

Fall 2010

CCIS network

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

Students Take Advantage of Global Learning Opportunities

Today, more College of Computer and Information Science undergraduates are pursuing international experiences as part of their education.

They're taking part in Northeastern University's Dialogue of Civilizations program, experiencing life and exchanging ideas with other students in countries around the globe. Led by a faculty member and joined by other Northeastern undergraduates, the CCIS students spend a summer month building on what they've learned on campus.

They study the language, politics, economy, environment, or another aspect of the country they visit. They attend lectures and cultural events, meet students and community leaders, and visit significant sites. Some pursue research or a service project.

For CCIS students with requirement-packed academic schedules, the short-term Dialogue of Civilizations offers an ideal opportunity to see the world and better understand an increasingly globalized society.

Ryan Cassidy: Northern Ireland

When Ryan Cassidy '13 talks about his Dialogue of Civilizations experience in Northern Ireland this summer, the word he uses most often is "perspective."



Ryan Cassidy traveled to Northern Ireland and is now in Seattle for a co-op at Amazon.com.

That perspective came as he studied the causes and consequences of social conflict in a Queen's University Belfast classroom he shared with Northeastern students in majors other than computer science. It grew as Cassidy interned at a school that brings Catholic and Protestant students together and as he met politicians and members of peace organizations. His understanding of social

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Northeastern

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Aligning Strategy and Success



The long-term strategic goals of the College of Computer and Information Science are driven by a clear vision of what we would like to achieve. Specifically, this means creating educational programs that combine computing with an important application domain, such as health care or security. It also calls for research

that both advances the computing discipline and contributes to resolving major societal problems.

Our applied research focuses on building more reliable software and hardware systems, reducing the cost and improving the quality of health care, and securing the nation's cyber infrastructure. We also take advantage of opportunities arising from significant additions to the faculty, such as in network science.

Our educational programs, faculty hiring, and research are aligned with these goals. For example, this fall we introduced an interdisciplinary PhD program in information assurance, and now we're developing a joint interdisciplinary PhD program in health informatics with the Bouvé College of Health Sciences. Each will complement our successful master's degree programs. We've also added faculty whose expertise enhances both our teaching and research in these fields (see page 3).

These programs and new hires highlight our commitment to interdisciplinary knowledge. This is reflected in the increasing number of faculty with joint appointments involving our college and another Northeastern department, including Albert-László Barabási with physics and David Lazer with political science. Our researchers collaborate with colleagues in other disciplines to achieve breakthroughs that make a difference in the way people live and work (see pages 4, 5, and 11). We also partner with other colleges and departments at Northeastern to develop and offer undergraduate combined majors pairing computer and information science with business, the sciences, and art, media, and design (see page 8).

Our strategy is working. In the past year, we've added programs and increased our overall student enrollment by nearly 200. Our research funding has risen significantly, to nearly \$5 million, and looks even stronger for the current year (see page 12).

Now, we are developing more BS/MS degree programs to expand the options for our highly motivated students (see page 7). We also plan to hire faculty members in both interdisciplinary and core computer science areas. And we anticipate further progress for our online programs launched last January.

Our momentum is positive, but our ever-changing field requires us to remain nimble and to seize opportunities as they emerge.

Larry Finkelstein
Dean

Professor Matthias Felleisen Wins Outstanding Educator Award

Fifteen years ago, Matthias Felleisen saw that high school students were inadequately prepared for college-level computer science coursework. He responded by creating the TeachScheme! Project, which has changed how students learn to program.



Professor Matthias Felleisen won the ACM Kalstrom Outstanding Educator Award.

"I used what I learned from my research to build a curriculum for middle school, high school, and college students," says the College of Computer and Information Science Trustee Professor, describing how TeachScheme! has evolved and become the country's longest-running outreach project.

Felleisen was honored for his efforts when the Association for Computing Machinery (ACM) held its annual awards presentation in San Francisco in June 2010. He is the most recent recipient of the ACM's prestigious Karl V. Karlstrom

Outstanding Educator Award recognizing "visionary and long-term" contributions to K-12 outreach programs and innovative teaching methods.

Today, Felleisen's TeachScheme! curriculum and step-by-step "design recipe" are in use at schools around the globe. High school teachers and college faculty across the United States have been trained in the TeachScheme! methods during intensive weeklong summer workshops. Felleisen helped guide the creation of a similar outreach effort—the Bootstrap Program—designed to interest Boston middle school students in computers and programming. And he has adapted TeachScheme! to develop a College of Computer and Information Science freshman curriculum that gives students the knowledge to understand and validate their work, not simply to solve programming problems correctly. Other colleges and universities have also adopted this curriculum since its introduction.

"That the work my team and I have done over 15 years has been acknowledged as very effective and helping a lot of people is very satisfying," says Felleisen, who is no longer directly involved in the summer TeachScheme! workshops but continues to develop lecture notes, books, software, and other teaching materials.

This isn't the first time the ACM has chosen to honor Felleisen. In 2006, he was named an ACM Fellow in recognition of his exceptional contributions to programming languages. ■

New Faculty Expand Expertise in Health Informatics and Information Assurance

With the addition of two new faculty members, the College of Computer and Information Science continues to add to its strength in health informatics and information assurance.

Associate Professor Stephen Intille has come to Northeastern University this fall as a member of both CCIS and the Bouvé College of Health Sciences faculty. He previously was a research scientist and House_n Research Consortium technology director at MIT, where he also earned PhD and master's degrees.

Intille's research and teaching focus on computational sensing for health technologies. Specifically, he is involved in applying pattern recognition and sensor technology to measure health activity and encourage behavior changes that can improve people's health.

"The goal is to build health systems that motivate people to get more physical activity, based on their current activity. Context-sensitive human-computer interfaces create an opportunity to give subtle positive feedback," Intille explains. "My primary interest is in prevention. The interesting challenge is how to make engaging health technologies that entice someone without a health condition to use them."

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Intille wants to help people avoid hospital stays or recover from them more quickly, using inexpensive technology. He says, "If technology can either lower the cost of existing care or provide higher quality care at a more reasonable cost, that's something everyone wants."

At Northeastern, Intille will continue this research and seek opportunities to collaborate with his new faculty colleagues. Intille previously worked with CCIS Assistant Professor Timothy Bickmore to place a virtual assistant on a mobile device to measure a person's physical activity.

Developing a PhD in health informatics at Northeastern that builds on the existing MS program is another high priority for Intille. He also will focus on teaching interdisciplinary courses related to health informatics.

The second new faculty member, Engin Kirda, will join CCIS as an interdisciplinary associate professor in January. He will have a



Associate Professor Stephen Intille



Associate Professor Engin Kirda

joint position with the Department of Electrical and Computer Engineering in the College of Engineering. Previously, Kirda was a tenured associate professor in the Networking and Security Department at Institute Eurecom in France and a member of the computer science faculty at Technical University of Vienna.

Kirda is also the co-founder and co-director of the International Secure Systems Lab, a collaborative effort of European and U.S. researchers focused on Web security, malware and vulnerability analysis, intrusion detection, and other computer security issues. This collaboration will continue at Northeastern when Kirda arrives at CCIS.

"We have quite a bit of visibility in industry and academia," Kirda says of the International Secure Systems Lab. "People know us by the tools we've created."

Among these tools are Anubis, which analyzes malware such as viruses and generates activity reports; FIRE [Finding Rogue Networks], which determines whether an Internet service provider has been hacked; and Pixy, which conducts vulnerability assessments for Web pages.

"I'm interested in any security-related problem with the possibility of affecting a large number of people," says Kirda. "I'm interested in practical computer science."

Now, Kirda will move his work to the United States, which he describes as "the place to be if you want to do security research." He's coming to Boston because he believes the college and Northeastern as a whole view security as a vital area of research. And he's looking forward to teaching in the college's new PhD program in information assurance.

"I was impressed with the quality of the faculty and the students at Northeastern," Kirda says. "The location in Boston is great, too." ■

Breaking New Ground in Formal Methods Research and Teaching

Panagiotis “Pete” Manolios develops tools to design highly reliable computer systems—the complex, “safety-critical” systems needed to keep airplanes in the sky and protect the nation’s cyber infrastructure. The College of Computer and Information Science associate professor has another critical responsibility: He teaches freshmen.

“At Northeastern, we’ve thought a lot about the undergraduate curriculum and how it fits together,” says Manolios, who teaches Logic and Computation, a first-year required course. “The dean seeks out senior faculty to teach freshmen. It’s a major priority for everyone. At the freshman level, you can really spark excitement in students.”

In both his research and his teaching, Manolios has been using his formal methods expertise to change what was believed possible. He’s proven that formal methods can be used to automatically solve problems that previously required years of manual effort. He’s also demonstrated that freshmen can learn and use complex concepts previously taught only to graduate students.

In collaboration with Boeing and NASA, Manolios has designed formal verification tools to help achieve the highest levels of systems reliability. He and his students developed a method to synthesize architectural models of systems that interact with the physical world in real time, and they successfully applied it to data from the aerospace giants. The method gives designers a new level of abstraction that lets them explore design spaces at the earliest stages, when they can gain the most benefit in terms of time, cost, and overall system efficiency.

“What if you realize years into the design process that a set of components requires more resources? Then, you have to make drastic changes when they’re extraordinarily expensive,” says Manolios.

He also works with the Semiconductor Research Corporation, a consortium



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—Professor Pete Manolios

Professor Panagiotis “Pete” Manolios uses formal methods to innovate in education and industry.

whose members include IBM and Intel, to develop verification technology for analyzing very large, complex circuits. In particular, he’s interested in using formal methods to increase the scalability of tools to design and build reliable hardware.

In the classroom, Manolios has developed tools that enable freshmen to use formal methods to reason about computer code and programs. He says, “It’s amazing—freshmen can do things faster than graduate students did before. They have great intuition about programming, and we build on that intuition to teach deep concepts.”

The ACL2 Sedan theorem prover Manolios developed has an intuitive, graphics-based user interface that enhances students’ learning. Manolios explains, “The ACL2 Sedan is like an expert that is available 24 hours a day. Before, when students informally developed and reasoned about programs, if they made a mistake or went off in a wrong direction, they might not realize it for weeks. With the automated tool, they get immediate feedback. It’s like having constant access to the professor.”

His breakthrough has attracted the attention of other universities interested in adopting his methods of teaching freshmen. Manolios is now developing lecture notes and course materials that will allow faculty elsewhere to teach similar courses.

Manolios believes that engaging in both research and teaching strengthens his contributions in each area. For example, teaching freshmen helps him better understand how industry programmers might use the tools he designs. He says, “To build a tool that can be used widely, teaching helps immensely. You see the problems people really have with it, not the ones you think they’ll have.”

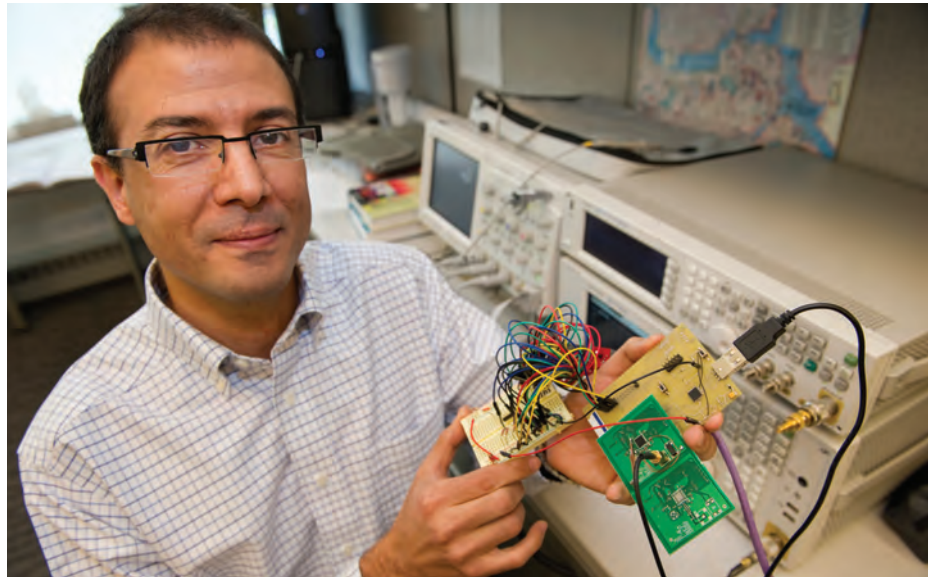
His research offers students insights not only into the content he covers, but also into the nature of learning. Manolios explains, “Freshmen often have the impression that all problems are already solved. That’s just not true. Making advances in research requires identifying questions for which no answer is currently known, and that only happens when you’re actively engaged and question everything.” ■

Professor's Innovative Work Advances Wireless Communication

Everyone uses wireless communication today, but these systems are far from perfect. Through his research, College of Computer and Information Science Associate Professor Guevara Noubir has set out to make them more robust in withstanding interference, more adaptable to increased demands on network capacity, and more secure.

A member of the CCIS faculty since 2001, Noubir has received several National Science Foundation grants, including the prestigious CAREER Award, to investigate new approaches to improving wireless communication. His work involves examining the fundamental constraints on wireless communication, developing novel algorithms and protocols, and creating prototypes for better systems.

In one avenue of research, Noubir has been exploring distributed diversity technology to maximize the use of wireless communication resources. With this technology, a mobile device could draw on all available wireless networks and devices in its environment rather than connecting to only one. Instead of simply co-existing, these networks would cooperate.



Professor Guevara Noubir leads an interdisciplinary research team developing a new sensor-networking instrument with several promising applications.

With an interdisciplinary team of researchers that includes his CCIS faculty colleagues Peter Desnoyers and Marty Vona, and others in engineering and physical therapy at Northeastern, Noubir is also developing a second-generation sensor networking instrument to enhance network security,

“We don’t know how to do this yet,” says Noubir, who has received NSF funding to convene experts in computer science, biological physics, synthetic biology, and other fields at a workshop in which they will join him in developing a vision for this work.

Noubir’s research delves into new territory, and his teaching has done so as well. For example, a course he developed—Secure Wireless Ad Hoc Robots on Mission, better known on campus as SWARM—was recognized for its innovative approach at the Colloquium for Information Systems Security Education and included in the NSF Division of Computer and Network Systems highlights for 2009. It has also attracted the interest of other universities.

In the popular course, students are exposed to the concepts underlying robust and secure wireless networks as they build robots that can communicate with each other. The course culminates in a competition among student teams.

“The students search for a device transmitting a message. Sometimes they have to relay the message to other robots,” Noubir explains. “They learn about the foundations of security, but it’s like a search-and-rescue mission.” ■

“Adequate mechanisms and cooperation among people can enable high-quality, universal wireless access to information at a low cost.” —*Professor Guevara Noubir*

Noubir has determined that this type of cooperation can result in substantial energy savings and, therefore, cost savings as well. He and his research team have developed new protocols that take advantage of the computation abilities of today’s computers while preventing anyone from blocking communication. Noubir is also looking at ways to leverage social networks.

“We believe that, in the future, devices will be able to have many interfaces. Adequate mechanisms and cooperation among people can enable high-quality, universal wireless access to information at a low cost.” Noubir says.

reliability, and energy efficiency. This work has promising applications in search-and-rescue efforts, health monitoring, and protecting the electricity grid.

Noubir’s latest project is his most novel: He’s researching the feasibility of using energy-efficient biological organisms to carry computation and communication, and interact wirelessly with traditional systems. Others have explored the potential of these organisms in drug delivery, but not with wireless communication. He theorizes that embedding functions in living organisms could enable them to interface with wireless networks, much like the human ear efficiently recognizes acoustic signals.

Undergraduate Researchers Learn About Computer Science and Themselves

Even among the many talented and motivated freshmen in the Fundamentals of Computer Science honors class Associate Professor Olin Shivers taught last fall, three stood out: Jim Shargo, Ryan Schwers, and Chris Souvey.

Committed to what Shargo calls “aggressive study,” they approached Shivers about enrolling in the professor’s spring course on compilers—a course designed for seniors and one Shivers says may be the most difficult offered by the college. No first-year student had ever taken such a course—not at Northeastern, or anywhere else. The students persisted, persuading Shivers to admit them to the class. And each earned an “A” in the course.

Next, they wanted to do independent research over the summer. The College of Computer and Information Science encourages students to pursue this kind of opportunity, and Shivers identified a project: They would rewrite and port Edwin, a large and complex program that implements a powerful and popular text editor called emacs. Edwin was developed in the 1980s using a now-obsolete version of the Scheme programming language. The students would have the task of putting Edwin into a functional version of modern Scheme.

Their work would enhance their programming skills, produce a valuable open-source program, and provide code that could become the basis of another of the professor’s projects. With only one year of college behind them, they would receive the challenge they desired.

By summer, Souvey had opted to return home to develop an Android application instead. But with funding from the newly created Brian Wenzinger Fund (see page 14) in place to cover summer living expenses, Shargo and Schwers were ready and able to start their project.

“I was looking forward to learning not only a great deal theoretically, but also about the life of a researcher,” says Schwers.

At first, they struggled; the work called for knowledge they hadn’t yet acquired in class. Schwers recalls, “It was a rough learning

Helping to Solve a Debugging Problem



“What initially drew me to computer science was to be creative, to create something from nothing and make the computer do exactly what I wanted it to do,” says Tyler Denniston ’12.

He’s found this opportunity as a member of Professor Gene Cooperman’s research group. Denniston joined Cooperman’s largest research project as a sophomore, after performing well in the graduate-

level Research in High-Performance Computing course and expressing his desire to do more. He has since become the only undergraduate among six co-authors of a technical report that will be submitted to a prestigious computer science conference.

“This has been a positive experience,” says Denniston. “I’ve discovered I like solving problems no one has solved before. The technical knowledge I’ve gained is far more than I’d learn just by taking undergraduate courses.”

Denniston is contributing to Cooperman’s effort to develop a reversible, or “time-traveling,” debugger that uses a novel form of checkpoint restart. “Checkpointing,” or saving the state of a program, should make it possible to replay a program to discover why a bug caused it to crash. But there’s no guarantee a program will subsequently return to the same place it was when the bug was first observed, making it difficult to confirm whether debugging was successful.

Programs that use the multiple cores common on today’s CPU chips complicate matters further. These programs are no longer deterministic, so Cooperman’s research team must add extra determinism while ensuring the program runs as fast as it did before debugging.

“In a sense, we’re laying out bread crumbs to be able to return to the same place,” Cooperman explains.

Solving these problems would revolutionize how computer programs are tested by making it much easier to fix bugs. It could also lead to a more widely accepted reversible debugger, a long-time goal for researchers.

Now that Denniston is spending a six-month co-op in Cooperman’s lab, he has developed the first version of a determinism module that will be integrated into the team’s research software.

“Tyler is getting the full PhD experience as a junior, and he’s been making tremendous progress,” says Cooperman. “He’s already shown himself to be extremely productive. He has the same skills as a first- or second-year PhD student.”

curve. We were still freshmen with very little exposure to this kind of thing.”

Schwers believes he and Shargo learned more quickly by working side-by-side every day throughout the summer. They could also turn to Shivers, who offered weekly lectures, hands-on assistance, and

guidance. Shargo says, “Professor Shivers was very encouraging. Every time I spoke to him, I learned something.”

The students’ breakthrough came in late July. Now, they were highly productive:

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Program Puts Students on Fast Track to a Master's Degree

A new program at the College of Computer and Information Science allows students to complete the MS degree in computer science with just one year of study beyond the BS degree.

Like other undergraduates, these students are able to participate in co-op, whether they choose the traditional five-year program including three co-ops or the new four-year option with two co-ops. But they also are able to take on the challenge of graduate-level coursework earlier in their academic careers.

Through an academic program customized to their goals, students can reduce the time to complete the BS/MS degree even further. For example, both Chris Lee '11 and Alex Brick '11 received credit for their high school Advanced Placement courses and will graduate with two degrees after just five years while incorporating three co-ops.

In the BS/MS program, students replace four undergraduate requirements with an equal number of graduate courses with similar but more advanced content. They also must complete four other master's-level courses.

The opportunity to learn more and earn a master's degree sooner appeals to CCIS students such as Lee and Brick whose grades and academic ambitions are suited to the program.

Lee decided to pursue the BS/MS program in his third year as a CCIS student. Mapping out his remaining undergraduate requirements with his academic advisor made him realize the option was feasible. Lee says, "I knew I wanted to get a master's degree, so why not do it now?"

Brick's path to the BS/MS program started sooner than most. Before college, he'd released a configuration utility application and been an intern at the National Institutes of Health; as a CCIS freshman, he wanted a demanding academic program. By sophomore year, he was in the BS/MS program. Last year, he took his first PhD-level course.

"I like the pace of the graduate courses," Brick says. "I like the fact that they're



The BS/MS program is beneficial to Alex Brick '11 in his co-op position at Amazon.com in Seattle.



Chris Lee will earn both bachelor's and master's degrees in five years.

more difficult, more detailed, and cover more interesting things at a higher level."

Lee says the graduate-level courses involve more challenging concepts and larger projects. He adds, "You need to be committed to spending more time, and you have to work harder. If programming is your strong suit, that helps."

Both students envision careers in software development after graduation and believe their extra effort will pay off professionally. Brick already points to his co-op experience at Amazon.com

as evidence of the benefits. He feels his graduate-level education is helpful in a corporate environment where many of his co-workers hold master's degrees.

"Being in the BS/MS program shows you're someone who wants to learn a lot and find ways to apply it," says Brick. He adds, "Amazon is a very competitive company, and it sets a very high bar. The courses I've taken have definitely helped with my work there."

Like other students enrolled in the BS/MS program, Lee and Brick have fewer electives, but they still find room in their schedules for what is most important to them. Lee took the math courses he thought would be helpful to him in the future. And Brick pursued his interest in Japan by studying abroad and taking Japanese language lessons.

"I have a lot of interests, and I've been able to do everything I wanted to do," says Brick, who also has assisted with a professor's research, completed his own computer science projects, and participated in dance and martial arts. "I'm busy, but I want to make the most of my time." ■

The College of Computer Science is currently exploring additional BS/MS options, including those that combine BS degrees in computer science or information science with the MS in Information Assurance or the MS in Health Informatics.

Combined Majors Offer Students an Interdisciplinary Education

At the College of Computer and Information Science, there are more students interested in combined majors and more combined majors for them to choose than ever before. Undergraduates can now combine computer or information science with 10 other fields to create 15 different majors, and nearly 50 percent of them are doing so.

“The combined majors give students more flexibility,” says Professor Richard Rasala, the college’s associate dean and director of undergraduate studies. “This lets students fulfill their ambitions. They do serious work in two disciplines.”

Yet a combined major requires no extra time or expense beyond the standard undergraduate program. The majors are carefully crafted to provide technical depth and breadth in computer science or information science plus knowledge of another field—all within the framework of a Northeastern education incorporating co-op experience.

“The combined majors give students more flexibility. This lets students fulfill their ambitions. They do serious work in two disciplines.”

—Associate Dean Richard Rasala

The combined majors involving business and game design are among the most popular. The latter is the newest of the combined majors, introduced just two years ago in response to student interest and strong co-op opportunities. But individual students’ experiences provide the clearest reason for the appeal of combined majors.



Adam Heaney, computer science and game design



Chris Chin, computer science and game design

Computer Science and Game Design

“Nationally, some game design programs are only at the master’s level,” says Rasala. “The students who come to game design through CCIS are interested in being very good in computing.”

Among the first group of students to choose the combined major in computer science and game design were Adam Heaney and Christopher Chin, both members of the Class of 2013.

Heaney, who says he has always liked things that are visually interesting, explains, “The combined major gives me the skill set to put interactivity behind something visually interesting.”

Computer science courses are giving him the programming background to become a game developer. Required art and design courses on such topics as animation, video, and three- and four-dimensional design help him better understand the visual aspects of game design.

Heaney values the chance to take courses with art students and feels this classroom contact is mutually beneficial. Heaney says, “I get a different perspective, and they see how computation can contribute to things that are visually interesting to people.”

But his courses in computer science and game design remain his favorites. This is fortunate: With two majors and an interest in adding a math minor, Heaney will take few electives. He notes, “On the one hand, there are no easy courses. On the other hand, all of my courses are really interesting to me.”

Heaney’s classmate Chin can easily identify the class he’s enjoyed most: a computer science course on computer graphics. Chin says, “It has really helped me in both computer science and game design. The projects were demanding, and I learned a lot about programming. The professor was great, and it was also a lot of fun.”

As a CCIS student, Chin has discovered that there’s more to game design than he’d imagined. He says, “It’s much more challenging. You need a strong knowledge of computer science because there’s a lot of coding in game design. You need to know object-oriented design—the easiest way to program a game. You also need to understand human–computer interaction so you know how people might like to use a game.”

Now that he has learned more about game design, he has become more discerning. Chin explains, “I’ve been playing games since I was five and had a really old Nintendo. But making a game that’s fun to play is very hard. When I play games, my standards are much higher now because I can see whether a game is well designed.”

Chin believes his combined major in computer science and game design will enhance his co-op and career opportunities. He remains enthusiastic about his choice, saying, “It’s difficult. It’s rewarding. There’s nothing quite like it. I’d love to be able to point to a game on a shelf in a store one day and say I worked on that.”



Elise Murray, computer science and business



Matthew Kohn, information science and business

Computer Science and Business

Combining computer science or information science with business lets students take their careers in any number of directions. Elise Murray '12 and Matthew Kohn '11—both with business concentrations in entrepreneurship—demonstrate the wide range of possibilities for students with these combined majors.

“I have a creative side, but I really love math and science,” says Murray, whose combined major in computer science and business lets her explore all of her interests.

Murray recently released her first iPhone application. Called AirhornPlus, it adds a hip-hop air horn sound to any song on an iTunes playlist, and Murray was excited to see it downloaded 340 times in its first week.

Buoyed by success, she may now use her final six-month co-op to launch her own business. Murray says, “I’m always brainstorming about doing something that could go really big.”

Yet a computer science co-op, not an entrepreneurship class, inspired Murray to develop her iPhone application. Murray worked in the iPhone group at Where, Inc., a start-up company that develops software for mobile applications.

Murray has seen the benefits of her combined major both on co-op and in the classroom. Group projects and presentations in business classes help her communicate effectively on co-op interviews and on the job. And she applies her computer science knowledge when databases and mobile communication are discussed in her business classes.

“Every area of business is affected by technology, so I would definitely recommend the combined major. It’s already helped me, and I think it will help me in the future,” Murray says.

Kohn’s combined major in information science and business—as well as his entrepreneurship concentration—proved invaluable in his recent co-op at Highmount Capital. Three months after he started, Kohn needed to move all computer systems for the 35-person, multi-office company while also negotiating its new Internet and phone contracts.

A computer science project management course he’d taken helped him perform the challenging tasks. Kohn says, “It provided a good overview of how projects are managed and the tools to use.”

Kohn continues to apply what he learned in that Information Systems Design and Development course in his current co-op with the U.S. Department of Defense in Washington, D.C., where he is involved in IT project management.

“My end goal is to do either high-level IT work or be a manager of IT projects,” Kohn says. “Having an understanding of business plus an IT perspective should offer me better opportunities because most IT relies on what business needs.”

Regardless of his career path after graduation, Kohn is pleased to have chosen his combined major. He says, “It exposes you to a lot of different things, and you get to meet so many more people. Especially in entrepreneurship, networking is key.” ■

Growing Opportunities

Students in the College of Computer and Information Science can choose from combined majors incorporating business, science, art, media, or design. The list demonstrates the range of current opportunities, and additional combinations are on the way.

Combined Major within Computer and Information Science

- BS in Computer Science and Information Science

Combined Majors with Business

- BS in Computer Science and Business
- BS in Information Science and Business

Combined Majors with Science

- BS in Computer Science and Mathematics
- BS in Computer Science and Biology
- BS in Computer Science and Physics
- BS in Computer Science and Environmental Science
- BS in Computer Science and Cognitive Psychology
- BS in Information Science and Environmental Science
- BS in Information Science and Cognitive Psychology

Combined Majors with Art, Media, and Design

- BS in Computer Science and Digital Art
- BS in Computer Science and Game Design
- BS in Computer Science and Interactive Media
- BS in Computer Science and Music Technology
- BS in Computer Science and Multimedia

Students Earn Top Prize in National Collegiate Cyber Defense Competition

In just their third year of competition, College of Computer and Information Science students topped 80 teams from across the country to take first place in the 2010 National Collegiate Cyber Defense Competition. At the end of the three-day San Antonio, Texas, contest, they were awarded the Alamo Cup, evidence of their success in the world's largest college-level cyber defense competition.

The winning team was comprised of CCIS information assurance graduate students Weiwei Hu and Alagu Irulappan as well as undergraduates Marc Held, William Nowak, Channing Conger, and team captain Shawn Smith. As in past years, Kevin Amorin MS'05, a faculty member in the CCIS Master of Science in Information Assurance program with additional experience as a network security manager, served as the team's coach.

Most of the students were veterans of previous competitions and had performed well in past years. In 2009, the CCIS team placed second nationally, and it had earned top regional honors in its first year of competition. In 2010, says Amorin, they knew what to expect. Undergraduate courses on topics such as networks and network security as well as the graduate-level Network Security Practices course that Amorin teaches also helped to prepare the team for the competition.

"We compete, but it's all about getting better and learning more about information assurance."

—Kevin Amorin MS'05, coach of the winning team

As Northeastern University students, the team members had another advantage. Amorin explains, "Through co-op, they also had six months of full-time industry work experience between the two competitions."



Cyber defense champions (left to right): Shawn Smith, Channing Conger, Marc Held, Weiwei Hu, Alagu Irulappan, coach Kevin Amorin, and William Nowak

College of Computer and Information Science students topped 80 teams from across the country to take first place.

The assignment in the National Collegiate Cyber Defense Competition simulates the students' real-world experience. Team members act as the IT department of a small business and are judged on their ability to detect and respond to external network security threats while maintaining essential computer operations and meeting service-level agreements.

"Everyone on the team really enjoys this type of work," says Amorin. "Networks and systems are of interest to them."

Now that three members of the 2010 team have graduated, Amorin is recruiting new students who share their interests and commitment to spending several months preparing for the competition. He knows that repeating as the national champion will be a challenge. In the competition's five-year history, only one school has ever achieved two consecutive wins; the following year, its team didn't emerge from the regional competition. What's

more, the competition continues to grow, involving more regions and students.

Next time, however, the CCIS students will have an early home-team advantage. Even before the 2010 outcome was known, Northeastern had volunteered to serve as the host of the Northeast Region competition in February 2011.

But CCIS benefits from participation in the competition whether its team wins or loses. Team members meet professors and students from their own and other regions. They also can speak with recruiters from companies and government agencies that sponsor the competition each year. And Amorin and his fellow coaches have an opportunity to collaborate on ways to advance information assurance and network security.

"We compete, but it's all about getting better and learning more about information assurance," he says. ■

Engaging People with Technology for Better Long-Term Health

College of Computer and Information Science Assistant Professor Timothy Bickmore and his research group developed the interactive “virtual nurse” software technology to educate patients about their medications, follow-up appointments, and health condition before they’re discharged from the hospital. This research, funded by the National Institutes of Health, could lead to healthier patients and lower health-care costs.

Accessed via touch screen, the virtual nurse offers responses and expressions tailored to how patients answer questions. This adaptability is particularly helpful for patients with low literacy skills, and the virtual nurse can allot more time to ensure all patients fully understand their care and condition.

The virtual nurse has already been tested at Boston Medical Center and is now being commercialized. But additional research remains: Patients leaving hospital care will need to turn to the virtual nurse for help managing their health and medications at home. How do you build systems to ensure this happens, especially over time?

Laura Pfeifer, a PhD student in information science and a member of Bickmore’s research group, is exploring that question. Her doctoral research focuses on using computerized systems to help patients make successful transitions from the hospital to their homes.

“It’s an important topic, but for some reason it hasn’t been investigated yet. She’s looking at it over the long term, in a longitudinal context,” says Bickmore, noting that Pfeifer’s research has already resulted in eight significant publications, including journal articles.

Pfeifer is examining long-term engagement with health technology, including what motivates people to continue using it. She’s also looking at follow-up systems that could recognize when someone needs a different or new way to engage with the technology—or a medical professional’s intervention.

With more people coping with chronic medical conditions, her work could have



Laura Pfeifer’s doctoral research involves technology to help hospital patients manage their health at home over the long term.

With more people coping with chronic medical conditions, Pfeifer’s work could have a positive impact on long-term health monitoring and patient–physician communication.

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Pfeifer is seeking to improve people’s interactions with health technology. As part of her research on engagement, she has tested the impact of having technology like the virtual nurse use human conversation fillers—“um,” “uh,” “like,” and other common sounds—that are atypical in computer-generated speech.

Modeling human behavior, says Pfeifer, provides a “nice, natural interface for people who are not familiar with computers.” If they’re more comfortable with the technology, people are less likely to view its use as a burden and more likely to respond truthfully when the animated interface questions them about their health.

“Laura’s been a terrific addition to the lab. She quickly took a lead role on the virtual nurse project,” says Bickmore. “Because she’s worked in industry, she’s brought a professional attitude and work ethic.”

Before beginning her graduate studies, Pfeifer spent three years as a software implementation specialist with ProVation Medical in Minneapolis, a health information company that’s now part of Wolters Kluwer Health. Her work took her into hospitals and health clinics, which ultimately led to her current research interests.

“It was fascinating to me,” says Pfeifer. “There’s so much work to be done in health technology.”

As a PhD student, she has continued to benefit from contact with health-care professionals and researchers. Through her lab’s collaboration with Boston Medical Center, she says, “I’ve been exposed to their research practices on a daily basis. It’s one thing to be in a lab doing research and thinking critically. To be thrown into the mix with doctors doing full-blown medical trials is another thing entirely. And when you see something you’ve done have a real-life impact on someone, it’s rewarding.” ■

Record Research Funding Includes Support to Reimagine Computer Systems

Funding for research at the College of Computer and Information Science is continuing to rise, totaling nearly \$5 million in 2009–2010.

The current year promises to top the college's previous totals for research support. Leading the list is a four-year, \$4.5 million grant from DARPA [Defense Advanced Research Projects Agency]. Of more than 70 proposals submitted, only 15 received funding.

The DARPA grant is both sizeable and prestigious. Associate Professor Olin Shivers,



Professor Olin Shivers is principal investigator for the DARPA grant.

“DARPA is a ‘blue sky’ research organization that’s willing to take risks. They’re not interested in incremental improvements. They only fund revolutions.” — Professor Olin Shivers

who is the principal investigator for the CCIS research and highly regarded for his work in analysis for advanced programming languages, explains, “DARPA is a ‘blue sky’ research organization that’s willing to take risks. They funded the Internet, the stealth fighter, and all of the big-ticket computer research in the 1970s and 1980s. They’re not interested in incremental improvements. They only fund revolutions. They swing for the bleachers.”

This time, the agency wants to reimagine computer systems. With the U.S. military increasingly networked and dependent on software, systems that won’t crash and aren’t vulnerable to cyber attacks are urgently needed.

DARPA is looking for a “clean-slate” design of new computer systems that are highly resistant to cyber attacks. If an attack occurs, these systems must be able

to continue to provide services, repair themselves, and learn from it to guard against and cope with potential incidents in the future. To create these robust, secure systems, DARPA is turning to experts in systems research and programming languages for new ideas.

Shivers and his CCIS faculty colleagues Mitch Wand, Matthias Felleisen, and Panagiotis “Pete” Manolios will work with two professors at the University of Utah on the operating systems, programming languages, and formal methods aspects of the research effort. They’ll seek to develop bug-free, secure technology using brand-new programming languages that enable programmers to write large, complex software.

“It leverages a lot of the expertise we have across the board—about 100 years of experience in these areas,” says CCIS Dean Larry Finkelstein.

Shivers notes that Wand and Felleisen are among the world’s top researchers in their areas. He says, “It’s exceedingly rare that someone can simultaneously make deep, foundational contributions to the theory of a field and translate these insights and research prototypes into practical systems. They’re known for managing both feats—thousands of people use the systems they’ve built every day.”

Manolios brings similar skills to formal methods, the science of automated reasoning (see page 4). With all these researchers in the mix, says Shivers, “We have a kind of ‘dream team’ here.”

Aside from working with his CCIS colleagues, Shivers is part of a second team involved in the DARPA project. He and researchers from Harvard, the University of Pennsylvania, and industry are focusing on the design of hardware and the low-level software to control it. Their proposal incorporates a novel feature: hardware with built-in safety checks and the ability to verify information.

Just as with past DARPA projects, Shivers anticipates the computer systems that emerge from the new research will have an impact far beyond the military. He believes it’s imperative.

“Society is completely reliant on software; it is in the fabric of day-to-day life,” Shivers says. “We’ve been lucky so far—we haven’t had a technology catastrophe because of software. It’s really important that software works—people’s lives depend on it.” ■

The current year promises to top the college’s previous totals for research support.

GLOBAL LEARNING OPPORTUNITIES *continued from page 1*

conflict deepened as he walked Belfast streets where barbed-wire fences were reminders of long-standing divisions.

“It was one of the most important months for me ever. We weren’t just reading books and going to class every day. We were very engaged and involved in the community,” says Cassidy. “It opened my eyes to a lot of things that were brand new to me. Everything else I take is very quantifiable, but this was all about human interaction. I learned a lot about perspective, the way people with different backgrounds approach problems. I learned so much by listening to people.”

That was much more than Cassidy had expected from Dialogues of Civilization. Initially, he’d set out to meet a social sciences requirement. He thought, why not do this in an English-speaking, international setting? Northern Ireland, where earlier generations of his family had lived, seemed a good choice.

“It became something I really wanted to do. I fell in love with it,” Cassidy says now. “It took me totally out of my element for a whole month. That’s absolutely invaluable. It was definitely the most exciting experience of my life.”



Liz Brown studied Spanish in Argentina.

Liz Brown: Argentina

Liz Brown '13 wanted to add to her high school Spanish skills. But her combined major in computer science and information science left her with no time for a Spanish minor or a semester abroad. She found the perfect solution: Dialogue of Civilizations.

“In computer science, I love to learn new programming languages. I love spoken languages, too,” says Brown.

This summer, Brown traveled to Buenos Aires, where she studied the Spanish language and Argentina’s culture. Living with a local woman let her practice Spanish both in and away from class.

“This is a great way for computer science students to get study abroad experience,” Brown says. “I learned I can speak Spanish and live in a Spanish-speaking country.”

She plans to continue to use her language skills in Boston. Brown explains, “It may help with my volunteer work. Many of the middle school students I work with speak Spanish. I hope to practice my Spanish and connect with them at that level.”

Having completed Dialogue of Civilizations, Brown is halfway to a Latin American Studies minor now. She’s also eager to try a location away from Boston for her next co-op.

“I think it helps to have life experience that rounds out my education,” Brown says. ■

UNDERGRADUATE RESEARCHERS *continued from page 6*

writing code, fixing bugs, and designing subsystems. By summer’s end, they had unfinished work but planned to continue to make progress during the academic year.

Along the way, they gained new knowledge of both computer science and themselves. Shargo explains, “I learned a lot about adapting. This taught me how to get acclimated to a new environment. Working in an environment where you’re not the only contributor and people are pulling from the source code all the time was challenging and a new experience.”

The summer project provided Schwerts with new perspective. He says, “I feel I was rewarded with the chance to grow in ways I would never have realized I could. I’m more confident of my abilities regardless of what I end up doing. I think I’ll be a better team member and a more effective leader.”

For both students, the experience added to the appeal of a career in academia and research, although they aren’t yet certain of their future directions. Whatever his path, says Shargo, “Being on the cutting edge, being able to contribute whatever I can to the wealth of human knowledge, is a fascinating prospect.” ■



Student researchers Ryan Schwerts (left) and Jim Shargo spent the summer working with Professor Olin Shivers.

Gifts from Alumni Create New Motivation for Students

Brian Wenzinger BS'89 and Yiannis Tsiounis PhD'97 believe in motivating students. The gifts each recently made to the College of Computer and Information Science are a reflection of this belief.

A partner in Aronson+Johnson+Ortiz, a Philadelphia investment firm, Wenzinger provided \$100,000 to fund CCIS undergraduates interested in pursuing a unique opportunity or idea. This is the second time Wenzinger has shown significant support for undergraduates of the college; he previously established the Jane K. Wenzinger Scholarship Fund in his mother's honor.

Wenzinger views his latest gift as encouraging students to be highly motivated, engaged, and positive ambassadors for the college. He says, "Co-op doesn't always give students the opportunity to apply the theoretical aspects of what they learn in the classroom. This is another way to get undergraduates more engaged with technology and what they've learned in class. I hope that some interesting piece of research will come out of it, and I'll have had a part in it."

That's already starting to happen. By covering summer living expenses, the Brian Wenzinger Fund made it possible for two exceptionally talented students to undertake a challenging research project, working with Professor Olin Shivers (see page 6).

Tsiounis, a New York entrepreneur whose work to date has been in the financial industry, also made a gift of \$100,000. He and his wife created the Yiannis Tsiounis and Kiki Denis Endowed Scholarship Fund for CCIS graduate students, particularly international students. Tsiounis was a CCIS international student himself before he joined GTE Labs as a senior researcher, was a partner in Etolian Capital, and founded two companies, Internet Cash and BQuotes. He realizes that a U.S. education and its associated living expenses can place a financial strain on many students from his native Greece and other countries.



Brian Wenzinger BS'89 (left) believes in supporting students, as do Yiannis Tsiounis PhD'97 and his wife, Kiki Denis.

But Tsiounis also considered it important that his assistance take the form of a scholarship. He explains, "I wanted to do something as motivation, so students know it's something to strive for and work hard to get the scholarship."

As an entrepreneur, Tsiounis viewed CCIS as an "obvious choice" for his philanthropy, saying, "The environment helps people become entrepreneurs. Supporting computer science is one of the best ways to promote the next wave of innovation. A lot of ideas come out of the minds of students."

In deciding to provide support for students, these CCIS alumni are part of a national trend in giving to higher education. Today, many donors are more motivated to help students.

"The philanthropic goals exhibited by these two alumni are notable in their focus on encouraging students to reach beyond expectations, either by competing for merit-based scholarships or seeking to extend their knowledge beyond the standard curriculum," says CCIS Dean Larry Finkelstein. "This is especially beneficial to our college because many of our students are capable of achieving far more than they ever thought possible." ■

Alumni Notes

1980s

Ian Campbell BS'86 is the chief executive officer for Boston-based Nucleus Research, an investigative research firm that assesses the value of technology.

Marge Ginsburg BS'87 was appointed associate practice leader at IBM Global Services in August. She lives in New York City with her husband and daughter.

Michael P. Landino BS'87 is the enterprise content management (ECM) practice director at Burntsand, a division of Open Text, a business consulting and technology services company. He lives in Pepperell, Massachusetts, with his wife and five children.

John F. Murphy BS'87 is the director of global industry and product marketing for Infor Global Solutions in Massachusetts.

Xiao-Dong "Jack" Yang BS'87 opened the Asia Pacific office of Fidelity Investments in 2008 and is now the managing director and CIO for the Asia Pacific region.

George Kassabgi BS'88 is the co-founder and chief operating officer of Keas, an online health-care solutions company. He recently joined Bouvé College's Health Sciences Entrepreneurs Network to mentor students interested in health technology.

William T. Mayo BS'88 directs supply chain IT at Biogen Idec, a global biotechnology

company. He is also a lecturer for Northeastern's College of Professional Studies.

Elizabeth Cosgrove BS'89 is a systems analyst with United Health Care in Hartford, Connecticut.

1990s

Sean Condon BS'91 is a financial advisor with New York Life Securities LLC. He lives on the North Shore of Massachusetts with his wife and two daughters.

Steven Davi MS'91 is the vice president of software engineering for Seachange International in Acton, Massachusetts. He also ran in Northeastern's Big Dog 5K race again this year.

New PhD Program Responds to Need for Improved Cyber Security

The College of Computer and Information Science is now offering a PhD in Information Assurance program for students interested in advancing the reliability and security of cyberspace as researchers, educators, and policy advisors.

The new program is the college's latest response to the tremendous demand for highly trained information assurance professionals, both domestically and internationally. Program graduates will gain the knowledge and skills government, industry, and academia need to combat the cyber attacks, identity theft, computer viruses, and electronic fraud that are occurring with increasing frequency.

The interdisciplinary nature of the PhD program makes it unique in the Boston area and only the second of its kind in the country. It combines a strong technical foundation with a policy and social science perspective, drawing on faculty and courses in the College of Computer and Information Science and those from Northeastern's electrical and computer engineering, criminal justice, and social sciences programs.

The new program reflects Northeastern's commitment to increasing the presence of interdisciplinary faculty in information assurance. For example, Professor Engin Kirda, who co-founded and co-directs the International Secure Systems Lab, will arrive in January with a joint appointment in the College of Computer and Information Science and the College of Engineering (see page 3). The two colleges will conduct another joint search for a new faculty member in information assurance during the current academic year.

"Students will have access to faculty with varied backgrounds," says Associate Dean Agnes Chan, who directs CCIS graduate

education and was instrumental in developing the PhD curriculum. "The program also provides exposure to practical problems."

The program includes required courses on such topics as networks; hardware, software, and network security; cryptography; risk management; and policy. Students can choose from three tracks—network/communication security, system security, and policy/society—and take additional electives in computer and information science, software engineering, and research methods.

According to Chan, the PhD program is a natural path for both students in the college's MSIA program who want to pursue research and those with bachelor's degrees who are interested in research-focused careers. Students who enter with an undergraduate degree will typically need four to five years to complete the program, and they will be awarded a master's degree en route to the PhD.

The new PhD program builds on Northeastern's overall strength in education and research in the field. The National Security Agency and Department of Homeland Security has designated Northeastern as a National Center of Academic Excellence in both information assurance education and research. The university is also home to the Institute of Information Assurance (IIA), an interdisciplinary research center overseen by both the College of Computer and Information Science and the Department of Electrical and Computer Engineering in the College of Engineering, and the recipient of a National Science Foundation grant to train the country's next-generation cyber corps. In addition, Northeastern is the lead institution in the ALERT Center, a multi-university Department of Homeland Security Center of Excellence involved in research, education, and technology related to threats from explosives. ■

ALUMNI NOTES

Walter Hursch MS'92 is a partner in Zuehlke Engineering, where he also serves as the firm's chair. He lives in Zurich, Switzerland, with his wife and four children.

Yung-Fong "Frank" Tang MS'93 is a senior software engineer with Google in California. He recently returned from a long-term assignment in Beijing, China.

Kenneth Cain BS'94 is a software engineer with Mercury Computer Systems in Massachusetts.

Joseph Baldassini MS'95 serves as the liaison to Vandenberg Air Force Base in California for MIT Lincoln Laboratory.

Danna L. Sturdivant BS'95 is an information systems engineer with Philips Medical Systems in Massachusetts.

Alicia V. Zaanoni BS'96 is a principal product engineer with Motorola in Lowell, Massachusetts. She lives in Chelmsford with her husband and two children.

Hasmukh Ranjan MS'97 is the vice president of IT for Synopsys in California. His wife, Kobita, is a 1996 CCIS graduate.

2000s

David W. Smiley BS'00 is a software engineer at MITRE and co-author of the Solr 1.4 Enterprise Search Server, released in August 2009.

Andrea Grimes BS'05 is a fifth-year PhD student at Georgia Institute of Technology. In June, she married Lonnie Parker IV, another PhD candidate there.

Bryan Haggerty BS'05 lives in San Francisco and joined Twitter as a mobile UX designer in April.

Dave Herman PhD'10 now works full-time at Mozilla in Mountain View, California.

Alumni are important to the college, and we'd like to hear from you. If you have news you'd like to share, please contact director of development Jennifer Wong at je.wong@neu.edu or 617.373.4038. ■



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Mozilla and PhD Student Benefit from Static Analysis Breakthrough

When Mozilla recently announced its new Web service called DoctorJS, the company gave enthusiastic credit to its College of Computer and Information Science summer intern. He was PhD student Dimitrios Vardoulakis, and DoctorJS, which provides type inference for JavaScript, is based on the static analysis he implemented at Mozilla.

A static analysis is a way to analyze source code without executing a program, and the CFA2 static analysis Vardoulakis developed is more precise than existing methods. For example, it can infer the types of variables and functions in dynamic programming languages such as Scheme and JavaScript.

During his summer internship, Vardoulakis designed and implemented a static analysis for JavaScript to provide informative code completion in the Mozilla Skywriter editor. Like DoctorJS, it is based on CFA2.

"I was able to implement my analysis for JavaScript, which is probably the most widely used programming language in the world right now... This was nice because I had the opportunity to apply CFA2 to something very pragmatic, and it did very well," Vardoulakis says.

He's now discussing other ways his static analysis can be applied at Mozilla, which could lead to additional research. The possibilities include using it with the Mozilla Cross Reference tool or to run security checks for Firefox add-ons.

By working with Mozilla, Vardoulakis extends what has become a continuing and productive relationship between the California company and the College of Computer and Information Science. He is the third CCIS student to collaborate with Mozilla in recent years, following Dave Herman PhD'10 and postdoctoral student Sam Tobin-Hochstadt. Herman is now employed full-time at Mozilla and supervised Vardoulakis's work over the summer.

With the new academic year, Vardoulakis has returned to Northeastern to continue his doctoral research on CFA2 and prepare to complete his PhD in computer science in 2011. But he and Mozilla remain connected: The company is providing a grant to support his research this year.

Vardoulakis believes the ability to use his static analysis with a variety of applications will enable it to have an immediate and broad impact.

"CFA2 can help build better debuggers and optimizers for higher-order languages," Vardoulakis says. ■