



ILLINOIS COMPUTER SCIENCE

# DISRUPTING

*THE*

# STATUS QUO

IMPACT REPORT **FY18**



**WE DO THE IMPOSSIBLE EVERY DAY**

Illinois Computer Science continues to trail-blaze in the technology revolution. Our faculty and students are creating solutions to meet global challenges, from the modern battlefield to the battle against life-threatening diseases. We are making online experiences more transparent and safe, transforming the delivery of education in our classrooms, and fostering the entrepreneurial ecosystem where cutting-edge technology is born. We continue to pave new paths with academic and industry partners that enhance the student experience and inspire the next generation of computer scientists.

Please join me in celebrating the amazing accomplishments of the Illinois Computer Science faculty, staff, and students this past year, and their continued success in upholding our global reputation as a leader in computer science education and research.

Vikram Adve  
Interim Department Head and Gillies Professor

*This is the inaugural Illinois Computer Science Impact Report. It will be produced annually to showcase the innovations of our faculty and students and the accomplishments of our alumni, and to inspire our partners and peers in the field of computer science. Read more at: [cs.illinois.edu/news](http://cs.illinois.edu/news).*

*Editorial Board/Writers: David Mercer, Colin Robertson, and Michelle Wellens*

Contact us: [communications@cs.illinois.edu](mailto:communications@cs.illinois.edu)

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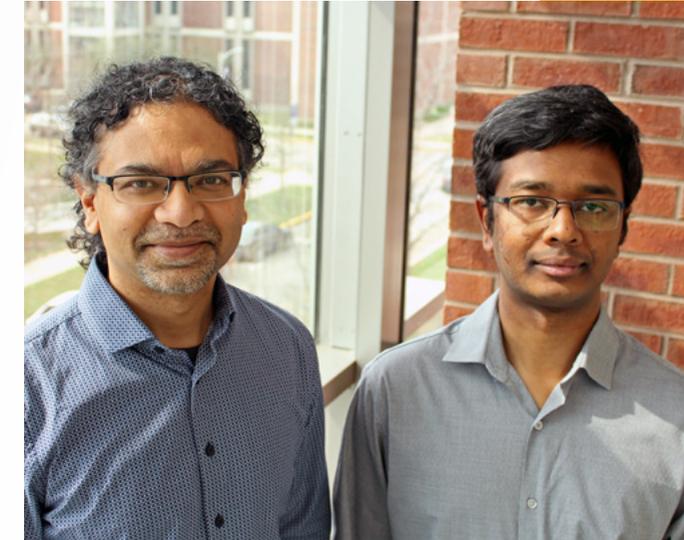


PhD student Everett Hildenbrandt, who won first prize at the 2017 IC3-Ethereum Crypto Boot Camp by extending the EVM smart-contract language, and Professor Grigore Rosu.

**SECURING SMART CONTRACTS WITH FORMAL VERIFICATION**

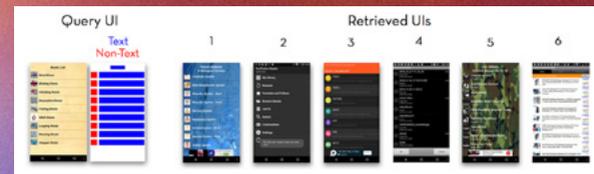
The blockchain technology that underlies cryptocurrencies is creating a wave of excitement that's reaching far beyond the financial world. One reason is the potential to ease commerce in places that lack stable banking or legal systems. **Prof. Grigore Rosu** focuses his work on one elusive barrier: making the potentially revolutionary blockchain contracts secure. Rosu's research group and his startup, Runtime Verification, are driving improvements in security and reliability through tools such as the ILELE virtual machine for the blockchain.

**ILLINOIS RESEARCHERS  
CHOSEN TO TAKE THE  
FIRST OUTSIDE LOOK AT  
MICROSOFT'S SERVICE FABRIC**



Microsoft recently opened the source code to Service Fabric, the distributed-systems platform that's the backbone of the company's Azure cloud-computing business. But before the public release, Microsoft chose **Prof. Indranil Gupta** and PhD student **Shegufta Bakht Ahsan** to be the first people outside the company to dig into the code. The result was the first published paper on Service Fabric, providing a guide to the research community about the service's internal workings and sketching out directions for potential improvements.

**WORLD'S LARGEST MOBILE DESIGN REPOSITORY HOLDS PROMISE FOR BETTER APPS**



**Prof. Ranjitha Kumar** has created the world's largest database of mobile app designs. Called Rico, it is a collection of more than 70,000 user interfaces from almost 10,000 Android apps. Now, funded by an NSF CAREER Award, Kumar hopes to provide designers with tools that will allow them to find the best possible

design solutions and the evidence they need to argue in favor of designing better apps. "So much design focuses on reinventing the wheel. The purpose of my group's work is to save you from spending your own time and engineering resources on problems that other people have already solved," Kumar said.



**HOW DOES SOCIAL MEDIA AFFECT THE SPREAD OF INFORMATION?**

A multi-university research effort led by **Prof. Tarek Abdelzaher** is focused on the propagation of information through social media – how that information moves and the impact it has. Their work is supported by \$4 million from the Defense Advanced Research Projects Agency, and it has implications for everything from how elections are won to the influence of terrorist groups. "How do beliefs form in that future where social media rule? How do they collide? How do they stabilize? I think those are fundamental, very, very interesting questions about that new reality that didn't exist 10 years ago," Abdelzaher says.

**ILLINOIS RECEIVES \$25 MILLION TO DEVELOP INTERNET OF BATTLEFIELD THINGS (IOBT)**

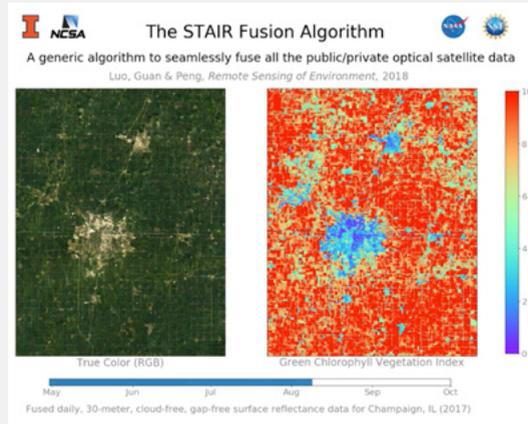


Battlefields of the future will be landscapes where humans and technology form cohesive fighting networks. **Prof. Tarek Abdelzaher** is the academic lead of a multi-institution, \$25 million effort funded by the Army Research Laboratory to build a foundation for the next-generation Internet of Battlefield Things. The IOBT goal: a cyber-network of “things” that adapts as missions evolve. “We can change our fundamental understanding of what’s possible when computers, sensors, data, weapons, soldiers, wearables, and media analytics are networked to empower new defense capabilities,” he said.



**OFFICE OF NAVAL RESEARCH FUNDS ILLINOIS EFFORT TO STREAMLINE COMPLEX MODERN SOFTWARE**

**Prof. Vikram Adve’s** LLVM compiler infrastructure can be found at work in a range of products from Apple, Google, Intel, and Qualcomm. But 15 years after its introduction, Adve and two other researchers are now building on an under-utilized aspect of LLVM – the ability to optimize software at any point in its lifetime – as part of a new \$5.6 million Office of Naval Research project aimed at simplifying and reducing the size of modern software systems. “LLVM allows you to do these kinds of late-stage software customizations or optimizations even after shipping the code because you ship it in this richer form,” Adve said.



Illinois researchers have successfully fused surface reflectance data in Champaign County, Ill., and generated daily time series for the growing season of 2017 at 30-meter resolution.

**NEW ALGORITHM PROMISES TO REVOLUTIONIZE SATELLITE IMAGERY**

Using a new algorithm, University of Illinois researchers, including **Prof. Jian Peng**, may have found the solution to an age-old dilemma plaguing satellite imagery – whether to sacrifice high spatial resolution in the interest of generating images more frequently, or vice versa. The new algorithm could greatly improve satellite imagery used to study everything from agricultural productivity to ecosystems and polar ice dynamics. “Our approach may revolutionize the use of satellite data,” Peng said.

ENABLING MEDICAL BREAKTHROUGHS

**LARGEST-EVER GENOME-WIDE ASSOCIATION STUDY OF ALS CONFIRMS NEW LINKS**



An international team of scientists, including doctoral candidate **Faraz Faghri** and **Prof. Roy H. Campbell**, has proven that mutations in the neuronal transport gene KIF5A are associated with ALS, commonly known as Lou Gehrig’s disease. More than 125,000 samples were used in this large-scale, genome-wide association study, published in *Neuron*. It was the largest such study of ALS to date, requiring new methods to handle the analysis of the massive dataset.

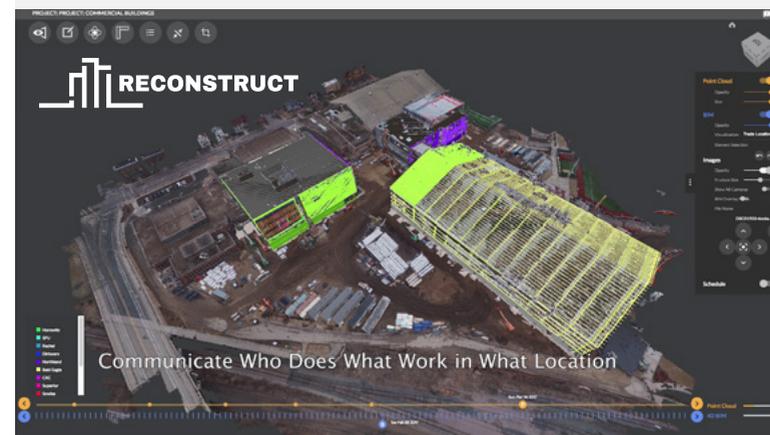
**NEW TOOL PREDICTS DRUG INTERACTIONS**



**Prof. Jian Peng** and collaborators from Tsinghua University have experimentally validated DTINet, a computational pipeline that integrates drug-related information from multiple sources, predicts new drug-target interactions, and suggests ways to repurpose existing drugs. Their tool provides a substantial performance improvement over other state-of-the-art computational drug-target interaction discovery methods and a significant savings in time and money compared to biochemical experiments.

AN ENTREPRENEURIAL ECOSYSTEM

**\$2.4M IN SEED FUNDING FOR CONSTRUCTION ANALYTICS STARTUP**



**Reconstruct, Inc.**, co-founded by **Prof. Derek Hoiem**, provides a visual data analytics platform that improves efficiency and reduces risks in construction and infrastructure projects. Last year, the company raised \$2.4 million in its seed funding round and opened an office in Silicon Valley to complement its office in the University’s Research Park. *Bloomberg* and *CNET* reported that the city of Chicago is using Reconstruct’s technology to help map the city’s underground infrastructure. In 2016, the company was recognized with an Innovation Award by Turner Construction, the largest builder in the U.S., which tested the technology during the construction of Sacramento’s new NBA arena.

**DEVELOPING PIONEERS**

The **Research Park** at the University of Illinois at Urbana-Champaign fosters opportunities for students and faculty to develop and commercialize their academic work through **EnterpriseWorks**, a business incubator for early-stage startups.

*In the summer of 2018, about 800 students worked at Research Park, and 35% – almost 300 – were CS or ECE students.*

Home to more than 100 companies, Research Park also allows established firms to collaborate with University of Illinois researchers and gives CS students access to exciting internship opportunities.

## BY THE NUMBERS

# 80

## WORLD-CLASS FACULTY

### DEPTH & BREADTH FACULTY BY RESEARCH AREA

Architecture, Compilers, and Parallel Computing	8
Artificial Intelligence	10
Bioinformatics and Computational Biology	4
Computers and Education	10
Database and Information Systems	5
Graphics, Visualization, and HCI	6
Programming Languages, Formal Methods, and Software Engineering	9
Scientific Computing	6
Systems and Networking	12
Theory and Algorithms	8

15 ACM Fellows	#5 Computer Science Graduate Ranking, U.S. News & World Report	32 NSF CAREER Awards	#2 University of Illinois in NSF Funding
15 IEEE Fellows		16 Endowed Chairs and Professorships	8 Sloan Research Fellows

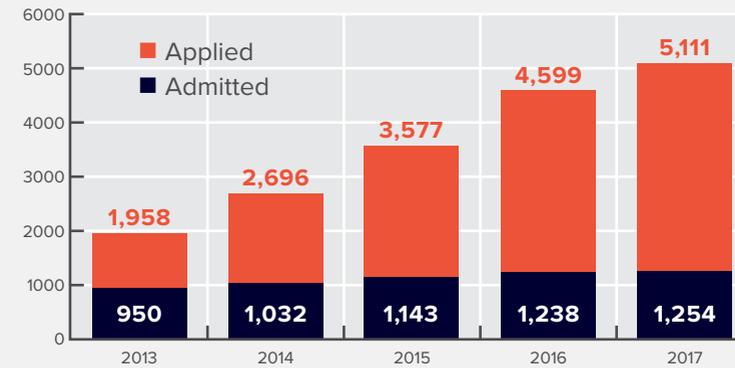
## 13,809 DEGREES CONFERRED TO 12,692 ALUMNI

BS 8,450	MS 3,998	PhD 1,361
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### \$18.8 MILLION ENDOWMENT PROVIDES SUPPORT FOR:

Faculty Chairs, Professorships, & Awards	\$10,080,284	Research Support	\$1,162,042
Graduate Fellowships & Awards	\$3,960,537	Distinguished Lectures	\$70,584
Undergraduate Scholarships & Awards	\$2,695,445	General Support	\$840,395

## UNPRECEDENTED UNDERGRADUATE DEMAND, TALENT, & DIVERSITY



- 36 STATES REPRESENTED
- 30 COUNTRIES REPRESENTED
- 33.1 INCOMING ACT (COMPOSITE AVERAGE)
- 71% MALE / 29% FEMALE (ENROLLED FRESHMEN)

### TOTAL UNDERGRADUATE FEMALE ENROLLMENT



FALL 2013



SPRING 2018

# \$96,518

Average Starting Salary Reported by Baccalaureates Who Graduated During Academic Year 2016-2017

### ACADEMIC YEAR 2017-2018 ENROLLMENTS

Computer Science (Engineering)	1,012
Five Year BS/MS	9 / 15
Five Year BS/MCS	34 / 53
Mathematics & Computer Science	286
Statistics & Computer Science	208
CS + Anthropology	28
CS + Astronomy	31
CS + Chemistry	40
CS + Linguistics	65
MCS	70
MCS Online	42
MCS in Data Science	405
MS	110
MS in Bioinformatics	5
PhD	316
<b>Total Undergraduate Enrollment</b>	<b>1,713</b>
<b>Total Graduate Enrollment</b>	<b>1,016</b>

# \$16.3 MILLION

in Support from the State of Illinois

# \$34.8 MILLION

in Research Expenditures for FY2017

# \$3 MILLION

in New Gifts

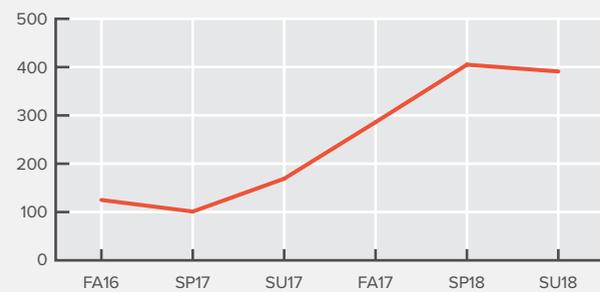


In May, students from the inaugural MCS-DS graduating class visited campus for commencement ceremonies.

**AN AFFORDABLE, FLEXIBLE, AND GLOBALLY ACCESSIBLE PROFESSIONAL MASTER'S DEGREE**

Starting in Fall 2018, Illinois Computer Science is offering a professional Master of Computer Science (MCS) on Coursera's massively open online course (MOOC) platform. The Online MCS expands upon the existing MCS in Data Science Track (MCS-DS), which launched on Coursera in 2016.

Semester-by-semester MCS-DS enrollment



"The Online MCS is a tremendous opportunity for those who want to expand their knowledge or need refresh their skills in computer science," said Prof. John C. Hart, the director of the program. In May, the first students completed the MCS-DS, with several graduates visiting campus to join commencement ceremonies. MCS-DS enrollment now stands at nearly 400 students.



**CS + CROP SCIENCES, CS + MUSIC  
BRING COMPUTATIONAL THINKING TO NEW FIELDS**

Illinois Computer Science added CS + Crop Sciences and CS + Music to its innovative CS + X degree option, which blends training in computer science with training in the arts and sciences. "This major is a response to the increasing demand for expertise in data analytics in agriculture," said German Bollero, head of the Department of Crop Sciences. "The new degree program addresses an area of intense student demand and positions us well to educate leaders in music technology," School of Music Director Jeffrey Magee added. The new majors join existing partnerships with Anthropology, Astronomy, Chemistry, and Linguistics.

**"The University of Illinois at Urbana-Champaign is updating and reinvigorating a number of traditional majors by combining them with computer science. The reasoning is that liberal-arts, arts, and agricultural fields increasingly encompass data analysis that requires computer-science skills."**

— *The Chronicle of Higher Education*  
Read the story: [go.cs.illinois.edu/Chronicle](http://go.cs.illinois.edu/Chronicle)



**STUDY ABROAD... IN CHICAGO**

A new College of Engineering program called City Scholars gives CS students the opportunity to live, study, and intern in Chicago. Students take a full load of classes while gaining valuable life experience in Chicago's growing technology ecosystem. "One of the most surprising things for me has been the abundance of entrepreneurship in the city," said Matthew Cannalte, a CS major in the program.

After spending a morning interning at DRW, City Scholar Zhiwei Zhang, a chemistry and computer science double-major, enjoys a view of Willis Tower on his way to class.

**THE IMPACT OF PHILANTHROPY**

Collectively, gifts from alumni, friends, and corporate partners provide student scholarships and fellowships, endowed faculty positions, faculty teaching and research support, send students to present research at conferences and participate in technical competitions, bring industry experts to campus for lectures and advising, enable student-alumni networking and recruiting opportunities, and fund K-12 outreach programs. Private support functions as a measure of the department's strength, impacts our national rankings, and enables us to innovate in an agile and timely way.

**CS Department Scholarships, Fellowships, and Awards for 2018**

<b>96 CS Students Supported</b>	<b>\$353,110 Awarded</b>	<b>New Desai and Golub Fellowships will support 4 more students with \$26,960</b>
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**EMPOWERING VISIONARY YOUNG MINDS**

The College of Engineering's \$100 Million Visionary Scholarship Campaign supported by **The Grainger Matching Challenge** (through December 2019) is giving donors the opportunity to double or quadruple scholarship gifts.

*In FY18 alone, 28 CS students received Visionary undergraduate scholarships.*

**TOWARD GENDER PARITY: ILLINOIS CS EFFORTS CONTINUE TO SET STANDARDS**

The Computing Research Association recognized Illinois Computer Science's ongoing work to bring more women into the discipline, inviting faculty to author and then publishing an article in the association's *Computing Research News* on how the department had more than doubled the percentage of women enrolled over just four years. This followed department's 2017 NCWIT NEXT Grand Prize for increasing women's participation in CS.

The week-long Gems Computer Science Camp for Girls is designed to dazzle and delight middle and high school students by exposing them to the broad field of computing and its applications. Photo Credit: Priten Vora.



# INDUSTRY ENGAGEMENT

## THE PROOF IS IN THE PARTNERSHIPS

Putting passion and partnerships into practice is the key strategy for how the Department of Computer Science manages seven K-12 outreach programs, supports eight CS-Affiliated Student Clubs, and engages with industry partners. The symbiotic relationships between these key stakeholders makes the Department's commitment to building the K-12 CS pipeline possible.

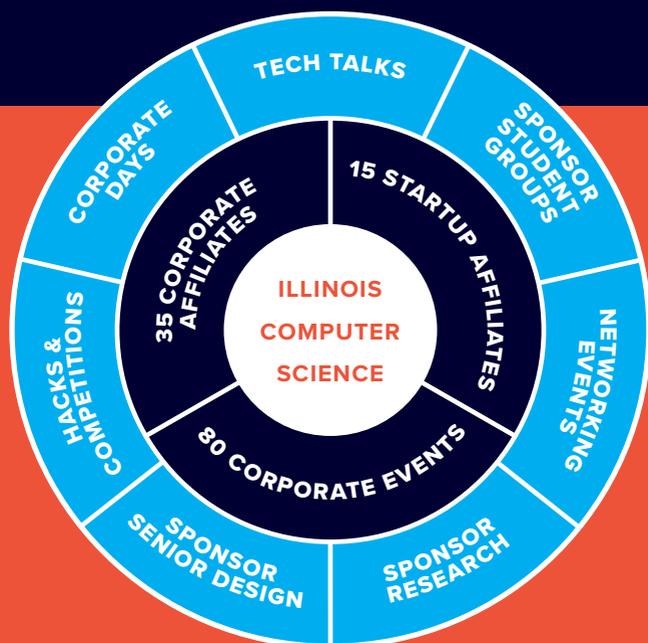


### HOW HUNDREDS OF K-12 STUDENTS RECEIVE OPPORTUNITIES TO LEARN ABOUT CS

Financial support from the department, industry partnerships, and alumni donations pay for program resources; to run, the programs require hundreds of man-hours (some paid, but mostly volunteered) by the department's staff and students; this results in hundreds of K-12 students having opportunities to learn about the many fun and fascinating applications of computer science.

### INDUSTRY PARTNERSHIPS AND RECRUITING

Illinois CS alumni play pivotal roles in nearly every high-tech company in the country and around the world. This visibility and the reputation of both our faculty and student body open many doors for industry partnerships, sponsored research, and recruiting top-tier talent.



■ CORPORATE PROGRAM ■ INDUSTRY PARTNER ENGAGEMENT



K-12 OUTREACH PROGRAMS

### INSPIRING THE NEXT GENERATION OF COMPUTER SCIENTISTS

The Department of Computer Science manages seven K-12 outreach programs, reaching young people of all ages and backgrounds with the goal of raising awareness about and interest in computer science as a potential career path.



Since January 2017, Illinois Computer Science has sponsored a community chapter of *Girls Who Code*, attracting about 30 middle- and high-school girls each week who are hungry to learn more about computer science. Last year, club members completed engaging semester-long workshops on web design and augmented reality, designed by 10 amazing facilitators and volunteers. Participants were also able to visit the offices of Agribe and State Farm in the University's Research Park and exercise their problem-solving skills in an AI-themed escape room.

### CS-AFFILIATED STUDENT GROUPS

#### PASSION FOR COMPUTING CONTINUES OUTSIDE THE CLASSROOM

Our eight CS-Affiliated Student Groups reflect the diverse interests, backgrounds, and passions of our student body and enhance countless learning and team experiences around computing.

The newest Illinois Computer Science student group, *Blacks & African Americans in Computing*, will be up and running when school begins this fall. BAAC will be the ninth



Illinois CS student group and hopes to celebrate diversity in tech while showing members and others that they can be successful in the field, regardless of their backgrounds. "We want to create

a community around our current members as well as promote exposure to technology among minorities," says co-founder and President Joseph Sieger. BAAC also plans to work with students beyond the campus and even in Chicago, he says. Membership is open to anyone, regardless of major. Reach out to BAAC at BAAC@cs.illinois.edu.



Alum and Distinguished Achievement Award winner, James E. Smith.

### DISTINGUISHED ALUMNI

Each fall, Illinois Computer Science recognizes the accomplishments and impact of its faculty and alumni, like computer architect **James E. Smith**, who received our Award for Distinguished Achievement. Smith developed dynamic history-based branch predictors, instruction issuing methods, and techniques for providing precise interrupts that are still widely used today. In recognition of his contributions, Smith received the ACM/IEEE Eckert-Mauchly Award in 1999.

In 2017, we also honored **Isaac J. Hall**, **Rajesh Karmani**, **Richard M. Schell**, and **Drina C. Yue** for Distinguished Achievement; **Nikil D. Dutt**, **Svetlana Lazebnik**, **Steven Y. Ko**, **Kishor S. Trivedi**, **Marianne S. Winslett**, and **Martin D.F. Wong** as Distinguished Educators; **Scott Fisher** and **Jill Zmaczynski** for Distinguished Service; **Andrei Stefanescu** and **Xiang Ren** with David J. Kuck Outstanding Thesis Awards; and **Aditya Parameswaran** with the C.W. Gear Outstanding Junior Faculty Award. To learn of their accomplishments, visit [cs.illinois.edu/alumni-awards](http://cs.illinois.edu/alumni-awards).

**WE DO**

# **THE IMPOSSIBLE**

## **EVERY DAY.**

**GROUNDBREAKING RESEARCH. INNOVATIVE EDUCATION. WE'RE TACKLING TOUGH SCIENTIFIC CHALLENGES – FROM THE BATTLE AGAINST LIFE-THREATENING DISEASES TO REALIZING THE PROMISE OF BLOCKCHAIN. AND WE'RE MAKING A CS EDUCATION AVAILABLE GLOBALLY, WHILE APPLYING IT TO NEW FIELDS. EVERY DAY, ILLINOIS COMPUTER SCIENCE STUDENTS, FACULTY, STAFF, AND ALUMNI ARE BLAZING NEW PATHS AND DISRUPTING THE STATUS QUO.**

#### **DEGREE PARTNERS**

College of Agricultural, Consumer,  
& Environmental Sciences

College of Engineering

College of Fine and Applied Arts

College of Liberal Arts & Sciences

College of Media

**I ILLINOIS**  
Computer Science  
COLLEGE OF ENGINEERING

University of Illinois at Urbana-Champaign  
Department of Computer Science  
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