – N. Vaidya  
*Performance of Wireless Networks Subject To Constraints and Failures*
- Biehl, Jacob – B. Bailey  
*An Interaction Framework for Managing Applications and Input in Multiple Display Environments*
- Cao, Qing – T. Abdelzaher  
*Litearch: An Energy-Centric Software Architecture for Wireless Sensor Networks*
- Chambers, Erin – J. Erickson  
*Computing Interesting Topological Features*
- Cheng, Hong – J. Han  
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- Colombi, Andrew – A. Hirani  
*Quick Evaluation of Small Body Gravitation*
- Crenshaw, Tanya – L. Sha  
*Architectural Reference Models for Safety-Critical Systems*
- Hendrix, Joseph – J. Meseguer  
*Decision Procedures for Equationally Based Reasoning*
- Iqbal, Shamsi – B. Bailey  
*A Framework for Intelligent Notification Management in Multitasking Domains*
- Jiang, Jing – C. Zhai  
*Domain Adaptation in Natural Language Processing*
- Kao, Gio K. – S. Jacobson  
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- Kushal, Akash – J. Ponce  
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- Lee, Adam J. – M. Winslett  
*Towards Practical and Secure Decentralized Attribute-Based Authorization Systems*
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*Verification of Simulation Models of Network Protocols Using State Space Exploration*
- Teodorescu, Mircea-Radu – J. Torrellas  
*Multilayer Techniques to Address Parameter Variation*
- Tiwari, Abhishek – J. Torrellas  
*Architectural Techniques to Mitigate the Effect of Spatial and Temporal Variations in Processors*
- Wang, Qixin – L. Sha  
*Real-Time and Embedded Systems Building Blocks for Cyber-Physical Systems*
- Yershova, Ganna – S. LaValle  
*Sampling and Searching Methods for Practical Motion Planning Algorithms*
- Yu, Jing – M. Snir and M. Garzaran  
*Efficient Software Checking For Fault Tolerance*
- Zwicky, William Roger – G. Agha  
*AJ: A System for Building Actors with Java*

## DECEMBER 2008

- Balaguer, Federico – R. Johnson  
*Using Frameworks to Extend Frameworks*
- Baugh, Lee W. – C. Zilles  
*Transactional Programmability and Performance*
- Cyr, Eric C. – S. Bond  
*Numerical Methods for Computing the Free Energy of Coarse-Grained Molecular Systems*
- David, Francis Manoj – R. Campbell  
*Building a Reliable Operating System*
- Gaonkar, Shraavan – W. Sanders  
*Exploring Alternative Configurations of System Models from Simultaneous Simulation to Search Heuristics*
- He, Wenbo – K. Nahrstedt  
*Achieving Privacy and Integrity of Data Aggregation in Wireless Sensor Networks*
- Hoberock, Jared – J. C. Hart  
*Accelerating Physically-Based Light Transport Algorithms*
- Jin, Jingyi – M.J. Garland  
*Three Novel Algorithms for Triangle Mesh Processing: Progressive Delaunay Refinement Mesh Generation, MLS-Based Scattered Data Interpolation and Constrained Centroid Voronoi-Based Quadrangulation*
- Lu, Shan – Y. Zhou  
*Understanding, Detecting, and Exposing Concurrency Bugs*
- Mitra, Soumyadeb – M. Winslett  
*Trustworthy and Cost Effective Management of Compliance Records*
- Peiper, Chad Evan – S. Kamin  
*A Teacher's Dashboard: Monitoring Students in Tablet PC Classroom Settings*
- Anwar, Zahid – R. Campbell  
*Automatic Security Assessment of Critical Cyber-Infrastructures*

# BAY AREA **ILLINI**

## CS Alumnus Starts Silicon Valley Alumni Club

When CS alumnus Roland Geisler first moved to the Bay Area in 1999, he looked for ways to connect with other Illinois alumni. With no active Illinois alumni club, it was difficult to make those connections. When he returned in the spring of 2007 to find that there was still no alumni club, he decided to take matters into his own hands.

Geisler first contacted the UI Alumni Association. From them he learned that while they had often thought about establishing a club in the Bay Area, they had trouble finding alumni who were serious about starting it. Geisler was.

Six months and 700 registered alumni later, the Silicon Valley Alumni Club continues to grow, and has recently combined forces with the Golden Gate Alumni Club to form the San Francisco Bay Illini Alumni Club. The Golden Gate Alumni Club had been recently revitalized by alumna Anita Anandan, who now serves as president of the group.

Today SFBIC stands poised to serve the needs of the *largest Illini population outside of Illinois*.

Club membership demonstrates a cross-section of not only the Illinois alumni base, but also of the Silicon Valley culture, with members who work in all aspects of the IT-based economy. Among the membership are professors, engineers, venture capitalists, developers, and entrepreneurs.

In the spirit of the Silicon Valley start-up culture, Geisler says that so far all club activities have been free for members.

“We want to make sure that first we are bringing value to the club members,” says Geisler. “Once we have demonstrated that we create value, then we can build a revenue model that supports it. It’s very similar to growing a company here in Silicon Valley.”

The club hosts monthly pub networking events and co-hosted a kick-off event with SDForum in December. The two groups sponsored a presentation by Nokia’s Joe McCarthy on Social Networking at Work. The event drew more than 100 alumni.

Geisler sees the club as much more than a networking tool, however.

“We want to create a great club environment, with lots of activities, but we also want to be a key contact point for the University. We want to help connect professors with companies that are looking for their expertise, and help companies find research and funding opportunities in line with their goals,” says Geisler. He also looks forward to harnessing the power of alumni, faculty, and staff to bring Illinois expertise to bear on projects that will benefit the planet and address important social causes.

To achieve the goals that he has set out for the club, the club has assembled a team of talented managers and advisors. Philip Lachman, Kuangwei Hwang, and Sandeep Gupta serve as VPs of Events in the Bay Area, South Bay, and San Francisco, respectively. Ivy Li will serve as VP of Finance. Li is also Senior Internal Auditor at Xilinx. Quintin Anderson serves as the first chair of the Advisory Board. Anderson is a Principal at Exodus Capital; while at Illinois, he was also active in directing one of Illinois’ award-winning volunteer tutoring programs.

With this powerful team assembled, the club is poised to begin expanding its scope and achieve Geisler’s goal of creating the most dynamic, successful, and fun Midwest university alumni club in Silicon Valley.

“It’s about a community — the freedom to define what this club will be. There is an opportunity for everyone to participate.”

For more information or to join the club, visit [www.sfbayillini.org](http://www.sfbayillini.org).

Other ways to connect with Illinois engineering alumni include:  
**Always Illinois:** [www.alwaysillinois.edu](http://www.alwaysillinois.edu)  
**LinkedIn:** [www.linkedin.com/e/gis/56165/78565757787A](http://www.linkedin.com/e/gis/56165/78565757787A)



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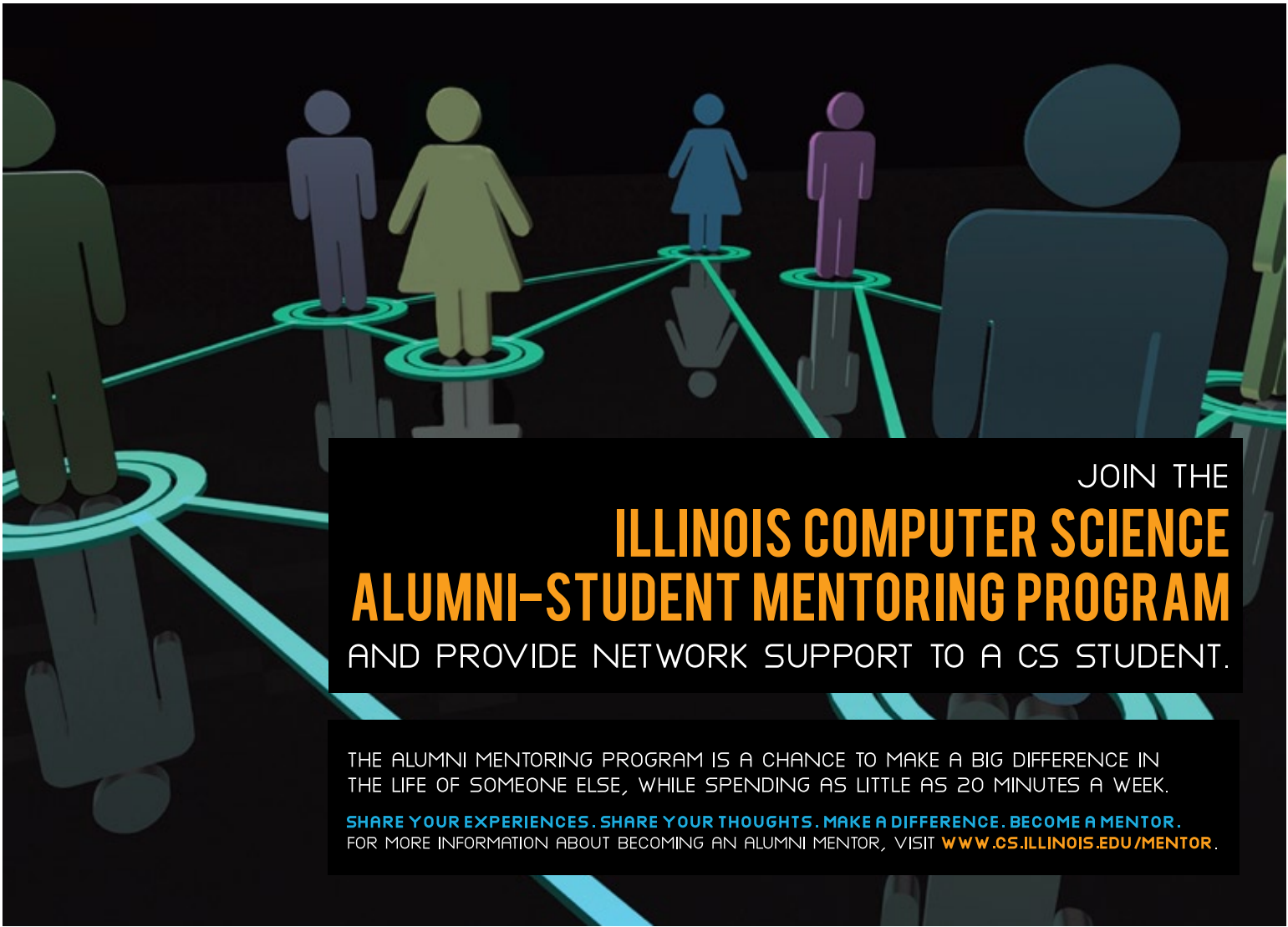
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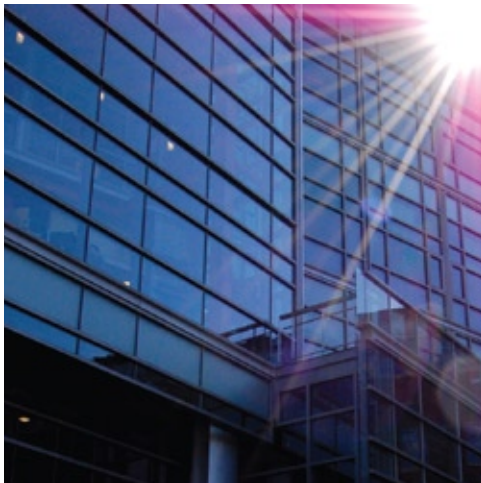
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## GIFTS IN ACTION

### Illinois Wins \$1.25M Funding for Undergraduate Information Trust Scholarship

By Jenny Applequist, Information Trust Institute



Spring 2009 at Thomas M. Siebel Center for Computer Science

PHOTO / KURT BIELEMA

The University of Illinois at Urbana-Champaign has recently won \$1.25 million in funding from the U.S. National Science Foundation (NSF) to support scholarships for undergraduate students who are working towards careers in information trust.

The grant, which establishes the Illinois Cyber Security Scholar Program (ICSSP) at the University of Illinois, was awarded by NSF's Federal Cyber Service: Scholarship for Service (SFS) program. SFS's mission is to increase the number of students entering the fields of computer security and information assurance, with the ultimate objective of improving the U.S. government's ability to protect its own information infrastructure. Under the terms of the award, each participating student will receive a scholarship and stipend in exchange for committing to work for two years following graduation as an information assurance specialist in the federal government. The funding will also support the development of innovative curriculum changes designed to support the scholarship program. The program will initially support five undergraduate students per year, and may be expanded in the near future.

"Information trust" consists of the study and practice of ensuring that networked information systems remain secure, dependable, correct, safe, and private, even in the face of accidents or malicious attacks. Skilled workforce development in the area of information trust is seen by experts as a crucial step in ensuring the trustworthiness of information systems that support critical areas of the U.S. economy, ranging from financial systems to homeland security defense.

"This scholarship program will be instrumental in attracting our outstanding pool of students in the College of Engineering to the critical area of information security," said Dr. Masooda Bashir, ITI's Assistant Director for Social Trust Initiatives, who is one of the co-Principal Investigators of the new ICSSP program. "This program will also continue to build on ITI's tradition of excellence and success to promote research and education in information trust and security."

ICSSP will be led by Professor Roy Campbell of the Department of Computer Science and ITI at Illinois; Professor William H. Sanders of ITI, the Coordinated Science Laboratory, and the Department of Electrical & Computer Engineering will serve as an additional co-Principal Investigator.

## WAYS TO CONTRIBUTE

Now, more than ever, we depend on the alumni and friends of the Department of Computer Science. In order to continue to flourish as one of the top computer science departments in the country, we depend on the generosity of our alumni and friends. Your gifts, large or small, monetary or gifts of your time, enable us to uphold our distinguished past, maintain excellent educational and research opportunities for our current students and faculty, and cultivate our outreach to future generations.

### Return to Campus

Give a gift of your time by returning to campus to share your career experiences with our students.

- » Give a lecture, seminar, or technical talk
- » Host an Engineer in Residence session
- » Contact Tiffany Xanos at [txanos@illinois.edu](mailto:txanos@illinois.edu) or 217-265-6823 for more opportunities to connect on campus

### Serve as a Mentor

Give the gift of experience to students bridging the gap between the classroom and the workplace, or between high school and university.

- » Mentor incoming freshmen students from your area and help guide them through their first years as a CS student
- » Sponsor a Senior Design project and provide valuable real world experiences to seniors preparing to enter the industry
- » Contact Sonya Harris at [lharris2@illinois.edu](mailto:lharris2@illinois.edu) or 217-244-4493 for more ways to mentor students

### Support Student Programs

Your contributions to the CS Annual Fund or a designated fund support student activities, scholarships, and programs to provide current students with a richer experience.

- » Give online at [www.cs.uiuc.edu/giving/](http://www.cs.uiuc.edu/giving/)
- » Contact Tiffany Xanos at [txanos@illinois.edu](mailto:txanos@illinois.edu) or 217-265-6823 for other ways to give

### Reach Out to Future Generations

Give a gift to future generations of computer science students by participating in an outreach program.

- » Visit a local high school through our ChicTech program
- » Sponsor a Technical Ambassadors Challenge project through ChicTech
- » Contact Sonya Harris at [lharris2@uiuc.edu](mailto:lharris2@uiuc.edu) or 217-244-4493 for more ways to reach out

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