IMPACT REPORT
BROADENING PARTICIPATION IN COMPUTING
ILLINOIS COMPUTER SCIENCE
EVERY CHALLENGE IS AN OPPORTUNITY

At the start of last year, no one could have imagined the coming challenges that the world would face. I am continually impressed with Illinois Computer Science’s incredibly talented students, faculty, staff, and alumni, but no more so than now, after seeing our response to the COVID-19 pandemic. It’s something that has been true of our community for as long as I can remember: the impossible is merely the next breakthrough in the making.

I am also proud of recent initiatives that Illinois CS has led to try to help make computing’s remarkable possibilities available to everyone. You can find summaries about just a few of these Broadening Participation in Computing efforts on page 8. Among them, I am particularly excited about the launch of the Illinois Computing Accelerator for Non-specialists (ICAN), a new year-long certificate program that provides a pathway into CS for people from diverse backgrounds who already hold a bachelor’s degree. It is just one of the ways that we are inspiring the next generation of innovation.

Nancy M. Amato (PhD CS ‘95)
Abel Bliss Professor
Department Head

This is the third edition of the Illinois Computer Science Impact Report. It is 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.

Editorial Board/Writers: Colin Robertson, Aaron Seidlitz, Laura Schmitt, and Michelle Wellens
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GROUNDBREAKING RESEARCH

This report highlights the innovations of our students, faculty, and alumni, and it recognizes their contributions to the field of computer science. See how the Illinois Computer Science community is leading the way.

HOW SMART ARE THOSE SMART DEVICES, ANYWAY?

Amazon Echo, Nest Thermostat, Ring Doorbell, Philips Hue Lighting, iRobot Roomba, plus televisions, locks, appliances, and even beds—the use of smart devices has exploded in the last few years. With it comes the promise of automation and control with a voice command or by tapping a smart phone’s button. But thanks to a $10 million NSF grant, Illinois CS professors and cybersecurity researchers Carl Gunter and Adam Bates are part of an interdisciplinary team seeking holistic answers to certain questions. For example, what does the lifecycle of these household Internet-of-Things (IoT) devices look like? What do all of these “smart things” in the home mean for users’ privacy and security?

From top: Adam Bates, Carl Gunter

UNDERSTANDING FUTURE EVENTS

Using artificial intelligence to predict future events still seems a bit like something from science fiction. But that’s one of the goals of the Defense Advanced Research Project Agency’s (DARPA’s) Knowledge-directed Artificial Intelligence Reasoning Over Schemas (KAIROS) program, which has awarded $12.3 million over four years to a team of researchers led by professor Heng Ji. The team’s project, named RESIN—Reasoning about Event Schemas for Induction of Knowledge, seeks to create a framework for the next generation of event understanding systems, with an ambitious goal: being able to provide a comprehensive understanding of evolving situations, events, and trends.

ADVANCED AUTOPILOT TO MIMIC THE “SULLY FACTOR”

A team of interdisciplinary researchers, including Donald B. Gillies Chair in Computer Science Lui R. Sha, is working on an advanced autopilot that will autonomously evaluate unforeseen circumstances, take the best course of action, and land a plane safely. Their inspiration for how the system should perform? The “Miracle on the Hudson,” where experienced pilot Chesley “Sully” Sullenberger quickly reacted to land an airplane safely after losing two engines shortly after takeoff.

Professor Wade Fagen-Ulmschneider created 91-DIVOC, an interactive data visualization that depicts the exponential spread of COVID-19. Since this tool was originally published on March 19, the 91-DIVOC visualization has gone viral, including being used in briefings by the governors of Kentucky and Washington state. It was named by The Verge as one of the six best illustrations of COVID-19 data, and was described by Popular Mechanics as the “easiest way to make sense of essential data.”

Explore the visualization at 91-divoc.com.
**C3.ai Digital Transformation Institute Launches, Supports Three Illinois CS Projects to Mitigate COVID-19**

A new research consortium chaired by Thomas M. Siebel (BA History ’75, MBA ’83, MS CS ’85) will spend $387 million in its initial five years to accelerate innovation in artificial intelligence. One of the initial goals for the C3.ai Digital Transformation Institute (DTI) is to mitigate COVID-19 and to address risks from future pandemics. “We have the opportunity through public-private partnership to change the course of a global pandemic,” said Siebel.

**C3.ai Digital Transformation Institute**

Professor Tandy Warnow is co-chief scientist for the institute, which awarded $5.4 million to 26 projects in June. Three COVID-19 related projects led by Illinois CS faculty received funding. Professors Sanmi Koyejo and Dakshita Khurana want to enable medical institutions to collaboratively train accurate models in order to improve decision support systems, while still respecting privacy regulations. “Our work is hoping to improve some of the tools at decision-makers’ fingertips to help them now, and, perhaps even more importantly, down the road,” said Koyejo.

**ASKING NEW QUESTIONS AFTER FINDING MULTIPLE SARS-COV-2 STRAINS**

Illinois CS researchers, including professors Mohammed El-Kebir and Jian Peng, co-principal investigators on an NSF RAPID grant, used genomic signature deconvolution to identify multiple SARS-CoV-2 strains present in the global population, and they found evidence of the coexistence of distinct strains within infected patients. El-Kebir hoped this finding would open the medical community up to new questions: “Do (the strains) behave differently in different organs? When spread happens, do they compete against each other? Or are they co-transmitted?”

**ADVANCED ALGORITHMS HELP CONSTRUCT GROUNDBREAKING EVOLUTIONARY TREE OF GREEN PLANTS**

Founder Professor of Engineering Tandy Warnow and her former student Siavash Mirarab developed the ASTRAL-II algorithmic method to help an international consortium of scientists construct a large evolutionary tree of green plants. The scientists released gene sequences for more than 1,100 plant species—the culmination of a nine-year research project known as the One Thousand Plant Transcriptomes Initiative—in *Nature* in October 2019. The team’s findings examined the diversification of plant species, genes and genomes across the more than one-billion-year history of green plants dating back to the ancestors of flowering plants and green algae. ASTRAL-II is now one of the leading methods for species tree estimation world-wide.

**ADVANCED ALGORITHMS HELP CONSTRUCT GROUNDBREAKING EVOLUTIONARY TREE OF GREEN PLANTS**


**FIRST-OF-ITS-KIND ANALYTICAL PLATFORM TO IMPACT GENOMIC RESEARCH**

A multidisciplinary team of researchers led by professor Saurabh Sinha unveiled the Knowledge Engine for Genomics (KnowEnG), a free-to-use, cloud-based analytical platform that guides researchers through the process of interpreting complex genomic datasets. The platform includes tools for popular bioinformatics tasks such as gene prioritization, sample clustering, gene set analysis, and expression signature analysis; it is expected to expedite biomedical discovery. The project was supported by an initial five-year grant from the National Institutes of Health as a Center of Excellence in Big Data Computing. Thanks to additional support from the Cancer Center at Illinois and NCSA, the system can accommodate new forms of data, new analytical processes, and new visualization strategies over time.

**ADVE EARNS AN HONOR UNLIKE HER OTHERS**

Sarita Adve, the Richard T. Cheng Professor in Computer Science, was elected as a 2020 member of the prestigious American Academy of Arts and Sciences. Even as her career accolades have become quite extensive, Adve called this the most selective honor she’s received. Established in 1780, the history of the Academy is rich, but new possibilities are the most important to Adve. “This definitely gives me a platform to further my efforts in making change,” she said. “Being a member of the Academy broadens my exposure to a diverse set of views from some incredibly talented people and amplifies my own message with additional credibility.”
100+ WORLD-CLASS FACULTY

16,227 Degrees CONFERRED TO 14,905 ALUMNI

ENDOWMENT
$20 MILLION

$786,000 INCOME
Funds student awards, scholarships, and fellowships; faculty chairs and professorships; lectureships; research; and general operations.

NEW GIFTS & COMMITMENTS
$5 MILLION

$1.7 MILLION in New Current Use Gifts and Commitments
$3.4 MILLION in New Endowment Gifts and Commitments

STATE OF ILLINOIS SUPPORT – FY19
$18.1 MILLION

RESEARCH EXPENDITURES – FY19
$31.8 MILLION

SPRING 2020 ENROLLMENTS

UNDERGRADUATE

Computer Science 958
Mathematics & Computer Science 271
Statistics & Computer Science 313
CS + Advertising 13
CS + Anthropology 25
CS + Astronomy 39
CS + Chemistry 30
CS + Crop Sciences 11
CS + Economics 34
CS + Geography and GIS 6
CS + Linguistics 80
CS + Music 14
CS + Philosophy 14
Total Undergraduate Enrollment 1,808

GRADUATE

Master of Computer Science (MCS) 87
Online MCS / MCS in Data Science 986
Master’s 105
Master’s in Bioinformatics 7
PhD 368
Total Graduate Enrollment 1,563

35 STATES, 35 COUNTRIES REPRESENTED

33.7 INCOMING ACT (COMPOSITE AVERAGE)

69.1% MALE / 30.9% FEMALE (ENROLLED FRESHMEN, FALL 2019)
BREAKING BARRIERS

IMPROVING EXAM EXPERIENCE FOR STUDENTS, FACULTY AND COURSE STAFF

The Computer Based Testing Facility (CBTF), which uses web-based learning management systems to deliver exams in a convenient, proctored environment, celebrated its five-year anniversary in the fall of 2019. Its services are especially useful to students with learning related disabilities and large-enrollment lecture classes that don’t have ideal classroom space to give exams. Co-founded by professor Craig Zilles, CBTF typically proctors more than 50,000 exams for about 6,000 unique students in 25–30 classes each semester.

CBTF founders, Craig Zilles, far left, Matthew West, foreground center, and David Mussulman, back row second from left, join each semester.

Above: CBTF founders, Craig Zilles, far left, Matthew West, foreground center, and David Mussulman, back row second from left, join

“Illinois pioneers new CS + Animal Sciences degree”

The new CS + Animal Sciences degree, first of its kind in the country, expands the number of blended CS + X degrees pioneered by Illinois CS to 11, joining CS + Crop Sciences as the second such degree to be offered in the College of Agricultural, Consumer, and Environmental Sciences. CS + X, which offers a strong foundation in computer science with training in the arts or sciences, was featured in U.S. News & World Report’s “Best Colleges of 2020” guidebook.

“Illinois hosts record number of Rising Stars”

The University of Illinois at Urbana-Champaign welcomed 90 promising early-career women in electrical engineering, computer engineering, and computer science to campus for Rising Stars in EECS, an intensive workshop for graduate students and postdocs who are interested in pursuing academic careers. Department Head Nancy M. Amato, one of the workshop’s organizers, said, “The Rising Stars Career Accelerator for Non-specialists (iCAN) - a new one-year certificate program focused on broadening participation in computing - is designed for students who have a bachelor’s degree in any field other than computer science. "Someone who enjoys solving problems, creating innovative solutions, and who is looking for a pathway to a satisfying tech career in industry or research would be a great candidate," Williams said.

Learn more at cs.illinois.edu/ican.

“Increased participation in computing is crucial for continued leadership in research and innovation, and it is necessary to provide access to the opportunities in this exciting field to all.” - Department Head Nancy M. Amato

FIRST-EVER WORKSHOP ON DEPARTMENTAL PLANS FOR BPC

In an effort to support expanded access to computing, Illinois CS hosted the first-ever workshop on Departmental Plans for Broadening Participation in Computing (BPC). Eighty-six leaders from 31 computing institutions across the U.S. were invited to Urbana for the NSF-sponsored workshop, which was designed to help departments outline plans for activities, goals, and metrics to provide more inclusive environments. The NSF Directorate for Computer and Information Science and Engineering is planning to phase in a requirement for Principal Investigators to include meaningful BPC plans for all of its research programs. “Increased participation in computing is crucial for continued leadership in research and innovation, and it is necessary to provide access to the opportunities in this exciting field to all," said Department Head Nancy M. Amato, one of the workshop’s organizers.

BROADENING PARTICIPATION IN COMPUTING

ADVE CO-LEADS NEW CENTER FOR DIGITAL AGRICULTURE

A new center at Illinois brings together agricultural producers, researchers, and industries to innovate on the technology that is transforming agriculture to feed and support a growing global population. The Center for Digital Agriculture, which is a collaboration between The Grainger College of Engineering, the College of Agricultural, Consumer and Environmental Sciences, National Center for Supercomputing Applications, and the Carl R. Woese Institute for Genomic Biology, seeks to develop digital solutions to agricultural roadblocks. Co-directed by Vikram Adve, the Donald B. Gillies Professor in Computer Science, the Center’s faculty and staff are working closely with the colleges to design a new master’s degree in Digital Agriculture.

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Learn more at cs.illinois.edu/ican.
BRINGING THE FIELD TOGETHER
INDUSTRY / FACULTY / STUDENTS / ALUMNI

Lecture Series Gift Reflects Banerjee’s Pursuit of New Ideas

When Utpal Banerjee (MS CS ’76, PhD CS ’79) died in 2017, members of his family said they were only beginning to understand the impact the Illinois CS alumnus had on high performance computing. Using a gift to ensure his memory and legacy live on at Illinois, Banerjee’s daughter – Sanchita Banerjee Saxena – agreed to establish the Utpal Banerjee Distinguished Lecture Series in High Performance Computing. “My dad always wanted to engage with new ideas that were coming up, he always loved interacting with both junior and senior scholars and taking part in interesting conversations,” said Saxena.

Innovation, Perseverance Lead to Cleetus’ Success

Illinois CS undergraduate student Ananya Cleetus understands what the struggle with mental health is like. Rather than allowing it to define her, she used it to create an app called Anemone. With the app, users can create a crisis plan, which provides information including warning signs, coping methods, medications and emergency contacts in the event of a mental health crisis. “I realized that a good idea is a good idea, no matter what your background is, where you’re from, or what your focus is,” Cleetus said. Its effectiveness earned her the Fiddler Innovation Fellowship, a $10,000 scholarship.

Networking Startup Veriflow Acquired by VMware

Illinois CS startup Veriflow, a network vulnerability and outage prevention company, was acquired by VMware in August 2019. VMware is integrating Veriflow technology into its vRealize Network Insight product to enhance its network visibility and analytics capabilities. Veriflow was founded by CS alumnus Ahmed Khurshid (PhD CS ’15) and faculty Matthew Caesar and Brighten Godfrey in 2013 as the first networking company to apply formal verification to network infrastructure, mathematically assuring that an organization’s network is operating with the intended availability and security. The core technology was originally developed at Illinois as part of Khurshid’s PhD dissertation.

Corporate Connection

Corporate Connection, a comprehensive program to help industry connect with faculty and students who are at the forefront of computing. And Startup Corporate Connection is just for startups - part of our vibrant ecosystem for innovators and entrepreneurs.

BAAC STUDENT CLUB WINS STATE FARM GRANT

Representatives from State Farm presented the Blacks and African Americans in Computing (BAAC) student club with a $5,500 check from the State Farm Foundation, after the group’s grant proposal was accepted by the Good Neighbor Citizenship® Company Grant program. BAAC is eager to use the funds to expand their outreach and community building efforts in the spirit of the group’s mission, which is to become a strong support system for minorities in computing-related fields that fosters scholarship, professional development, and a sense of community. “Our members are looking forward to working with State Farm to build a future for underrepresented computing students in our club and in our community,” said Joseph Sieger, BAAC president and co-founder.

Entrepreneurship

Illinois Computer Science recognizes the accomplishments and impact of its faculty and alumni every year, like professor Clarence Ellis, who was honored with our Distinguished Achievement Memorial Award in 2019. Ellis, who died in 2014, was the first African American to earn a PhD in computer science (1969). He did pioneering research in operational transformation, groupware, and computer-supported cooperative work, holding multiple positions in industry before joining the Illinois Computer Science faculty at the University of Colorado at Boulder in 1992. Ellis was named an ACM Fellow in 1998.

Illinois CS and Illinois ECE sponsor Corporate Connection, a comprehensive program to help industry connect with faculty and students who are at the forefront of computing. And Startup Corporate Connection is just for startups - part of our vibrant ecosystem for innovators and entrepreneurs.

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In 2019, we also honored Vinay Hiremath for early Career Achievement; Jeff Holden for Distinguished Achievement; Hui Fang and Ali Farhadi for early Academic Achievement; Sy-Yen Kuo and Raymond Mooney for Distinguished Academic Achievement; Shig Matsuhita for Distinguished Service; Umran Jain and Shadi Abdollahian Noghabi with David J. Kuck Outstanding Thesis Awards; Wade Fagen-Ulmschneider with the Scott H. Fisher Computer Science Teaching Award; and Jian Peng with the C.W. Gear Outstanding Junior Faculty Award. To learn of their accomplishments, visit cs.illinois.edu/about/awards/alumni-awards.

Celebrating Excellence

Over 150 of the department’s amazing students and faculty were recognized during the 2019-2020 academic year with awards, scholarships, or fellowships. Many of these recognitions provide financial support thanks to generous donations from friends and alumni. Thank you for your support!

Corporate Connection

Left to Right: Ahmed Khurshid, Matthew Caesar, Brighten Godfrey

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ILLINOIS COMPUTER SCIENCE

IMPACT REPORT / FY20

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10
GROUNDbreaking research. Innovative education.
We’re tackling tough scientific challenges – from predicting the future to helping to mitigate a global pandemic. And we’re making a CS education more accessible to people from diverse backgrounds, while applying it to new fields. Every day, Illinois Computer Science students, faculty, staff, and alumni are embracing new opportunities.

We do the impossible everyday.

Degree Partners
College of Agricultural, Consumer, & Environmental Sciences
The Grainger College of Engineering
College of Fine and Applied Arts
College of Liberal Arts & Sciences
College of Media