

Fall 2011

CCIS network

The newsletter for the College of Computer and Information Science at Northeastern University

Number of New Faculty Members Reaches a New High

Increased Enrollments, Interdisciplinary Focus Spur Growth

This fall, the College of Computer and Information Science (CCIS) welcomed eight new faculty members, far more than in years past. The additions also significantly increase the number of women among the CCIS faculty. The new professors enhance the college’s strength in core areas of computer science and expand its education and research combining computer and information science with knowledge of other disciplines, including security, health, design, science, and the social sciences.

Christopher Huang, Northeastern University



Assistant Professor Amy Sliva

Amy Sliva: Countering Terrorism with Computing

Working in two fields that she says “people initially think don’t go together,” Amy Sliva feels she has found an ideal home at Northeastern. The newly appointed assistant professor in both CCIS and the Department of Political Science develops techniques to model, forecast, and analyze behavior that have proven useful in international security and public policy.

“There’s support here for me to be an interdisciplinary researcher,” says Sliva. “The world is so complex; there’s no reason why people in the social sciences

and technical fields can’t work together to answer the big questions in international security and conflict.”

Sliva has been combining computer science and the social sciences since her undergraduate days at Georgetown University, where she pursued a double major in computer science and international relations and first developed an interest in computational cultural dynamics. She went on to earn master’s degrees in both computer science and public policy and a PhD in computer science at the University of Maryland.

The forecasting and modeling techniques that Sliva developed as a doctoral student

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Northeastern

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Growth and Distinction

Heratch Photography



In all the measures that matter, the College of Computer and Information Science is seeing positive trends—and in some cases breaking past records.

The total number of students enrolled at our college has increased by more than 25 percent in a single year. In our master's programs, we have experienced growth of more than 50 percent and

now enroll 530 students. Our PhD programs have also grown substantially, to 84 students from 65 a year ago. We are attracting more undergraduates as well, with their count rising to 560 from 520 in fall 2010.

Our faculty hiring has increased in conjunction with our student enrollments and supports University-wide strategic initiatives. We welcomed a record number of new faculty this fall (see page 1), and four of the eight are women, increasing the diversity of our faculty significantly. These new hires also represent a diversity of research interests, in keeping with our strategy of emphasizing interdisciplinary knowledge while also strengthening our core capacities in computer and information science.

Faculty members in our college have been gaining more external grant support for their research and teaching. Faculty research funding is expected to reach \$6.8 million, an approximately 40 percent increase over the record set last year.

There is a reason for these positive trends: What we do is fundamentally different than other computer and information science colleges and schools. We focus on educational programs that combine computing with an important application domain, such as health or security, and on research that both advances the computing discipline and contributes to resolving major societal problems. We are putting to the test and validating the notion that computer and information science are critical to many disciplines by emphasizing joint faculty appointments across colleges and departments. And we are offering our students the opportunity to enrich their education through cooperative education as well as international experiences.

We are also taking steps to enable the positive trends to continue. Our college is currently recruiting faculty for five positions within the computer and information science disciplines and several more that are part of Northeastern University's interdisciplinary initiative. We expect to add faculty in the areas of game design, cyber security, and health informatics, and are also seeking those with expertise in the social and economic factors that influence cyber security. These actions will build the capabilities of our college as well as add to our distinction.

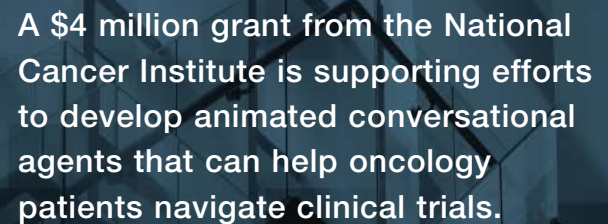


Larry Finkelstein
Dean

Record Funding Supports Research with Impact

The College of Computer and Information Science (CCIS) is on track to top last year's record level of external support for faculty research, with approximately \$6.8 million anticipated in 2011. This exceeds the nearly \$5 million in research grants awarded to CCIS in 2010, which had far surpassed previous totals.

Faculty members garnered substantial support from the National Institutes of Health (NIH) as well as the National Science Foundation (NSF), which this year granted the prestigious CAREER Award to Assistant Professor Alan Mislove for his work involving social networks (see page 4). The projects of several professors are representative of the breadth and potential societal impact of CCIS research.



A \$4 million grant from the National Cancer Institute is supporting efforts to develop animated conversational agents that can help oncology patients navigate clinical trials.

Mobile Phones for Better Health

Stephen Intille, a faculty member of both CCIS and the Bouvé College of Health Sciences, is interested in computer technology that measures and improves health behavior. He has been developing small, low-cost sensors that can be worn for months at a time to automatically monitor physical activity via a mobile phone. Intille and his collaborators at MIT and Stanford Medical School received NIH funding for this project and are now evaluating the technology's usability.

"There are a lot of commercial sensing devices for physical activity measurement, but what makes this unique is that it uses mobile phones and provides immediate feedback. You can't do that with existing tools," says Intille. In the long term, he notes, the technology could motivate behavior change in people who have diabetes, want to lose weight, or need to monitor recovery from a cardiac event.

New Tools to Detect Botnets

Engin Kirda, who holds a joint faculty appointment in CCIS and the College of Engineering, received a three-year NSF grant to build a system to monitor large amounts of network traffic and automatically identify machines compromised by botnets, the illegitimate networks that attackers create. His Disclosure system is an extension of earlier research in which he created a tool called Exposure to automatically detect bad domain names.

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Faculty Members Honored with Interdisciplinary Professorships



Michael Mazzanti



Christopher Huang, Northeastern University

Honored Faculty: Professors Engin Kirda (left) and Alessandro Vespignani (right) have been recognized for their research that crosses academic disciplines.

Northeastern University has named the recipients of two prestigious interdisciplinary professorships, and both are faculty members with ties to the College of Computer and Information Science (CCIS).

Professor Alessandro Vespignani now holds the Sternberg Family Distinguished University Endowed Chair, created to honor senior faculty whose research and teaching cross the boundaries of academic disciplines and whose achievements bring significant recognition to Northeastern. New to Northeastern this fall (see page 7), Vespignani is highly regarded for his research using computational models to understand the spread of infectious diseases, computer viruses, social networks, and other contagion processes. Vespignani's appointment as a faculty member of CCIS, the Department of Physics, and the Bouvé College of Health Sciences reflects the wide scope of his work.

Northeastern President Joseph E. Aoun has described the professorships as supporting "eminent scholars whose work in emerging fields has substantial impact on the world."

"I'm very grateful to the University and to the Sternberg family," says Vespignani. "This professorship is a great honor and also a great responsibility. Someone is trusting in you, and you want to do your best. I'm flattered, honored, and grateful."

A second member of the faculty, Engin Kirda, was awarded the Sy and Laurie Sternberg Interdisciplinary Endowed Professorship,

which was created to recognize an outstanding associate professor whose work shows exceptional promise to enhance one or more academic disciplines. Kirda, who joined the Northeastern faculty in January 2011 and is affiliated with both CCIS and the College of Engineering, focuses on security issues that have the potential to affect a large number of people (see page 2 to learn about one of his current research projects). He teaches in the PhD in Information Assurance program and is the co-founder and co-director of the International Secure Systems Lab, a collaborative effort of European and U.S. researchers who are involved with Web security, malware and vulnerability analysis, intrusion detection, and other issues related to computer security.

"I really enjoy what I do, and I also believe that it has an impact. This is recognition that people think my research is useful and shows that they feel security is an important area of research," Kirda says.

Northeastern President Joseph E. Aoun has described the Sternberg Family Distinguished University Endowed Chair and the Sy and Laurie Sternberg Interdisciplinary Endowed Professorship as supporting "eminent scholars whose work in emerging fields has substantial impact on the world."

The two faculty positions were established in 2008 with a \$5 million donation from Sy Sternberg, who earned a master's degree in electrical engineering at Northeastern in 1968, and his wife, Laurie Sternberg. Sy Sternberg, who is the chairman of the Northeastern University Board of Trustees and former chairman and CEO of New York Life Insurance Co., had noted at the time, "Our decision to support interdisciplinary faculty in particular stemmed from a desire to help professors pursue the kind of innovative research that leads to a better society for all of us. We're happy to do our part." ■

Social Networks and Systems Intersect in Professor's CAREER Award

Assistant Professor Alan Mislove is the latest College of Computer and Information Science faculty member to receive the National Science Foundation (NSF) CAREER Award. Formally known as the Faculty Early Career Development Program, the CAREER Award is the NSF's most prestigious award supporting junior faculty for outstanding research, education, and integration of education and research.

The five years of funding the CAREER Award provides will help Mislove develop systems, networks, and distribution systems that reflect emerging patterns of content sharing over the Internet. His goal is to allow people to create and exchange content more freely, exercise greater control over access to content, and limit vulnerability to fraud.

"My CAREER Award is centered around the direction of my research in the next few years, the intersection of systems and social networks," Mislove says. "The patterns of communication now revolve around social networks. We have unique opportunities to take advantage of the properties of social networks to build better computer systems. This is a new and exciting area."

He explains that individuals have replaced organizations as the primary generators of content. Empowered by digital devices and social networks, they are now responsible for a significant portion of Internet traffic. Yet the techniques and infrastructure used to share and control access to content have been slow to change.

"My CAREER Award is centered around the direction of my research in the next few years, the intersection of systems and social networks."

—Assistant Professor Alan Mislove

Mislove is exploring better ways to address the new patterns of content creation and distribution. He is building a system that would bring decentralized content sharing to the Web, resulting in faster performance for users and lower costs for businesses such as Facebook.

"On Facebook, people share content with friends, and most are in the same geographic area. Leveraging a high geographic locality means it's cheaper. If Facebook deploys our solution, it could save money because it doesn't have to send images across the Internet from one of its data centers to users," says Mislove, noting that content creators might also benefit from lower costs for the social networking sites. "The need to make money



Assistant Professor Alan Mislove, recipient of a prestigious National Science Foundation award for junior faculty.

constrains the services available online. If you make it cheaper, you open the door to services that you couldn't make an economic case for before."

The CAREER Award is also supporting Mislove's research related to privacy defaults on social networking sites. He is measuring the prevalence of incorrect privacy settings and developing solutions to the problem. Mislove says, "People say that 'visible to all Facebook users' is not the best default, and we agree. We're looking at how to express to users the implications of the defaults. People don't understand who can access their content. We did a survey and found that users were wrong two-thirds of the time—and their content was more often incorrectly shared with too many people, not too few."

In addition, Mislove is examining the properties of social networks to develop a means to limit, or bound, online fraud. He points to the example of eBay, where malicious users have manipulated their reputations to gain the trust of honest buyers and defraud them. His approach bounds the fraud to the dollar value of goods used honestly.

"Instead of explicitly identifying malicious users, I'm limiting their impact," Mislove explains, noting that his techniques could also be applied to reduce credit card and Medicare fraud.

The focus of Mislove's research reflects what he sees as a continuing trend: computer systems closely linked with social networks. Mislove says, "Particular sites may not exist in five or 10 years, but the underlying challenges—privacy and how we make these systems work efficiently—will all be very relevant." ■

New PhD Program Innovates by Shifting Health Care Perspective

Northeastern will break new ground in health informatics education when it introduces its PhD in Personal Health Informatics program offered jointly by the College of Computer and Information Science (CCIS) and the Bouvé College of Health Sciences next fall. Unlike other academic training focused on technologies used primarily by medical professionals, the Northeastern program will center on tools that allow consumers and patients to monitor and improve their own health and wellness at all stages of life.

“The idea of developing technology first from the perspective of a person’s or patient’s needs is an unusual way of thinking,” says Associate Professor Stephen Intille, a member of the faculty of both colleges who has been charged with leading the new program’s development. “This program is looking toward the future, when individuals will have more control over their own care. The trend is already there, and it will just be more common in the future.”

Intille notes several changes in the delivery of health care in the United States and in patient and provider demographics that make it important to shift perspective. Rising health-care costs have increased the emphasis on preventive care. The population is aging, and more people are coping with chronic diseases. At the same time, the number of medical professionals available to treat them has been decreasing, and negative consequences resulting from poor communication between patients and providers have been growing more frequent.

These circumstances are creating a demand for cost-effective human-computer interfaces that help consumers and patients better understand their health conditions and take measures to improve their outcomes. Changing practices also strengthen demand for researchers who have the skills and knowledge to develop innovative personal health technologies.

The PhD in Personal Health Informatics program will enable students with technical backgrounds to gain experience deploying and evaluating technologies in health-care settings and those with health-care backgrounds to acquire the



Christopher Huang, Northeastern University

The program will center on tools that allow consumers and patients to monitor and improve their own health and wellness at all stages of life.

technical skills needed to prototype and assess their ideas to improve care. Intille says, “The purpose of our program is to empower students to not only envision systems, but also to lead teams to prototype, evaluate, and ultimately disseminate these systems.”

The program is designed to be completed in five years following a bachelor’s degree and includes newly developed courses covering the theoretical foundations of personal health informatics; personal health interface system design, development, and evaluation; and health data systems standards. In keeping with Northeastern’s emphasis on interdisciplinary knowledge and the program’s goals, students will learn from business, engineering, communication, and psychology faculty members as well as those drawn

Associate Professor Stephen Intille is among the faculty who developed the innovative new program crossing the computer science and health disciplines.

from CCIS and Bouvé College. They also will participate in personal health informatics seminars featuring lectures by local and national experts.

A cornerstone of the program is what Intille describes as a “user interface practicum” that will take advantage of Northeastern’s strong ties to Boston’s leading hospitals and medical research centers. In their first year, students will shadow a physician or nurse to determine how to design an interface to benefit a population of interest to them. In their second year, they will apply what they learned through this experience to collaboratively conceive, build, and deploy a personal health technology and create a plan for its wider use.

“The difference in our program is that students will work individually and in teams to develop and test a technology to understand principles that extend beyond building a device or system,” Intille says. “Our program involves the deployment of systems into populations in a way that’s taken seriously by the medical community and technical innovation that’s taken seriously by the computer science field.” ■

can help policymakers determine how to effect change in an environment to achieve a desired outcome. She says, “In terms of security, this means a reduction in the incidence of violence.”

Sometimes the findings aren’t what policymakers expect. For example, Sliva discovered a connection between Hezbollah’s use of violence and the Lebanese election cycle: When elections were pending, Hezbollah tended to turn its attacks from Israel to local rivals. This behavior, says Sliva, calls into question the idea that including Hezbollah in the democratic process will reduce the group’s need to turn to violence.

At Northeastern, Sliva is continuing to examine the semantics for a probabilistic logic framework to represent the time as well as probability of a terrorist attack, failed state, or other critical event. She is also exploring ways to categorize and respond to cyber security incidents even when the perpetrator is unknown.

Currently teaching a graduate-level course on artificial intelligence, Sliva hopes to help integrate political and computing perspectives in both CCIS and political science courses. She says, “I want to contribute to blending the disciplines so we don’t see huge gaps between them.”

Magy Seif El-Nasr: Expanding Game Design

With expertise on both the computing and creative sides of game design, Associate Professor Magy Seif El-Nasr is ready to contribute to the expansion of the field within and beyond Northeastern.

Seif El-Nasr incorporates knowledge of computer science, human-computer interaction, software and visual design, and psychology to create tools and methods that enhance the user experience. Previously an assistant professor in the School of Interactive Arts and Technology at Simon Fraser University in Vancouver, Canada, she is the managing editor of the *International Journal on Art*



Christopher Huang, Northeastern University

Associate Professor Magy Seif El-Nasr

and *Technology* and the associate editor of *IEEE Transactions on Computational Intelligence and AI in Games*, *Computers in Entertainment*, and the *International Journal on Entertainment Computing*. Seif El-Nasr is also the co-editor of two books, one on game metrics and the other on nonverbal behavior and the use of avatars in game environments. In addition, she is serving as the chair of the 2012 Foundations of Digital Games conference and on the advisory board of the Game User Research Community, a group that involves companies such as Ubisoft and Electronic Arts.

“It’s very exciting to hear the deans and the provost say game design is an important area to grow,” says Seif El-Nasr, who holds a joint faculty appointment in CCIS and the College of Arts, Media, and Design. She is affiliated with the Creative Industries Program, which encompasses game design and interactive media, and will teach courses that are part of undergraduate majors combining computer science with these areas.

Combining disciplines has long been of interest to Seif El-Nasr, who integrated theater techniques and theories with technical design and algorithms while earning her PhD at Northwestern University. She since has researched

believable characters in games and behavior related to games, and she has become interested in exploring interactive experiences more broadly. Recently, she has turned to determining how games can be used to improve health.

“I’ve been starting to look at social media and social games to enhance healthy lifestyles,” says Seif El-Nasr, who is collaborating with a Vancouver start-up company called Igniteplay to build a virtual-world platform for women over age 30 to encourage better health habits. “I want to do more in this area, so it’s exciting to have a lot of people to collaborate with here.”

Thomas Wahl: Contributing to Formal Methods

The addition of Thomas Wahl to the faculty expands the college’s expertise in formal methods. The new assistant professor previously served as a research assistant at the Computing Laboratory at Oxford University and also was a postdoctoral researcher and lecturer at the Swiss Federal Institute of Technology. Like his CCIS faculty colleague and fellow formal methods researcher Panagiotis (Pete) Manolios, he earned a PhD in computer science at the University of Texas in Austin.



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Assistant Professor Thomas Wahl

For Wahl, the presence of others in his field and in the related area of software design and programming languages was among the appeals of joining the CCIS faculty. Wahl says, “Formal methods research is not yet represented at most universities. Both fields are needed to ensure reliability in software.”

Wahl’s research focuses on model checking, an area in which he says progress made on paper has only been put into practice in the past 10 to 15 years. Most recently, he has been involved with model checking concurrent software and multithreaded programs. He notes, “My analysis methods depend on certain software aspects that people in the programming language group here are already exploiting.”

These methods have the potential not only to find bugs in computer programs, but also to analyze models of evolving systems in general. Wahl explains, “The potential is being recognized in systems biology, health science, and security. For example, there is an obvious incentive to make security protocols very formal, strictly defined entities.”

Contributing to the continued growth of research and education in formal methods at CCIS will also help Wahl give his specialization the greater visibility he believes it merits. He says, “Formal methods is a wonderful combination of the theoretical and the practical that you don’t often find in computing.”

Amal Ahmed: Strengthening Programming Languages

Amal Ahmed’s addition to the faculty further strengthens the college’s highly regarded Programming Languages Research Group. The new assistant professor, who earned her PhD in computer science at Princeton University, recently received a grant from the National Science Foundation (NSF) that makes her among the few to pursue formal study of software contracts in presence of state.

Previously an assistant professor at Indiana University’s School of Informatics and



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Assistant Professor Amal Ahmed

Computing, Ahmed is noted for her research involving logical relations, a technique used to prove that program components are equivalent to one other before and after code optimization. She is also known for her work in language-based security, particularly related to information hiding or extraction.

Now examining security-preserving compilation, Ahmed says, “This is a difficult problem. When you compile a high-level language such as Java to assembly language, how do you know the information is still secure? There should be certain guarantees about the behavior after compilation.”

In addition to pursuing research, Ahmed is tackling a new challenge: teaching freshmen for the first time. She says of her experience teaching Fundamentals of Computer Science I, “I think this is one of the best places to teach freshmen because the college puts so much emphasis on freshmen and has really fine-tuned the course. I always wanted to teach freshmen, so it’s really exciting for me.”

Alessandro Vespignani: Modeling Contagion Processes

Alessandro Vespignani’s research crosses computing, science, and health, and his

faculty appointment at Northeastern reflects this. He is affiliated with three colleges: CCIS; the Bouvé College of Health Sciences; and the College of Science, where he is a member of the Department of Physics.

“Everyone says interdisciplinary knowledge is a great thing, but Northeastern is really fostering it. There is a drive here to create something new and empower people,” says Vespignani, whom Northeastern recently awarded the Sternberg Family Distinguished University Endowed Chair (see page 3). “What is exciting is that there are several leaders in network science in different domains.”

Vespignani, who came to Northeastern from Indiana University, is among them. The world’s leading computational epidemiologist, he has studied a wide range of contagion processes and developed computational models to forecast the spread of disease, projecting a pattern based on human mobility and contact networks.

“We integrate huge databases and mix these with computational models. Out of it, we are able to make some predictions,” says Vespignani. “We’ve found that you

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Professor Alessandro Vespignani

need to limit human travel by 99 percent to contain the spread of diseases.”

Vespignani started as a physicist working on autocatalytic reactions, which he says are much like epidemics. Then he wrote a paper about complex networks and applied his knowledge to computer viruses. Vespignani recalls, “As a physicist, I realized that Internet and computer viruses were a lot like human science. What we were looking at in computer viruses was ready to translate to human biology.”

That led him to focus on the spread of disease for the past eight years. Now, he is shifting his attention to the spread of knowledge and social networks. For example, he wants to understand why a certain meme will explode on Twitter and how people can manipulate a meme.

Vespignani says, “In a strange way, the loop is going back; I’m applying epidemiology expertise to social contagion and social networks. The exciting thing about research is that it’s always a surprise. In many cases, you take a turn that you don’t expect.”

Matthew Goodwin: Shaping Computational Behavioral Science

While studying at Oxford University more than 15 years ago, Matthew Goodwin observed a class for students with autism. He recalls, “I was intrigued with the idea that there could be disability and super ability in the same person.”

Today the new assistant professor with a faculty appointment in both CCIS and Bouvé College is focusing on autism as a co-Principal Investigator and the associate director of a \$10 million project funded by an NSF Expeditions Award. He and his fellow researchers are developing computational sensing and modeling technologies to capture, measure, analyze, and understand human behavior. Through their efforts and wearable technologies designed for use in the classroom, pediatrician’s office, and home, they hope to revolutionize the diagnosis

Christopher Huang, Northeastern University



Assistant Professor Matthew Goodwin

and treatment of a variety of behavioral and developmental disorders.

“This is the first large-scale collaboration between behavioral and computer scientists. Collectively, we’re trying to start a new field, computational behavioral science,” says Goodwin. “We selected autism because of the size and complexity of the health issues. The idea was that if you could solve the issues in autism, you could have an impact on issues in other areas.”

Goodwin’s work on this project began when he was the director of clinical research and co-director of the Autism and Communication Technology Initiative at MIT. Now that he has joined Northeastern, he is also focusing on another effort that pairs health and technology: the University’s new PhD in Personal Health Informatics (see page 5).

“The program was the impetus for my making this move,” says Goodwin. “I’ve come to Northeastern so I can do large-scale translational research—applied research in the health domain.”

Goodwin’s desire to combine health and technology continues a pattern in his academic career. He completed a

technology-related dissertation to earn his PhD in behavioral science and followed it with a postdoctoral fellowship in affective computing. He has combined research in autism with computer vision and ubiquitous computing. And he has published in both the behavioral and computer science fields.

“I realized that the questions that interest me weren’t in the laboratory,” Goodwin says.

William Robertson: Protecting Systems from Attack

How do you secure against unknown unknowns? That’s what Assistant Professor William Robertson describes as the challenge of his research. The new member of both the CCIS and College of Engineering faculty focuses on designing systems to be resilient against security threats. He says, however, “There are theoretical limits to guarantees you can make about properties of software. For better or worse, I’m interested in tackling the hard problems.”

Robertson, who earned his PhD in computer science at the University of California in Santa Barbara and previously was a postdoctoral researcher at the University of California in Berkeley,



Christopher Huang, Northeastern University

Assistant Professor William Robertson

joined Northeastern to work with others interested in similar problems. He says, "There's a lot of support for security work here. I know that there are excellent people working in areas that are closely related to my research, and the joint appointment is a huge benefit. Security is a cross-cutting discipline."

As part of his research, Robertson has been exploring the detection and prevention of attacks against Web applications and the design of development frameworks that automatically secure against certain classes of attacks. He also has focused a substantial portion of his work on trustworthy computing, platforms, and hardware.

"There is no basis for trust in the fundamental components of computer systems. My work looks at how to build in a reduced vulnerability," Robertson says. "To design a secure system, you have to look at all layers, including the hardware."

This fall, Robertson is educating Northeastern undergraduate and graduate students about these issues as part of a course on network security. He's chosen to take a novel approach, asking members of the class to assume the attacker's mindset.

"This is a way to internalize security," Robertson says. "How would you attack a network? How would you break it? It's a switch in perspective. I think there's a lot of excitement about it. I've had a lot of interest from the students."

Rupal Patel: Developing New Speech Technologies

Rupal Patel may be among the new members of the faculty, but she's made an impact on education and research at CCIS as an adjunct professor since 2005. Patel first joined Northeastern as an assistant professor in the Department of Speech Pathology and Audiology in 2003 and was promoted to associate professor in 2007. Now she is an associate professor with a joint appointment in Bouvé College and CCIS.



Christopher Huang, Northeastern University

Associate Professor Rupal Patel

"Many of my grants are through the Directorate for Computer and Information Science and Engineering of the National Science Foundation, so this is in line with what I'm actually doing," says Patel, who describes her new status as a way of formalizing her increased involvement with CCIS over time.

Patel has been integrating speech and technology throughout her career. Her early work focused on studying the acoustics of disordered speech to build tailored speech recognition systems. Currently, she directs the Communication Analysis and Design Laboratory, an interdisciplinary research group that analyzes speech and designs novel human-computer communication interfaces. Patel is also examining how to use games and visual interfaces to enable more natural communication for children with and without speech impairments.

"I want to emulate face-to-face communication because that's how we connect with others and generate ideas," says Patel, who focuses on prosody, or the melody of speech production, including pitch, loudness, and changes in duration. "Even in the severely speech impaired, prosody is preserved."

Patel's ReadN'Karaoke and Prosodic Marionette projects are part of her speech visualization research, which involves displaying and manipulating the melody of speech. She explains, "ReadN'Karaoke provides cues about how something should be read aloud. This helps young readers with fluency and expressive oral reading. Prosodic Marionette uses spatial rather than voice manipulation to help determine what someone knows about prosody. This is important for assessment and because it can be used to enhance output on assistive communication devices."

Over the past year, Patel has also been involved in developing the curriculum for the new PhD in Personal Health Informatics program offered by both CCIS and Bouvé College (see page 5). She views it as closely related to her research interests, saying, "The PhD program is focused on health and wellness. Technology has the potential to dramatically alter allied health professions such as communication sciences and disorders. At the same time, knowledge of language development, speech processing, and behavioral interventions will play an important role in designing innovative health and wellness technologies." ■

On the Move

Promotions

Timothy Bickmore, from Assistant Professor to Associate Professor

Doreen Hodgkin, from Assistant Dean to Associate Dean, Administration and Student Affairs

Bryan Lackaye, from Assistant Director to Assistant Dean of Graduate Programs

Guevara Noubir, from Associate Professor to Professor

Retirements

John Casey, Associate Professor

Carole Hafner, Associate Professor
Effective June 2012

Undergraduate Makes Computer Security Conference Presentation

By definition, an undergraduate is a student. But the student became the educator when CCIS junior Greg Kerr presented his research to an audience of professionals attending RECON 2011, a computer security conference held in Montreal in July.

“For an undergraduate, this is a very unusual experience. It’s partly luck and partly because Greg is a fantastic student,” says CCIS Professor Gene Cooperman. “In any given year, there might be 10 undergraduates in the country doing work at his level. It goes way beyond what’s in the course work.”

Kerr has been working in Cooperman’s research lab, where he is porting the Distributed MultiThreaded CheckPointing (DMTCP) tool to a newer high performance network called InfiniBand. His efforts are making it possible for supercomputers running InfiniBand to save data partway through a computation and transparently checkpoint and restart applications.

“Greg led this research all the way through. He’s the one who did the majority of the work and looked at the code day after day,” says Cooperman. “Another way Greg showed his leadership was by choosing to develop a technical report on InfiniBand. One of the core developers of InfiniBand wrote to compliment him on his work.”

Nonetheless, Kerr was surprised to receive the invitation to make a presentation at the RECON conference—and especially to learn that he would be an opening-day speaker.

The hour-long length required of the presentation was equally intimidating. Kerr says, “In the classroom, presentations are five minutes long. All of a sudden, I was doing an hour. I was really nervous about that. The whole time I was up there, I was watching the time.”

Before he spoke in front of an audience of 250 conference attendees, Kerr prepared diligently. He held practice sessions with



Greg Kerr practiced before professors and others to prepare for his conference presentation.

“For an undergraduate, this is a very unusual experience. It’s partly luck and partly because Greg is a fantastic student.” —Professor Gene Cooperman

Cooperman, Visiting Assistant Professor David Van Horn, CCIS graduate students, and others. Cooperman says, “He took a very professional approach. He realized it was a high-profile opportunity, and he wanted to make the most of it.”

On the day of the presentation, Kerr earned what Cooperman describes as a “terrific round of applause.” But that wasn’t the only benefit of the experience, as Kerr also was able to meet many of the attendees. Cooperman says, “He had access to some incredibly smart people in computer science, and these were people he’d have difficulty meeting any other way.”

This was among the advantages Kerr believes he gained by presenting at the conference. He says, “It definitely helps to have something like this on my résumé.

The fact that I spoke at a conference will help in getting internships and interviews. It also offers me more opportunities to collaborate and present at other conferences.”

In the meantime, he has informed a group of professionals interested in reverse engineering and advanced exploitation techniques about the detailed workings of InfiniBand. Kerr says, “Most of the people there weren’t that familiar with high performance computing, so they learned about a new kind of technology and new techniques.”

Now Kerr has returned to his role of student and to Cooperman’s lab, where he is currently completing a research co-op. Cooperman says, “Greg presented his initial results. There’s still more work to be done.” ■

Fellows Program Supports Success for Freshmen

Starting college can be a tremendous change for freshmen anywhere. They're in new academic and social settings as well as unfamiliar surroundings. Many are living away from their families for the first time. It's a challenging transition.

The College of Computer and Information Science (CCIS) set out to make it easier. Through the CCIS Fellows program launched in fall 2010, freshmen receive support and guidance from students who have already experienced success in academics, co-op, and college life.

"This grew out of a desire to create a stronger connection between freshmen and our college. Research shows that a student who's gone through a program like this in the first semester will have more success in college," says Aileen Kent-Yates, who serves as an academic and co-op advisor to CCIS students and developed the CCIS Fellows program. "The Fellows are students who excel both academically and in co-op, have strong leadership qualities, and truly care about the college. They reach out to our freshmen and serve as mentors."

The CCIS Fellows participate in the two Computer & Information Science Overview courses that orient freshmen to college life, academics, co-op, and the professional workplace. They meet weekly with Kent-Yates and other co-op and faculty members to discuss the curriculum and whether any freshmen face issues that require attention. They are available to freshmen before, during, and after class to offer academic support and share their own experiences as CCIS students. During the fall, they also invite the freshmen to join them for a "Coffee Talk," either one-on-one or in small groups.

"We involve the CCIS Fellows in a way that gives them a lot of visibility. They're approachable, so having the Fellows in class helps build a sense of community. And students hear things differently when they hear them from another student," says Kent-Yates.

The CCIS Fellows and the students they support agree that the program works. Looking back at his freshman year, Eric Chin '14, a computer science major from



First Fellows: Matt Howansky, Greg Kerr, Mike May, Mike Amirault, Nick Labich, Tim Briggs, Adam Alix, and Ali Green (shown left to right) formed the inaugural group of CCIS Fellows in fall 2010.

"I enjoy volunteering my time to help freshmen develop into better programmers, better CCIS students, and better people." —Mike May

Houston, Texas, says, "When you come from more than 1,000 miles away, it helps to know there's an older, wiser person available."

Rose DeMaio '14, a computer science and business combined major, traveled only from Westford, Massachusetts, to study at Northeastern, but she was equally pleased to know she could turn to the CCIS Fellows. DeMaio says, "To know before I even started school that I'd have someone to go to if I had questions about homework or study partners was a big comfort to me. Making that connection helped me adjust and feel like I had a new home."

Theresa Aristarco '14, a computer science and math combined major, found the presence of the CCIS Fellows in the Overview 2 course particularly helpful. She says, "The Fellows are usually top-notch students with the most coveted, most interesting co-ops, and you get to hear about their experiences. This makes you want to work hard and be like them."

The CCIS Fellows were eager to provide insights and help freshmen transition to college and co-op. For example, Adam

Alix, a computer science major who's now a junior, says, "I had a lot of questions when I was a freshman and thought it was a good opportunity for me to help freshmen."

Trevor Sontag '13, a combined major in computer science and information science, chose to be a CCIS Fellow in the Overview 2 course because of its focus on preparing freshmen for successful co-op experiences. Sontag says, "Co-op attracted me to Northeastern, so I appreciated the opportunity to be involved in making co-op better for students."

Mike May '13, a computer science and mathematics combined major, found being a CCIS Fellow so rewarding that he's taken on the role again. May says, "I enjoy volunteering my time to help freshmen develop into better programmers, better CCIS students, and better people."

The students who benefited from the support and enthusiasm of these CCIS Fellows are now sophomores, and some want to help newer arrivals. Aristarco says, "The Fellows made such a big impact on me. I'm hoping to become one." ■

Programming Languages Scholars Enhance Teaching and Research

The chance to work with leaders in the field first drew Sam Tobin-Hochstadt and David Van Horn to the Programming Research Lab at the College of Computer and Information Science (CCIS). Today, they're making their own noteworthy contributions to research and teaching.

Tobin-Hochstadt, who completed his PhD and a postdoctoral fellowship at CCIS, recently became a research assistant professor whose work is funded by grants from the Mozilla Corporation and the Defense Advanced Research Projects Agency (DARPA). His research focuses on the design of programming languages that adapt to the entire software lifecycle. This work includes developing new features for the next version of JavaScript.

"I'm interested in how to provide language support for the whole trajectory of software. JavaScript epitomizes this sort of lifecycle. It's designed to be quick and easy to learn, but it's used to build large applications," says Tobin-Hochstadt, who is seeking to make JavaScript more robust, safe, modular, and expressive. "Mozilla is interested in moving JavaScript and the Internet forward."

Tobin-Hochstadt has had an impact in the classroom as well. He has incorporated experimental ideas from his research into the curriculum and is co-teaching the honors-level Fundamentals of Computer Science II freshman course with Van Horn. Earlier, the college adopted Typed Racket, which Tobin-Hochstadt developed as a PhD student, as the primary language used in the Programming Languages course, and he was involved in creating software and revising notes for this course.

"CCIS is all about doing great research and bringing that into the classroom to give undergraduates the best education. The real test of research is whether you can take the key insights and translate them."

—Research Assistant Professor Sam Tobin-Hochstadt

In turn, Tobin-Hochstadt's research has benefited from his experience in the classroom. He is part of the CCIS team contributing to DARPA's effort to design new computer systems that are highly resistant to cyber attacks. This work is based on Racket, a language developed at CCIS, and Tobin-Hochstadt says, "We're using a lot of technology developed through the Racket system—including Typed Racket—to build reliable and secure software systems."

He also continues to collaborate with Van Horn, a visiting assistant professor and member of the CCIS team working with DARPA. They are developing new techniques to analyze and verify software, and the work relates closely to Van Horn's current research in program analysis.



Heratch Photography

David Van Horn (left) and Sam Tobin-Hochstadt enhance CCIS research and teaching.

"My PhD examined the complexity of the problems from a theoretical point of view. Now I'm using these insights to build better program analyzers," says Van Horn, who earned his doctorate in computer science at Brandeis University and recently completed a postdoctoral fellowship at CCIS awarded through the Computing Research Association's Computing Innovation Fellows Project.

Aside from working with Tobin-Hochstadt, Van Horn collaborates with other researchers within and outside CCIS. Recently, a paper he wrote with Matthew Might of the University of Utah was nominated and selected for inclusion in the American Computing Machinery (ACM) research highlights. The two researchers also have been awarded a DARPA contract to explore how program analysis can increase confidence and security in mobile device software. In addition, Van Horn has collaborated with CCIS professors Olin Shivers to develop the honors curriculum for the Fundamentals of Computer Science I course and with Matthias Felleisen to produce a book on programming written by and for computer science freshmen.

Van Horn enjoys the opportunity to work with these faculty members on projects related to both education and research. He says, "As a person who studies programming languages, I was attracted here because it's such a rich environment. Northeastern is just a powerhouse."

Tobin-Hochstadt adds, "CCIS is all about doing great research and bringing that into the classroom to give undergraduates the best education. The real test of research is whether you can take the key insights and translate them. You understand new research challenges by having people use your research. There's no better way to see that than in the classroom." ■

Wireless Network Security Research Earns Best Paper Award

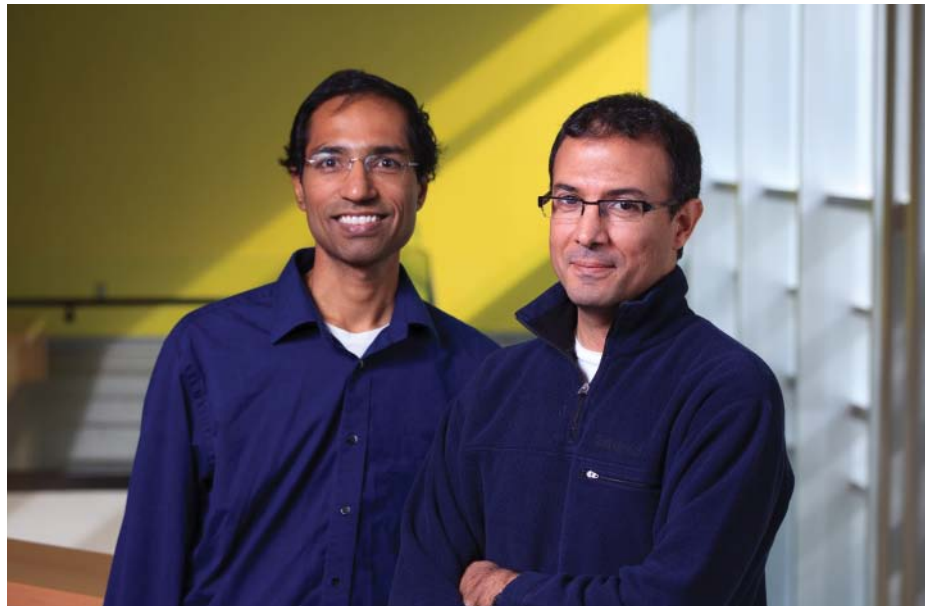
A team of College of Computer and Information Science (CCIS) researchers led by Professor Guevara Noubir received top honors for a paper submitted to the Association for Computing Machinery (ACM) Conference on Wireless Network Security in June. “On the Robustness of IEEE802.11 Rate Adaptation Algorithms Against Smart Jamming” was one of only two papers to earn this recognition.

“This is a relatively small conference, but it is highly focused on wireless security and the premier ACM conference on wireless security,” says Professor Rajmohan Rajaraman, one of Noubir’s co-authors and a fellow researcher on the project. Former postdoctoral research associate and current University of Massachusetts, Boston, assistant professor Bo Sheng and former PhD student Bishal Thapa, who is now employed by Raytheon’s BBN Technologies, also were co-authors of the paper.

The work described in their paper is funded by a National Science Foundation (NSF) grant and is part of a project supported by the NSF, the Defense Advanced Research Projects Agency (DARPA), and Microsoft. Their faculty colleagues Associate Dean and Professor Agnes Chan and Associate Professor Ravi Sundaram are also involved in the larger research effort.

“We’re all working on a broader project to understand the limitations of wireless communication and come up with methods to produce reliable, secure, and robust communications in an adversarial environment. This particular piece looked at wireless communication protocol design,” Rajaraman explains.

Noubir, Rajaraman, Sheng, and Thapa investigated a vexing problem involving rate adaptation algorithms (RAAs) and IEEE802.11 RAAs in particular. Wireless local area network security is a serious concern because attackers can send intermittent signals that slow and interrupt network traffic, effectively jam signals, and disrupt operations—all at minimal cost. An RAA allows network users to choose the optimal transmission rate, but it can’t



Heratch Photography

Professors Rajmohan Rajaraman (left) and Guevara Noubir were among the authors of the winning paper.

distinguish between poor link quality and attacker interference. That problem is compounded in IEEE802.11 RAAs, in which the link with the poorest performance dictates the transmission rate of the network. A jammer targeting that link to slow its data rate can therefore harm an entire network.

The CCIS researchers modeled the behavior of the IEEE802.11 RAAs and demonstrated the existence of optimal jamming strategies that exploit the weaknesses of these RAAs. To complement their theoretical analysis, they built a test bed that allowed them to conduct a comprehensive experimental evaluation of the RAAs.

“We are the first to show that smart jamming, with very little effort, can have a significant impact and trigger a catastrophic event,” Noubir says. “An attacker can make a network disappear or replace it with another, rogue network. Beyond denial of service, this has an impact on privacy because it can capture user information by leveraging some of these attacks.”

In their paper, they made preliminary proposals about techniques to mitigate the

“We are the first to show that smart jamming, with very little effort, can have a significant impact and trigger a catastrophic event.”

—Professor Guevara Noubir

problem. They advised that post-coding encryption could substantially limit information about the transmission rate that an adversary can determine. The researchers also suggested that less predictable rate-selection rules could increase resiliency against smart jamming for certain protocols and that some mechanisms could be used to better differentiate between unintentional and malicious interference.

They believe the most important contribution of their paper is to raise awareness of how easily an adversary can jam a wireless network. Noubir says of an occurrence such as this, “It’s not that prevalent because attackers have to be quite local. But there’s a potential for it to become more visible.” ■

Student Organizations Gain Wider Recognition

The accomplishments of two student organizations within the College of Computer and Information Science (CCIS) have been garnering attention both within and beyond Northeastern.

CISters, a group committed to supporting and informing women in computer and information science, recently earned recognition as an official Northeastern University student organization. This is significant for the women of CCIS: Only a group that is of interest to a sufficiently large number of students can be granted this status.

“This validates what we’ve known all along—that there are women in computer and information science and who have an interest in these subjects,” says Liz Brown ’13, vice president of CISters. “The college has always been supportive, but it’s nice to know the University recognizes us, too.”

Gaining official recognition provides new benefits to the organization. CISters has presented social, professional, educational, and outreach programs since its inception in 2005, but now it can turn directly to the University when it needs to reserve space, advertise, or obtain funding for larger events. With the change in status, CISters can also include the Northeastern name on its t-shirts and flyers.



Heratch Photography

Leading CCIS women: CISters and ACM student chapter president Melissa Xie (left) and CISters vice president Liz Brown.

“This validates what we’ve known all along—that there are women in computer and information science and who have an interest in these subjects.” —Liz Brown

“Getting our name out through Northeastern will help in getting our name out to the Boston community in general,” says Brown.

Melissa Xie ’12, president of CISters for the past three years, notes, “It’s kind of like growing up. You can be independent. For the past few years, CISters had been under the wing of ACM [the Northeastern student chapter of the Association of Computing Machinery]. To promote CISters outside CCIS, we had to go through ACM. Luckily, there are more and more women at CCIS every year.”

This year, Xie is also serving as the president of Northeastern’s ACM student chapter, winner of the 2010–2011 Student Chapter Excellence Award in the category of Outstanding Chapter Web Site. This is the fourth time in less than a decade that ACM, the

world’s largest educational and scientific computing society, has given this honor to the Northeastern chapter’s Web site. ACM awards also have gone to the Northeastern chapter in two other categories in recent years: Outstanding School Service in 2005–2006 and Outstanding Activities in 2004–2005.

The latest ACM award recognizes the design, content, and noteworthy features of the Northeastern chapter Web site, as well the students’ efforts to create and maintain it. Xie says, “This time, we wanted to do a Web site overhaul to make it simple and easy to access. Everything is right there, consolidated in one place. We wanted to keep up with the times and new technologies.”

The Northeastern ACM student Web site now incorporates a wiki that makes it easier to find chapter events, speakers, photos, meeting notes, and other information of interest to members. Visitors to the Web site can also access YouTube videos of presentations made at past chapter events.

“We have really smart, creatively inclined members who put their effort into it,” says Xie. “We’re proud of what we put out, and it’s nice to be recognized. It tells us that we’re doing something right in presenting our information to our members and our community.” ■

FACULTY RESEARCH FUNDING *continued from page 2*

“In the security world, there is no silver bullet; to get rid of crime is nearly impossible. But with better techniques and better tools—automatic tools—we can bring crime to a manageable level,” says Kirda, who has already built several widely used tools for malware and botnet detection and was among the first to pursue research in this area.

Help for Patients Navigating Clinical Trials

A \$4 million grant from the National Cancer Institute is supporting CCIS Associate Professor Timothy Bickmore’s efforts to develop animated conversational agents that can help oncology patients with limited health literacy navigate clinical trials. His research is part of an ongoing collaboration with nationally recognized health literacy expert Dr. Michael Paasche-Orlow, of Boston Medical Center.

“There is a low participation rate in clinical trials, especially for disadvantaged groups. This provides an accessibility mechanism,” Bickmore says.

The researchers are developing technology to help patients find appropriate clinical trials, understand complex informed-consent documents, and follow study protocols correctly at home using a “Study Buddy” on a smart phone.

“Administering informed consent in clinical trials is a big problem, and the protocols for oncology patients are quite complicated. They can create a challenge to anyone, and they’re definitely not tailored to low-literacy patients,” Bickmore explains. “In five years,

we hope to have a tool box that can be distributed to hospitals and other sites that administer clinical trials.”

Networks from a New Perspective

Professors David Lazer and Alessandro Vespignani are combining their individual knowledge of networks to lead the first multidisciplinary study exploring network interdependencies. They are supported by an NSF grant that awards nearly \$1.2 million to Northeastern.

“Today, we have blurred the boundary between the physical and virtual worlds, and our networks are all nested together. We need a systemic view of these networks,” says Vespignani.

The professors are seeking to understand the consequences of potential disruptions and failures of interdependent networks, such as the Internet and the power grid. They will develop mathematical models to define network interdependencies and computational methodologies for forecasting tools.

Both Vespignani and Lazer work with large data sets and computer simulations as part of their research, but they are grounded in different disciplines. Vespignani’s faculty appointment spans CCIS, Bouvé College, and the Department of Physics, and Lazer is a member of both CCIS and the Department of Political Science. Vespignani says of the opportunity to collaborate with Lazer, “We are combining our expertise to create something new. It’s a great example of the synergy that’s being created at Northeastern.” ■

Alumni Notes

1980s

Benoit Menendez ’86 is a senior software engineer with Enphase Energy, a San Francisco Bay Area solar power systems company. He lives north of the city with his wife and three children.

Arthur Riel ’87 has been appointed as the chief enterprise architect for the World Bank. In June, he relocated from Connecticut to Washington, DC, with his wife and two children.

1990s

Peter Karlson ’90 is the founder and CEO of NeuEon, a technology consulting firm. He was recently appointed as the Cape Cod Chamber of Commerce Entrepreneur in Residence.

Michael Odell ’92 is vice president of Gild, a global community of developers who build, share, and compare their skills profiles. Gild has its headquarters in California as well as offices in India and China. Odell works in San Francisco and lives in Healdsburg, California.

Jim Fei ’94 is the founder of Baycrest International Inc., one of the largest electronic plastic recycling companies in the United States. He lives in the San Francisco Bay Area with his wife and daughter.

Ignacio Silva-Lepe ’94 and **Kim Kvech Silva-Lepe** ’92 are married and have two children. Ignacio Silva-Lepe works at IBM Research in New York.

Cristina “Crista” Lopes ’98 is an associate professor of computer science at the University of California, Irvine, where she has been a member of the faculty since 2002. She also served as the General Chair for the SPLASH Conference held in Portland, Oregon, in October.

Luis Blando ’99 is the director of Intel Corporation’s McAfee Strategic Engagements Office. Blando, who returned to the United States earlier this year after spending several years in Argentina, now lives in California with his wife and two children.

2000s

Johan Ovingler ’04 is a software engineer with Google. He recently married and lives and works in Boston’s Metro West area.

Therapon “Theo” Skotiniotis ’10 completed his PhD under the supervision of Professor Karl Lieberherr and is now a software development engineer at Amazon’s headquarters in Seattle, Washington.



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College Sends Students to Conference for Women in Computing

Eleven College of Computer and Information Science (CCIS) undergraduates traveled to Portland, Oregon, in November for the Grace Hopper Celebration of Women in Computing Conference, an annual event presented by the Anita Borg Institute for Women and Technology and the Association for Computing Machinery (ACM). Named for the pioneering inventor of the compiler and Navy Rear Admiral Grace Hopper, it brings professionals and students together in the largest technical conference for women in computing.

This is the first year CCIS women attended the conference. Several were interested in going in the past but lacked the financial means to do so. This time, the college covered their conference fees and travel expenses.

“It was an opportunity most of us wouldn’t have had otherwise,” says Liz Brown ’13, who serves as vice president of the student organization CISTers (see page 14). “We’re really excited that the college did this for us.”

The students’ participation was made possible with resources from the Brian Wenzinger Fund, established by a graduate who earned his bachelor’s degree at CCIS in 1989 and wanted to support undergraduates interested in pursuing a unique opportunity or idea.

CISTers president Melissa Xie ’12 was among the undergraduates who traveled to Portland. She says, “I’m really happy that we were able to go to the conference. It’s something CISTers had been working toward, and it was a good step forward for us.”

The conference offered the CCIS students an opportunity to meet peers from across the country and interact with women who hold leadership positions in industry, academia, and government. Brown notes, “It’s always great to network with people in industry and see women who have made it in computing.”

Xie and Brown were particularly interested in learning about outreach programs designed to interest more women in computer science. Brown says, “One of my passions is how to expose young girls, especially middle school girls, to computer science. It was good to see what’s going on in other parts of the country and bring some ideas back to CISTers and our college.” ■

