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FUELING THE Entrepreneurial Spirit

ALSO IN THIS ISSUE:

Department of Computer Science

Information technology and business are becoming inextricably interwoven. I don't think anybody can talk meaningfully about one without talking about the other.

Bill Gates

CS @ ILLINOIS

Department of Computer Science
College of Engineering, College of Liberal Arts & Sciences
University of Illinois at Urbana-Champaign

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MAGAZINE 2015, VOLUME I

> **The entrepreneurial vibe at Illinois is pervasive, and the ecosystem is robust.**

The Brookings Institute recently reported that Champaign-Urbana is one of the top locations in the country for per-capita venture capital. And, as you'll see in this issue, CS faculty entrepreneurs are leading the way on exciting trends like this one. What's even more impressive: they're pursuing these startups in ways that enhance how they teach, do research, and collaborate with each other, students, and industry. The entrepreneurial vibe at Illinois is pervasive, and the ecosystem is robust—I invite you to learn more about how CS alumni can be a part of this vibrant community.

The other achievements and recognitions of our faculty, students, and alumni make me marvel at their ingenuity and energy; they are simply among the best anywhere in the academy and in industry. From career awards, to research prizes, to hack championships, "CS @ ILLINOIS" is synonymous with excellence.

I want to thank the many CS alumni who came back to be a part of our 50th Anniversary Celebration and Awards program last fall. You made the event an incredible success, and I hope you will make this an annual homecoming—be sure to mark your calendar for our next awards event on October 23, 2015. One focus moving forward is to increase our engagement opportunities with you both on campus and in major cities across the country. We will be in Chicago, New York, and San Francisco, so please keep an eye out for those invitations. We look forward to connecting with you soon.

Rob A. Rutenbar, Bliss Professor and Head, CS @ ILLINOIS

Celebrating CS @ ILLINOIS

BY TOM MOONE

As the fall 2014 undergraduate admissions were finalized, it became clear that the number of female students joining the CS Department would be markedly higher than in previous years. All told, the number of undergraduate women who accepted admission to the CS @ ILLINOIS program grew by more than 27 percent over the past two years. This year, 84 of the 341 entering students were women—almost 25%.

This would seem to be an achievement to celebrate. And in fact, CS faculty member Cinda Heeren and staff member CJ Coleman thought that an actual celebration was in order.

"I started reaching out to student leaders who were far away on their summer internships for their ideas on an awesome event we could have for the whole department," Coleman said. "We all worked together via email to plan the theme."

Though spurred on by the increase in female students, the event was created to celebrate the entire CS @ ILLINOIS family.

Because memory errors such as segmentation faults (*segfaults* for short) are a common challenge faced by students in upper level courses, and because they can be frustrating when first encountered, the theme for this first Celebrating CS @ ILLINOIS event was "Segfaults bring us together." T-shirts with this theme—designed by CS student Eva Shih—

were distributed to students, faculty, and staff throughout the afternoon.

The atrium of the Thomas M. Siebel Center was filled with students, staff, and faculty at 4 p.m. on September 2, 2014. CS Department Head Rob A. Rutenbar welcomed all the attendees.

Heeren gave a brief overview of segfaults for any students who might not yet have encountered them in their CS @ ILLINOIS career—though all assuredly will by the time they graduate.

In her talk, Heeren pointed out that responding to segfaults requires three things from the students: tenacity, curiosity, and communication. "It's not really the segfaults that define us," Heeren said. "It's our response to them that makes us strong."

Coleman and Heeren hope that this celebration can become an annual event that can celebrate a different aspect of the CS @ ILLINOIS experience every year.

More photos available on Facebook!
http://on.fb.me/1Do4Pbd

CS @ ILLINOIS 23
RECOGNIZES
for ACHIEVEMENT & SERVICE

The CS @ ILLINOIS Awards ceremony was held October 24. This year's event was the culmination of a week of celebration of the 50th Anniversary of the establishment of CS as a department at the university.

These awards recognize alumni and faculty who have made professional, technical, educational, and service contributions that bring distinction to themselves, the department, and the university.

Five current and past presidents of ACM met at the Awards Ceremony (from left): Mark Tebbe (BS CS '83), Alan Braverman (BS CS '96), Parisa Tabriz (BS CS '05, MS '07), current president Cole Gleason, and Alex Bratton (BS CE '93). Right: CS Award recipient Der-Tsai Lee (MS CS '76, PhD '78) was also recognized as a UI Alumni Association Comeback Guest.

The Distinguished Service Award honors alumni or faculty who have demonstrated an outstanding level of commitment to the department and its students, faculty and alumni through their support and service. This year past department heads were particularly recognized for their service to CS @ ILLINOIS.

Alan M. Braverman

Alan M. Braverman (BS CS '96) is a serial entrepreneur who has been building startups in Silicon Valley since the mid-1990s. He shares this expertise with his fellow alumni as an Advisory Board Member of the University of Illinois Silicon Valley Round Table, a speaker in the Illini Center West Luncheon Series, and through his startup studio, The Giant Pixel Corporation.

Roy H. Campbell

Roy H. Campbell is the Sohaib and Sara Abbasi Professor at the University of Illinois. He is a distinguished researcher and prolific mentor with contributions to concurrent programming, system software, security, and ubiquitous computing. Campbell served as director of graduate admission and advancement for CS @ ILLINOIS from 2007 to 2013. He is currently chair of the University of Illinois Faculty Senate, and his campus leadership also includes chairing recruiting for the Grainger Engineering Breakthroughs Big Data Initiative and running the Illinois Cyber Security Scholars Program.

C. William Gear

C. William Gear (MS Math '57, PhD Math '60) is president emeritus of NEC Research Institute and professor emeritus of CS @ ILLINOIS, where he served as department head from 1985 to 1990. A pioneer in numerical analysis and scientific computing, Gear is a leader in computer science education and industrial research. He created a seminal method for solving stiff ordinary differential equations on digital computers and wrote a landmark program for the automatic integration of ordinary differential equations. As Head, he oversaw the third addition to the Digital Computing Lab and founded the *CS Alumni News*.

Michael T. Heath

Michael T. Heath is Fulton Watson Copp Chair Emeritus at the University of Illinois. He was the long-time director of the Computational Science and Engineering (CSE) program, the most successful program of its kind, and led the Center for Simulation of Advanced Rockets (CSAR). He is also an internationally recognized educator known for his effective communication and inspirational teaching. Heath served as department head of CS @ ILLINOIS from 2007 to 2010 while continuing to direct CSE and CSAR, helping to bring high-profile projects like the UPCRC and the Cloud Computing Testbed to Illinois.

Brigid A. Johnson

Brigid A. Johnson (BS CS '08) is senior technical product manager at Amazon. An inspiration to students and faculty alike, she has previously returned to campus on multiple occasions, including as a CS @ ILLINOIS Engineer in Residence and as Keynote Speaker for the Women in Computer Science Annual Banquet, sharing about her experiences in industry and in pursuing her MBA.

Distinguished Service continued

Duncan Lawrie

Duncan Lawrie (MS CS '69, PhD '73) is professor emeritus of the University of Illinois. An academic leader in high-performance computing, he contributed to the design of the ILLIAC IV, Burroughs Scientific Professor, and Cedar. He helped shape computing's direction through service on numerous policy committees and as IEEE Computer Society president. As head of CS @ ILLINOIS from 1990 to 1996, he helped to strengthen alumni relations, to introduce Senior Projects, and to launch our first webpage.

Daniel A. Reed

Daniel Reed is vice president for research and economic development at the University of Iowa. He tirelessly promotes the value of computing and computational science at both the academic and national policy levels. He has created multiple large-scale HPC systems and tools to support scientific research. As head of CS @ ILLINOIS from 1996 to 2001, he helped launch the online MCS degree; oversaw increases in gifts, endowments, and research funding; and initiated planning for the Siebel Center.

Marc Snir

Marc Snir is director of the Mathematics and Computer Science Division at Argonne National Lab and the Michael Faiman and Saburo Muroga Professor at the University of Illinois. He has made significant research contributions to the development, theory, and standardization of high-performance parallel computing through his work on the Message Passing Interface and IBM's SP scalable parallel system. As department head from 2001 to 2007, he managed the transition into the Siebel Center and the department's subsequent expansion. Later, he served as first director of the Illinois Informatics Institute, as chief software architect for Blue Waters, and as co-director of UPCRC.

DISTINGUISHED ACHIEVEMENT

The Distinguished Achievement Award honors alumni or faculty who have made professional and technical contributions that bring distinction to themselves, the department, and the university.

Steve Chen

Steve Chen is entrepreneur in residence at Google. He is a technology innovator and entrepreneur who co-founded YouTube. He is also co-founder of AVOS Systems, which builds a common technology platform to speed app development and whose products help people create, find, and share multimedia content.

Jason Cong

Jason Cong (MS CS '87, PhD '90) is a Chancellor's Professor and former CS department chair at UCLA. He is an academic and entrepreneurial leader in electric design automation and is widely known for pioneering work on FPGA technology mapping and high-level synthesis. He has founded or co-founded three companies and trained more than 30 doctoral students.

Jawed Karim

Jawed Karim (BS CS '04) is a founder/partner of Y Ventures. He is an entrepreneur and tech startup mentor who co-founded YouTube. He also helped develop the real-time antifraud systems for PayPal. With Y Ventures, he helps entrepreneurs to move their innovative products into the marketplace.

Kenichi Miura

Kenichi Miura (MS CS '71, PhD '73) is professor emeritus at the National Institute of Informatics (Tokyo, Japan). He is an innovative researcher and corporate executive who made significant contributions to Fujitsu's VP series of vector supercomputers, demonstrating how vectorizing compilers effectively take advantage of hardware architectures. His numerical algorithms expertise led to systems for high-speed execution of scientific computational applications. From 2003 to 2008, he directed the Japanese National Research Grid Initiative (NAREGI).

Trevor Mudge

Trevor Mudge (MS CS '73, PhD '77) is the Bredt Family Professor at the University of Michigan. He is an outstanding educator and researcher whose work has significantly advanced the field of low-power computer architecture and its interaction with technology. His students can be found throughout academia and the semiconductor industry.
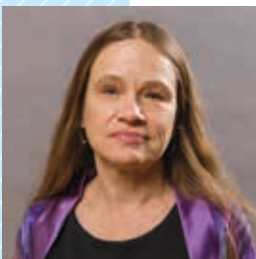
Linda Petzold

Linda Petzold (BA Math & CS '74, PhD CS '78) is a professor at the University of California, Santa Barbara and past chair of its CS department. She is an innovative researcher who advanced new methods for computationally solving differential algebraic equations and incorporated these solutions into widely distributed software. A creative teacher and mentor, she has made pioneering contributions to computational science and engineering education.

Parisa Tabriz

Parisa Tabriz (BS CS '05, MS '07) is Chrome Security Manager at Google—also known as Google's Security Princess—and lead for the Chrome/Chromium Security engineering team. She got her start learning how to exploit software in ACM@UIUC, and then leveraged the "attacker mindset" to improve the security of Google software and teach other developers to do the same, protecting billions of Internet users from malicious cyber attacks.

DISTINGUISHED EDUCATORS

The Distinguished Educator Award honors alumni or faculty who have made outstanding contributions to computer science education and research, and recognizes those who excel at motivating computer science students.

Lawrence Angrave

Lawrence Angrave is a senior lecturer at the University of Illinois. He is a brilliant, charismatic, and insightful instructor responsible for transforming "Introduction to Computer Science" into a highly interactive and fun—but challenging—course. He is also a trail-blazer who ran the first MOOC on Android app development—with over 140,000 registered students.

Cinda Heeren

Cinda Heeren (PhD CS '04) is a senior lecturer at the University of Illinois. She is a passionate, enthusiastic, and engaging teacher who challenges hundreds of students each semester to become better problem solvers in her "Data Structures" course. A mentor who continues to stay involved as students complete their studies, she also helps spearhead our summer outreach efforts to middle school girls.

Der-Tsai Lee

Der-Tsai Lee (MS CS '76, PhD '78) is president of National Chung Hsing University in Taiwan. He is a pioneer in computational geometry and algorithm design and analysis. In his roles of researcher and university president, his work and leadership have impacted bioinformatics, information security, and digital library fields.
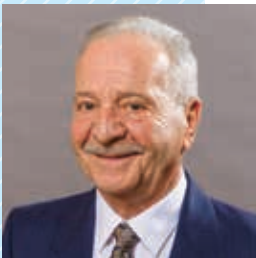
Franco P. Preparata

Franco P. Preparata is the An Wang Professor of Computer Science at Brown University. A CS @ ILLINOIS professor from 1966 to 1990, he literally wrote the book on computational geometry (*Computational Geometry: An Introduction*; Springer, 1985). His outstanding research contributions span coding theory, distributed computing, fault diagnosis, VLSI, and computational biology, while many of his students have gone on to highly successful careers around the globe.

Koushik Sen

Koushik Sen (MS CS '03, PhD '06) is an associate professor at the University of California, Berkeley. He is an outstanding researcher, educator, and mentor whose work impacts the software verification and testing fields. He is developer and co-inventor of Directed Automated Random Testing (DART) and Concolic Testing software, which detects standard errors such as program crashes, assertion violations, and non-termination.

C. W. GEAR JUNIOR FACULTY AWARD

The C. W. Gear Outstanding Junior Faculty Award was established in honor of the contributions and services of C. William Gear, head of the department 1985–1990. The award recognizes outstanding teaching and service.

Derek Hoiem

Derek Hoiem is an assistant professor at the University of Illinois. He is an innovator at the forefront of a paradigm shift in computer vision. His work pioneers new approaches to object recognition through the use of attributes, and it includes new tools to better compare competing object recognition systems.

DAVID J. KUCK OUTSTANDING THESIS AWARDS

Established in honor of David Kuck's intellectual and leadership contributions, this award recognizes one outstanding master's thesis and one outstanding doctoral dissertation.

Siva Kumar Sastry Hari

Siva Kumar Sastry Hari (MS CS '09, PhD '13) is now a research scientist at NVIDIA. His breakthrough thesis work establishes the viability of software-driven hardware resiliency. His Relyzer tool allows for the low-cost prediction of a hardware fault injected anywhere into a software application's execution, without the impractical use of comprehensive fault injection.

Wenxuan Zhou

Wenxuan Zhou (MS CS '12) is a PhD student at the University of Illinois. She is a creative researcher working to speed up the Web. Her practical low-latency transport mechanism influenced SPDY, an open networking protocol that has seen widespread deployment—with implementations found in every major Web browser plus the Apache and NGNIX Web server platforms.

Save the Date

Make your plans now to join us for our 2015 CS Awards Banquet on Friday, October 23, to celebrate the accomplishments of our outstanding alumni, faculty, and students. This will again take place in conjunction with Homecoming and the WCS Banquet (Thursday, October 22), so there will be lots to do on campus throughout the weekend.

If you know a member of the CS @ ILLINOIS family who is deserving of recognition by the department, please nominate them for one of our awards.

Ira and Debra Cohen Receive William E. Winter Award

In recognition of their many and extensive efforts in support of the University of Illinois, Ira Cohen (BS CS '80) and his wife Debra were named the 2014 recipients of the William E. Winter Award for Outstanding Advocate Leadership at the University of Illinois at Urbana-Champaign. This award recognizes individuals outside the university structure who play an active role in securing private support for the University of Illinois.

With the launch of the Engineering Visionary Scholarship Initiative, the Cohens served on the Advisory Board and provided leadership and insight for this ambitious, $100 million fundraising initiative.

Ira Cohen received the Department of Computer Science Distinguished Alumni Service Award in 2011. In 2013 the American Cancer Society awarded Debra Cohen the St. George Medal, the society's highest distinction for volunteer service.

In CS @ ILLINOIS, the Cohens have endowed the Debra and Ira Cohen Graduate Fellowship, the Sara and Louis Cohen Undergraduate Scholarship in honor of Ira's grandparents, and the William and Ruth Witt Scholarship in honor of Debra's parents. They have also been supporters of the CS Annual Fund and the Geneva Belford Memorial Fund.

The William E. Winter Award is named in honor of Bill Winter, a former CEO of the 7-Up Company and a University of Illinois Foundation Board Member.

Gahvari Receives First Sidney Fernbach Postdoctoral Fellowship

Hormozd Gahvari (PhD '14) has been chosen as the first recipient of the Sidney Fernbach Postdoctoral Fellowship in the Computing Sciences.

The Fernbach Postdoctoral Fellowship was created by Lawrence Livermore National Laboratory's (LLNL's) Computation Directorate as a named fellowship in computational mathematics, scientific computing, and computer science. It honors Sidney Fernbach, a pioneer in scientific high-performance computing and the former head of LLNL's Computation and Theoretical Divisions, as well as Deputy Associate Director for Scientific Support. The fellowship is intended to attract top doctoral graduates in the computing sciences and provides full funding for two years with which fellows can pursue their own research agendas.

Gahvari, a former LLNL summer intern, was a doctoral student of CS Professor William Gropp. His research is in the area of parallel performance modeling and analysis of numerical algorithms. This work involves constructing mathematical models that capture the behavior of computer systems and the applications that run on them. These models can help researchers understand how applications will have to adapt to changes in parallel computing hardware design to ensure that they continue to perform well.

Levchin Inducted into Engineering at Illinois Hall of Fame

BY MIKE KOON, COLLEGE OF ENGINEERING

Max Levchin (BS CS '97) was recently inducted into the Engineering at Illinois Hall of Fame. He was recognized for his roles as "technology entrepreneur, angel investor, and cryptographer; co-founder of PayPal, creator of online security and fraud-prevention systems; founder and CEO of Slide; founder and CEO of Hard Valuable Fun (HVF) incubator lab."

A native of Ukraine, Levchin grew up in Chicago, where his family was granted

After merging with X.com, PayPal, Inc. went public in 2002 and was subsequently acquired by eBay. Today, PayPal has over 148 million active accounts in 26 currencies across 203 markets.

In 2004, Levchin also helped start and continues to serve as chairman of Yelp, an online social networking and review service, inviting customers to post reviews for local businesses. Yelpers have written more than 57 million reviews, and in the

"HVF" for Hard Valuable Fun, the lab is meant to be an incubator for data-driven projects. According to its website, HVF is "interested in consumer finance, enterprise document security and disease prevention/wellness industries. But if it's got data, we want to think about it."

To date, two companies have been spun from HVF: the finance company Affirm, and Glow, an app that is giving women the information they need for fertility.

To understand the impact Max Levchin has had on world culture, simply consider the tools this on-line giant has already founded or has had a hand in developing—PayPal, Yelp, Slide.

political asylum, and earned a bachelor of science degree in computer science from the University of Illinois in 1997.

Levchin's rise to prominence has been swift. In 1998, he co-founded Fieldlink. After changing the company name to Confinity, he and Peter Thiel developed the popular payment product, PayPal, which gives users a way to send money without exchanging financial information. Levchin served as PayPal's Chief Technology Officer and Director and was responsible for developing PayPal's anti-fraud measures.

first quarter of 2014 alone had 132 million unique visitors.

In 2004, Levchin also founded Slide, a media-sharing service for social networking sites. In 2010, the company was sold for $182 million to Google, who named Levchin its Vice President for Engineering.

Levchin also serves on the Board of Directors of Yahoo! and continues to push the envelope of data-focused innovation working out of his own research lab. Founded in 2011 and dubbed

In addition to being an innovator, Levchin has dabbled in the media world, serving as executive producer for the movie *Thank You for Smoking* and teaming with Thiel and Garry Kasparov to write the book, *The Blueprint: Reviving Innovation, Rediscovering Risk, and Rescuing Free Market*.

Levchin has also been a generous donor, establishing the Frima Lukatskaya Scholarship in Computer Science in honor of his grandmother.

CS @ ILLINOIS
Celebrates
Its First 50 Years

BY TOM MOONE AND LAURA SCHMITT

On October 23 and 24, CS @ ILLINOIS commemorated the 50th anniversary of the establishment of the Department of Computer Science at the University of Illinois at Urbana-Champaign. The week-long event brought together some of the department's most distinguished alumni, its faculty and students, and university dignitaries for a grand celebration that showcased the reach and impact our department has had on the computer science field.

The opening event on Monday, October 20, featured a fireside chat with Max Levchin (BS CS '97), who reminisced about his days as PayPal co-founder and discussed the new ventures he is currently engaged in.

On Thursday, October 23, the department joined with Women in Computer Science (WCS) to welcome back alumna Parisa Tabriz (BS CS '05, MS '07), who currently leads the security team that protects the Chrome browser. Tabriz has the distinction of having her business cards state her official title as "Security Princess."

Tabriz provided the keynote address to the annual WCS Alumni and Student Banquet.

In her talk, she discussed the importance of security to the Internet and the people and businesses that depend on it. She gave some general descriptions of how hackers with either good or bad intent look at problems of vulnerability in computer systems and the Internet.

The anniversary celebration culminated on Friday, October 24, as some of the department's most accomplished and influential alumni spoke about their experiences in industry and academia. In addition, four former department heads returned to join current CS Head Rob A. Rutenbar in a panel discussion and give first-hand insight into the history of the department over the last several decades.

KEYNOTE SPEAKERS

Thomas M. Siebel (BA History '75, MBA '83, MS CS '85) opened the day with the first keynote. In it he discussed how he had conceived and developed businesses. Siebel entered the relational database business when it was a $5 million market and built Siebel Systems into a $5.8 billion company. His current venture, C3 Energy, is helping the Smart Grid reach its full promise while revolutionizing the energy business using data.

In the second keynote of the day, Jeff Holden (BS CS '90, MS '91) gave an overview of his career, beginning with his stint with a Wall Street firm, where his manager was Jeff Bezos. In 1997, Holden joined Bezos at his startup, Amazon, as engineer number nine, learning about supply chain and inventory management. Later, Holden was the force behind Amazon Prime, the company's loyalty program. After nine years at Amazon, Holden launched his own startup, Pelago, which was sold to Groupon. Today, he is at Uber, where he is working to bring their ride sharing app and service to a larger portion of the country.

After lunch, Chris Lattner (MS CS '02, PhD '05), who was the main designer at Illinois of the LLVM compiler infrastructure, spoke about the tool's development, as well as the Clang compiler. He discussed how compilers and software engineering have developed during the last decade.

Lattner has worked at Apple since 2005, where he currently leads work on the Swift programming language.

Linda Mills (MS CS '73), corporate vice president of operations at Northrop Grumman gave the final keynote of the day. She spoke about the need in the technology field for more women and other underrepresented populations. The U.S. has been a leader in innovation throughout the era of the computer, but that leading role has been eroding over recent years. Educating underrepresented populations in STEM fields could be a key to bringing the U.S. back to prominence and could ensure the future of the technology field in the United States.

PANEL DISCUSSIONS

The panel discussions were designed to provide a wide scope of opinion and insight on particular topics of interest to the department and guests.

In the "CS @ ILLINOIS: Past and Present" panel moderated by David J. Kuck, current CS Department Head Rob A. Rutenbar joined former heads C. William Gear, Daniel A. Reed, Michael T. Heath, and Marc Snir to discuss the history of the department from the perspective of the people who led the department. It was informative and instructive to learn how all the heads had experienced similar difficulties in running the department. Hiring faculty was a regular issue that they had to deal with. Many of the former faculty members noted that space for offices and classrooms was long an issue that they needed to deal with. Though the Siebel Center opening provided relief for that issue, the current growing popularity of CS as a major has brought it back.

A panel on "Entrepreneurship @ ILLINOIS" brought together faculty and alumni entrepreneurs. Led by Alan Braverman (BS CS '96), the panel discussed the ups and downs faced by someone trying to develop a startup company. Panelists included Jeff Holden (BS CS '91, MCS '92), chief product officer at Uber; Marcin Kleczynski (BS CS '12), founder and chief executive officer at Malwarebytes; Steve LaValle (BS EE '90, MS EE '93, PhD '95), CS @ ILLINOIS professor and principal scientist at Oculus VR; Mark Tebbe (BS CS '83), operating executive at Lake Capital; and Zao Yang (BS CS '05),

chief executive officer at LaunchHub, Inc. The day ended with a look at "The Future of Computer Science." CS Professor Klara Nahrstedt and several CS alumni who are educators—Daniel Atkins (MS EE '67, PhD CS '70), Jason Cong (MS CS '87, PhD '90), Mary Jane Irwin (MS CS '75, PhD '77), Der-Tsai Lee (MS CS '76, PhD '78), and Linda Petzold (BA LAS '74, PhD CS '78)—discussed exciting new research directions within computer science.

OTHER CELEBRATION EVENTS

The 50th anniversary celebration ended with the CS @ ILLINOIS Awards Ceremony, where several alumni and former department heads were recognized for their distinguished achievements in the computer science field and for service to the department.

Der-Tsai Lee was also recognized by the university at the Homecoming game on October 25 as one of three Comeback Guests, a recognition for particularly distinguished alumni of the University of Illinois who are invited by the Alumni Association.

CS Culture Values
ENTREPRENEURIAL SPIRIT

BY LAURA SCHMITT

CS @ ILLINOIS has long been a vibrant ecosystem of entrepreneurial activity—from Kuck & Associates Inc.'s performance-oriented compilers and parallel software tools, to the revolutionary Web browser Mosaic, to new student and faculty ventures.

"It's a common touch point among the great CS departments to have startup activity," said CS Department Head Rob A. Rutenbar. "Every so often, people spin out cool, impactful work."

When those entrepreneurs are faculty, they gain valuable experiences that enhance their teaching and research, and may even inspire the next generation of innovators. "It's nice to be a part of a culture where entrepreneurship is valued and not seen as a threat to your academic work," said CS Assistant Professor Ranjitha Kumar, co-founder of a Silicon Valley startup company. "Illinois cares most about faculty making an impact in the world, and that really resonates with what I want for my career."

In 2014, several CS faculty-related companies had noteworthy achievements, Here are their stories.

APROPOSE:
Harnessing big data to enhance Web design

Apropose is a Bay Area software startup founded to bring data to the Web design process. Apropose's core technology is based on CS Assistant Professor Ranjitha Kumar's Stanford doctoral research, which applied data-mining and knowledge-discovery techniques to Web design.

"Data has helped in countless other fields—finance, healthcare, marketing—so why not apply it to Web design," said Kumar, who co-founded the company in 2013 with three of her Stanford colleagues, including Jerry O. Talton, a CS alumnus (BS '03, MS '05).

Kumar believes Apropose's software will enable clients to produce better design through rapid iterative cycles that are too labor intensive and expensive to execute by hand. According to Kumar, figuring out what to build can take up to 50% of a Web design team's time and effort. By bringing data to the design process, Apropose aims to revolutionize how design is done. "We want to be that tab that's always open in your browser when you're doing creative work," she said. "Data can help creative people make better design decisions, more quickly, with higher confidence."

In September 2014, the company raised $1.875 million in seed funding from New Enterprise Associates and Andreessen Horowitz to validate product/market fit and scale the company's core infrastructure.

Interestingly, Kumar deferred her Illinois faculty offer for a year in order to launch the company. "There are a lot of parallels between startups and research groups," she said. "A startup provides a good template for how to set up a research organization: to maximize productivity, you want people loosely coupled, but highly aligned."

In addition, Kumar said, having a foot in industry helps her conduct academic research that solves problems people care about. "I feel like my career has been a template for how academia and industry should intersect," said Kumar, whose CS research focuses on creativity and design in non-Web domains such as mobile apps, print media, and fashion.

apropose

EMBEDOR TECHNOLOGIES:
Smart sensors to monitor infrastructure health

An early-stage startup, Embedor Technologies is commercializing a novel wireless, smart-sensor technology developed by CS Professor Gul Agha and Civil Engineering Professor Billie Spencer over the last 13 years. The smart sensor system, which consists of arrays of low-cost wireless sensor networks that link to the Internet, provides continuous, real-time structural health monitoring of bridges and other civil infrastructure.

According to Agha, there are more than 600,000 bridges in the United States, including more than 300,000 bridges that will soon exceed their 50-year design life. Already 72,000 bridges are considered structurally deficient.

Using the small Embedor sensors (about 5cm x 7cm) offers several advantages over existing infrastructure monitoring approaches like wired sensors: they are less expensive, they run on batteries that last up to five years, and they can be deployed in hours or days rather than weeks or months. The sensor network turns the bridge into a smart structure, which can pinpoint and report its own problems, rationalizing maintenance schedules and helping avoid potential catastrophic failures.

Although the initial market focus is bridges, the Embedor system can be applied to heavy machinery or to smart cities, monitoring traffic loads or tracking resource usage.

In the fall, Embedor won an Internet of Everything competition sponsored by Cisco and the Chicago Innovation Exchange (CIE), providing the company with access to the business planning expertise and resources of the CIE incubator facility at the University of Chicago, as well as providing a partnership with Cisco and access to capital.

Being an entrepreneur positively impacts teaching and research, said Agha. "Entrepreneurism is a different universe, and many students are interested in startups," he said. "Having an inside view, I can give them a lot better direction and advice on getting them started and pointing them to resources."

NexLP:
Rapid conversion of big text data to meaningful information

NexLP is an e-discovery startup that is commercializing text understanding and analytics tools developed by CS Professor Dan Roth over the last 15 years. Roth's machine-learning methods facilitate natural-language understanding, revealing narratives and connections within vast collections of documents like email messages.

NexLP's core technology is Story Engine, which can automatically extract and organize facts from the documents and help users understand the key themes in these vast amounts of data—information such as who are the key people, how often they communicate, and what topics or entities are being discussed.

A potentially disruptive technology for e-discovery, NexLP's products can be used by any large organization that needs to know what is in its unstructured data for investigation, compliance, information security, or patent issues. NexLP's initial customers are law firms and investigation departments of large corporations that used to rely on keyword search software or additional manpower to sift through mountains of documents to determine which ones were relevant to a case.

In 2014, NexLP was a winner in the prestigious Techstars Chicago startup competition, which provided valuable management coaching and office space in Chicago's trendy 1871 digital startup hub. The company also raised $2.1 million in private investment funding thanks in part to connections provided by the College of Engineering.

While not involved in the company's daily operations, Roth does regularly consult with his colleagues on technical direction. The entrepreneurial experience, he said, has enhanced his ability to describe the current state of language-understanding technology to students and other researchers.

"I can use examples from the company to explain to people what is important, what is difficult and why, and basically use real-life examples to show what type of problems people want solved and where are we today."

OCULUS:
Advancing virtual reality gaming

An expert in robotics and motion planning, CS Professor Steve LaValle was recruited by Oculus VR in 2012, when the nascent company had just completed its Kickstarter funding campaign. The maker of Rift, an immersive virtual reality gaming headset, Oculus wanted to tap LaValle's expertise in sensing and tracking for an early prototype.

During a two-year leave from Illinois, LaValle led Oculus' R&D efforts as principal scientist, working on some of the toughest engineering and software challenges, including sensor fusion, magnetic drift correction, and kinematic modeling.

According to LaValle, he initially developed head-tracking methods followed by work on perceptual psychology, computer vision, sensor calibration, health and safety, automated testing, and optics.

In March 2014, Oculus made major headlines when Facebook acquired the company for $2 billion. Last fall, LaValle returned to campus, in part, because he missed the academic culture, which allows him to work with bright passionate students and a broad range of brilliant researchers. He relishes the chance to share his experiences in the classroom.

"That's where the real future of VR lies," said LaValle, who is currently teaching a VR class that includes the development of core software, interactions with content developers, and human perception studies.

According to LaValle, it's easier than ever to create a VR experience, but researchers still have a lot to learn about the interaction between the human body and the VR device. "I want to teach students the fundamental principles that we have learned so far and [are] likely to survive the test of time, so that they can play a leading role in shaping this emerging ecosystem," he said.

VOCI TECHNOLOGIES:
Delivering high-volume speech recognition

Founded in 2008, Voci Technologies is a leader in enterprise-level accelerated speech-recognition technology, which spun out of Rob A. Rutenbar's research group when he was a professor at Carnegie Mellon University. Voci's core product is a hardware appliance that instantly and reliably converts massive quantities of recorded voice data into text. Other Voci products automatically run analytics on the data and then produce actionable insights.

According to Rutenbar, the market for Voci's system, which also comes in a cloud-service version, includes any industry that generates and reviews loads of voice data, including law firms, enterprises involved in compliance and risk, as well as customer call centers.

"Voci technology is unique because it gets all the words and is the fastest, high-capacity speech-recognition engine in the world," explained Rutenbar, who noted that conventional approaches like keyword spotters and statistical sampling often miss a lot of customer issues and trends. "Our technology also gathers sentiment in addition to the words."

Last summer, Verizon adopted Voci's speech-recognition technology to power a new data analytics system that processes the results of customer voice surveys. This helps Verizon dig deeper into issues culled from as many as 750,000 surveys each month.

The management lessons he learned from starting two companies has helped Rutenbar be a better department head, and the experience has enhanced his interactions with alumni—some of whom are highly successful entrepreneurs. "It's very easy to have deep conversations with them because we share some common experiences," said Rutenbar. "The connection is immediate."

VOCI™

CS @ ILLINOIS
Strong in MOOCS

CS @ ILLINOIS and the University of Illinois continue to remain committed to a strong presence in the area of **massive**, **open online courses** (MOOCs).

Illinois to Offer Data Mining & Cloud Computing "Specializations" on Coursera Platform

Coursera and the University of Illinois announced a pair of computer science specializations, one in data mining and one in cloud computing. To receive recognition for having taken part in the specializations, learners will pay a fee of $49 per class.

Illinois' College of Business will also offer a pair of specializations, collaborating with Illinois' College of Media.

"These new specializations will more than double the number of MOOCs being offered by Illinois," said CS Department Head Rob A. Rutenbar. "They'll teach crucial topics in computer science in an important, emerging format."

The cloud computing specialization includes five courses in distributed systems, cloud apps, and networking. The data mining specialization includes six courses in data mining, text mining, and data visualization. Both specializations require a capstone project, which allows participants to demonstrate their new knowledge on a substantial project using realistic data.

"These courses build skills that are desperately needed and offer them to an unprecedented number of learners," Rutenbar said. "We're proud to be a part of these Coursera specializations because they're at the heart of what we do, and do so well, as a land-grant university."

CS Department Head
Rob A. Rutenbar

Most Anticipated MOOCs 2015

Professor Jiawei Han

One of the courses that will be part of the Coursera specialization in data mining—Pattern Discovery in Data Mining with CS Professor Jiawei Han—was listed as one of the "Top 10 Most Anticipated MOOCs of 2015" as compiled by Class Central, an aggregator of MOOC course listings.

Pattern Discovery in Data Mining teaches general concepts of data mining along with basic methodologies and applications. Students then move to an in-depth look at pattern discovery, a subfield in data mining.

Pattern Discovery in Data Mining serves as the first course of the Data Mining Specialization.

500,000 Learners

Demand for previous Illinois computer science MOOCs has been incredible. By the time this publication goes to press, MOOCs from the University of Illinois will have surpassed a total of half a million registered learners.

Professor Lawrence Angrave

The leading course for this was a course in programming Android mobile apps, which was taught by CS Lecturer Lawrence Angrave. More than 160,000 learners signed up for the course. Those who completed the course developed more than 10,000 different apps for this platform.

coursera

CS @ ILLINOIS Specializations on Coursera for 2015

CLOUD COMPUTING
This Specialization takes you on a tour inside, outside, and underneath, cloud computing systems.

Cloud Computing Concepts
with Indy Gupta (Feb 2–Mar 5)

Cloud Computing Concepts 2
with Indy Gupta (Mar 16–Apr 16)

Cloud Computing Applications
with Roy Campbell (Aug 24–Sep 29)

Cloud Networking
with Brighten Godfrey & Ankit Singla
(Oct 26–Nov 29)

DATA MINING
This Specialization will teach you data mining techniques for both structured data which conform to a clearly defined schema, and unstructured data which exist in the form of natural language text.

Pattern Discovery in Data Mining
with Jiawei Han (Feb 9–Mar 7)

Text Retrieval and Search Engines
with ChengXiang Zhai (Mar 16–Apr 11)

Cluster Analysis in Data Mining
with Jiawei Han (Apr 27–May 23)

Text Mining & Analytics
with ChengXiang Zhai (Jun 8–Jul 4)

Data Visualization
with John Hart (Jul 20–Aug 15)

New Paradigm Enables More Secure, Reliable Control Networks for Power Grid

KATIE CARR, COORDINATED SCIENCE LAB

When an energy company sustains a cyber attack, control system operators must quickly identify, isolate, and reroute around the affected network areas in order to maintain critical energy delivery functions. A global view of all communication flows would make that task much easier, but unfortunately, such an overview map isn't available to the energy sector at this time.

However, Oregon State University Assistant Professor Rakesh Bobba, Electrical and Computer Engineering Professors William H. Sanders and David Nicol,

Professor Roy Campbell

and CS Professor Roy Campbell, along with their collaborators at Schweitzer Engineering Laboratories (SEL), Ameren Corporation and Pacific Northwest National Laboratory (PNNL), are working to solve that problem through a $4.9 million software-defined networking (SDN) project funded by the Department of Energy and led by SEL. The team is developing a flow controller—including both a hardware device and supporting software—that will monitor, configure and maintain safe, reliable network traffic flows in energy system control networks.

The flow controller will bring the advantages of software-defined networking to power control networks. The project will build on the success of the current SEL Cybersecurity for Energy Delivery Systems (CEDS) Watchdog project, which produced a software-defined switch with deep packet inspection capabilities.

"Software-defined networking is a new paradigm that has emerged in the last few years and one which brings lots of advantages for reliability and security," said Bobba, who was previously a research assistant professor at Illinois.

The Illinois effort will focus on validation of flow configurations and on the security and reliability of SDN architectures, while Project Director Rhett Smith of SEL and his team will simultaneously work on network visualization and configuration programming. The validation part will be designed on the Illinois side and then later integrated into the controller.

The Illinois team will leverage results of prior Illinois validation research, such as Nicol's NP-View tool, which performs automated analysis of firewall configurations, and the Flow Verification Technology, created by Computer Science Professors Brighten Godfrey and Matt Caesar, which can be used to develop a validation framework for software-defined networking that is very specific to power control networks.

The goal of the project is to develop an overview map that would allow controllers to visualize the entire network of flows happening in real time and be able to detect anomalies and take preprogrammed actions. The project will produce the first solution available to system operators that allows them to view and configure a substation network in a single entity.

Professor Brighten Godfrey
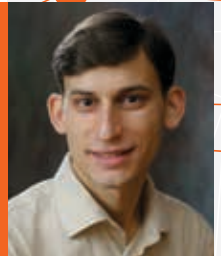
Professor Matt Caesar

New Method Helps Map Species' Genetic Heritage

BY LIZ AHLBERG, U OF I NEWS BUREAU

Where did the songbird get its song? What branch of the bird family tree is closer to the flamingo—the heron or the sparrow?

These questions seem simple, but are actually difficult for geneticists to answer. A new, sophisticated statistical technique developed by researchers at the University of Illinois and the University of Texas at Austin can help researchers construct more accurate species trees detailing the lineage of genes and the relationships between species.

The method, called statistical binning, was used in the Avian Phylogenetics Project, the subject of a December 12 special issue of the journal *Science*.

"A species tree is a way of describing how a species evolved from a common ancestor," said study leader Tandy Warnow, Founder Professor of Engineering at the University of Illinois. "Researchers use a species tree to do all sorts of things, like figure out when different traits came into being, and what triggered that trait evolution, and how those things may or may not have been triggered by environmental changes."

There are two main approaches to constructing a species tree from genomic data, Warnow said. One method, which has prevailed for decades, puts all the gene data together into one giant matrix and analyzes it to map the overall species tree. This is called *concatenation*. The difficulty with that approach is that individual genes often have different lineages, which

can diverge greatly from each other and the species tree as a whole.

A second approach, the coalescent-based method, looks at the data for each gene and estimates gene trees for each trait. Then it combines all the trees together to create the overall species tree. While this approach is sound theoretically and statistically, it does not perform as well as expected in practice.

"We realized that the gene trees that are combined have error in them," Warnow said. "When the gene trees have error, then when you combine them you get a bad estimate of the species tree. So we needed to get better gene trees, and the question is, how do we do that?"

Statistical binning takes all the gene data and uses statistical optimization techniques to sort the genes into sets or "bins." The genes in each bin have trees that don't seem to have statistically significant

differences. The data for each bin is combined into a "supergene" tree, and then the supergene trees are combined into an overall species tree.

"You can think of statistical binning as combining the best properties of the two dominant approaches," said Siavash Mirarab, graduate student at the University of Texas at Austin and first author of the paper detailing the statistical binning method. "Without this method, what people had to do was throw away data they didn't like. This approach allows you to use all the data you have and you don't have to throw away anything. We have a method that achieves that by grouping things together in a way that makes sense, statistically."

The researchers compared the species trees produced using the coalescent method with statistical binning to trees produced with concatenation or coalescence alone for several biological classes, such as birds, mammals, yeast and others. They found that adding the statistical binning process to the pipeline produced species trees that were better than the trees produced by either of the conventional methods.

"We sort the gene data in a sophisticated statistical way, but having done it we get better trees," Warnow said. "The result is significantly improved estimates of the gene trees, which gave us better estimates of the species tree and branch lengths, which helps you figure out when things happened. Everything was much more accurate."

Statistical binning allowed the Avian Phylogenetics Project to analyze more than 14,000 genes—one of the largest such projects yet published—and construct a large tree linking many different bird species.

Warnow and Mirarab plan to continue to refine the statistical binning method and hope that it can add accuracy to many other similar studies.

"There's a large divide in the research community as to whether to use concatenation of a coalescent analyses. What we did was understand why the coalescent method didn't give good results and came up with a way of improving the input so that it could have good results. It's a way of bringing these two very divided communities into greater agreement with each other," Warnow said.
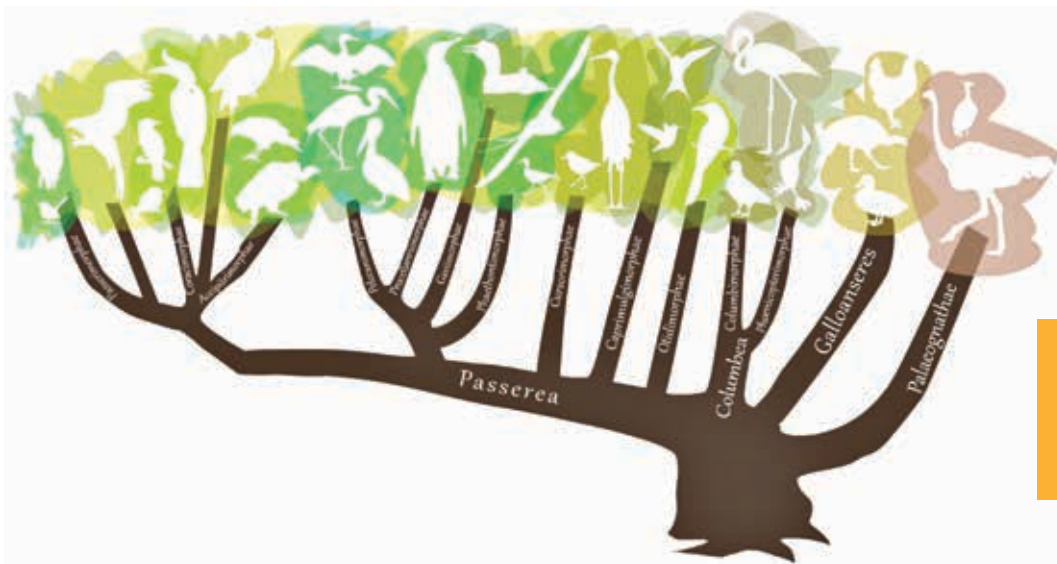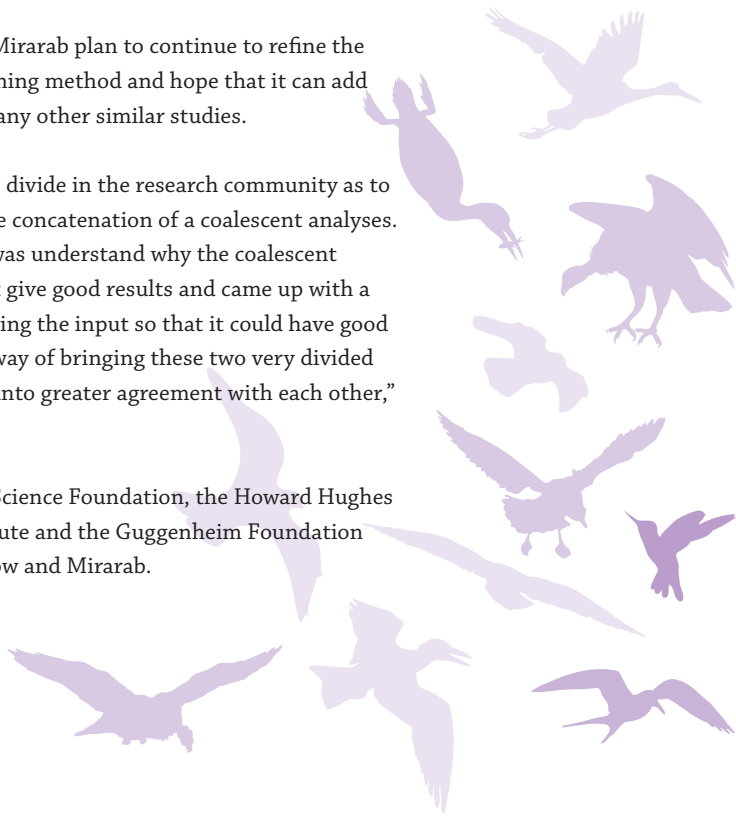
Bird Tree of Life

Explore an interactive Flash graphic that illustrates the evolutionary relationships of dozens of bird species: http://bit.ly/1ywZ1X0

Upgrading Programming for Mobile Cloud

KATIE CARR, COORDINATED SCIENCE LAB

Professor Gul Agha

While many mobile device applications are backed by cloud servers and storage, the current programming technology is tedious and potentially error prone. According to CS Professor Gul Agha, developing individual application parts is not difficult, but developing an entire system is far more challenging and there's currently no way to map user-level application code to the computational resources available in a flexible way.

Professor Darko Marinov

Agha, along with CS Professor Darko Marinov, proposes a new methodology for building mobile cloud applications that can leverage cloud resources in a scalable way, while dramatically simplifying the development effort. Their project, titled "Model-Based, Event-Driven Scalable Programming for the Mobile Cloud," aims to develop a high-end interface language that's simple for programmers, while back-end programming could still be done using an actors model, which is optimal for scaling and was developed by Agha in 1985. This will make it easier to program web applications without compromising their efficiency and scalability in execution, using the actors model. The project, a collaboration with Daniel Jackson at MIT, recently received a three-year NSF grant for $1 million to fund the project, of which two-thirds is allocated to Illinois.

"Programmers often want to do simpler operations that are domain specific and to do it easily," said Agha. "This work will help translate a high-level user language for web applications into something that's very parallel. While more sophisticated programmers can still use actors for programming, such a translation will allow for a simpler interface that less sophisticated application programmers can use."

Agha said the challenge has been getting translations that are correct and efficient while creating an interface that's very intuitive. He added that there are lots of software errors and they're very expensive and time consuming to correct.

"Fifty to eighty percent of the effort in programming goes into stitching software components together and debugging the integrated system," Agha said. "So if you are programming in a model that's a lot friendlier for composition, that problem becomes a lot easier. That's why the actor model has been used for large-scale parallel and distributed applications such as Twitter, LinkedIn and Facebook Chat, but doing so now requires a lot of sophistication."

Software Teaches Computers to Translate Words to Math
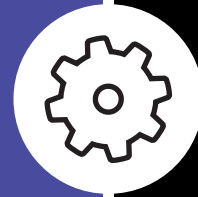
LIZ AHLBERG, U OF I NEWS BUREAU

If Johnny has five apples and seven oranges, and he wants to share them with three of his friends, can a computer understand the text to figure out how many pieces of fruit each person gets?

Thanks to new software developed at the University of Illinois, machines now can learn to understand mathematical reasoning expressed in language, which could greatly improve search engines and access to data as well as boost mathematics education.

CS Professor Dan Roth and graduate student Subhro Roy published their work in the journal *Transactions of the Association for Computational Linguistics*.

"There is a lot of data available in news archives and public records, but it cannot be accessed in a meaningful way," Roth said. "For example, if people want to know what percentage of a state's budget has been spent on education over the past 20 years, a query like that won't give the desired result with a keyword search performed today in a search engine like Google. But if the engine were able to do quantitative reasoning, it would infer from the text the type of information the user is looking for. It can find the numbers, then calculate the percentages and addition required to do this."

The first hurdle, and the biggest challenge, was in teaching the computer to identify quantities and units in text regardless of how they are expressed, something humans do unconsciously when reading. Secondly, the software has to decide what to do with the identified numbers.

In the problem with Johnny, for example, the computer has to understand that both apples and oranges are fruit; it has to know that the words *five*, *seven*, and *three*
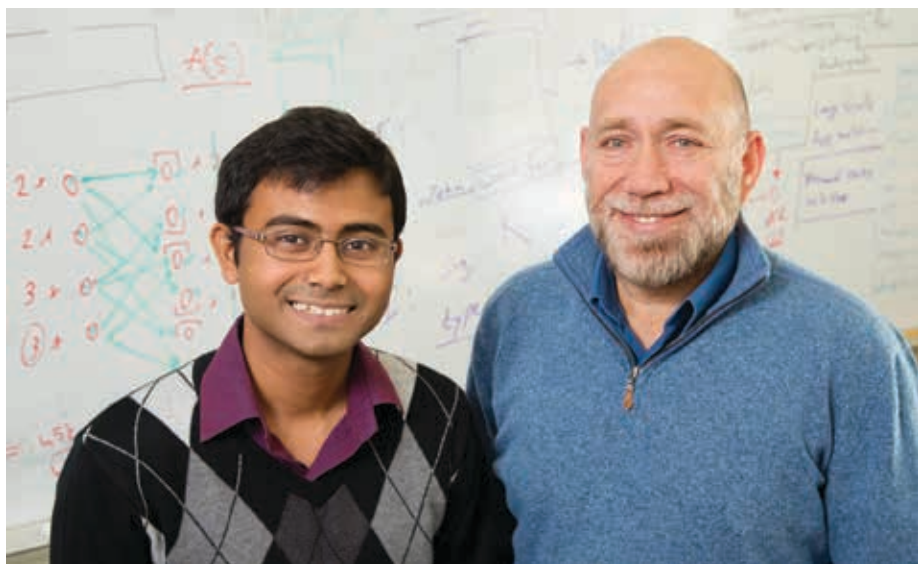
are equivalent to the numerical values 5, 7, and 3; it has to determine what kind of operation(s) the question requires—in this case, addition and division—and in which order to conduct those operations. Once the program has converted the text into an equation, it can easily compute that Johnny and his friends each have three pieces of fruit.

The researchers tested their software's abilities to identify and normalize quantities in text, to perform searches regarding monetary currencies, and to understand and solve elementary-school-level math word problems. They found that the software performed well in all tasks. It even outperformed the average elementary-level student on standardized word problems, Roth said, getting 87 percent of answers correct.

The Army Research Laboratory and the Defense Advanced Research Projects Agency supported this work.

CS graduate student Subhro Roy (left) and Professor Dan Roth developed software to help computers understand math concepts expressed in text. This will improve data accessibility, search and education. Photo by L. Brian Stauffer.

THE ILLINOIS-

University of Illinois Collaborates with Mayo Clinic to Revolutionize Genomic Data Analysis

Today's researchers, working with the advantages of new, sophisticated laboratory technology, have unleashed a river of valuable biomedical data—much more, in fact, than many of them have the tools to properly analyze, or the capacity to store. In 2012, the National Institutes of Health created the Big Data to Knowledge (BD2K) initiative to enable efforts to harness the potential of this flood of information. As part of the first wave of BD2K funding, the University of Illinois at Urbana-Champaign and Mayo Clinic have now received a $9.34M, 4-year award to create one of several new Centers of Excellence for Big Data Computing.

The NIH initiative encompasses a broad range of "big data" types, including collections of high-resolution research images or real-time recordings of complex biological phenomena. The Illinois-Mayo Center, to be located on the Urbana-Champaign campus, will focus on the analytical challenges posed by the rapidly growing body of genomic and transcriptomic data produced by genome-wide, high-throughput experimental technologies.

The Center's research goal is to create a revolutionary analytical tool that allows any biomedical researcher to place a gene-based data set in the context of "community knowledge," the entire body of previously published gene-related data. This broad context for individual data sets will offer new functional insights for the genes being studied. The proposed Knowledge Engine for Genomics, or KnowEnG, will be unique in its integration of many disparate sources of gene-related data to increase its analytical power, as well as in its planned scalability—the tool will be designed to accommodate the continued growth of genomic community knowledge, and the increasing computational infrastructure required to work with genomic data.

To create KnowEnG, the Center will combine the expertise of many units across the U of I campus, including the Institute for Genomic Biology (IGB), the Department of Computer Science, the Coordinated Science Laboratory, the College of Engineering, and the National Center for Supercomputing Applications (NCSA). As a leader of biomedical research and structured data collection, Mayo Clinic will play a vital role in design, testing, and refinement.

The Center will be led by computer scientist and IGB affiliate Jiawei Han, who will serve as Program Director. Other Principal Investigators are computer scientist and IGB member Saurabh Sinha;

MAYO CENTER

Professor Jiawei Han

Professor Saurabh Sinha
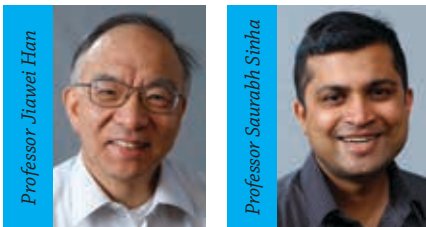
physicist, bioengineer and IGB member Jun Song; and Richard Weinshilboum, M.D., interim director of the Mayo Clinic Center for Individualized Medicine and director of the center's Pharmacogenomics Translational Program. IGB and NCSA Director of Bioinformatics and Director of the High-Performance Biological Computing Group, C. Victor Jongeneel, will function as Executive Director.

The Center's transcendence of disciplinary boundaries will be key to its success. Insights drawn from many areas of computer science will strengthen KnowEnG's design.

"By integrating multiple analytical methods derived from the most advanced data mining and machine learning research, KnowEnG will transform the way biomedical researchers analyze their genome-wide data," said Han. "The Center will leverage the latest computational techniques used to mine corporate or Internet data to enable the intuitive analysis and exploration of biomedical Big Data."

The Center will also rely on communication between interface design experts at Illinois and biomedical researchers at Mayo Clinic, who represent KnowEnG's intended users. Feedback among these Center members will ensure that the developed tool is valuable, intuitive, and customizable for use in a broad array of experimental contexts.

Describing his excitement for the project, co-PI Sinha explained,

"This is [a project] that's bigger than all of us … what I'm most excited about is the actual possibility that this could be a tool which everybody uses in the world."

In addition to development of KnowEnG, the Center will develop a training framework that empowers researchers to use the new tool and engage in bioinformatics research, regardless of their prior computational knowledge. The Center will also participate in a planned nation-wide consortium, composed of all the BD2K Centers of Excellence established by the NIH initiative, to exchange insights, contribute to standards for tool development, and help set broad goals for the future of work on Big Data.

Nahrstedt Receives SIGMM Award
for Outstanding Technical Contributions

Professor Klara Nahrstedt

CS Professor Klara Nahrstedt was the 2014 winner of the prestigious ACM Special Interest Group on Multimedia (SIGMM) award for Outstanding Technical Contributions to Multimedia Computing, Communications and Applications.

Nahrstedt is a leading researcher in multimedia systems. She has made seminal contributions in quality of service (QoS) management for distributed multimedia systems. Her pioneering work on QoS brokerage with QoS translation, QoS negotiation and QoS adaptation services set between application and transport layers to enable end-to-end QoS contract changed the way multimedia end-system architectures are designed and built. This result was published as the "QoS Broker" in 1995. Her novel QoS adaptation extended this work by modeling the end-to-end QoS problem based on a control-theoretical approach. This work gained wide recognition as the first usage of

Coordinated Science Laboratory on the University of Illinois campus

control theory in multimedia systems and received the Leonard C. Abraham Paper Award from the IEEE Communication Society.

Nahrstedt also made fundamental contributions to QoS routing. In her 1999 JSAC paper "Distributed Quality of Service Routing in Ad-hoc Networks," she derived a distributed time and bandwidth sensitive routing scheme for a dynamic multi-hop mobile environment. Her *IEEE Network Magazine* paper, "An Overview of Quality-of-Service Routing for the Next Generation High-Speed Networks: Problems and Solutions" received the "Best Tutorial Paper" Award from the IEEE Communication Society in 1999 and is still highly relevant today.

She leads the 3D tele-immersive systems and networking field. She was the first to develop a multiview 3D video adaptation framework for bandwidth management and view-casting protocols for multiview 3D video. She has developed new metrics for 3D immersive video and the first comprehensive framework based on sound theoretical underpinnings for Quality of Experience in Distributed Interactive Multimedia Environments. This work was awarded Best Student Paper Award at the premier SIGMM conference, ACM Multimedia 2011, and her PhD student received the SIGMM 2012 Best PhD Thesis Award as a result.

She has co-authored two widely used textbooks: *Multimedia Systems* and *Multimedia Computing, Communications and Applications*. Among her other recognitions are the 2009 Humboldt Fellow Research Award, the 2012 IEEE Computer Society Technical Achievement Award, the 2013 ACM Fellow recognition and the 2014 induction into the German National Academy of Sciences.

Earlier this year Nahrstedt was named the director of the Coordinated Science Laboratory on the University of Illinois campus.

Khandelwal Receives CRA Outstanding Undergraduate Researcher Award

BY TOM MOONE

CS senior Urvashi Khandelwal was named one of only four recipients of the 2015 CRA Outstanding Undergraduate Researchers Award. This award recognizes undergraduate students in North American colleges and universities who show outstanding research potential in an area of computing research.

Khandelwal has an interest in data mining and machine learning that began when she was in high school and her brother was at graduate school with a focus in data mining. He used to talk to her about what he was working on, and even though she did not understand all the intricacies of his research and coursework, she discovered this was a subject area she wanted to learn more about.

When she got to the University of Illinois as a freshman, Khandelwal knew early on that she wanted to get involved in research. She sent a note to CS Professor Jiawei Han expressing interest in working in his research group.

Professor Jiawei Han

"He was extremely welcoming and warm and encouraging," said Khandelwal. "Over the years he's always been really helpful and encouraging and a great advisor."

Khandelwal's work with Professor Han has focused on heterogeneous information networks (HINs). Such networks contain multiple types of objects and links. They can be used to model many real-world situations, making them extremely useful in solving a variety of problems in the domain of recommendation systems, information retrieval, etc.

Her current project, which is the basis of her senior thesis, involves creating a personalized list of recommended publications for researchers who are new to a topic. She plans to use phrase types and

ontology in a paper to optimize relevance, use authors and venues to learn authority, and use meta paths to determine diversity and semantic justification.

"Urvashi is surely an asset to our group," Han said. "She has been very active working on research, collaborating with multiple PhD students. She has been constantly generating innovative ideas and very good results on data mining research, especially related to heterogeneous information networks. We expect she will make notable contributions on research."

Khandelwal was co-author on three publications presented at prestigious conferences. She plans to continue research in graduate school after completing her bachelor's degree.

Five CS @ ILLINOIS Graduate Students Named Siebel Scholars

Amirhossein Aleyasen

Gourav Khaneja

Mayank Pundir

Lamyaa Eloussi

Jereme Lamps

BY TOM MOONE

"Every year the Siebel Scholars Program recognizes the top students in the top graduate programs in the world," said Andreas Cangellaris, dean of the College of Engineering. "We join them in applauding these students' dedication and achievements. They remind us that our institution's place as a world leader of research and innovation is secure."

AMIRHOSSEIN ALEYASEN is completing his master's degree working with CS Professor Marianne Winslett and GSLIS Professor Jana Diesner (Diesner was herself a Siebel Scholar, class of 2011, from Carnegie Mellon University). His research brings an integrated perspective to the analysis of unstructured and semi-structured data from three disciplinary points of view: data management, text mining and social network analysis. While still an undergraduate, Amirhossein was co-founder of a successful startup that provides real-time location-based analytics for public transportation in a large city of over three million inhabitants.

Aleyasen received his bachelor's degree from Sharif University of Technology in Tehran, Iran. In 2013 he was a finalist in the SignalFire University Hacker Olympics held in San Francisco, and received honorable mention at the Facebook Midwest Regional Hackathon held at the University of Illinois.

LAMYAA ELOUSSI is pursuing a master's degree under the direction of Professor Darko Marinov on software testing, and she published two papers on test selection and test non-determinism. Her work focuses on making the process of regression testing faster and more reliable. She also works with Professor Vikram Adve's group on making deterministic parallelism more usable.

Eloussi received her bachelor's degree from Al Akhawayn University in Ifrane, Morocco, in 2013, graduating at the top of her class. In 2011, she spent a semester abroad at the Claremont Colleges in California. In 2013, she did a six-month internship at ST Microelectronics in Brussels, Belgium where she developed a security module for a smart-meter gateway.

GOURAV KHANEJA is working on self-adaptable cluster management and scheduling strategies for multitenant cloud computing platforms, shared by a wide variety of applications and services. Working in Brighten Godfrey's research group, Khaneja is actively contributing to the open source cluster management framework. His goal is to build a pluggable scheduling and resource allocation system for popular cluster management frameworks. His research focuses on the scalability, reliability, availability, and performance guarantees of cloud computing components.

Khaneja received his bachelor's degree in Computer Science from Indian Institute of Technology (IIT) Kharagpur in 2010. He worked as a Senior Software Engineer in Yahoo for two years and spent a year working as a Quantitative Researcher in WorldQuant LLC.

In addition to being a graduate student, **JEREME LAMPS** is also a researcher at Sandia National Laboratories in the Critical Infrastructure Systems group. A member of Professor Matthew Caesar's research group, Lamps has a strong interest in computer security. As part of his research work he has developed a tool that performs rootkit detection for systems in a cloud environment. This tool allows for added data integrity and privacy. Currently, he is working on bringing virtual time to the Linux kernel. When integrated with a network simulator (such as ns-3), this tool will allow for more advanced and complex network simulations with existing equipment.

Lamps received his bachelor's degree from the University of Illinois in 2012. In 2012 he received first place at the Tracer Fire Training and Competition and second place in the Illinois Collegiate Cyber Defense Competition.

MAYANK PUNDIR works on distributed compute and storage systems under the direction of Professors Roy Campbell and Indranil Gupta. He has been involved in research covering a variety of topics including distributed systems, information retrieval and location privacy. He has also interned at Facebook, working on the core data infrastructure group in Menlo Park, California.

Pundir earned his bachelor's degree from Indraprastha Institute of Information Technology, New Delhi, where he received the Chancellors Gold Medal for best academic record.

ABOUT SIEBEL SCHOLARS

The Siebel Scholars program was established by the Siebel Foundation in 2000 to recognize the most talented students at the world's leading graduate schools of business, computer science, and bioengineering. Each year, 85 exceptional students receive a $35,000 award during their final year of studies based on outstanding academic performance and leadership. Today, an active community of over 950 Siebel Scholars serves as advisors to the Siebel Foundation and works collaboratively to find solutions to society's most pressing problems.

This exceptional group has the unique opportunity to directly influence the technologies, policies, and economic and social decisions that shape the future. Siebel Scholars can guide the development of innovative programs the Foundation initiates. The Siebel Scholars community is also integral to a highly outcome-driven Siebel Scholars conference held regularly to explore critical social issues.

Scholarships & Fellowships BY TOM MOONE

Calhoun Receives Blue Waters Graduate Fellowship for Work on Algebraic Multigrid

Jon Calhoun received one of six nationally competitive Blue Waters Graduate Fellowships in recognition of his research.

Calhoun's work focuses on improving the resiliency of algebraic multigrids (AMGs). The detection of transient faults at scale will be the first stage of his project. The work will transcend AMG and can be applied to other nonnumerical codes. Calhoun then plans to utilize algorithmic properties of AMG to create a tailored recovery scheme.

The Blue Waters Fellowship provides a year of support, including a $38,000 stipend, up to $12,000 in tuition allowance, an allocation on the powerful Blue Waters petascale computing system, and support for travel to the annual Blue Waters Symposium.

Calhoun is completing his PhD under the direction of Professor Luke Olson.

Menon Receives George Michael Memorial HPC Fellowship

Harshitha Menon, a PhD candidate advised by CS Professor Laxmikant Kale, is a recipient of the 2014 ACM/IEEE-CS George Michael Memorial High Performance Computing Fellowship. This fellowship honors exceptional PhD students around the world whose research focuses on high-performance computing, networking, storage, and large-scale data analysis. Fellowship winners are selected based on overall potential for research excellence and academic progress. This fellowship provides a $5,000 honorarium, and the award was presented at the Supercomputing 2014 Awards Ceremony.

Menon's research focuses on developing scalable load balancing algorithms and adaptive run time techniques to improve the performance of large scale dynamic applications. Her research covers performance optimizations of a cosmology simulation application called ChaNGa, which is a collaborative research project between PPL and astrophysicists at University of Washington.

Menon previously received the 2014 Google Anita Borg Memorial Scholarship, and in 2012 she was selected as a Siebel Scholar.

Yoon Receives Intel PhD Fellowship & Padovani Scholarship

Man-Ki Yoon was one of just nine recipients of a 2014 Intel PhD Fellowship. The fellowship program recognizes top students in engineering and computer science.

Yoon received the fellowship to support work on his dissertation "Secure Multicore Architecture for Embedded Systems," which he is completing under the direction of CS Professor Lui Sha and Illinois ITI Research Scientist Sibin Mohan. His research examines the threats that are increasingly being placed upon embedded systems. These systems can be found in mobile devices, and in automated systems throughout industry.

Yoon's research will work to address these security challenges inherent in embedded systems. He examines a combination of analytic and system architectural solutions for detecting threats to embedded systems.

Yoon also received the Roberto Padovani Scholarship from Qualcomm. The Roberto Padovani Scholarship program was created in 2008 to recognize Qualcomm Research interns who demonstrate extraordinary technical talent during their summer internships. It is a global program that includes nominees from Qualcomm Research offices across the globe.

Yoon worked at Qualcomm Research Silicon Valley in Santa Clara, California, on mobile security and privacy for smart phones.

Naveed Receives Google PhD Fellowship in Security

Muhammad Naveed was one of just 15 recipients of a 2015 North American Google PhD Fellowship. Created in 2009, these fellowships recognize outstanding graduate students who are doing exceptional work in a number of computing disciplines. Naveed is a fourth-year PhD student working in the area of security.

Naveed said his research projects fall into three broad areas: cryptography, systems security, and genomic privacy. In the area of applied cryptography, he is working to bridge the gap between theoretical cryptography and real applications. His work on systems security focuses on Android devices. He works to identify fundamental security flaws in the Android system and to suggest solutions. In the genomic privacy area, Naveed is working on both technological and policy issues.

He is working under the direction of Manoj M. Prabhakaran and Carl Gunter.

Illinois Students Claim Top Prizes at Hackathons

HackGT2014

Four CS @ ILLINOIS students claimed the top prize at HackGT2014, a hackathon held at Georgia Tech. The group of Kevin Jasieniecki, Keagan McClelland, Kevin Scheer, and Nathan Dolph was one of three teams from Illinois that finished among the top 10 in a contest that attracted about 1,000 college students.

For coding an app called PickMeUp, the foursome won $10,000 in cash, $60,000 in Microsoft server credits, $50,000 in investment funding from TechSquare Labs, a provisional and utility patent, and a second round of interviews with Trip Advisor.

The idea behind the app is an interesting take on natural language processing (NLP), which uses the connection of language to determine mood and thus predict behavior. In this particular case, it would take a series of text messages from a phone to determine the mood of the user and if he is sad, automatically send a car to their home and prompt them to go out on the town.

"We decided to use the final hours to figure out how we could extend this concept and make it more applicable to the real world and practice our pitching skills," McClelland said. "That ended up catching a lot of the judges' attention."

"It's 'a Pick Me Up that picks you up,'" Jasieniecki said of the ultimate tag line. "When we said that line at the end of the pitch, it really struck a chord with audience and ultimately the judges."

More information on the winning project can be found at: http://cpo.st/1DUTxe

Hack the North

At Hack the North, held in September at the University of Waterloo, a team made up of CS graduate student Oreoluwa Alebiosu and CS undergraduates Neville Jos, Timothy Ong, and Arjun Sarode, were among the 10 winning teams for the hackathon.

The team built an integration of both hardware and software system that helps translate physical sign language to spoken words.

"With so many motion detector/sensor and gesture control systems that are being introduced with the likes of Leap Motion, Myo, and Nod, we found it useful to utilize their SDKs [software development kits] to help build our system," said Alebiosu.

It is estimated that 2 million people rely on sign language for communication in the United States. With SignLang, these users will be able to better communicate with those who do not sign. They used a LeapMotion and a Myo to detect hand and arm movements and then used meSpeak to speak once the letter has been identified. The team also won the LeapMotion prize for their use of that product.

Learn more about the project from Hack the North at: http://cpo.st/1ALCSHs.

Major League Hacking

Illini Hackers were named the winner of the Major League Hacking Fall 2014 North America Season. The Illinois team collected the most merit points of any school for the fall season.

According to Major League Hacking, the season scored universities based both on how many of their members attend each event, and also on how many top-placed hacks each team earns. Illinois performed excellently in both metrics.

Learn more about Illinois winning Major League Hacking for fall 2014: http://bit.ly/17zuRuZ.

Graduate Students Inspired by Research Giants

BY LAURA SCHMITT

How cool would it be to meet and chat with the biggest names in computer science and mathematics—people like Internet architect Vinton Cerf or computer graphics pioneer Ivan Sutherland? Three CS @ ILLINOIS researchers found out last fall when they attended the second annual Heidelberg Laureates Forum in Germany.

Sponsored by the Heidelberg Institute for Theoretical Studies and the Klaus Tschira Foundation, the forum brings together the winners of the most prestigious math and science awards with 200 of the world's most promising young researchers during five days of lectures, informal networking, tours, and receptions.

"I couldn't think of a better use of my time probably for my whole life," said CS graduate student Sridhar Duggirala, who met his intellectual hero at the event— ACM A.M. Turing Award winner John Hopcroft. Duggirala read Hopcroft's groundbreaking textbook, *Formal Languages and Their Relation to Automata*, which inspired him to pursue formal methods research.

"[Hopcroft] autographed my copy of the textbook," said Duggirala. "Although he's older now, he still has the drive to do research and teach. I got a chance to see how motivated he is, and how friendly he is to young researchers, which was inspiring."

According to Duggirala, attending the forum solidified his decision to pursue an academic career. "[The laureates] showed me the clear advantages of being an academic, such as having the freedom to think of and work on interesting problems," he said, noting that many of the scientists who won Turing Awards did so based on their academic work.

Duggirala was delighted to have conversations with famous researchers like Sir Michael Francis Atiyah, who created the mathematical proof of the index theorem; Daniel Spielman, who developed the idea of smoothed analysis of algorithms; and Manjul Bhargava, known for developing new methods in the geometry of numbers.

These conversations changed his outlook about what it takes to do groundbreaking research. "As a new grad student, your idea of research is writing a few papers and finding some problems to work on," he said. "But talking to [the laureates] made me realize the importance of persistence, diligence, managing the risks, and creativity in knowing which problems to pursue and in finding solutions to those problems."

In addition to Duggirala, CS alumni Wonsun Ahn (PhD '12), who is now a CS faculty member at the University of Pittsburgh, and David Morrison (PhD '14), who is at DM Consulting in California, also attended the forum this year. Last year, Abhinav Bhatele (MS CS '07, PhD '10) and Siva Kumar Hari (MS CS '09, PhD '13) attended the inaugural Heidelberg Laureate Forum.

CS graduate student Sridhar Duggirala, met his intellectual hero at the event—ACM A.M. Turing Award winner John Hopcroft.

HEIDELBERG
LAUREATE
FORUM

Two Exceptional CS Seniors Among 2015 Knights of St. Patrick

BY LAURA SCHMITT

A non-traditional student, CS senior Marrissa Hellesen never thought she'd receive the College of Engineering's highest student honor. "I was in the dean's office [206 Engineering Hall] one spring after the Knights had decorated, and my advisor told me about them," said Hellesen, referring to the annual prank the Knights play on the engineering administration. "I thought, 'That's something I'll never have.'"

On March 14, though, Hellesen and fellow CS senior Matthew Dierker were among the 12 engineering students inducted as Knights of St. Patrick, an honor that recognizes leadership, excellence in character, and exceptional contributions to the college and its students.

A community college transfer student, Hellesen initially struggled with the transition to Illinois. But with the support of Assistant Dean Ivan Favila and her own perseverance, Hellesen has thrived at Illinois.

Wanting to help other transfer students, Hellesen has served as a teaching assistant for Engineering 300, a required introductory course, for three semesters. "It's been very meaningful for me to be able to help students with the transition so they can avoid some of the pitfalls that I encountered," Hellesen said

During her summers, she has worked as a counselor for the CS @ ILLINOIS Girls Engaged in Math & Science (GEMS) middle school camp and taught computer programming at the Campus Middle School for Girls on campus.

A native of Sugar Land, Texas, Dierker has also made major contributions to the college. In 2014, he led a team of nearly 200 staff and volunteers in organizing the first HackIllinois, a student-run event that attracted more than 750 students from 25 colleges and universities for 36 hours of fun yet intense, CS-related competition.

"We worked on this for six months and poured a lot of passion into it," said Dierker, who met Hellesen for the first time in planning the event. "Seeing it turn out so well was pretty cool."

Since his freshman year, Dierker has also served as a CS @ ILLINOIS ambassador, interacting with prospective and admitted students through tours, luncheons, and Q&A sessions. According to Dierker, his efforts at helping the department attract the best students been especially rewarding.

"One of the students once told me that he was at Illinois because of something I said," Dierker said. "That made an impact."

Hellesen and Dierker also helped organize Splash, a one-day CS conference in April that attracted 250 high school students. Splash grew out of the Women in Computer Science's ChicTech Retreat. Hellesen and Dierker worked on a small team of staff to train the teachers and coordinate the event.

Colorized scanning electron micrograph of a single filamentous Ebola virus particle. Image courtesy of National Institute of Allergy and Infectious Diseases.

Jacobson Brings Analytics Expertise to Ebola Screening

BY TOM MOONE

Last year, the world watched as Ebola again appeared in West Africa. In prior outbreaks, the disease surged but would soon disappear as doctors and other aid workers moved in to help the sick and contain the spread of the disease.

In 2014, the United States saw just how fragile this containment could be. In September, a man who had flown from Monrovia, Liberia, to Dallas by way of Brussels and Washington became the first person to be diagnosed with Ebola while on U.S. soil. Soon after two healthcare workers who had been treating this patient also became infected.

Suddenly the disease was a very real U.S. health problem.

The press turned to CS Professor Sheldon H. Jacobson for answers. In August, Jacobson had been contacted by a reporter for *Defense One*—a journal covering U.S. defense and national security policy—to comment on how Jacobson's research in airline security analytics could apply to Ebola screening. "I said there are some similarities and some differences," Jacobson said. "[Ebola's] a lot harder."

Following on the heels of Ebola's arrival in the U.S., Jacobson's appearance in the earlier *Defense One* story led to an invitation by the *Washington Post* to write an op-ed on the topic. Titled "Airports Should Be Screening for Ebola the Same Way They Screen for Terrorists," the piece appeared on October 2. In it, Jacobson said that screening would be the key approach to controlling the spread of the disease. "Screening passengers before they get onto an airplane is the best weapon available for limiting the spread of Ebola," Jacobson said in the op-ed. "The least intrusive approach would be to question passengers on their travel histories over the previous three weeks." Any passengers who can show they have not been in infected areas would be allowed to continue their travel to the U.S.

This piece in the *Washington Post* led to other invitations to share his expertise on this topic. He took part in a number of interviews with such media outlets as MSNBC, WAND TV in Decatur, CBC Radio Canada, and Huffington Post Live.

"We're not social scientists or epidemiologists. We are trying to understand the decision making process," Jacobson said of his approach. "Right now we don't know if the right decisions are being made, so we're trying to create an analytic framework."

Professor Sheldon Jacobson

Since he was first approached last summer, Jacobson has started a new research focus on Ebola screening to help develop an understanding of the best practices for controlling and preventing the spread of the disease. He has also been invited to join a bi-weekly online discussion group that brings together leading researchers from a variety of scientific fields to understand the issues Ebola poses for the United States.
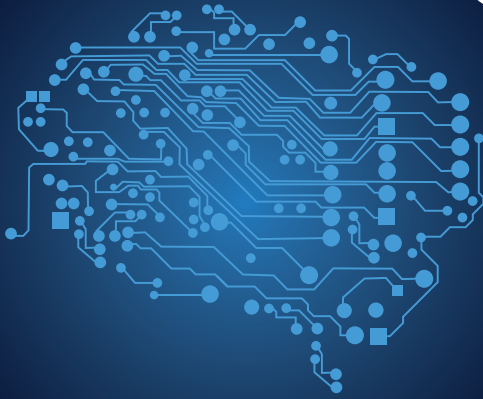
Roth One of Six Illinois Faculty Elected AAAS Fellows

Professor Dan Roth

CS Professor Dan Roth was one of six University of Illinois at Urbana-Champaign faculty members elected a 2014 fellow of the American Association for the Advancement of Science. The other recipients were Placid M. Ferreira (Mechanical Science and Engineering), Brendan A. Harley (Chemical and Biomolecular Engineering), Joseph W. Lyding (Electrical and Computer Engineering), Phillip A. Newmark (Cell and Developmental Biology), and William H. Sanders (Electrical and Computer Engineering).

The Illinois researchers are among the 401 new fellows chosen for their efforts to advance science applications that are deemed scientifically or socially distinguished. The new fellows were honored at the AAAS annual meeting in February.

"These are extraordinary faculty members who are making great contributions in their fields. They are innovators and educators who are committed to addressing the grand challenges of our society. They are prime examples of the scholarship, ingenuity and quality teaching that are Illinois hallmarks," said Ilesanmi Adesida, the vice chancellor for academic affairs and provost of the Urbana-Champaign campus.

Roth was honored for distinguished contributions to the field of computer science and engineering, particularly for innovations in machine learning. His research focuses on machine learning methods for natural language understanding, or helping computers to understand language to better interact with humans.

Roth earned his PhD from Harvard University in 1995 and joined the faculty at Illinois in 1997. He is a fellow of the Association for the Advancement of Artificial Intelligence, the Association for Computational Linguistics and the Association for Computing Machinery, and received an NSF CAREER award. He also is affiliated with the Beckman Institute at Illinois.

The American Association for the Advancement of Science, the world's largest general scientific society, was founded in 1848. Fellows are chosen for their outstanding contributions to the field, a tradition since 1874.
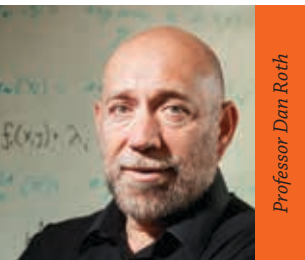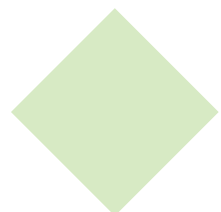
Adve Named a Fellow of ACM

BY TOM MOONE

CS Professor Vikram Adve has been named a 2014 Fellow of the Association for Computing Machinery (ACM). In his citation he was recognized "for developing the LLVM compiler and for contributions to parallel computing and software security." He is one of 49 ACM members being recognized this year for their contributions to computing.

Adve is an expert in compilers and programming languages, and their use for software security, system reliability, and parallel programming. He is one of the developers of the LLVM compiler infrastructure, which provides novel and unique capabilities for compiling software in any programming language

In nominating Adve for the award, CS Professor David Padua wrote, "Adve has made notable and influential contributions to compiler design and infrastructure, parallel computing, and software security."

ACM will formally recognize the 2014 Fellows at its annual Awards Banquet in June 2015 in San Francisco.

In addition to this recognition, Adve and his colleagues received the ACM Software System Award in 2012 for their work on LLVM. This award is given by ACM to one software system every year "that has had a lasting influence, reflected in contributions to concepts, in commercial acceptance, or both."

Professor Vikram Adve

> **Adve has made notable and influential contributions to compiler design and infrastructure, parallel computing, and software security.**

Professor David Padua

at link-time, install-time, or run-time. LLVM was released to the public in October 2003 as open source software, and has since had a major impact on the computing industry across platforms ranging from smartphones to supercomputers.

LLVM is used to build the primary compilers on all Apple iOS and MacOS systems, is used on all recent Android phones, and is used for major compiler products at Qualcomm, Sony, ARM, Intel, NVIDIA, Cray, and others. It is also used extensively for academic research, open source projects, and at government laboratories.

Smaragdis Named an IEEE Fellow

Professor Paris Smaragdis

CS Assistant Professor Paris Smaragdis was recently named a Fellow of IEEE "for contributions to audio source separation and audio processing."

Being named an IEEE Fellow is a distinction reserved for select IEEE members whose extraordinary accomplishments in any of the IEEE fields of interest are deemed fitting of this prestigious grade elevation. IEEE is the world's largest technical professional society.

"I am very honored to have received this distinction," said Smaragdis. "Knowing that this comes from my peers is particularly gratifying, as is receiving this from such a well-established and respected organization."

In his research, Smaragdis focuses on computational foundations for constructing systems that can understand sound (e.g., speech or music) the same way people do. He attacks these problems from both theoretical and a practical sides.

Smaragdis has created a demonstrations page that illustrates some of the work he has done, including audio interface, source separation, video content analysis using sound, filling in missing data, and source localization.

"I find the automatic understanding of sound endlessly fascinating, especially since we don't really know how we hear ourselves, so making machines that can do so is quite an adventure," said Smaragdis. "Nowadays, we are constantly surrounded by microphones (cellphones, laptops, cameras, etc.), we find even more exciting research prospects in computational audition, as we try to consolidate massive amounts of uncurated acoustic data and combining them so as to make sense of our environments. Thankfully we have our work cut out for the next few decades!"

In 2006 Smaragdis was selected by MIT's *Technology Review* as one of its Innovators Under 35.

> **I find the automatic understanding of sound endlessly fascinating, especially since we don't really know how we hear ourselves, so making machines that can do so is quite an adventure.**
>
> Professor Paris Smaragdis

On the theoretical side this involves creating new tools for processing and analyzing time-series, and draws heavily from the fields of machine learning and statistical signal processing. On the practical side this results in constructing actual machines with hearing abilities such as TVs that can find when the football game gets interesting, stethoscopes that detect and analyze heartbeats, music players that automatically DJ for you and smart traffic lights that can hear accidents that happen in their intersection.

See Paris Smaragdis's demonstration page: http://bit.ly/1LLemJK

Gropp Wins SIAM/ACM CS&E Prize for PETSc Numerical Library

BY KIM GUDEMAN, COORDINATED SCIENCE LAB

> " We have had people use it to write mathematical models for how to stamp parts of cars and others who have used it to model the movement of brain tumors in the skull. It's still widely relevant today. "

Professor William Gropp

CS Professor William Gropp has been awarded the SIAM/ACM prize in Computational Science and Engineering (CS&E) for his work on the Portable, Extensible Toolkit for Scientific Computation (PETSc), a numerical library for the scalable solution of scientific applications modeled by partial differential equations. PETSc "has transformed the way large-scale software libraries are developed, supported, and used within the CS&E community," according to a SIAM/ACM press release, and its impact "has been felt worldwide."

Gropp, a Siebel Chair in Computer Science at the University of Illinois, and his colleagues at Argonne National Laboratory began developing PETSc, which also received an R&D 100 Award in 2009, in 1990 after struggling to execute increasingly complex applications using existing software libraries. The software was funded through the Department of Energy, which has listed PETSc as one of its top 10 advances in computational science in 2008.

"We found existing numerical libraries weren't able to handle a certain class of methods," said Gropp, director of the Parallel Computing Institute at Illinois. "The way we organized the software made it much easier for people to adapt it to their needs than other libraries."

Previous numerical libraries coupled the code with the data structure. The PETSc researchers separated the two, making the software more flexible. The concept wasn't new to computer science, but the application to numerical libraries was novel.

Gropp shares the honor with Satish Balay, Jed Brown, Matthew Knepley, Lois Curfman McInnes, Barry Smith, and Hong Zhang. The prize of $5,000 is awarded biennially by SIAM and ACM in recognition of outstanding contributions to the development and use of mathematical and computational tools and methods for the solution of science and engineering problems.

Gropp said he has been amazed at the range of applications that has utilized PETSc over the years. "We have had people use it to write mathematical models for how to stamp parts of cars and others who have used it to model the movement of brain tumors in the skull," he said. "It's still widely relevant today."

Professor William Gropp

HPC Innovation Excellence Award

Paul Fischer was part of a team of researchers from the Department of Energy's (DOE) Argonne National Laboratory, the University of Illinois, and three nuclear reactor design centers in the United States and Europe that received the HPC Innovation Excellence Award at SC'14, the supercomputing community's premier annual event, November 18.

The award, presented by International Data Corporation, recognizes noteworthy achievements by users of high-performance computing (HPC) technologies. The program's main goals are to showcase return on investment and scientific success stories involving HPC; to help other users better understand the benefits of adopting HPC and justify HPC investments, especially for small- and medium-sized businesses; to demonstrate the value of HPC to funding bodies and politicians; and to expand public support for increased HPC investments.

The award-winning project involved development of high-fidelity simulation techniques for nuclear reactor thermal hydraulics.

Pattern Analysis and Machine Intelligence (PAMI) Young Researcher Award

CS Associate Professor Derek Hoiem was one of the recipients of the 2014 Pattern Analysis and Machine Intelligence (PAMI) Young Researcher Award. This award is given by the Technical Committee on Pattern Analysis and Machine Intelligence (TCPAMI) of the IEEE Computer Society at the CVPR to a researcher within 7 years of completing their PhD for outstanding early career research contributions. Candidates are nominated by the computer vision community, with winners selected by a committee of senior researchers in the field. This award was originally instituted in 2012 by the Elsevier journal *Image and Vision Computing*, also presented at the CVPR, and the ICV continues to sponsor the award.

Feeding the Pipeline: New CS Education Initiative to Reach Middle School Students Statewide

BY LAURA SCHMITT

The CS department is partnering with 4-H in a new two-year initiative to attract more youth to computer programming and related fields. 4-H Computer Connections is the latest CS @ ILLINOIS endeavor to address the projected imbalance between computing jobs and college graduates.

"We want to get young people interested in programming, which will help feed the pipeline," said CS Professor Lenny Pitt, who leads the department's outreach efforts. "Even if they don't go into CS, understanding a bit about how computers work is going to be important in just about every field."

By 2020, the US Bureau of Labor Statistics predicts that American colleges and universities will produce 40,000 CS graduates while there will be close to 140,000 CS-related jobs. In addition, 62% of the new jobs created between 2010 and 2020 in science, technology, engineering, and math (STEM) fields will be in the computing field.

By partnering with Illinois 4-H, which is operated by the U of I Extension, CS will be able to reach as many as 1,000 middle school-age students statewide by next year. "4-H has an incredible reach, with staff in every county of the state," noted Pitt. "This seems like a really natural partnership."

Other partners include the U of I College of Education, the Department of Mechanical Science and Engineering, and the Office of Math, Science & Technology Education. Pitt and his colleagues are developing easy-to-use computer programming modules based on Scratch, a popular online programming environment.

In June, they will host a workshop on campus for 4-H volunteers from around the state who run after-school technology clubs to train them on implementing the modules. According to Robert Smith, U of I Extension Robotics Educator and part of the collaboration, Pitt's involvement is crucial because he can help volunteers who may be intimidated by programming.

"One of Lenny's gifts is that he's very good at teaching anybody that they can teach computer programming," Smith said.

The program will continue through next year, with a second workshop for 4-H volunteers either on campus or in Chicago in spring 2016. In addition, all the CS programming modules will be available on the statewide 4-H website.

CS Professor Lenny Pitt (bottom right) hopes to inspire 4H youth to become more computer literate.

CS alumni are welcome to lend their expertise to the effort by volunteering as a mentor at any of the 4-H technology clubs statewide. "Chances are there are alumni around the state with computing and programming skills and 4-H could definitely use their help," Smith said.

This 4-H partnership is the latest example of CS outreach efforts aimed at middle school students, a critical age at which to pique kids' interest in science and technology. "You want to catch them here so they can take relevant courses in high school," Pitt noted.

Other CS-related outreach efforts include: the very popular Girls Engaged in Math and Science (GEMS) free summer camps, as well as the Girls Adventures in Math, Engineering & Science (GAMES) for high-school-age women. In addition, Pitt, CS Associate Professor Craig Zilles, and CS Lecturer Cinda Heeren have developed curriculum modules for local high school teachers and conducted summer workshops for elementary and high school teachers so they can learn to incorporate programming into the K–12 curriculum.

Legacy Gift Honors Friend and Enables More Student Scholarships

BY LAURA SCHMITT

In 2014, Ron Cytron (MS CS '82, PhD '84) lost a dear friend and colleague, a university educator who cared deeply about students. In his will, the friend bequeathed a sizable sum of money, instructing Cytron to endow a computer science undergraduate scholarship at the school of his choice. The only major condition was complete anonymity for the donor.

Wanting to maximize the impact of the gift and properly honor the memory of his friend, Cytron carefully weighed his options before deciding to establish the Ron Cytron Family Computer Science Visionary Scholarship at Illinois.

"The Visionary Scholars fund was a nice lever for combining my friend's gift with additional funds to have a greater effect than the money on its own," explained Cytron, who envisions the scholarship aiding students who are underrepresented in computer science. "I'd like to see students who couldn't otherwise attend Illinois benefit from this scholarship."

Although he can't divulge much about his friend, Cytron wants scholarship recipients and alumni to know this: "My friend was a passionate, caring instructor, as well as a role model to faculty for how one should approach teaching. My wife Betsy and I were glad to present this gift to the University of Illinois Computer Science Department, knowing the legacy of my colleague's pedagogy will live on through the students who benefit from the scholarship fund."

A professor of computer science at Washington University in St. Louis, Cytron conducts research on automatic program optimization and transformation.

While at Illinois, he met his wife Betsy, who earned bachelor's and master's degrees in music education. Cytron worked in Professor David Kuck's group on the Parafrase project, which explored techniques to translate conventional code into parallel code. "Dave Kuck is a luminary in parallel processing," Cytron said. "He taught me how to do research, write papers, and frame problems."

The Engineering Visionary Scholarship Initiative

Launched in 2013 with a $30 million lead gift from the Grainger Foundation, the College of Engineering's Visionary Scholarship Initiative is raising a $100-million endowment to attract the nation's best students by providing large, renewable scholarships. These scholarships are especially valuable to top-performing students who may be considering generous offers from peer institutions. In 2013, this initiative allowed the College of Engineering to offer substantial scholarships to 50 first-year students. Thanks to the Cytron Family Scholarship in CS and the help of other donors, that number will grow. We invite all CS alumni and friends to lend your support to this initiative.

For more information, or to make a gift, visit: http://visionary.engineering.illinois.edu/give/giving-options.html

Alumnus Cheng's Gift Helps Retain & Recruit Exceptional Faculty

BY LAURA SCHMITT

"The quality of the professors defines the quality of the programs at a university," said Richard T. Cheng (MS '69, PhD '71), an influential educator, who founded the computer science departments at the Rochester Institute of Technology and Old Dominion University and served as their head. "Good faculty are always recruited by others, so you have to have a way to retain them."

Recently, Cheng endowed a professorship in computer science to help CS @ ILLINOIS not only retain but also attract the most talented faculty. "A professorship is one tool to do that," Cheng noted. "The university already has an abundance of excellent professors, but there can never be too many."

In fact, Illinois is aggressively hiring CS faculty, so Cheng's gift couldn't have come at a better time.

Cheng's philanthropy at Illinois began more than 15 years ago when he established the Richard T. Cheng Endowed Fellowship in CS. His motivation? He was grateful for the fellowship and research assistantship that enabled him to complete graduate school while supporting his wife and three young children.

"I appreciate that the university gave me such a good foundation for pursuing my career, and I wanted to give back for all Illinois has done for me," said Cheng, who recognizes the financial challenges that today's students face. "I was trying my best to help out… so young people can pursue their dreams."

Cheng's academic influence reached beyond CS departments in the United States. He helped establish the College of Computer Science and Engineering at King Saud University in Saudi Arabia, where he also advised the government about the nation's computer network system. An entrepreneur, he also founded ECI Systems & Engineering in 1980. At its peak, the Virginia-based company was a leading integrated systems provider for the U.S. military and government, with annual sales of $50 million, more than 500 employees, and 32 offices around the world. Cheng retired from ECI in 2002 and the company has since gone through several mergers.

In 2011, Cheng was recognized by the College of Engineering at Illinois with the Alumni Award for Distinguished Service for his outstanding leadership in education and in business. In his free time, Cheng serves on the Board of Visitors at Old Dominion University and he enjoys traveling.

> **I appreciate that the university gave me such a good foundation for pursuing my career, and I wanted to give back for all Illinois has done for me.**
>
> Richard T. Cheng

Celebration of Excellence
Student Awards

Each semester, CS @ ILLINOIS honors students who have received important distinctions. We extend congratulations to these individuals whose hard work is a credit to themselves and a source of pride for the department.

Andrew & Shana Laursen Fellowship

YONTAN BISK is studying natural language processing under the guidance of Professor Julia Hockenmaier, with a focus on creating programs which automatically learn linguistic properties of languages. Previously, he was a State Farm Companies Foundation Doctoral Scholar and was a recipient of the CS Graduate Student Outstanding Ambassador Award.

Graduate Fellowships & Awards

3M FOUNDATION FELLOWSHIP
Bryan Plummer
Saurabh Singh
Sheng Wang

ACM IEEE-CS GEORGE MICHAEL MEMORIAL HPC FELLOWSHIP
Harshitha Menon

ANDREW AND SHANA LAURSEN FELLOWSHIP
Yonatan Bisk
Hyojin Sung
Ehasan Totoni

BLUE WATERS GRADUATE FELLOWSHIP
Jon Calhoun

CHIRAG FOUNDATION GRADUATE FELLOWSHIP IN COMPUTER SCIENCE
Yunhui Long

COMPUTER SCIENCE EXCELLENCE FELLOWSHIP
Kajori Banerjee
Ching-Pei Lee
Luke Leslie
Jingbo Shang
Dimitrios Skarlatos
Chi-Hsien Yen

DEBRA AND IRA COHEN GRADUATE FELLOWSHIP IN COMPUTER SCIENCE
Charles Blatti

DISSERTATION COMPLETION FELLOWSHIP
Benjamin Raichel

EPSILON BIG DATA SCHOLARSHIP
Read Sprabery

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Justin Thorsen

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NATIONAL DEFENSE SCIENCE & ENGINEERING GRADUATE FELLOWSHIP
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OUTSTANDING TEACHING ASSISTANT, SPRING 2014
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Kent Quanrud
Matthew Sinclair
Kai Zhou

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Ali Kheradman
Helen Wauck

RICHARD T. CHENG ENDOWED FELLOWSHIP
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Yihan Gao
Adam Vollrath

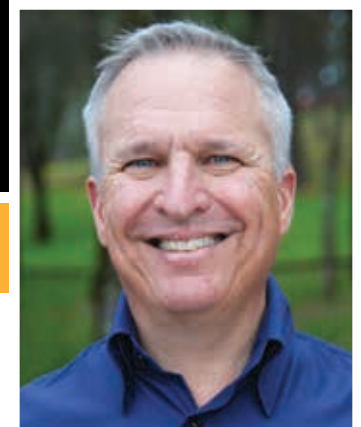**ROY J. CARVER FELLOWSHIP**
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SABURO MUROGA ENDOWED FELLOWSHIP
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Gabriel-Alexandru Gyori
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Muntasir Rahman

WARREN W. YEE MEMORIAL FUND FELLOWSHIP IN ENGINEERING
Shijiao Yuwen

WING KAI CHENG FELLOWSHIP
Silu Huang

Undergraduate Scholarships & Awards

CHANNING BROWN SCHOLARSHIP
Matthew Rasmussen

CHAN-TSAI SCHOLARSHIP
Shannon Strum

CISCO WCS SCHOLARSHIP
Briana Chapman

FRIMA LUKATSKAYA SCHOLARSHIP
Alexander Chiang

JOHN DEERE & COMPANY SCHOLARSHIP
Emily Chao
Corly Leung
Annie Rong

ROWE FAMILY SCHOLARSHIP
Steven Schmidt

SANDRA L. AND JOHN P. RANKIN ENGINEERING SCHOLARSHIP
Ziwei Ba

SARA AND LOUIS COHEN UNDERGRADUATE SCHOLARSHIP
Elliott Rodriguez

SPYGLASS ENDOWED SCHOLARSHIP
Akvile Puraite

STATE FARM COMPUTER SCIENCE SCHOLARSHIP
Koren Castillo
Michael Evertz
Miranda Kang
Paige Kordas

SUSAN SILVER AND ROSS ERLEBACHER SCHOLARSHIP
Polina Volodina

WILLIAM AND RUTH WITT SCHOLARSHIP
Prathyusha Namburi

Grace Hopper Celebration Awards

CS GRACE HOPPER CELEBRATION SCHOLARSHIP
Motahareh EslamiMehdiabadi
Kristen Vaccaro
Wenting Wang

TWO SIGMA WCS GRACE HOPPER SCHOLARSHIP
Annie Rong

WCS GRACE HOPPER SCHOLARSHIP
Akshay Bajaj
Brianna Ifft
Emily Tran

YAHOO! GRACE HOPPER CELEBRATION SCHOLARSHIP
Sarah Helm
Mariko Wakabayashi

ANDREW LAURSEN (MS CS '81) is currently vice president of engineering at Predicta, a data science and analytics startup. Previously, he was vice president of development at Oracle, where he wrote Oracle's Real Application Clusters and led teams responsible for the Network Computer and massively scalable video server. He and his wife, Shana, established the Andrew and Shana Laursen Fellowship in 2001 to provide meaningful support to CS @ ILLINOIS graduate students.

Support CS Students

Many of these awards and scholarships are made possible by generous donations from alumni and corporate partners. If you would like to support an exisiting fund or create a new one, please contact Director of Advancement Michelle Wellens at mwellens@illinois.edu for more information. Gifts are always welcome to support the CS Engineering Visionary Scholarship Fund, which helps us give more and larger scholarships to deserving students. To give online, visit http://cs.illinois.edu/giving/give-now.

Supporting What Works: Richardson's Gift Benefits GEMS Camp

BY LAURA SCHMITT

A pioneer and entrepreneur in the CAD/CAM industry, Fontaine Richardson (PhD '68) hired software engineers for his company, Applicon during the early 1970s. "More often than not, I hired females rather than males," he said, noting how he strove to hire the best talent regardless of gender.

Fast forward to the present and Richardson laments the fact that women are still underrepresented in the high-tech workforce. With two granddaughters of his own, he wanted to do something about that.

After reading an article about the CS @ ILLINOIS-sponsored Girls Engaged in Math & Science (GEMS) summer camp and meeting its director, CS Lecturer Cinda Heeren (PhD '04), Richardson pledged $25,000 over five years to support the popular and successful program.

GEMS provides local middle-school girls with a fun, interactive introduction to computer science and engineering through a week's worth of activities, and it is free for all its participants, who have learned about astronomy, wearable computing, and sustainable foods.

According to Heeren, CS hosted 48 girls in 2013, and thanks in part to Richardson's gift, they increased the enrollment to 144 girls in 2014. "I feel like Fontaine understands that what we're doing is special," said Heeren, who taps women CS students to help run the camp.

"I wanted to light a match and help get a fire started, and see that it would have some sort of energy over time," said Richardson, who has a history of giving to CS as a former president of the CS alumni group and donor to faculty and student awards named in honor of CS Professor Emeritus C. William Gear, Richardson's PhD advisor and a former department head.

This past fall, Richardson was on campus as part of the department's 50th anniversary celebration and awards weekend, where Heeren received a distinguished educator award. "It struck me how engaged she is and how important the young faculty are to the campus and to CS. I wanted to do more to support them," he said.

What Richardson did was double his support of GEMS for the next four years. "It's not a big gift, but the notion is to put as much energy behind programs that are working and are successful because they'll attract other support among alumni—among people whose daughters or granddaughters go to these schools so they can enjoy it and be energized about doing something in the science and engineering field."

Richardson adds: "I encourage all my fellow alums to support the Computer Science Department in any way you can. The work that is being done in the department is exciting and is among the best work that is being done anywhere today. We all need to pitch in and help."

Please help GEMS Camp continue to thrive. For sponsorship information, please email Michelle Wellens at mwellens@illinois.edu; or make a gift online at: http://cs.illinois.edu/giving/give-now

the #lastword

CS @ ILLINOIS is using its social networks
to enhance its connection to students, faculty
and alumni. Are YOU Linked, Liking, and Following?
Here are some excerpts of notable posts:

University of Illinois Computer Science

CS Professor Karrie Karahalios helped lead a panel discussion at SXSW about how algorithms are influencing what we read, hear, and watch.

In Men's Health: "Sixty-eight teams going head-to-head in single-elimination games over six rounds leaves some 147 quintillion ways to blow your office bracket, says [CS Professor] Sheldon Jacobson."

"For better or worse, humans are the weak link in [Internet] security," said alumna Paris Tabriz (BS CS '05, MS '07) in a CBS News story.

Illinois is #1 in National Science Foundation (NSF) funding for computer science, according to Bloomberg Business.

@IllinoisCS

#Siri co-founder @Dagk [Dag Kittlaus] calls #ILLINOIS "one of the top #computerscience schools on earth."

[Chicago Tribune] recently talked to CS Prof. Steve LaValle about the potential and challenges of VR.

#ILLINOIS Alum Startup Malwarebytes on Forbes list of 100 Most Promising Companies.

Mr. Herzog! This man has single handedly guided me through some tough times, partially owe my career to him.

CS @ ILLINOIS

The University of Illinois Board of Trustees recently voted unanimously to establish the College of Medicine at Illinois, the nation's first college of medicine focused, from the beginning, on the intersection of engineering and medicine.

Congratulations to Steven Ashby (MS CS '85, PhD '88), who was named director for Pacific Northwest National Laboratory (PNNL) in Richland, WA.

A study from the Brookings Institute has Champaign-Urbana in the top 10 communities per capita for early-stage venture capital.

Congratulations to AJ Christensen (BS CS '09) of NCSA who was part of a team that won the Oscar for Best Visual Effects for their work on "Interstellar."

Marcin Kleczynski (BS CS '12) was named one of Forbes 30 Under 30 in the Enterprise Tech category.

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Expand your network—join the College of Engineering and CS @ ILLINOIS at both on-campus and regionally hosted events throughout the year. Follow our social media posts or visit the online calendar to register for upcoming programs.

Make your 2015 Homecoming plans now to reconnect with fellow alumni, faculty, and student groups like ACM. Join us for the WCS Student-Alumni Banquet (October 22), CS @ ILLINOIS Awards (October 23), and Fighting Illini Homecoming Football game (October 24).

Is your email address current with us? Send us a note to alumni@cs.illinois.edu

Visit our website to learn the latest news and connect to social media, engage through corporate partnerships and recruiting opportunities, shop for CS @ ILLINOIS swag, and make your gift to support the department.

To see the CS Master Calendar, please visit:
http://go.cs.illinois.edu/calendar

cs.illinois.edu