

CS @ ILLINOIS

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MAGAZINE 2014, VOLUME II

50
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FIVE DECADES AS A DEPARTMENT. THOUSANDS OF REMARKABLE GRADUATES.
COUNTLESS INNOVATIONS.

Department of Computer Science



click! Magazine is produced twice yearly for the friends of CS @ ILLINOIS to showcase the innovations of our faculty and students, the accomplishments of our alumni, and to inspire our partners and peers in the field of computer science.

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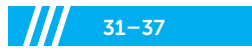



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Machines take me by surprise
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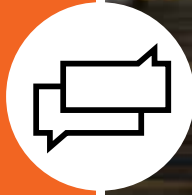
Alan Turing

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MAGAZINE 2014, VOLUME II

| | |
|---|---|
| 2 | Letter from the Head |
|  4 | ALUMNI NEWS |
| 4 | Alumni Win Prestigious Awards |
|  6–25 | ANNIVERSARY FEATURES |
| 6 | 50 years, 50 Innovators (part 2) |
| 12 | CS @ 50 |
| 22 | Siebel Center @ 10; Siebel Chair Investiture |
|  24–30 | IN THE LAB |
| 25 | LaValle Central to Oculus' \$2 Billion Success |
| 26 | Angrave Teaches first MOOC on Developing Android Apps |
|  31–37 | STUDENTS |
| 32 | First-Ever HackIllinois |
| 34 | Student Startup Luminous Wins Big |
|  38–41 | FACES |
| 38 | CS @ ILLINOIS Welcomes Five New Faculty |
|  42–43 | OUTREACH |
| 42 | ChicTech & GEMS Camp Inspire Girls Toward STEM |
|  44–48 | GIFTS IN ACTION |
| 45 | CS Professor Emerita Geneva Belford Remembered |
| 48 | Visionary Scholarships That Work |
| 49 | The #lastword |

“ It’s a good time to be in computer science at Illinois. ”



This issue of *click! Magazine* was over 50 years in the making.

CS @ ILLINOIS has been celebrating two major milestones this year—the 50th anniversary of Computer Science as a university department (1964-2014), and the 10th anniversary of our home: the Thomas M. Siebel Center for Computer Science (2004-2014).

Computing, of course, has a history on this campus that precedes the establishment of the department. Work on computers and computer systems had been going on since the late 1940s, evolving out of the Digital Computer Lab (DCL). We embrace this history as our own, and we are honored to use this year to recognize the entrepreneurs and innovators whose contributions to the field of computer science have brought distinction to themselves, the department, and the university.

In this issue, we present some highlights of the history of computing at Illinois—recognizing the difficulty of compressing this story into one that can sit easily within this magazine. So, we have posted online an expanded version of the historical material we have compiled, and we invite you to share your comments on this issue, as well as your memories of the department (see p. 13).

And while our history deserves a fitting tribute, it also serves as an inspiration to our current alumni, faculty, and students who continue to innovate every day. CS @ ILLINOIS is hugely popular right now; we received more applications for this fall than any other department in the history of the College of Engineering. We have launched a new degree program that teaches students how to apply the power of computing to their passions in the arts and sciences; the number and prestige of the awards being won by our alumni, faculty, and students is truly astounding; and startups and companies with close ties to CS @ ILLINOIS are seeing billion-dollar successes.

Yeah, it’s a good time to be in computer science at Illinois—please come back and be a part of the fun.

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



New CS + X Degrees Combine Computing Power with Passion

Computing is ubiquitous, with application areas in virtually any field imaginable—from developing gene-sequencing algorithms, to designing methods for analyzing astronomy data, creating computer-generated graphics and special effects, analyzing social data from internet communications, and creating embedded real-time systems for medical devices. In fact, according to a National Science Foundation report, “Knowledge of computer science and computer programming is becoming a necessary skill... in marketing, advertising, journalism, and the creative arts.”

CS @ ILLINOIS remains at the forefront of this effort. According to CS Professor Lenny Pitt, Director of Undergraduate Programs, “We have long recognized the importance and influence of different subject areas for CS. In fact, our first degree offered was the Math & CS degree almost fifty years ago. As CS broadens its impact daily, the need for truly interdisciplinary programs has never been more pressing. The CS + X degrees address this need by expanding on our longstanding Math & CS, and Statistics & CS degrees, to, potentially, any area in the arts, humanities, and sciences.”

These new degrees further strengthen the partnership between the College of Engineering and the College of Liberal Arts and Sciences (LAS). They enable students to pursue a flexible program of study incorporating a strong grounding in computer science with technical or professional training in liberal arts and sciences.

“CS + X will offer students new opportunities for pursuing interdisciplinary education that will be appealing to employers after they graduate or that can enhance students’ graduate studies in a wide variety of fields,” said Pitt.

In early 2013, curricula under the CS + X umbrella were approved for students in Anthropology, Astronomy, Chemistry, and Linguistics. As the program gains traction, additional joint programs in LAS are expected to emerge during the next year or two. The vision is not limited to LAS alone; plans are underway for a joint CS + Advertising degree with the College of Media, and discussions with colleagues in the College of Fine & Applied Arts are now focusing on joint opportunities in art, music, and design. These efforts will make the CS degree options offered at Illinois truly unmatched.



CS Professor Lenny Pitt



TREVOR Mudge: Eckert-Mauchly Award

Trevor Mudge (MS CS '73, PhD '77) received the 2014 ACM/IEEE Eckert-Mauchly Award, one of the most prestigious awards in the area of computer architecture. He was recognized for his contributions to low-power computer architecture for high-performance microprocessors.

His research has led to new technologies that reduce the energy consumption of microprocessors while maintaining acceptable performance. His current research includes investigations into 3D processor architectures, parallel systems that increase the sharing of operations amongst those cores, and near-threshold computing systems that operate at a low-voltage level.

Mudge is the Bredt Family Professor of Engineering in the Department of Electrical Engineering and Computer Science at the University of Michigan.

ROBERT L. Mercer: ACL Lifetime Achievement Award

Robert L. Mercer (MS CS '70, PhD '72), co-CEO of Renaissance Technologies, received the 2014 Lifetime Achievement Award from the Association for Computational Linguistics (ACL) during its meeting in June.

After joining IBM's Watson Research Center in 1972, Mercer worked in a research group focusing on speech recognition. The group advocated probabilistic and information theoretic approaches, producing numerous breakthroughs. They pioneered the use of statistical approaches to machine translation.

Mercer and colleagues demonstrated the power of big data approaches to language problems, and the impact of their work was revolutionary. Probabilistic approaches to computational linguistics now dominate the field of machine translation and underpin many current tools.



DANIEL E. Atkins III: National Academy of Engineering

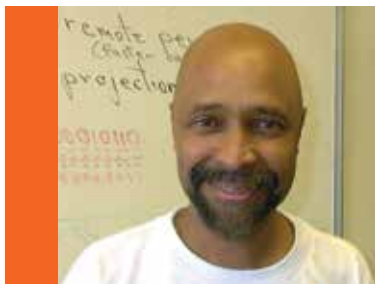
Daniel E. Atkins III (MSEE '67, PhD CS '70), a professor of electrical engineering and computer science at the University of Michigan, has been elected to the National Academy of Engineering (NAE) "for leadership in development of radix algorithms and cybertechnical collaborative systems."

Over the course of his career, Atkins has made contributions to high-performance computer architecture, participating in the design and building of major experimental machines, including some of the earliest parallel computers. He has also conducted pioneering work on special-purpose architecture and collaborated with the Mayo Clinic on development of computer-assisted tomography (CAT). A leader in the research community, Atkins was the first Director of the Office of Cyberinfrastructure for the National Science Foundation.

GREG Chesson: Alumni Award for Distinguished Service

In April, Greg Chesson (MS CS '75, PhD '77) received the Alumni Award for Distinguished Service from the College of Engineering. He was recognized for "outstanding contributions to early UNIX operating systems and to the design and development of high-performance and wireless computer networks."

Chesson has been called the godfather of networking due to his many contributions to the area. He spent much of his career as chief scientist with Silicon Graphics Inc. (SGI), the maker of powerful computer workstations and servers whose realistic 3D graphics technology became popular during the 1980s and early 1990s. He has been a senior staff engineer at Google since 2005.



In Memory: Clarence "Skip" Ellis, 1943-2014

It is with sadness that CS @ ILLINOIS notes the passing of Clarence "Skip" Ellis (MS Math '66, PhD CS '69) on May 17. He was 71.

Ellis was the first African American to receive a PhD in computer science. While at Illinois, he worked on hardware, software, and applications of the ILLIAC IV supercomputer. Over the course of his career, he worked at Bell Telephone Laboratories, IBM, Xerox, Microelectronics and Computer Technology Corporation, Los Alamos Scientific Labs, and Argonne National Lab.

Ellis joined the University of Colorado at Boulder in 1992 and retired in 2010. He was an early leader in research on office automation, collaborative software, and human-centered computing.



NANCY M. Amato: CRA, NCWIT Awards

Nancy M. Amato (PhD CS '95), the Unocal Professor in the Department of Computer Science and Engineering at Texas A&M University, has received the Computing Research Association's (CRA's) 2014 A. Nico Habermann Award, as well as the inaugural Harrold and Notkin Research and Graduate Mentoring Award from the National Center for Women & Information Technology (NCWIT).

She was recognized by the CRA for her leadership with programs that engage women and underrepresented minorities in computing research, particularly the CRA-W Distributed Research Experience for Undergraduates program. The NCWIT award honors faculty who combine research and excellent graduate mentoring while advocating for recruiting, encouraging, and promoting women and minorities in computing fields.

Amato's main areas of research focus are motion planning and robotics, computational biology and geometry, and parallel and distributed computing.



CS is extraordinarily proud of all our creative and driven graduates. In our last issue of *click! Magazine*, we introduced 25 successful alumni who have birthed entirely new industries, generated **billions** of dollars in commerce, created **tens of thousands** of jobs, and **revolutionized** the way people communicate, shop, conduct business, and are entertained. In this issue, you'll meet some more of our innovators.



DER-TSAI Lee

Degrees: **MS CS '76, PhD '78** Affiliations: **Academia Sinica, National Chung Hsing University, Northwestern University**

Pioneer in computational geometry and algorithm design and analysis. University president and distinguished academic researcher whose work and leadership has impacted the bioinformatics, information security, and digital library fields.



MAX Levchin

Degree: **BS CS '97** Affiliations: **PayPal, Slide, Google, HVF, Glow, Affirm**

Entrepreneur, angel investor, and cryptographer. Co-founded PayPal, the easy and safe online payment system, where he created the security and fraud-prevention systems before it was acquired by eBay. Founder and CEO of Slide, the maker of apps for social networking sites, which he sold to Google. CEO of Affirm, an online lending company, and Chairman of Glow, an infertility app, both launched from HVF, his innovation lab. Board of Directors for Yelp, Yahoo!, and Evernote.



PAUL Magelli Jr.

Degrees: **BS Math & CS '84, MS CS '86** Affiliations: **AT&T Bell Labs, Lucent Technologies, Apertio, Nokia Siemens Networks, Pervasive Health**

Co-founder of Apertio, provider of real-time information solutions for mobile telecommunications operators. Visionary who applied information systems expertise to health enterprises for better health care and outcomes.



MARY McDowell

Degree: **BS CS '86** Affiliations: **Compaq, Hewlett Packard, Nokia, Autodesk**

Leader of multi-billion-dollar businesses in the mobile, telecom, services, and enterprise sectors. Led Nokia's global feature phone business and associated digital services, bringing mobility to the Next Billion. Early career spent as part of core team at Compaq developing the first x86 server and grew to oversee the market-leading ProLiant server business, now under the HP logo. Board of Directors, Autodesk.



LINDA Mills

Degree: **MS CS '73** Affiliation: **Northrop Grumman**

Successful corporate executive who leads the engineering, quality, and technology operations for a multi-billion-dollar business enterprise providing advanced solutions for homeland security, health IT, cybersecurity, and global warming.



KENICHI Miura

Degrees: **MS CS '71, PhD '73** Affiliations: **Fujitsu, Japan's National Institute of Informatics**

Innovative researcher and corporate executive who made significant contributions to Fujitsu's VP series of vector supercomputers, demonstrating how vectorizing compilers effectively takes advantage of hardware architecture. His numerical algorithms expertise led to systems for high-speed execution of scientific computational applications. From 2003 to 2008, directed the Japanese National Research Grid Initiative (NAREGI).



TREVOR Mudge

Degrees: **MS CS '73, PhD '77**
Affiliation: **University of Michigan**

Outstanding educator and researcher whose work has advanced the field of low-power computer architecture and its interaction with technology.



PENG T. Ong

Degree: **MS CS '88** Affiliations: **Match.com, Interwoven, Encentuate, Monk's Hill Ventures, Singapore University of Technology and Design**

Successful entrepreneur, engineer, executive, and investor who founded several companies, including Electric Classifieds (Match.com), Interwoven (content management software), and Encentuate (identity management systems). Invested in both China and U.S. technology companies. Respected leader who fosters economic development in Singapore and U.S.



RAY Ozzie

Degrees: **BS CS '79, Hon. DSc '12** Affiliations: **Lotus Development, Iris Associates, Groove Networks, Microsoft, Talko Inc.**

Software visionary and entrepreneur who commoditized the use of computers for collaborative work. Creator of Lotus Notes, his software contributed to the early success of Windows. As chief software architect at Microsoft, he helped lead the software giant into cloud computing.



ANNA Patterson

Degree: **PhD CS '98** Affiliations: **Cuil, Stanford University, Google**

Entrepreneur, search index architect, and software technology leader who developed TeraGoogle, one of the world's largest search indexes. While working at a non-profit, she wrote Recall, the largest search engine of its time with 12 billion pages. Board of Directors for Harvey Mudd College and Mathematical Sciences Research Institute (MSRI).



LINDA Petzold

Degrees: **BA Math & CS '74, PhD CS '78** Affiliations: **Sandia National Lab, Lawrence Livermore National Lab, University of Illinois, University of Minnesota, University of California, Santa Barbara**

Innovative researcher who advanced new methods for computationally solving differential algebraic equations and incorporated them into widely distributed software. Creative teacher and mentor who pioneered computational science and engineering education.



CONSTANTINE Polychronopoulos

Degree: **PhD CS '86** Affiliations: **University of Illinois, Bytemobile, Citrix Systems**

Entrepreneur and software strategist who created Web and video optimization technologies that enhance the performance of mobile wireless networks and data services. As a faculty member, his research has been adopted by high-performance computer system manufacturers like Cray, Silicon Graphics, Intel, and Hewlett Packard.



LYNN Reedy

Degrees: **BS Math & CS '77**

Affiliations: **Accenture/Andersen Consulting, Amdahl, Miller Freeman, and Ebay**

Successful technology executive who led the complete redesign of Ebay's website, hardware and software, without disrupting the auction site's operations.



FONTAINE Richardson

Degree: **PhD CS '68**

Affiliations: **MIT Lincoln Laboratory, Applicon, Eastech Management Company**

Entrepreneur, software visionary, and CAD/CAM industry pioneer who redefined how millions of products are conceptualized, designed, and produced.



RICK Schell

Degrees: **BA Math '72, MS CS '77, PhD '79**

Affiliations: **Intel, Sun Microsystems, Borland, Netscape, iSharp, NetIQ, ONSET Ventures**

Technology executive, entrepreneur, and investor, who successfully transforms high-tech businesses. Played a leading role in guiding Netscape from startup to major commercial Internet success.



KOUSHIK Sen

Degrees: **MS CS '03, PhD '06** Affiliations: **University of California, Berkeley**

Outstanding researcher, educator, and mentor whose work impacts the software verification and testing fields. 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.



THOMAS M. Siebel

Degrees: **BA History '75, MBA '83, MS CS '85, Hon. DSc '06**

Affiliations: **Oracle, Gain Technology, Siebel Systems, First Virtual Group, C3 Energy**

Technology entrepreneur, software visionary, and philanthropist best known for founding and leading Siebel Systems, a global leader in customer relationship management application software that merged with Oracle Corporation in 2006. Currently Chairman and CEO of C3 Energy.



RUSSEL Simmons

Degree: [BS CS '98](#) Affiliations: [PayPal](#), [Yelp](#), [Learnirvana](#)

Lead software architect at PayPal, who helped design the Web-based payment system from scratch. Co-founder and former CTO of Yelp, popular social networking site that allows users to write reviews of local businesses.



ANIL Singhal

Degree: [MCS '79](#) Affiliations: [Wang Laboratories](#), [NetScout Systems](#)

Entrepreneur and technology innovator in network traffic monitoring and analytics field. Co-founder and CEO, Netscout, a market leader for advanced network, application, and service assurance solutions. Business leader, with a unique philosophy of running a "Lean, but not Mean" operation.



GORDON Stewart

Degree: [BS CS '83](#) Affiliation: [Northrop Grumman](#)

Accomplished executive in charge of Northrop Grumman's laser systems programs. Oversaw the development of the All Semiconductor Airborne Laser Threat Terminator (ASALTT) family of infrared countermeasure systems that protect fixed-wing and rotary military aircraft.



PARISA Tabriz

Degree: [BS CS '05](#), [MS '07](#) Affiliation: [Google](#)

Security Princess (that's her real job title!) and lead for the 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 how to do the same, protecting billions of Internet users from malicious cyber attacks.



MARK Tebbe

Degree: [BS CS '83](#) Affiliations: [Arthur Andersen](#), [Lante Corp.](#), [Answers Corp.](#), [Lake Capital](#), [University of Chicago Booth School of Business](#)

Entrepreneur, writer, business mentor, and teacher. Co-founded Lante, a technology consulting firm that built back-end infrastructure and websites for major corporations and helped launch over 250 new businesses. Co-conceived the Answers.com website, one of the Web's leading Q&A publishers. Teaches entrepreneurship at a leading business school.



BRIAN Totty

Degrees: **MS CS '92, PhD '94**

Affiliations: **Apple Computer, Silicon Graphics, Inktomi, Ludic Labs, Groupon**

Entrepreneur, educator, business mentor, and technology executive who founded a popular search engine company and a local marketing services firm. An expert in graphical user interfaces and high-performance computing, he wrote a definitive reference book on Internet technology.



ANDREW Yao

Degree: **PhD CS '75**

Affiliations: **MIT, Stanford, Princeton, Tsinghua University, Chinese University of Hong Kong**

Turing Award Winner, esteemed teacher, and computational theorist whose groundbreaking research has had a lasting impact on the foundations of cryptography, computer security, computational complexity, and randomized computation.



Amitt Mahajan

Degree: **BS CS '06**

Affiliations: **Epic Games, MyMiniLife, Zynga, Red Hot Labs**



Luke Rajlich

Degree: **BS CS '05**

Affiliations: **Citadel Investment Group, MyMiniLife Inc., Zynga**



Joel Poloney

Degree: **Attended through 2007**

Affiliations: **MyMiniLife Inc., Zynga, Red Hot Labs**



Sizhao Zao Yang

Degree: **BS CS '05**

Affiliations: **IBM, MyMiniLife Inc., Zynga, BetterWorks, NewCo**

Entrepreneurs, angel investors, and technical team who co-created MyMiniLife and FarmVille, which became the technical infrastructure for Zynga's other social networking games. Collaborated on scaling, mobile applications, and major deals with corporate partners.



BY LAURA SCHMITT AND COLIN ROBERTSON

"I am a HAL 9000 computer... I became operational at the H.A.L. plant in Urbana, Illinois..."

says the cunning character near the end of the iconic film, "2001: A Space Odyssey." Although author Arthur C. Clark said he wrote HAL's birthplace as a tribute to his college mathematics professor, it was quite appropriate that the cutting-edge computer be born in Urbana—home to one of the most prestigious computer science departments in the world.

Two decades after Clark wrote his story, Illinois continued to be held in the highest regard. "Illinois was where the future was born," said Dan Reed, former CS department head who joined the CS faculty in 1984, in part, because of Illinois' stellar reputation in high-performance computing. Fast forward to the present and Illinois still ranks among the top.

In October, CS will celebrate its 50th anniversary as a university department. Anyone old enough to remember will know that computing at Illinois actually began in 1949 when physics, math, and engineering faculty formed the Digital Computer Laboratory (DCL). Fifteen years later, DCL was reorganized as the Department of Computer Science, subsequently allowing for the creation of the university's first degree programs in CS and opening a new chapter in history.

And what a rich history it is. CS @ ILLINOIS faculty, students, and alumni are well known for creating killer apps like Mosaic/ Netscape, PayPal, YouTube, Lotus Notes, Eudora, Yelp, and Farmville. Perhaps lesser known to the general public, but just as important, are major technological advances that members of the CS @ ILLINOIS family have made in hardware, software, and theory. Here are just some of the highlights.

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THOUSANDS
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Please read the expanded version of this article online at <http://go.cs.illinois.edu/CSat50>; please share your comments on this issue, as well as your memories of the department by email to: click@cs.illinois.edu.

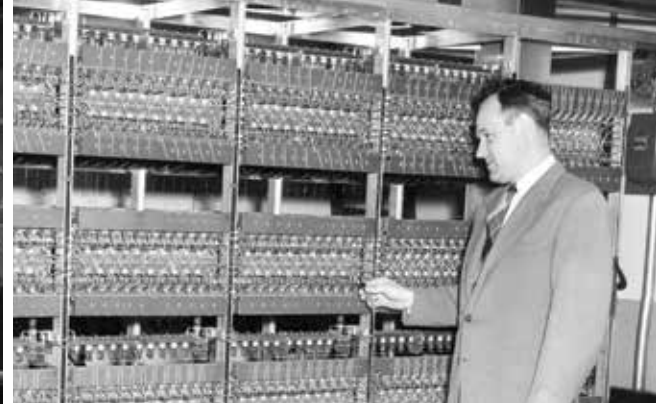
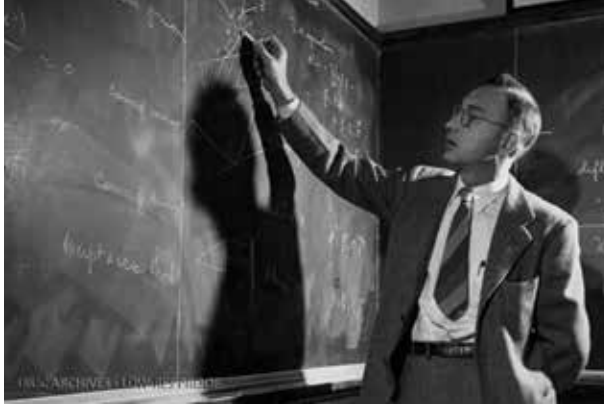




The Army used ORDVAC to perform ballistic trajectory calculations, and Illinois researchers used ILLIAC to calculate Sputnik's orbit.

Harold Lopeman working on ILLIAC II. Photo courtesy of University of Illinois Archives.

Mathematician Abraham Taub (left) and physicist Ralph Meagher (right) led early computing work at Illinois.



IN THE BEGINNING... BIG IRON

Illinois established itself as a high-performance computing force in 1951 when a research team led by Ralph Meagher and Abraham Taub designed and built ORDVAC and ILLIAC, two nearly identical computers—based on famed mathematician John von Neumann’s architecture. The machines were big, strong, and fast for their time—weighing five tons, measuring 170 cubic feet, containing 2,800 vacuum tubes, equipped with 5Kb RAM, and running at 200 KHz. The Army used ORDVAC to perform ballistic trajectory calculations. ILLIAC provided most of the computer services for campus for 10 years, while faculty and graduate students used its computing power for their research.

When the Soviet Union launched Sputnik I on October 4, 1957, Illinois CS and astronomy researchers used ILLIAC to calculate the satellite’s orbit from radio interferometer measurements. Their results were published in *Nature*, helping to calm some of the country’s apprehension about the surprise launch.

Although it had limitations, due in large part to the undependable vacuum tube technology, ILLIAC sparked the imagination of Illinois researchers, who began work on a second generation supercomputer. Led by Jim Robertson, ILLIAC II came on line in 1962 and was one of the early computers to replace vacuum tubes with transistors—50,000, in fact, making it 100 times faster than its predecessor.

After the transition from tubes to transistors, Illinois researchers turned their focus to parallelism. At the time, it was not

obvious that huge speed and complexity gains could be achieved through integrated circuit technology. Designed by CS Professor Dan Slotnick, ILLIAC IV was one of the first experiments in large-scale single instruction multiple data (SIMD) machines. Capable of calculating up to 200 million instructions per second and with a one gigabit per second I/O transfer rate, ILLIAC IV was the most powerful supercomputer of its time. Coming on line in 1972, it performed critical computational work for 10 years.

A young assistant professor named David Kuck developed many of the initial ideas about how to restructure computer source code for parallelism. “ILLIAC IV was the most ambitious floating point parallel computer of its time,” Kuck said in a 2012 article. “We were able to get a lot of parallel programming applications running on it and demonstrated that they actually worked well.” According to CS Professor David Padua (PhD CS ’80), the

ILLIACs established Illinois as *the* place where systems were being built. “ILLIAC IV made Illinois the center of the universe,” said Padua.

A lasting legacy of the ILLIAC family of computers was the opportunity it provided for graduate students, several becoming major players in the supercomputing arena. For example, Kenichi Miura (MS CS ’71, PhD ’73) made significant contributions to Fujitsu’s VP series of vector supercomputers. Steve S. Chen (PhD CS ’75) built Cray’s first shared memory vector CPU, for the renowned X-MP and Y-MP machines.

Clarence Ellis (PhD CS ’69)—the first African American to earn a doctorate in computer science—also worked on ILLIAC IV. Later, he pioneered office automation software at Xerox PARC.

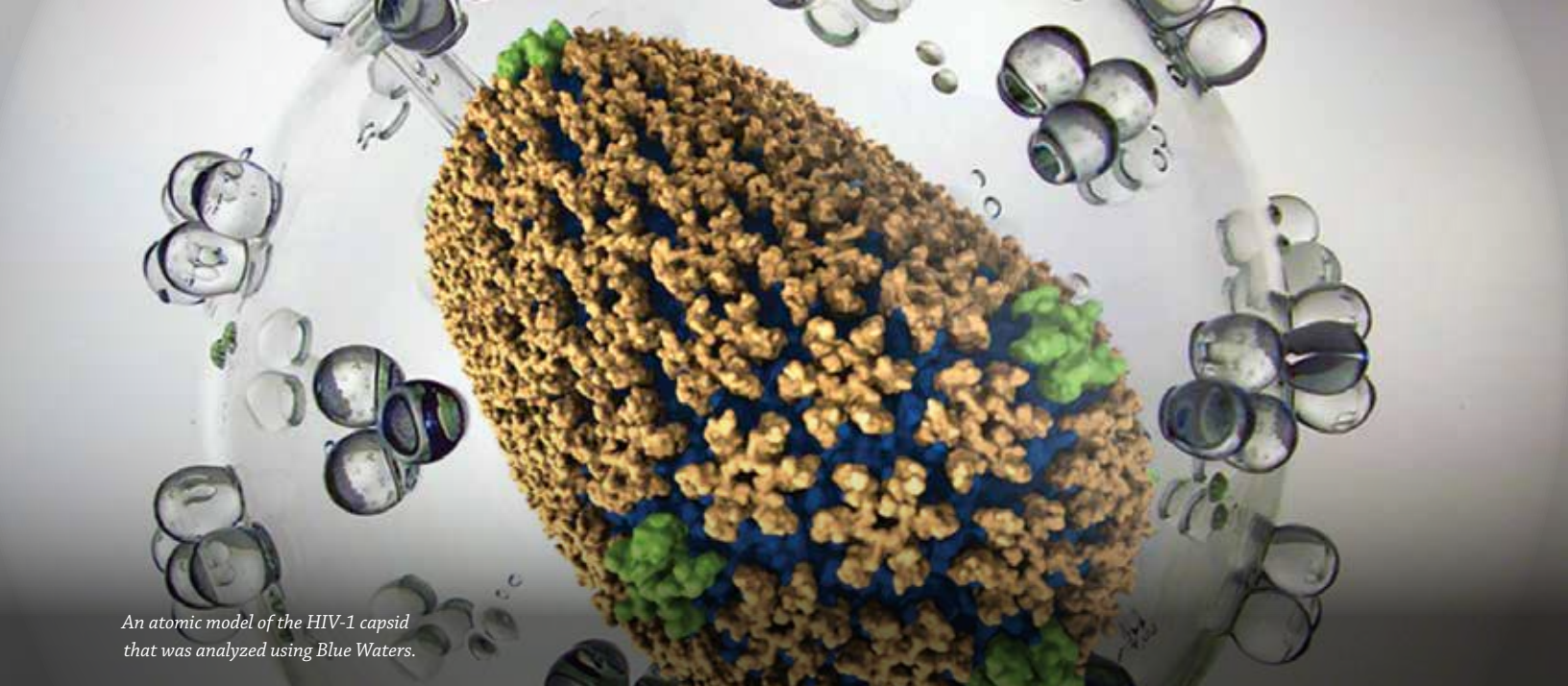
As the ILLIAC era drew to a close in the 1980s, Illinois researchers launched a final big iron prototype, a shared-memory

“ILLIAC IV made Illinois
the center of the universe.”

CS Professor David Padua

Researchers working on ILLIAC IV.





An atomic model of the HIV-1 capsid that was analyzed using Blue Waters.

symmetric multiprocessing (SMP) system called Cedar. Led by Kuck, Cedar resulted in important contributions to parallel system design and software. For example, in an effort to consolidate parallel programming directives used by supercomputer vendors, Kuck's team helped lay the foundation for the OpenMP standard.

With the recent proliferation of multicore chips, shared memory machines are now everywhere thanks, in part, to the work of the Cedar team. "This isn't to say that we invented whatever it is people are doing today, but we were one of the first to demonstrate that you could do that in a certain way," explained Kuck, who is now an Intel Fellow.

COMPILERS

Kuck's research has also had a major influence on compilers. In fact, he built the first vectorizing compiler, and in 1979, founded a successful company, Kuck & Associates, Inc., to exploit the technology. "The truth is every compiler on this planet has automatic translation for parallelism," explained Padua. "Kuck's technology has been very successful—every compiler uses it."

More recently, CS Professor Vikram Adve and Chris Lattner (MS CS '02, PhD '05) initiated work on the modular LLVM compiler infrastructure. Adoption of LLVM

The most powerful academic-based supercomputer in the world, scientists are using Blue Waters to address major challenges like earthquake preparedness, severe storm forecasting, and how viruses invade cells.

has exploded since its release a decade ago—it is now incorporated into numerous products, including the iPhone and Android mobile operating systems, the Sony PlayStation, and Cray supercomputers. *Wired* magazine called LLVM "a piece of technological brilliance" that is "changing the way we build and run computer software."

HIGH PERFORMANCE LIBRARIES AND PROGRAMMING SYSTEMS

Before joining CS's faculty, Marc Snir and William Gropp made major contributions to the development of the Message Passing Interface (MPI), currently the industry standard for exchanging messages between computer nodes running a parallel program across distributed memory. With MPICH, Gropp developed the first functional

implementation of MPI, helping to popularize the standard.

At Illinois, they have helped lead one of the most important systems running MPI—the university's own Blue Waters, the most powerful academic-based supercomputer in the world. Scientists are using it to address major challenges like earthquake preparedness, severe storm forecasting, and how viruses invade cells.

To effectively harness the power of machines like Blue Waters, Professor Laxmikant Kalé's group develops Charm++, a machine-independent parallel programming system. It improves productivity and performance via an intelligent runtime system. Charm++ is a crucial part of the NAMD molecular dynamics code, co-developed with Illinois Physics Professor Klaus Schulten, which recently ran on Blue Waters and achieved an important breakthrough in understanding the HIV virus.

COMPUTER ARCHITECTURE & DESIGN

At Illinois, former CS Professor David Liu pioneered algorithmic electronic design automation because he saw the value of developing more formal, powerful techniques to effectively solve complex design automation problems. His technical contributions are at the foundation of many current EDA tools within several disciplines, including behavioral synthesis, logic synthesis, and physical design.

Meanwhile, Fontaine Richardson (PhD CS '68) had cofounded Applicon in 1969 to commercialize an integrated circuit layout system, making his startup one of the first computer-aided design (CAD) companies.

More recently, CS Professor Josep Torrellas has made important contributions to thread-level speculation, an architectural technology for parallelization and programmability that has been incorporated into a number of commercial products. While CS Professor Sarita Adve has co-developed the memory consistency models for the Java and C++ languages, building on the data-race-free models pioneered in her early work.

Launched in 1960, PLATO was the first online community, with email, instant messaging, chat rooms, online gaming, project collaboration, and discussions.

This early 1970s photo shows a user at a PLATO IV terminal. Photo courtesy of University of Illinois Archives.

Critical to iPhone, Android, Sony PlayStation, and Cray supercomputers, *Wired* magazine called LLVM "a piece of technological brilliance" that is "changing the way we build and run computer software."



The LLVM dragon logo represents the power, speed, and intelligence found in the LLVM Compiler Infrastructure.

SCIENTIFIC COMPUTING & NUMERICAL ANALYSIS

Historically, Big Iron has attracted people to Illinois who wanted to solve big problems. In the late 1960s, Bill Gear developed a novel method for solving stiff differential equations. "The method got a lot of uses," Gear said. "At one time it was the only reasonable way to solve that type of problem." Gear published the method and supporting computer code in an ACM paper and book, allowing researchers worldwide to use his technique for free. "[This] caused others to see that this was an important way to propagate new ideas and not just make money," Gear said. "I certainly used to urge students to do the same."

One of Gear's students was Linda Petzold (BA Math & CS '74, PhD '78), who developed the DASSL code in 1982 at Sandia National Laboratory. DASSL solved differential

algebraic equations, and was incorporated into widely distributed software.

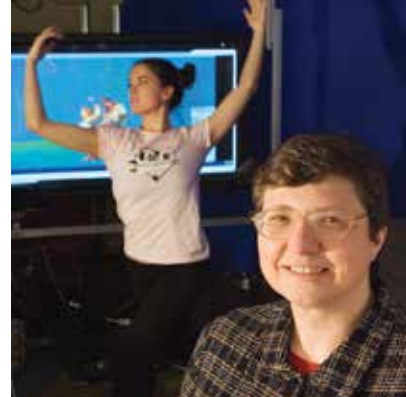
A particularly distinguished alumnus in the numerical analysis field was Gene Golub (BS Math '53, MS Stats '53, PhD Math '59), who helped found the CS department at Stanford in the 1960s. He was best known for creating the versatile singular value decomposition (SVD) algorithm, which is used in a variety of applications, including search engines, signal processing, and data analysis.

PLATO: THE WORLD'S FIRST ONLINE COMMUNITY

"PLATO was the first grand experiment in online education," said former CS Professor Dan Reed. Launched by ECE Professor Donald Bitzer in 1960 on ILLIAC, the



In 2000, CS Professor David Liu's former student, Andrew Yao, won the Turing Award for his fundamental contributions to the theory of computation.



Dancers from Illinois and Berkeley have performed together simultaneously thousands of miles apart, interacting through CS Professor Klara Nahrstedt's 3D TEEVE system.

Programmed Logic for Automatic Teaching Operations (PLATO) evolved from a single system on the Illinois campus that taught students computer programming to a fully interactive instructional system deployed at 23 locations worldwide, providing 7,000 hours of instructional material in more than 150 subject areas.

Perhaps more importantly, PLATO was the world's first online community, and it was the catalyst for an array of successful technologies. Ray Ozzie (BS CS '79) was a PLATO programmer, where he was exposed to email, instant messaging, chat rooms, online gaming, project collaboration, and discussions. Later, Ozzie, along with Len Kawell (BS CS '77) and Tim Halvorsen (BS CS '77) created Lotus Notes, a revolutionary email and collaborative workspace software package for the personal computer. Ozzie's later projects at Groove Networks and Microsoft—where he succeeded Bill Gates as chief software architect—continued to implement his vision for computer-aided collaboration.

A PLATO programmer while at Illinois, Ray Ozzie later helped create Lotus Notes and succeeded Bill Gates as chief software architect at Microsoft.

SYSTEMS AND NETWORKING

As a graduate student, Greg Chesson (MS CS '75, PhD '77) brought the UNIX operating system to Illinois in 1973, accelerating operating systems and networking research. After a stint at Bell Labs, where he worked on the UNIX networking stack, Chesson spent much of his career with Silicon Graphics, where he invented the Xpress Transfer Protocol (XTP).

A CS faculty member since 1976, Roy Campbell is perhaps best known for creating Gaia, a smart-space operating system that allowed applications to adapt themselves to the available distributed resources in a new location. "[In the late 1990s] we had voice recognition and synthesis so the system could talk to you; we could play music, share tunes with people, and we could even play videos and move them from one room to another room." Many of the students who worked on Gaia went to work for smartphone technology companies.

Meanwhile, CS Professor Klara Nahrstedt has helped pioneer quality of service and resource management in wired and wireless networks. Her research allows streaming services to guarantee that users will have some minimum level of service, even in the face of network congestion. She's also widely recognized as a leader in 3D tele-immersive systems, which have exciting potential applications in fields like communication, medicine, and entertainment.

REAL-TIME SYSTEMS

CS Illinois faculty have made groundbreaking contributions to real-time computing systems. Professor David Liu developed Rate-Monotonic Scheduling (RMS), the first useful model for real-time guarantees in the early 1970s.

Lui Sha joined faculty in 1998, continuing Illinois's leadership in real-time systems. He and his colleagues developed the Generalized Rate Monotonic Scheduling (GRMS) theory, which provides not only scheduling predictability, but also efficiency and flexibility. Nearly every commercial real-time operating system, real-time middleware, and real-time development tool supports the use of GRMS.

In 1981, Jerry Fiddler (MS CS '77) co-founded Wind River Systems and guided the company to become a leading software provider for embedded devices before it was acquired by Intel. Wind River supplied the operating system (VxWorks) for the Mars Pathfinder Lander (1997), as well as Spirit and Opportunity, the Mars Exploration Rovers (2004).

THEORY, ALGORITHMS, AND USING MATHEMATICS TO STUDY THE POWER AND LIMITATIONS OF COMPUTING

In 2000, CS Professor David Liu's former student, Andrew Yao (PhD CS '75), won the Turing Award for his fundamental contributions to the theory of computation. Yao's co-invention of complexity-based pseudorandom number generation provided



The Mars Pathfinder Lander, on the surface of Mars.
Image Courtesy of NASA

a key tool for cryptographers, ensuring that encrypted sensitive data appears completely random and conveys no information to hackers. Yao later became the director of the Institute for Theoretical Computer Science at Tsinghua University in China. “He planted a flag in China for computer science as a serious discipline,” said CS Professor Jeff Erickson. “On the theory side it’s basically gone from very little to an absolutely world class presence—one of the top institutions in the world—completely based on his leadership and influence.”

Historically, Illinois is known for its strengths in computational geometry. In 1985, former CS Professor Franco Preparata wrote *Computational Geometry*, the field’s

Herbert Edelsbrunner developed the theory and software that made it possible to create 3D models of objects and then print them.



The Mars Pathfinder Lander, as well as Spirit and Opportunity, the Mars Exploration Rovers, depended on the VxWorks real time operating system developed by Jerry Fiddler’s company Wind River Systems.

first textbook and the standard for many years. His student, Der-Tsai Lee (MS CS ’76, PhD ’78), currently the president of National Chung Hsing University, developed several seminal results on shortest paths, Voronoi diagrams, and medial axes. Lee’s work has impacted the bioinformatics, software security, and digital library fields.

In 1987, former CS Professor Herbert Edelsbrunner wrote the second textbook in the field: *Algorithms in Combinatorial Geometry*. Edelsbrunner also developed the theory and software that made it possible to create 3D models of objects and then print them. Understanding the commercial value of his alpha shapes and wrap algorithm discovery, he co-founded a company (Geomagic, acquired by 3D Systems) with Ping Fu (MS CS ’90) in 1996.

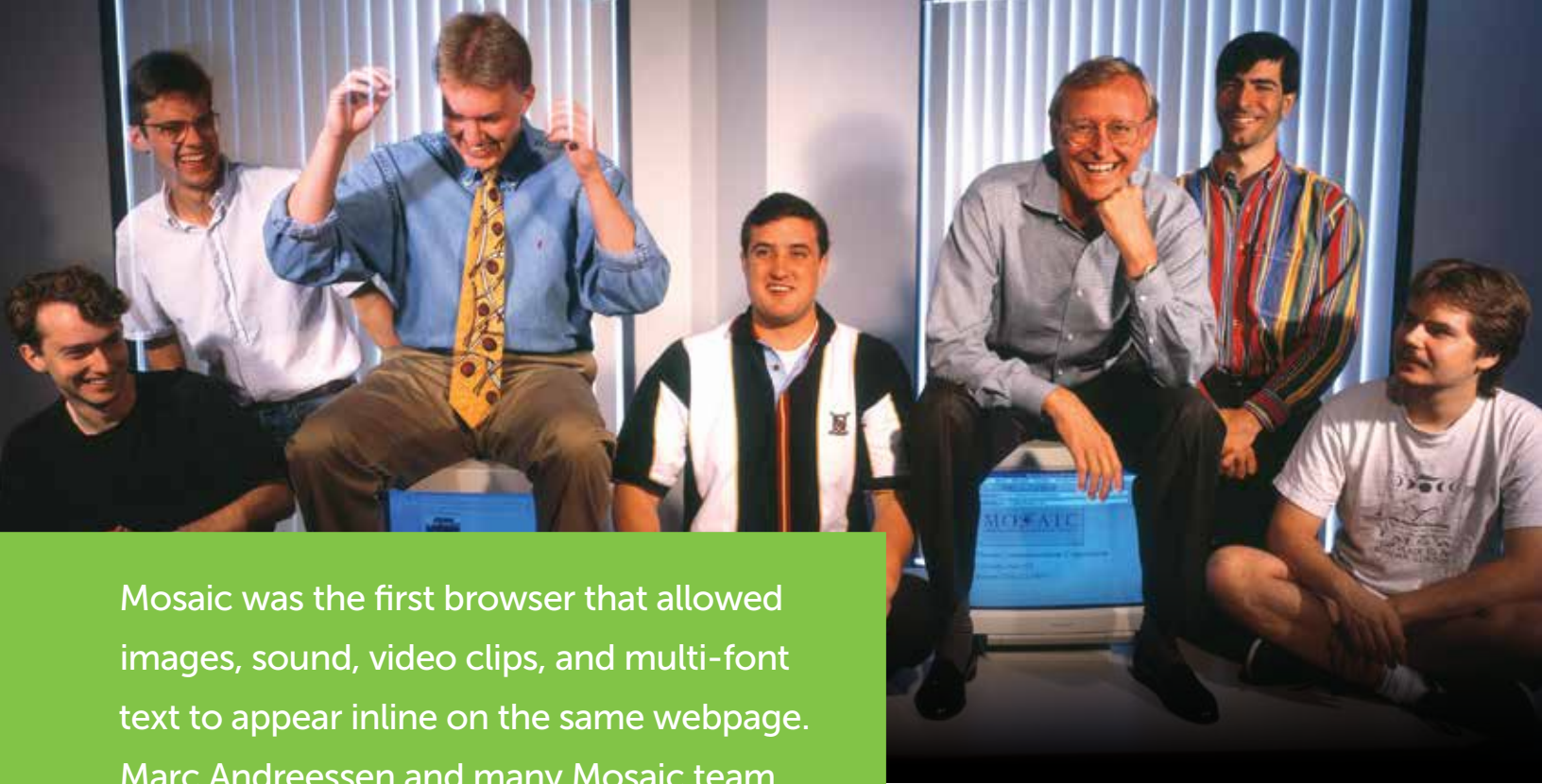
MOSAIC: THE WORLD’S BROWSER

By 1992, the Internet had become quite popular among university faculty and

researchers primarily because of Tim Berners-Lee’s World Wide Web hypertext system. Finding and downloading documents was cumbersome, though—users deployed text-oriented tools like FTP, Gopher, and Telnet on computers running the UNIX operating system.

CS undergraduate Marc Andreessen (BS CS ’94), who had worked for a short time as a programmer on Edelsbrunner’s alpha shapes project at NCSA, was familiar with the Web. He had an idea of how to make using the web easier—integrate the accessing functions into a single program that would be hidden behind an easy to use graphical interface. He teamed up with NCSA employee Eric Bina (BS CS ’86, MS ’88) and within six months they had created Mosaic, the world’s first browser that allowed images, sound, video clips, and multi-font text to appear inline on the same web page. As a result of their work, the Internet was about to change into a medium for the masses.

Andreessen and many Mosaic team members left Illinois in 1994 and founded Netscape Communications. Their browser,



Mosaic was the first browser that allowed images, sound, video clips, and multi-font text to appear inline on the same webpage. Marc Andreessen and many Mosaic team members also founded Netscape, where Navigator and Javascript were born.

Many of the original Netscape team members: Chris Houck (MS CS '92), Aleks Totic (MCS '94), Marc Andreessen (BS CS '94), Jon Mittelhauser (BS CS '92, MS '94), Jim Clark, Lou Montulli, Rob McCool (BS CS '95).
Photo Credit: Andy Freeberg.

Netscape Navigator, brought the web to the world. At Netscape, Brendan Eich (MS CS '86) created the JavaScript programming language in 1995 and guided its ongoing standardization and evolution. Later, he co-founded the Mozilla organizations behind the Firefox Web browser.

ARTIFICIAL INTELLIGENCE

CS Professor David Forsyth is well-known for his contributions to computer vision, and he co-wrote the leading textbook on the topic with former CS Professor Jean Ponce—*Computer Vision, A Modern Approach*.

In robotics, CS Professor Steven LaValle (BS CE '90, MS '93, PhD EE '95) is a leading authority on motion planning. Many of the driverless cars in the 2007 DARPA-sponsored autonomous urban driving challenge used his Rapidly-Exploring Random Tree (RRT) algorithm to navigate in city-like traffic conditions. The RRT

algorithm, which is the most popular planning method in robotics, has also been widely used on humanoid robots and is part of several open source libraries.

PROGRAMMING LANGUAGES, FORMAL METHODS, & SOFTWARE ENGINEERING

The Actor Model is a mathematical model of concurrent computation that is used for developing parallel, distributed, and mobile computing systems. The Actor specification that is most commonly used today springs from the work of CS Professor Gul Agha, whose 1985 doctoral dissertation provided a capstone for the theory, after over a decade of development by the research community.

CS Professor Jose Meseguer's rewriting logic and the language based on it, Maude, have been applied to specify and verify programming languages, like Java; secure systems, like browsers and cryptographic protocols; distributed cyber-physical systems, like schedulers and medical devices; and cell biology systems.

CS Professor Emeritus Ralph Johnson and his student William Opdyke (PhD '92) were pioneers in the area of formal code refactoring, a technique for restructuring existing computer code without changing its behavior in order to improve maintenance and extensibility. A key leader in the software patterns research area, Johnson also co-authored the groundbreaking book, *Design Patterns: Elements of Reusable Object-Oriented Software*, in 1994. This book describes recurring solutions to common problems in software design.

BIG DATA

CS Professor Emerita Geneva Belford (PhD Math '60) was one of the early database and distributed systems researchers in the department. She enthusiastically advised the work of students with little or no computer science background. One of those students was Tom Siebel (BA History '75, MBA '83, MS CS '85) who worked on distributed database problems at Illinois

and wrote similar software to manage his own sales force while at Oracle. In 1993, he founded Siebel Systems, which dominated the customer relationship management software market until he sold the company to Oracle in 2006 for \$5.85 billion.

Another one of Belford's students who worked at Oracle was Sohaib Abbasi (BS CS '78, MS '80). During his 20 years at Oracle, Abbasi helped grow the business from \$4 million in 1982 to more than \$9 billion in annual revenues—and he envisioned and launched the Oracle Tools business. Today he is CEO of Informatica, the largest independent provider of data integration software.

As the World Wide Web's popularity has increased over the last 20 years, so too has the amount of information available. CS Professors Jiawei Han, Dan Roth, and their colleagues are developing techniques to discover, extract, manage, and exploit the large amounts of text information—news articles, email messages, scientific literature, government documents, and Web pages.

A towering figure in data mining, Professor Han has made pioneering contributions to the development of effective and scalable methods for mining knowledge from large data sets. He introduced a pattern-growth methodology for mining frequent, sequential, and structured patterns, and he developed a set of important algorithms for mining

such patterns. His FPgrowth algorithm is introduced in most data mining textbooks, and Google and Microsoft are among the companies who have used the algorithm. Meanwhile, through his leadership of the Homeland Security-funded Multimodal Information Access and Synthesis Center (MIAS) on campus, Professor Roth has worked to improve how we deal with large amounts of unstructured data. His contributions have changed how we develop algorithms and programs for natural language understanding and how we think about computational modeling of learning and reasoning.

HEALTH IT & SECURITY

Health information technology and security are areas of increasing importance; not surprisingly, CS faculty and alumni are leaders in the field.

Carl Gunter, Karrie Karahalios, Klara Nahrstedt, Bruce Schatz, and Wai-tat Fu are among the faculty conducting research to help solve healthcare delivery and cost issues, and to improve the privacy and security of health information technology, including electronic medical records. Within the last few years, CS research has coalesced around two multi-million-dollar centers led by Professor Gunter—Health Information Technology Center (HITC) and Strategic Healthcare Information Technology Advanced Research Projects on Security (SHARPS).

A particularly interesting online security success story is Malwarebytes Anti-Malware software created by Marcin Kleczynski (BS CS '12) as an Illinois student in 2008. With more than 300 million downloads, Malwarebytes protects consumers and businesses against malicious programs that escape detection by other antivirus solutions.

YouTube co-creator
Jawed Karim decided
to major in computer
science at Illinois
after he discovered
that Mosaic was
invented here:
“I wanted to join
the innovators.”

THE NEXT 50 YEARS...

With a history like this, it's not surprising that CS @ ILLINOIS continues to attract the most creative and intellectually curious people. For example, Jawed Karim (BS CS '04), known for co-creating the popular video sharing web site YouTube with Steve Chen, decided to major in computer science at Illinois after he discovered that Mosaic was invented here. “Why would I go anywhere else?” he told the Illinois graduates in his May 2007 commencement address on campus. “I wanted to join the innovators.”

Our current faculty, students, and alumni continue to generate knowledge and technology that will help solve the complex problems facing our global community in the 21st century. They will also inspire the next generation to follow in their footsteps.

“A remarkable list of people have been here at one point or another and everyone I've talked to has remembered this place fondly,” said Gropp. “I fully expect we'll have more big successes.”



Principal scientist at Oculus VR, CS Professor Steve LaValle (BS CE '90, MS '93, PhD EE '95) is helping teach the next generation of innovators (see page 25).



Celebrating 10 Years of the Siebel Center

BY TOM MOONE AND MICHELLE WELLENS



Thomas M. Siebel talks with Roy H. Campbell, the Sohaib and Sara Abbasi Professor.

Hundreds of students, faculty, staff, alumni, and special guests visited the Thomas M. Siebel Center for Computer Science on April 3 to commemorate its 10th Anniversary. No one seemed more proud to mark this special occasion than Tom Siebel (BA History '75, MBA '83, MS CS '85) himself.

During the program, Chancellor Phyllis Wise described the tremendous impact of Siebel Center: “This building has had a transformative effect on the way we are able to teach, the kind of scholarship we are able to do, and the people we are able to reach; it serves as a vehicle to reach so many more students, and to recruit and retain spectacular faculty—we are so thankful to Tom for his generosity that makes this place possible.”

“Our idea towards philanthropy is to try to make change happen.”

—Thomas M. Siebel

And while Siebel Center is so much more than just a physical structure, Siebel is proud that “the building looks as modern and timely today as it was the day it was built.” Renowned architect Peter Bohlin and the Illinois team that managed the

construction delivered “a building at a high level of quality we can all take pride in.” CS Professor and Department Head Rob A. Rutenbar shared that Siebel Center makes a remarkable difference in recruiting faculty and graduate students. “When they find themselves in Siebel Center’s atrium, often the first word out of their mouth is ‘Wow.’”

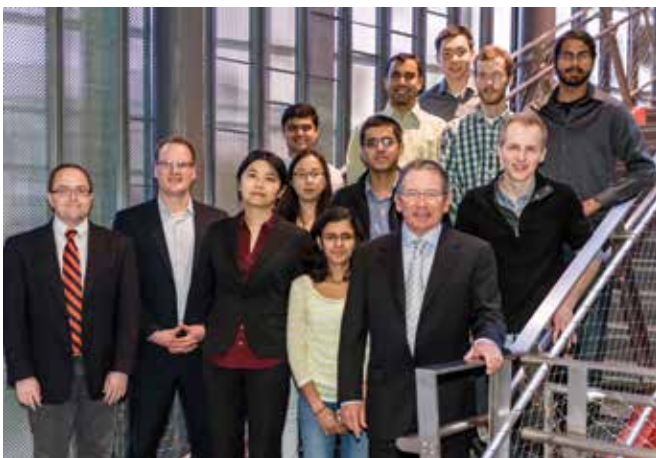
Rutenbar and Siebel discussed Siebel’s Illinois experience, which included the history major and MBA deciding to pursue a CS Master’s degree. “It was a life-changing event. Learning the languages of history, commerce, and computer science enabled me to play the game at a very high level.”

Siebel reminisced fondly about the late CS Professor Geneva Belford (see p. 45), who mentored and encouraged him. It was Belford who recommended that Siebel take a job at a new company—Oracle. His first manager there was Sohaib Abbasi (BS CS ’78, MS CS ’80) now Chairman and CEO of Informatica and long-time friend of Siebel. From Oracle, Siebel went on to lead Gain Technology, which merged with Sybase in 1992. He then formed Siebel Systems, which became one of the world’s leading software companies. Siebel Systems was acquired by Oracle in 2006. Siebel is now chairman and CEO of C3 Energy, a software company that helps utility companies realize the full promise of their investments in smart grid technologies.

Siebel concluded the conversation with his perspective as an engaged philanthropist, serving as the founder and chairman of the Siebel Foundation. “Our idea towards philanthropy is to try to make change happen.” The Foundation supports efforts related to education and research programs, the homeless and underprivileged, public health, and energy solutions. His generosity to the University of Illinois has included major funding for the Thomas M. Siebel Center for Computer Science, the Thomas M. Siebel Chairs in Computer Science and in the History of Science, and the worldwide Siebel Scholars program.

Siebel will be returning to campus to deliver a keynote address at CS @ ILLINOIS’s 50th Anniversary Celebration on October 24.

Thomas M. Siebel with current and past Siebel Scholars.



Siebel Chair Investiture

Following the Siebel Center anniversary festivities, the focus of the afternoon turned to the investiture of William D. Gropp as the first Thomas M. Siebel Chair in Computer Science. Gropp is an expert in parallel computing, software for scientific computing, and numerical methods for partial differential equations. He played a major role in the development and popularization of the Message Passing Interface (MPI) and is coauthor of MPICH, one of the most widely used implementations of MPI. Gropp is the chief applications architect and co-PI on the Blue Waters sustained petascale computing facility on the University of Illinois campus. Since 2008, Gropp has also been deputy director for research for the Institute of Advanced Computing Applications and Technologies at the University of Illinois. In 2011, he became the founding director of the Parallel Computing Institute.

“I’m really honored to be recognized as the inaugural Thomas M. Siebel Chair in Computer Science,” said Gropp as he accepted the medallion marking his investiture. “Being a chair is not just an honor—it is an opportunity to explore, to challenge, and to change.”

Gropp wants to encourage more undergraduates to participate in the high-performance computing opportunities available through such venues as the annual Supercomputing conference.

“There is no better place in the world to lead the next era in computer science than Illinois,” Gropp said. “I’m proud to be part of the Illinois family.”



Godfrey Sets Course for Speed-of-Light Computing

CS Professor Brighten Godfrey wants to make the Internet faster. That does not just mean more and more bandwidth. It means coming to terms with network latency, the time spent to send a message and receive the reply.



Professor Brighten Godfrey



Read a longer discussion of Godfrey's project: <http://bit.ly/1nJzc0o>.

"Latency is the key challenge for our interactive experiences on the Internet, whether between people or computers," Godfrey said. "And today every millisecond matters."

He calls his project "Networking at the Speed of Light": this means attaining an Internet with as close as possible to speed-of-light latency, which is the ultimate physical limit of network speed.

This could have a transformational effect on how we use the Internet. "Humans perceive visual events within about 30 milliseconds as indistinguishable," said CS PhD candidate Ankit Singla, who leads Internet-wide measurement work on the project.

"If we can push latencies down that low, this effectively instant response would be an important threshold in user experience."

The first stage of the project, which is a collaboration with Balakrishnan Chandrasekaran and Bruce Maggs of Duke University, is to understand the state of the Internet today.

The team's task is to examine the causes of the latency. That is, where does the time go? "Why is the Internet actually so slow, compared to what it could be?" Singla said. "That involves a measurement of factors at every layer of the Internet. Fully end to end—let's understand the problem of where the time goes."

With the measurement work serving as a guide, Godfrey's research group is also developing new

technology to reduce latency in some of the Internet's most important protocols.

CS PhD student Ashish Vulimiri developed a technique that uses redundant requests to halve DNS resolution time—a key step in loading a web page. Vulimiri demonstrated that the technique is effective despite increased server utilization.

Meanwhile, CS PhD students Mo Dong and Qingxi Li are taking on one of the biggest causes of high latency—the venerable TCP protocol. Their "Performance-Oriented Congestion Control," or PCC, uses online learning algorithms to dynamically find the most effective strategy for data transmission.

To help launch and support his efforts to build speed-of-light networking, Godfrey recently received a Beckman Fellowship in the Center for Advanced Study for the 2014-2015 school year. With this distinction comes a semester of release time to pursue a particular project. "This time will allow me to focus in a way that's usually very difficult while you are trying to teach classes and advise students and work on service and apply for grants," said Godfrey. "The CAS Fellowship lets you take something that is potentially high impact and jump start it. That will lead to a broad research direction that will carry us forward for years."

Godfrey said that he is grateful for the opportunity to launch this research with the CAS Fellowship. "Giving faculty the ability to focus deeply on a topic is a rare and valuable opportunity."

LaValle Central to Oculus' \$2 Billion Success

BY RICK KUBETZ AND MICHELLE RICE,
COLLEGE OF ENGINEERING

On March 25, both the business and technology news pages excitedly announced Facebook's \$2 billion acquisition of Oculus VR, the maker of a virtual reality gaming headset called Oculus Rift.

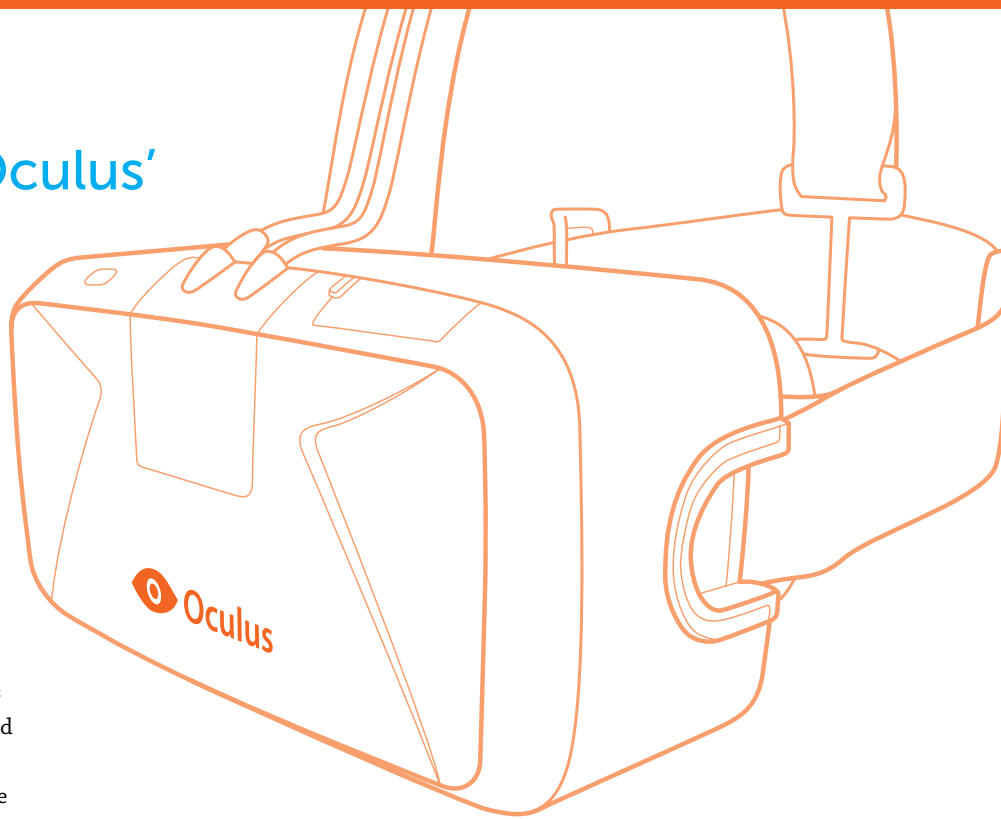
"Imagine sharing not just moments with your friends online, but entire experiences and adventures," stated Facebook's Mark Zuckerberg, as he explained the reasoning behind the acquisition. "After games, we're going to make Oculus a platform for many other experiences. Imagine enjoying a courtside seat at a game, studying in a classroom of students and teachers all over the world, or consulting with a doctor face-to-face—just by putting on goggles in your home."

CS Professor Steven LaValle (BS CE '90, MS '93, PhD EE '95) has a special insight into the development of the new virtual reality (VR) technology.

"I realized when I tried the Oculus VR prototype that it cleverly leveraged the latest hardware that exists thanks to the smart phone industry," explained LaValle, who has been leading Oculus' R&D efforts as its head scientist since taking leave from the university in September 2012. At that time, Oculus comprised only a handful of people working from their homes, and they had just successfully completed their Kickstarter run.

"They reached out to me because my free online book contains material that they needed to get started with head tracking. I loved their passion and was impressed with the first prototype that they showed me. I was convinced right away that the technology had finally arrived to realize the VR dream of the 1990s."

By using microelectromechanical systems (MEMS) sensors and high-resolution screens from these devices, Palmer Luckey, the company's 21-year-old founder, showed that they could be rearranged to make a VR



experience that is low cost and highly immersive. LaValle has been leading research and development on some of the toughest VR challenges, including sensor fusion, magnetic drift correction, and kinematic modeling.

During his time at Oculus, LaValle has worked side-by-side with his wife, Anna Yershova (PhD CS '08), whose own research interests include robotics, motion planning, and computational geometry.

LaValle says that he has been fortunate to be in an environment where he is always learning and interacting with extremely smart people. "Over the years, I have been able to both deepen my scientific background and broaden my collaborations. This has made me aware of cultural issues in research communities and technology fields that often cause people to become stuck. I have therefore learned to identify problems from unusual angles and fundamentally question common beliefs. This has been extremely valuable in helping to shape the future of technology."

Although he has been successful outside the classroom, LaValle has returned to the Illinois campus, ready to teach future innovators and entrepreneurs.



Professor Steven LaValle



Creative Course. Serious Science.

Angrave Teaches First MOOC on Developing Android Apps



One of Angrave's videos introduced the Java language—in song. bit.ly/1nGKeP



BY TOM MOONE

No matter how experienced a teacher you are, launching a course with over 140,000 registrants is daunting. CS Professor Lawrence Angrave knows that feeling well; he just completed teaching the first MOOC on developing apps for the Android platform.

And yet, throughout the course, he remained buoyant and excited. This in spite of the fact that Angrave noticed how quickly a MOOC instructor can become somewhat schizophrenic. At any time during the course, he would be thinking of the current week the online students were working on, the upcoming week that needed to be finalized, and the week in the future he was putting the finishing touches on.

“You have to have this split brain,” Angrave said. “People ask, ‘How is it going?’ And I have to say, ‘Well, which week are you talking about?’”

Vibrant online community

Angrave was pleased to see an active, supportive online community develop among students. Forums became places for students to solve unusual situations that they came across. With participants from around the world, unique software and hardware problems developed for some students. The forums provided solutions. “Students have been able to come up with fixes to a variety of bizarre situations,” Angrave said.

Even more impressive were the personal connections students made through the forums. Students learned they were not alone in finding a particular assignment challenging. In addition, “there were connections

// There were connections made on the newsgroups among people who had similar backgrounds, but who lived in geographically different places. It was a very human element to this very technical course. //

Professor Lawrence Angrave

made on the newsgroups among people who had similar backgrounds, but who lived in geographically different places,” said Angrave. “It was a very human element to this very technical course.”

Course with impact

“I get a lot of satisfaction out of realizing that so many people are excited about this content,” said Angrave. But, though the content did have impact on the students, the extent of that impact was up to each participant. For some students, just watching the videos available online will be as far as they want to go with the course. Others will be more fully engaged with completing assignments and interacting with other students. “I think that is one of the great benefits of MOOCs,” Angrave said. “You have structured introductory material in a way that is accessible to people given a certain amount of time. MOOCs have been a great leveler.”

Keeping it interesting, keeping it real

Angrave worked to keep the students interested and—where possible—entertained during the class. One particular approach was what he called “a fun video” that they did at the end of the week.

One end of the week video was recorded in the Spurlock Museum. There Angrave showed the Nobel Prize won by Illinois faculty member John Bardeen for the invention of the transistor. “We were able to look at it as the grandfather of our computers

and cell phones and the Blue Waters facility,” Angrave said. “It was nice to place Android development within the broader context of computer science.”

A team effort

Angrave recognized that a course like this takes the work of many. “Creating the course was an extraordinary amount of work,” explained Angrave. “This course is the product of many talented and dedicated people from Illinois, including Jason Mock, Liam Moran, Colleen Cook, Katherine Woodruff, and Angie Mock, representing groups from ATLAS and CITL. My graduate and undergraduate Computer Science assistants were Rohan Arora, Will Hennessy, Vishal Disawar, Vishnu Indukuri, and Nelson Osacky. Everyone worked very hard to create and then run this course, and we made a worldwide experience that Illinois can be proud off.”

This first MOOC for creating apps on the Android platform ended on February 14. Angrave is already making plans for how he will make the course even better the next time he has an opportunity to teach it.



Angrave on Illinois’ influence on modern tech:

// We were able to look at [the invention of the transistor] as the grandfather of our computers and cell phones and the Blue Waters facility. //



University Central to \$320M Digital Lab for Manufacturing

Representatives from the University of Illinois stood alongside President Obama as he announced a new Chicago-based public-private partnership called the Digital Lab for Manufacturing on February 25.

The Digital Lab for Manufacturing is an applied research institute that will develop digital manufacturing technologies and commercialize these technologies with key industries. These technologies will be used to make everything from consumer products to heavy machinery to equipment for the military.

It will launch with \$70 million from the U.S. Department of Defense. More than \$250 million in additional funding will come from industry, academic, government, and community partners.

The University of Illinois at Urbana-Champaign's top 5 College of Engineering and its world-renowned National Center for Supercomputing Applications (NCSA) are central to the Digital Lab for Manufacturing. Mechanical Science and Engineering Professor William King is the Digital Lab's principal investigator and will serve as its Chief Technical Officer.

The Digital Lab for Manufacturing will develop data integration technologies for the manufacturing industry. Companies will use the resulting "Digital Manufacturing Commons" to collect all of the data generated in a product's life cycle, analyze that data, and unlock its value. Developed by GE, this software will be made open-source through the Digital Lab for all its partners. "Think of it as Facebook for

manufacturing—a digital platform that will link innovators, factories, and computing," said King.

"Digital manufacturing requires world-changing, research-driven innovation—the sort of innovation that has always been at the heart of pre-eminence at Illinois. NCSA and the College of Engineering will drive a new era of national manufacturing prominence," said Chancellor Phyllis Wise. "Some might find that mandate intimidating; we find it exhilarating. We're proud to take on such a leading role."

The University of Illinois at Urbana-Champaign's role in the successful Digital Lab for Manufacturing proposal was widespread. Several Illinois faculty members and staff were also critical to developing and writing the proposal, including:

Rakesh Bobba,
Electrical and Computer
Engineering

Roy Campbell,
Computer Science

Placid Ferreira,
Mechanical Science
and Engineering

Merle Giles, NCSA

John Hart,
Computer Science

Shiv Kapoor,
Mechanical Science
and Engineering

Klara Nahrstedt,
Computer Science
and Coordinated
Science Laboratory

Rob Pennington,
NCSA



Learn more about the Digital Lab for Manufacturing: <http://digitallab.uilabs.org>

Roşu and Hoiem Win Dean's Award for Excellence in Research

BY LEANNE LUCAS

CS Professors Grigore Roşu and Derek Hoiem received the College of Engineering Dean's Award for Excellence in Research.

Roşu is a leading researcher in programming languages and formal methods, using mathematical techniques to verify software programs. His approach to programming languages involves two novel ideas: the K language definitional framework and matching logic. K is a rewrite-based framework for defining formal operational semantics of programming languages. A K-derived semantics can be executed and tested as if it was an interpreter. This way, there can be confidence in the correctness of the semantics. Matching logic consists of a language-independent proof system to reason about programs in any language that has a rewrite-based operational semantics.

Roşu has also helped develop a new subfield of formal methods called runtime verification, a computing system analysis and execution approach based on extracting information from a running system and using it to detect and avoid errors in computer systems as they execute. He has started a company, Runtime Verifications, Inc., and currently has contracts with Toyota (on runtime verification) and NASA (on semantics-based verification.)

Much of Hoiem's research in computer vision has focused on the subjects of object recognition and physical scene interpretation. Hoiem has explored algorithms to make statements about objects by describing their attributes. This is a revision of object recognition, by which he can demonstrate methods that describe unfamiliar objects, and recognize objects entirely from textual description. He further proposed a system that uses the idea that unfamiliar objects are like familiar objects with similar parts.

Hoiem is also making exciting strides in the area of physical scene interpretation. Hoiem has shown that approximate estimates of geometry, obtained from a single picture, can enhance other visual processing. Using a single image of a location to build a representation, one can view the location from other directions, insert 3D object models, and so on. This information significantly improved the performance of several modern statistical object recognition methods.



Professor Grigore Roşu



Professor Derek Hoiem

Adve's Research Group Chosen for IEEE Micro Top Pick

For the second year in a row, work done by CS Professor Sarita Adve's research group has been chosen as an IEEE Micro Top Pick. This designation recognizes the top papers in computer architecture. Published in the May/June 2014 issue of IEEE Micro, this paper was one of 12 selected for publication.

The paper, "DeNovoND: Efficient Hardware Support for Disciplined Non-Determinism," was written by Adve

wouldn't believe that we could extend the approach to common non-deterministic (e.g., lock based) codes, hence questioning the entire line of work," Adve said. "DeNovoND showed that our approach works for non-deterministic codes as well and its recognition as a top pick symbolizes that we have crossed the threshold from 'whacky idea that will never work' to 'novel work with large potential impact.'"

// DeNovoND and its recognition as a Top Pick allows us to cross the threshold from 'whacky idea that will never work' to 'novel work with large potential impact.' //

Professor Sarita Adve



and her students Hyojin Sung and Rakesh Komuravelli. In it, the authors describe the DeNovoND system, which builds on work on the DeNovo project, one of the key research thrusts of Adve's group. It takes a combined software-hardware approach to rethink the multicore

memory hierarchy to greatly improve the complexity, performance, and power efficiency of current hardware. Simultaneously improving the efficiency along all three dimensions is unusual.

Of the paper's selection, Adve said, "The final selection is the result of an extremely competitive and rigorous review process. This year, only twelve papers were selected. It is therefore quite an honor to be selected."

It is particularly significant that this work was selected because at first, it was not clear that the approach her research group was taking would in fact bear fruit. "When we started DeNovo, we showed the benefits of our approach for deterministic codes. Most people

Last year, Adve and her students Siva Kumar Sastry Hari and Pradeep Ramachandran, along with their collaborator from Intel, Helia Naemi, were similarly recognized for their paper "Relyzer: Exploiting Application-Level Fault Equivalence to Analyze Application Resiliency to Transient Faults."

Previously, Adve co-developed the memory models adopted by widely used multicore programming languages such as Java, C++, and C. She was named a Woman of Vision in innovation by the Anita Borg Institute for Women in Technology in 2012. She has been honored as an IEEE Fellow (2012) and ACM Fellow (2010). She received the ACM SIGARCH Maurice Wilkes Award in 2008, was named a University of Illinois University Scholar in 2004, and received an Alfred P. Sloan Research Fellowship in 1998.



Read the IEEE Micro abstract about DeNovoND at <http://bit.ly/1oeCUho>.

Computer Science Students Creating “Pandora for Fashion”



BY MIKE KOON, COLLEGE OF ENGINEERING

Its co-founder and CS graduate student Tobias Lei calls it the “Pandora for Fashion,” and for those who just can’t figure out what to wear, it may be the ultimate time saver.

Lei, together with fellow CS student Gong Chen and creative lead Liz Li, a recent Illinois advertising graduate, developed an app called StylePuzzle, which helps make informed suggestions as to what to wear each day.

Here’s how it works. Login to stylepuzzle.com. Give a few simple pieces of information like the weather and the occasion, and through its machine-learning algorithm, the app will provide photos of potential apparel combinations for you based on recent fashion trends, your preferences, and clothes you own.

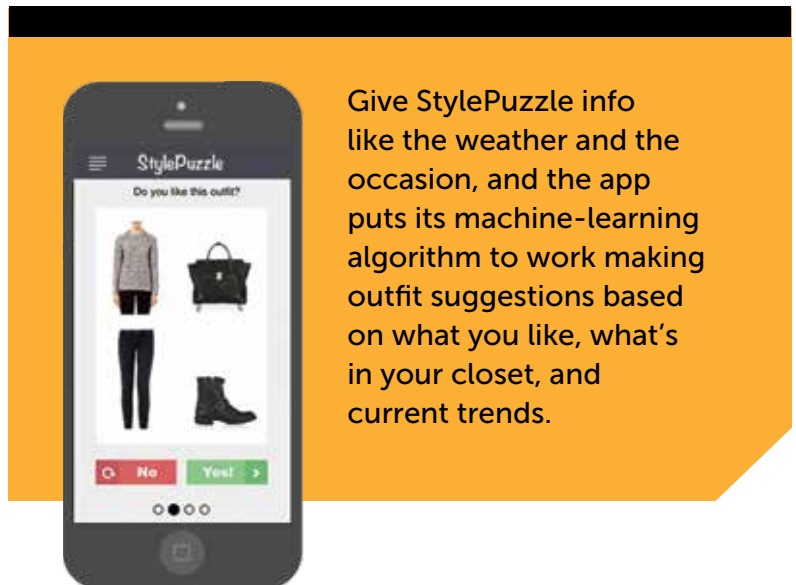
StylePuzzle currently has a photo library of over two million choices from more than 20,000 fashion brands. Much like Pandora, as a user makes a few choices, StylePuzzle learns the user’s preferences to make better future recommendations.

Lei is specializing in data science and has always had an interest in e-commerce. The idea for StylePuzzle came after one of his friends routinely was having a problem with what to wear and would ask him to send the URL of some suggestions. After extensive research into fashion cloud sourcing, the idea became the subject of one Lei’s class projects.

While the app has affiliate links to over 20,000 fashion brands on affiliate platform ShopSense, the long-term goal is to not only convince designers to advertise on the site, but be an online retailer for them. StylePuzzle would offer whole catalogs inside the app from only selected brands.

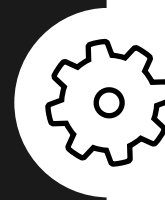
“We realize that in order to make this a big money operation, we have to be the marketplace where people can actually buy something from our site,” Lei said. “In order to do that, we need to further partner with manufacturers and brands and we’re heading in that direction. The advantage we have is we know their closets and thus capable of making smart recommendations,” Lei said.

Above: Liz Li, Gong Chen, and Tobias Lei, co-founders of StylePuzzle represent another startup generated from Engineering at Illinois.



Give StylePuzzle info like the weather and the occasion, and the app puts its machine-learning algorithm to work making outfit suggestions based on what you like, what’s in your closet, and current trends.

HackIllinois: Concentrated Innovation



BY TOM MOONE

Friday, April 11, was the start of the first-ever HackIllinois event. This student-organized and student-run event brought in 750 students from 21 universities and colleges in the Midwest to the Siebel Center for 36 hours of intense computer science competition and fun.

CS student Matthew Dierker was the event director—his email seeking volunteers in October 2013 initiated this event. “My job was to build the whole thing,” he said. “To bring people in, and when they were there, to put them on doing things. Later we were moving people to coordinating with companies, and moving on to logistics, and making sure we have stuff for the website. It’s creating the teams, all that sort of thing.”

Dierker was assisted by Marrison Helleesen, corporate director; Emily Tran, operations director; and Alex Burck, systems director. They also had a staff of over 50 who participated in these various areas. During the HackIllinois weekend an additional 200 volunteers assisted with the event.

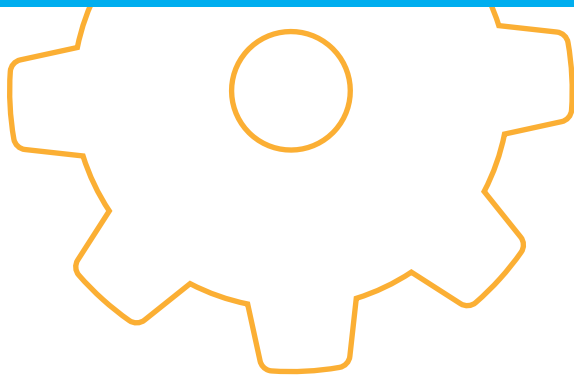
Tran described the goal of HackIllinois as “[creating] a fun atmosphere where students get a chance to collaborate with their peers to work on cool projects outside of the classroom and to use the latest and greatest technologies.”

Throughout the weekend, the participants worked in teams of up to four. The projects could be anything they dreamed up—a useful tool they wish existed or a skill or language they wanted to learn. Web apps, mobile apps, and hardware hacks were all welcome. The only hard rule: projects had to be done during the HackIllinois weekend.

Corporate support for HackIllinois was extraordinary—57 companies provided \$175,000 in financial sponsorship of the event. These companies also sent a total of 150 representatives to the event to interact with the participants.

HackIllinois culminated in a Project Fair where teams presented and were judged on their final creations. Top project honors went to teams from Illinois and Purdue. First place went to the Illinois team that created Walter, a news app; second to a Purdue team that created Clock, a clock app for Pebble; and third to another Illinois team for GoQ, an office hours and course organizing tool also for Pebble. In addition, some sponsoring companies gave out prizes to teams that used their products in their team projects. Tran said, “There were so many new and useful tools and apps made that meshed together technologies in ways that were brilliant.”





Though the participants in HackIllinois were all computer enthusiasts, they couldn't really go an entire weekend on a completely serious schedule. Diversions were provided by the Moonshots, a group of (mostly freshmen) volunteers who were given the task to add some fun to the event. The Moonshots decorated the Siebel Center and DCL; brought in a photo booth; organized Nerf wars for the participants, staff, and sponsors; and even had therapy dogs visit—all to give the participants something to take their mind away from the computer for a time.

Organizers are already looking forward to next year's event—February 27-March 1, 2015. Overall, they were very pleased with how things went this first event. "A lot of things worked really well," said Dierker. "People enjoyed how organized everything was. People's projects worked pretty well. I think sponsors were happy."

Looking back over the event, Hellesen said that she would gladly give six months of her life to HackIllinois. "It gets the creative juices flowing," she said. "You take a step back and do something totally different. It opens up a world of possibilities."



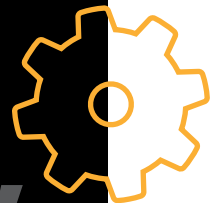
Top: HackIllinois had students working long into the night.

Right: Participants took advantage of the latest high-tech construction material.

HackIllinois staff created a YouTube video celebrating the success and fun of their event.



“There were so many new and useful tools and apps made that meshed together technologies in ways that were brilliant.”



Emily Tran, HackIllinois Operations Director



Student Startup Luminous Brings Projection Mapping Out of the Arena

BY TOM MOONE

“Projection mapping everywhere.” That’s the slogan of Luminous, a startup founded by CS PhD students Brett Jones, Kevin Karsch, and Raj Sodhi.



Projection mapping is the process of using projected light and color to turn everyday objects or structures into immersive and interactive displays. Currently, it is an expensive process requiring several experts working for weeks or months on a particular project, depending on the complexity. You may have seen these dramatic displays at auto shows, theme parks, concerts, or festivals.

Compared to photo manipulation, projection mapping is “a lot more expensive, and it takes a lot more time to do it,” said Sodhi. “That’s where we come in with our experience with computer vision and graphics to make this much easier for people to do.”

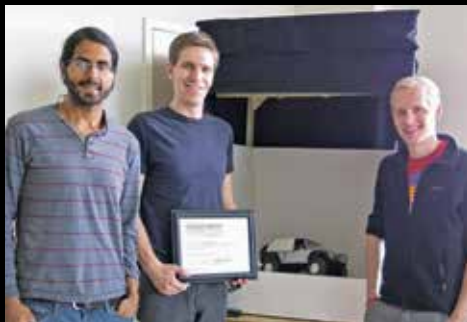
The Luminous team is currently developing a beta version of their product, which will include both hardware and software to make projection mapping easier and more efficient. "Instead of taking ten experienced people to create something, one or two designers could take a day to make something and then set it up in just a few hours," said Karsch.

"What we are trying to do is to revolutionize project mapping," said Jones. "Instead of only being in high budget public events, you'll see it in more and more local retail experiences."

Award-Winning Ingenuity

Luminous was one of the winners of the 2014 Cozad New Venture Competition at the University of Illinois. In its 14th year, the annual Cozad Competition encourages students from across campus to develop new sustainable businesses. This year, 18 student teams competed. Luminous won in the non-university funded research category. They received a \$20,000 cash prize, legal services from Polsinelli, a Chicago law firm, and web design services from TINITT, a Champaign design firm.

Previously, in 2012, Karsch won the \$30,000 Lemelson-MIT Illinois Student Prize. And in 2013, Jones and Sodhi were each recognized with a \$10,000 Illinois Innovation Prize.



Rosen Competes in Collegiate Chess Finals for Second Time

BY DAVID CUNNINGHAM

CS undergraduate Eric Rosen, a seasoned competitive chess player returned to the Presidents Cup chess finals with the Illini Chess Club for the second year in a row. Known as the Final Four of collegiate chess, the Presidents Cup is every bit as significant to those competing as the NCAA Final Four is for basketball players.



Other members of the Illini team include returning competitors Michael Auger, Xin Luo, and Akshay Indusekar. They competed against teams from Webster University, Texas Tech University, and The University of Maryland at Baltimore. Webster University won the championship.

The Illinois team is entirely student run. Unlike the other teams in the Presidents Cup, they do not have sponsorship for travel or training. "It's quite difficult for a small organization like the Illini Chess Club at a big university to achieve the necessary funding to maintain a high quality chess club and team," said Rosen. We are greatly appreciative to everyone who has given us their generous support."

Shah Named a Knight of St. Patrick

BY DAVID CUNNINGHAM

CS and Aerospace Engineering senior Akash Shah was named a Knight of St. Patrick, one of the highest honors in the College of Engineering.

The Knight of St. Patrick honor recognizes students who exemplify leadership, character, and contribution to the department and other students.

"I am very humbled to have been selected to be a part of it. I am very proud to have been able to make a positive impact on this college when I have gained so much from it in my four years here."

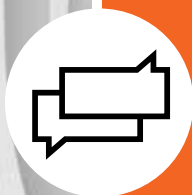


Shah was the director of the Dean's Student Advisory Committee, taught an Engineering 100 class, helped expand the Illinois Space Society, and participated in organizing Engineering Open House and Engineering Employment Expo. Shah has left a positive mark on the Illinois community, and will continue to do so as he moves on to new adventures.

This spring Shah also received the Stanley H. Pierce Award, which recognizes students and faculty who develop close cooperation.

Silicon Valley Workshop

Provides Students with Valuable Entrepreneurial Knowledge



Trip participants with Max Levchin (CS BS '97), who hosted at his innovation lab, HVE, where new startups like Glow and Affirm have launched.

BY DAVID CUNNINGHAM

Over winter break, the Technology Entrepreneur Center (TEC) at the University of Illinois sponsored the Silicon Valley Entrepreneurship Workshop, taking a select group of students for a week-long trip of visits to Silicon Valley startups and technology companies.

The trip gave participants the opportunity to interact with individuals who had successfully transitioned between each stage of the entrepreneurial track. "I could tell that the organizers really made an effort to introduce us to a wide breadth of entrepreneurial styles, which was awesome because it tailored directly to the diversity of the students on the trip," said CS student Jay Bensal, who recommends that everyone take advantage of future TEC opportunities.

// You have to constantly question what you're doing, and evaluate how to improve; never be satisfied with mediocrity, because mediocrity doesn't stand out from the pack. //

Arpit Agarwal

During the Silicon Valley Entrepreneurship Workshop students visited the following companies:

This unique opportunity enabled students to network with former Illinois students who have made the jump from academics to the complex entrepreneurial landscape. Navigating the dynamic and ever-changing “real-world” is something that can be fully learned only through trial and error, but supplementing that with the experiences of others is exactly what this trip aimed to do.

“The highlight of the week for me was definitely the MalwareBytes event,” said Bensal. “Marcin Kleczynski (BS CS '12) was absolutely awesome and is definitely someone that I look up to. So the chance to meet him was incredible. I was a little star struck to be honest with you.”

CS student Arpit Agarwal echoed similar sentiments: “The chance to meet really well-established alums in Silicon Valley was fantastic. One of the most important things that I learned from the trip is that you have to constantly question what you’re doing, and evaluate how to improve; never be satisfied with mediocrity, because mediocrity doesn’t stand out from the pack. If you’re true to yourself, and have passion for what you’re doing; then you’re on the right track.”

TEC was founded in 2000 to inspire students to become world-changing visionaries, leaders, and entrepreneurs. It offers courses, workshops, extracurricular events, and competitions to nurture students as they work to develop themselves for a future in entrepreneurship.



Thomas M. Siebel (BA History '75, MBA '83, MS CS '85) personally hosted students on a tour of his company, C3 Energy.

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C3 ENERGY

GE SOFTWARE CENTER OF EXCELLENCE

GIANT PIXEL

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MALWAREBYTES

OPTIMIZELY

SILICON VALLEY BANK

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YELP

CS @ ILLINOIS Welcomes Five New Faculty

PAUL Fischer

CS and Mechanical Science and Engineering Professor Paul Fischer is well-known for his research on numerical methods and large-scale computer software for computational fluid dynamics (CFD). Fischer comes to Illinois from Argonne National Laboratory, where he led development of *nek5000*, a widely used CFD software package.



A pioneer in higher-order spectral and finite-element methods, Fischer wrote the definitive book, *High-Order Methods for Incompressible Fluid Flow*. His appointment

at Illinois is expected to strengthen connections between CS and vital physical applications that rely on CFD simulations. Fischer received the Gordon Bell Prize for High-Performance Computing in 1999 and the University of Chicago Distinguished Performance Award in 2009. In 2012, he was elected as a Fellow of the American Association for the Advancement of Science (AAAS) for outstanding technical contributions in CFD and fluid flow simulations on extreme-scale computers. At Illinois, Fischer has been named one of twelve Blue Waters Professors, an honor that grants substantial computing and data resources on the Blue Waters petascale supercomputer.

Prior to joining Argonne in 1998, Fischer had been a faculty member at Brown University (1991-1998). Earlier, he completed postdoctoral appointments at both MIT and at Caltech, where he held the first Center for Research on Parallel Computation Prize Fellowship. He received his PhD in mechanical engineering from MIT in 1989.

WILLIAM Kramer

William Kramer joins CS @ ILLINOIS as a research professor. Since 2008, Kramer has been with the National Center for Supercomputing Applications (NCSA) on the University of Illinois campus, where he is the director and principal investigator of the Blue Waters petascale supercomputer project.

Kramer will continue his ongoing work on large scale systems, but will branch out from his current research on resiliency, resource management, and performance metrics to include other areas of interest, like security, networking, and data management.



Prior to joining the University of Illinois, Kramer was the general manager of the National Energy Research Scientific Computing Center (NERSC) at Lawrence

Berkeley National Laboratory (LBNL). Earlier, he worked at the NASA Ames Research Center, where he was responsible for all aspects of operations and customer service for NASA's Numerical Aerodynamic Simulator (NAS) supercomputer center and other large computational projects.

Kramer was named one of HPCwire's "People to Watch" in 2005 and in 2013. In 2010, he was the first person selected as Inside HPC's "Rockstars of HPC." He has also received two Group Achievement Awards and a Special Achievement Award from NASA. He is the founder of several initiatives, including the ACM/IEEE George Michael Memorial HPC Fellowship Program, the Blue Waters Fellowship Program, the Open Science Grid Executive Committee, and the DECUS Seminar Program.

JIAN Peng

Assistant Professor Jian Peng received his PhD in 2013 from the Toyota Technological Institute at Chicago. Since then, he has been conducting postdoctoral research at MIT's Computer Science and Artificial Intelligence Laboratory.



His work focuses on the design and application of both efficient algorithms and effective statistical modeling techniques for processing, integrating,

and analyzing datasets in genomics, systems biology, and molecular biology. His doctoral research was on statistical models for structural bioinformatics, with a focus on statistical inference for protein structure modeling.

Peng was the winner of the 2013 CrowdScale Shared Task Challenge. He received a Microsoft Research PhD Fellowship for 2010-2012 and a Young Investigator Award from the Conference on Retroviruses and Opportunistic Infections (CROI) in 2011. Also in 2011, his work received a best performer ranking in breast cancer cell line pharmacogenomics challenge of Critical Assessment of Genome Interpretation (CAGI). In 2010, RaptorX, his protein modeling software, was ranked second overall and first for human template-based modeling in CASP9, the biennial assessment of protein structure prediction experiments sponsored by the National Institutes of Health (NIH).

HARI Sundaram

Associate Professor Hari Sundaram joins CS @ ILLINOIS and the Charles H. Sandage Department of Advertising in a novel, first-ever joint faculty position in computational advertising.

In this position, Sundaram will enable the two departments to respond to important academic questions and opportunities associated with big data and the rise of new media. It will also allow for the development of new curricula, research, and teaching at the vital intersection of information, technology, and society.

Sundaram's work addresses issues of sustainability by identifying mechanisms to engender cooperative behavior adoption in very large groups. He develops algorithms, efficient sensors, and novel applications to analyze social signals (communication and information flow) across networks of people and senses their physical activity using efficient sensors and smartphones.



Sundaram's research has received several awards, including best paper awards, from the IEEE and ACM and has been supported by federal sources (NSF, NEA, and

NEH) and a range of industrial sponsors (Avaya, IBM, NEC, and Microsoft and Ricoh).

New Faculty continued

TANDY Warnow

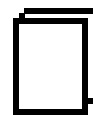


Professor Tandy Warnow comes to Illinois from the University of Texas at Austin, where she had been the David Bruton, Jr. Centennial Professor in Computer Science. At Illinois, she

holds a joint appointment as the Founder Professor in Bioengineering and Computer Science.

Warnow is an expert in the application of mathematics and computer science to develop algorithms for complex problems in the field of phylogenomics, which is the intersection of evolution and genomics, and the field of metagenomics, which is the study of genetic material in the environment. Warnow's current work is focused on developing methods to better analyze ultra-large datasets containing 10,000 to 1 million gene sequences.

Warnow's research has been highly recognized, receiving an NSF National Young Investigator Award in 1994, a David and Lucile Packard Foundation Fellowship in 1996, a Radcliffe Institute for Advance Study Fellowship in 2003, and a John Simon Guggenheim Foundation Fellowship in 2011.



Parameswaran Receives Dissertation Awards

CS Assistant Professor Aditya Parameswaran is the 2014 recipient of the ACM SIGMOD Jim Gray Doctoral Dissertation Award. This award recognizes excellent research in the database field.

Titled "Human-Powered Data Management," Parameswaran's dissertation develops novel formalisms, algorithms, and systems for the emerging area of human-powered (or,

crowdsourced) data management.



The notice from the ACM awards committee stated, "The work in the thesis is highly innovative

and interdisciplinary, bringing together areas such as data management, machine learning, and human computation, and making several technical contributions that span both theory and systems."

"I am thrilled at the response to my dissertation, especially given that it did not center around traditional "core" data management topics, but rather an emerging, inter-disciplinary area like crowdsourcing," Parameswaran said.

In addition, Parameswaran was named runner up for the SIGKDD Dissertation Award, and received the Arthur Samuel Dissertation Award from Stanford University, where he earned his PhD.

Parameswaran joined CS @ ILLINOIS this fall following a year-long postdoctoral appointment at MIT.

Heeren Receives Rose Award for Teaching Excellence



CS Professor Cinda Heeren and College of Engineering Dean Andreas Cangellaris.

BY TOM MOONE

CS Professor Cinda Heeren received the 2014 Rose Award for Teaching Excellence. This award recognizes teachers who excel at motivating freshman and sophomore students to learn and appreciate engineering. It fosters and rewards excellence in undergraduate teaching in the College of Engineering.

“I was excited and honored to receive this award,” said Heeren. “I was even grateful to be nominated. And I was grateful that the students had taken the time to write the letters of recommendation, because they are so busy.”

Heeren’s teaching philosophy revolves around making a large class feel small. While the size of CS 225 makes it difficult, if not impossible, to meet with every student individually, Heeren does what she can to make them feel their concerns are addressed. “We hold consulting sessions that we call solution parties, where students still get their questions answered, but instead of doing it in an individual setting, it becomes a social setting,” Heeren said. “They still feel connected to the course, and each other, and course staff.”

When describing what she likes about teaching, Heeren said, “It’s all about the people. I love that I know my door is going to be filled with people to talk to all day, every day. And they are very bright people.”

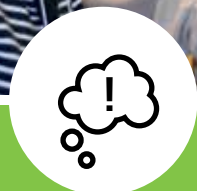
Heeren is quick to point out that she does not do the work for such a large class alone. “The biggest reason that CS 225 is successful is course staff,” said Heeren. “Kids come through the course, and they love the material. And I hire them and they become mentors for the next semester. I think the true value in the course comes from the students I hire for course staff.”

Yet Heeren also gets a charge out of the students she interacts with every day. “Our students are just so incredibly bright,” she said. “Who gets to teach 600 kids who are all that bright? It’s amazing, the potential in that room.”

“Our students are just so incredibly bright.
Who gets to teach 600 kids who are all that bright?
It’s amazing, the potential in that room.”

CS Professor Cinda Heeren

ChicTech Retreat and GEMS Camp Create Pipeline for Women in CS



Beginners did basic level programming to create games in the “Make an Animation” workshop, using Scratch. More advanced students would work on website design or developing a computer operating system using Raspberry Pi.



You can read a longer version of this story at <http://www.istem.illinois.edu/news/chictech.html>.

ChicTech Retreat

BY ELIZABETH INNES, I-STEM EDUCATION INITIATIVE

Bringing together over 30 volunteers and 35 middle and high school students, the 10th annual ChicTech Retreat was intended, according to CS sophomore Lily Sellers (one of its directors), to “inspire young girls to pursue education in computer science.” So on May 3 and 4, 2014, ChicTech young women, many from the Chicago area, came to the Siebel Center for a weekend featuring fun activities focusing on computer science.

Sponsored by Women in Computer Science (WCS), ChicTech brings in middle and high school girls demonstrating diverse computer skills and experience. Beginners did basic level programming to create games in the “Make an Animation” workshop, using Scratch. More advanced students would work on website design or developing a computer operating system using Raspberry Pi.

“We really try to make it fun,” said WCS president Lavanya Iyer, “but we try to make it educational at the same time, so that every student is learning something when they come here.”

The participants weren’t glued to computer workstations, but also took part in a number of fun activities. For example, a Google-sponsored scavenger hunt encouraged the girls to see campus. Saturday’s movie and activity night offered fun, “girly” activities, including a sleepover in Siebel Center.

But one of the most important things the girls did during the retreat was build relationships—both with their peers and with current Illinois students. CS freshman Brianna Ifft, who co-taught the “Create a Website” workshop, had attended ChicTech as a senior in high school. That retreat was pivotal in her decision to come to Illinois: “I was trying to decide between two or three schools, so it was right in that decision-making time. For me, it helped sway my decision to come here.”

GEMS Camp

BY TOM MOONE AND MICHELLE WELLENS

Middle school girls, along with their enthusiasm and laughter, were once again a most welcome addition to the halls of Siebel Center this summer. Nearly 150 girls participated in the Girls Engaged in Math and Science (GEMS) Camp over a six-week period.

This free, full-day camp has been provided at the University of Illinois since 1994. Leadership for GEMS Camp was transitioned from the National Center for Supercomputing Applications (NCSA) to CS @ ILLINOIS just last year. This move has enabled organizers to expand the camp from its original one-week format, to last year's two-week format, to this year's six-week format. With each week able to accommodate 25 participants, GEMS Camp has expanded its reach from 25 girls, to 50 girls, to 150 girls each summer in just two year's time.

"Last year's camp was so successful that the department said let's go bigger," said Cinda Heeren, faculty director of the program. "This year we did six weeks with three different camp themes, each theme was offered twice." Heeren continued last year's theme of food and society, but added themes for wearable computing and astronomy.

In addition to leadership from Heeren and CS Professor Lenny Pitt, four undergraduates were the lead teachers for the camps: Calla Carter, Hanan Jaber (who also taught last year), Shazia Siddiqi, and Gail Steitz. All mentioned the important impact that GEMS Camp could have on the participants' lives. "The thing that made me like GEMS Camp was being able to convince girls to code. You don't have to be a computer scientist to code," said Jaber, a math major. Jaber had two sisters take part in a week of camp this year, and when they got home, one sister "literally ran to the computer and said, 'I'm going to code,'" Jaber said.



Steitz said that one positive effect GEMS Camp had was being able to start the participants off with high expectations that they were able to achieve. "These are middle school girls, and we are the first people who get to tell them what girls can do," she said. "So we start with 'Girls can do anything. You're good.'"

"I think at the end of the day it's all about having the patience to sit there and work through it," said Siddiqi. "It's applicable to many areas of study."

Support for GEMS Camp was provided by CS @ ILLINOIS, NCSA, and TCIPG Education, a joint project of the Office for Mathematics, Science, and Technology Education and the Information Trust Institute. From corporate partners, GEMS Camp participants received "swag bags"—a huge hit with the girls—filled with items like T-shirts, water bottles, pens, and notebooks from Microsoft, Facebook, Google, and Groupon. And thanks to contributions from Fontaine Richardson (PhD CS '68) and others, CS @ ILLINOIS has established a gift fund to benefit GEMS Camp. This underwriting keeps the camp free for participants, covers meals and snacks, and pays for teachers, staff organizers, and IT support.



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>



Alumni Cohen and Taylor Serve as EOH Judges

BY TOM MOONE

Every year, Engineering Open House (EOH) greets thousands of visitors who walk the halls of the buildings on the engineering campus. It is a great way to showcase the ingenuity and creativity of students.

Students involved in EOH take part in competitions throughout the event. To evaluate these projects for these competitions the EOH committee relies on alumni who come back to campus to serve as judges. This year 60 Illinois alumni participated in EOH as judges.

Two CS @ ILLINOIS alumni who participated in this year's EOH were Ira Cohen (BS CS '80) and Ken Taylor (BS CS '81). "I have always enjoyed EOH, both as a

student and as a parent," said Taylor. "I wanted to give back to the university, and this was a fun way to support Engineering at Illinois."

Cohen has served as an EOH judge more than 20 times, and he has enjoyed the experience greatly. "Engineering is such a dynamic field," he said. "The exposure to the current areas of exploration is always exciting."

Though he hasn't served as many times as Cohen, Taylor has also been a judge several years, and there are always projects he is looking forward to seeing year after year: "There are so many fantastic exhibits that are on my must-see list: the Physics Van Lecture Demos, the robots in the AMD Jerry Sanders Creative Design Competition, and the Rube Goldberg Machines."

What makes a successful EOH exhibit? "Creativity and enthusiasm are big factors," said Taylor. "Also, I like to see a group effort where more than one person can explain the aspects of the exhibit."

Cohen also looks for an "ability to communicate in terms that a non-engineer can understand." If the project was done as part of a class or is based on some project from the past, Cohen wants to see that something new has been done with the project.

Save the dates for EOH 2015—March 13-14.

// I wanted to give back to the university,
and this was a fun way to support
Engineering at Illinois. //

Ken Taylor BS CS '81



Ira Cohen (BS CS '80), Debra Cohen, and Ken Taylor (BS CS '81).

CS Professor Emerita Geneva Belford Remembered



BY COLIN ROBERTSON AND MICHELLE WELLENS

CS Professor Emerita Geneva Belford (1932-2014) positively influenced students at the University of Illinois for more than 48 years, first as a professor of Mathematics, next as a professor of Computer Science, and then as the CS Department's Graduate Program Coordinator, even after her official retirement in 2000.

After completing a bachelor's degree in mathematics at the University of Pennsylvania, Belford came to the University of Illinois as a mathematics PhD student, graduating in 1960. She joined the Chemistry Department as a research associate until 1964, when she became an assistant professor of Mathematics. In 1972, she joined the Center for Advanced Computation as a research assistant professor, and in 1976 she was promoted to research associate professor. Professor Belford joined the Department of Computer Science in 1977.

In CS, she quickly became one of the most popular faculty advisors. Over the course of her career, she supervised 34 CS PhD dissertations and 153 CS MS theses. Many of Belford's students have gone on to have highly successful careers, which have ranged from faculty positions across the world, to holding important CS positions in large companies, starting large enterprises, and even becoming practicing physicians. Two students of particular note described her influence this way:

"It is my privilege to recognize Professor Geneva Belford for all her remarkable contributions and role in shaping the career of so many students. My master's thesis in 1980 was titled "Design of Relational Database Operators as

an Extension of an Experimental Programming Language." It turned out to be the single most important decision of my career. It has been the foundation of my entire career as I have stayed in that field ever since." (Sohaib Abbasi (BS CS '78, MS CS '80), President and CEO of Informatica)

"She was tough and practical, yet empathetic and generous with her time. She encouraged exploration, experimentation and creativity. She brought rigor and incisiveness to every decision. She was an important catalyst in my career." (Thomas M. Siebel (BA History '75, MBA '83, MS CS '85), Chairman and CEO of C3 Energy)

An outstanding educational leader, teacher, and mentor, Belford received several campus honors, including the 1986 College of Engineering Halliburton Educational Leadership Award, the 1991 Dad's Association Outstanding Faculty Award, the 2005 Graduate College Outstanding Mentor Award, and the 2007 Mom's Association Medallion of Honor. In 2012 Belford received a CS @ ILLINOIS Distinguished Service Award.

Friends, students, and colleagues are invited to post remembrances about Professor Belford's life and career at <http://go.cs.illinois.edu/RememberingBelford>.



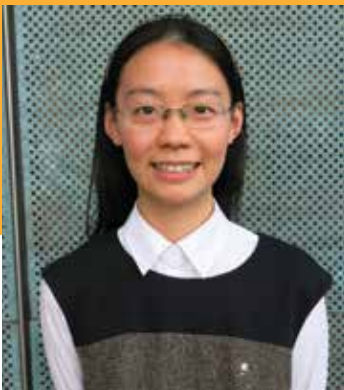
Donations to the Geneva Belford Memorial Fund in Computer Science are most welcome to honor her legacy. Give online at: <http://cs.illinois.edu/giving/give-now>

Celebration of Excellence

Student and Faculty Awards



CS @ ILLINOIS honored the students and faculty who have received important distinctions over the past academic year. We extend congratulations to these individuals whose hard work is a credit to themselves and a source of pride for the department.



YIFAN WANG is a senior in computer science and is also pursuing minors in math and statistics. She interned for Microsoft in the summer of 2013, where she served as president of the Microsoft Intern Community. She has assisted Beckman Institute researcher John M. Hart in analyzing the efficiency of freight trains. Also, she has served as a course assistant for both CS 125 and CS 242.

GRADUATE FELLOWSHIPS & AWARDS

ACM IEEE-CS GEORGE MICHAEL
MEMORIAL HPC FELLOWSHIP
Jonathan Lifflander

C. L. AND JANE W.-S. LIU AWARD
Shashank Agrawal

C. W. GEAR OUTSTANDING
GRADUATE STUDENT AWARD
Milos Gligoric

FENG CHEN MEMORIAL AWARD
Shashank Agrawal
Abhishek Gupta
Rakesh Komuravelli
Akhil Langer
Hyojin Sung

FENG CHEN MEMORIAL AWARD IN
SOFTWARE ENGINEERING
Parasara Sridhar Duggirala
Yu Lin

GRADUATE STUDENT OUTSTANDING
AMBASSADOR AWARD
Nathan Dautenhahn

GRADUATE STUDENT OUTSTANDING
SERVICE AWARD
Christopher Cervantes

INTERNET2 INNOVATIVE APPLICATION AWARD
Mo Dong
Qingxi Li

KENICHI MIURA AWARD
Babak Behzad

OUTSTANDING TEACHING ASSISTANT, FALL 2013
Theodoros Kasampalis
Juan Mancilla Caceres
Amarin Phaosawasdi
Daniel Uhlig
Lingyong Wang

W. J. POPPELBAUM MEMORIAL AWARD
Nima Honarmand
Hyojin Sung

YAHOO! OUTSTANDING TEACHING
ASSISTANT AWARD
John Lee

UNDERGRADUATE SCHOLARSHIPS & AWARDS

C. W. GEAR OUTSTANDING
UNDERGRADUATE AWARD
V. S. P. Vijay Bhattacharjee
Tej Chajed

CIMIT STUDENT TECHNOLOGY PRIZE FOR
PRIMARY HEALTHCARE, FINALIST
Ronit Chakraborty
Hyun Duk Cho
Seungchul Lee
Mariko Wakabayashi

CISCO WOMEN'S UNDERGRADUATE SCHOLARSHIP
Laura Makdah

CRA OUTSTANDING UNDERGRADUATE
RESEARCHER AWARD, HONORABLE MENTION
Jack Weinstein



WILLIAM M. DUNN (BS CS '86, MS '87) is President of Dunn Solutions Group Inc., which he founded in 1988 as Dunn Systems Inc. Over the years, the company has steadily grown and diversified from its roots as a custom application developer, expanding to five cities across the world while adding quality assurance and business intelligence services, as well as user interface development and web design, to its list of offerings. In 1996, he generously established the Dunn Systems Scholarship in Memory of Arthur R. Dunn in the Department of Computer Science in honor of his father.

**CROWE HORWATH LLP OUTSTANDING
COMPUTER SCIENCE STUDENT**

John Espinosa
Marrissa Hellesen

DANIEL L. SLOTNICK SCHOLARSHIP

Cole Gleason

DUNCAN H. LAWRIE STUDENT LEADERSHIP AWARD

Akash Shah

**DUNN SYSTEMS SCHOLARSHIP IN
MEMORY OF ARTHUR R. DUNN**

Yifan Wang
Dmitriy Zavelevich

ERNST & YOUNG SCHOLARSHIP

Akash Shah

FRANZ HOHN AND J. P. NASH SCHOLARSHIP

Hongyi Wu

ICCP JAMES N. SNYDER MEMORIAL AWARD

William Hennessy

**JAMES N. SNYDER AWARD FOR
SCHOLASTIC ACHIEVEMENT**

Luvsandongov Lkhamsuren
Rishabh Marya

JEFFREY P. BLAHUT MEMORIAL SCHOLARSHIP

JunYoung Gwak

JOHN DEERE & COMPANY SCHOLARSHIP

Briana Chapman
Shreya Garg
Lily Sellers
Shareefah Williams

JOHN R. PASTA AWARD

Wei Chen
Robert Weber

DEAN'S AWARD FOR EXCELLENCE IN RESEARCH

Derek Hoiem
Grigore Roşu

ENGINEERING COUNCIL OUTSTANDING ADVISOR

Matthew Caesar
Carl Gunter
Jiawei Han
Steve Herzog
Laxmikant Kale
Karrie Karahalios
Darko Marinov
Dan Roth
Paris Smaragdis
ChengXiang Zhai

**HPCWIRE AWARD FOR BEST USE
OF HPC IN LIFE SCIENCES**

Laxmikant Kale

IEEE COMPUTER SEYMOUR CRAY AWARD

Marc Snir

INFORMS FELLOW

Sheldon Jacobson

**GERMAN NATIONAL ACADEMY OF
SCIENCES LEOPOLDINA**

Klara Nahrstedt

ROSE AWARD FOR TEACHING EXCELLENCE

Cinda Heeren

**SIAM ACTIVITY GROUP ON
SUPERCOMPUTING CAREER PRIZE**

William Gropp

SLOAN RESEARCH FELLOWSHIP

Brighten Godfrey

FACULTY AWARDS

ACM FELLOW

David Forsyth

ACME MEDIA RELATIONS AWARD

Sheldon Jacobson

CAS FELLOW

Brighten Godfrey

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 establish a scholarship or sponsor an award, 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>.



VISIONARY SCHOLARSHIPS THAT WORK

MEET Chase Duncan



Being a non-traditional student can be tough.

Before joining CS @ ILLINOIS, Chase Duncan dropped out of the 9th grade, worked hard at a community college, and was then accepted as a transfer student.

Not to mention the fact that he got married and had a baby son along the way. Chase is a guy who is up for a challenge.

"You can probably imagine that all I do is work," he says. "I work very hard to keep up with my peers. "Yet, I love it. Every day I am grateful that I have the opportunity to attend a college like Illinois. I feel so blessed to spend these hours and hours every day studying, learning and bettering myself."

Chase is here because he knows how to work hard and because he knows the value of that hard work. He's also a grateful recipient of a large undergraduate scholarship made possible through the Engineering Visionary Scholarship Initiative.

The Engineering Visionary Scholarship Initiative

The Engineering Visionary Scholarship Initiative will raise a \$100 million endowment to bring the nation's best students to Engineering at Illinois by making college more affordable. This endowment—started with a \$30 million gift from The Grainger Foundation—will give a vibrant new generation of engineers the skills they need to improve our world in ways we can only imagine.

Scholarships work best when we offer a student \$10,000 or more and when students know they can count on them every year throughout their undergraduate careers. These are the scholarships that turn elite students' heads and help them choose Illinois over a competing offer. In 2013, this Initiative allowed the College of Engineering to offer large, renewable scholarship to about 50 additional students. With your help, that number will grow.

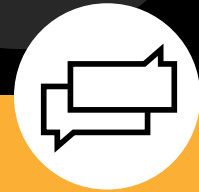


People like Chase need visionaries like you.

To support the Computer Science Visionary Scholarship Fund, visit: <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



Illinois HPC experts—including CS professors William Gropp, Sanjay Kale, and Marc Snir—recently revisited their '09 report on the resiliency challenges involved in reaching exascale computing.

Professor Sheldon Jacobson has launched the 2014 edition of his election forecasting machine, which will follow US Senate elections.

An appropriate Facebook post: CS Associate Professor Karrie Karahalios has been studying how Facebook chooses what appears on your news feed.

Wired speculates that Swift, Apple's new programming language created by CS alumnus (and LLVM creator) Chris Lattner (MS '02, PhD 05), will catch on in a big way.

On Sunday, May 18, CS @ ILLINOIS hosted a brunch for graduates and their families. One last time to let them know how proud we are of their accomplishments!

@IllinoisCS



@IllinoisCS grad Cristina Abad developed a benchmark designed to model the performance of next-gen storage systems.

Check out the New Yorker article on computer-assisted instruction [July 8, 2014]. There's a lot about PLATO.

Klara Nahrstedt has been appointed to CRA's Computing Community Consortium Council.

NexLP, co-founded by CS prof. Dan Roth, has been named to Techstars Chicago class of 2014! Congrats!

Check out the cool profile of Google Chrome security chief Parisa Tabriz (BS '05, MS '07) in @ELLEMAGAZINE.

CS @ ILLINOIS



On the passing of Geneva Belford: A sad day. She was the first professor I met when I arrived in Urbana as a fresh graduate student from a foreign country, as she was the academic advisor the department assigned to me. What I didn't know then was that she would be there for me throughout the long journey to give me soft yet strong encouragement whenever I hit an obstacle seemingly too high to climb. Her kindness was one of the indispensables that helped me get through the years in Urbana. Will truly miss her warm smile.

Six CS @ ILLINOIS students shared with Chicago Creative Space their take on the Chicago tech scene and what companies might want to think about when recruiting the university's top talent.

Department of Computer Science
College of Engineering, College of Liberal Arts & Sciences
University of Illinois at Urbana-Champaign
Thomas M. Siebel Center for Computer Science
201 N. Goodwin Avenue
Urbana, IL 61801

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CS @ ILLINOIS is celebrating two major milestones this year—the 50th anniversary of Computer Science as a University Department, and the 10th Anniversary of our home: The Thomas M. Siebel Center for Computer Science. *Special thanks to Tom Siebel and everyone who joined us for the 10th anniversary of Siebel Center on April 3, 2014.*

Please **JOIN US** on campus for our **50th Anniversary Celebration** at Homecoming—October 20-25, 2014.



Register at: go.cs.illinois.edu/50_10

Visit us—www.cs.illinois.edu—to stay connected with the latest news, social media, campus and regional networking events, plus corporate partnerships and recruiting opportunities; shop for CS @ ILLINOIS swag; update your contact information; and make your gift to support the department.

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