the LINK

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By the year 2040, there will be more people than food to feed them. SCS researchers are using AI to change that.

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Massive AI Is Coming

Long before there was a School of Computer Science, great Carnegie Mellon minds were already contemplating the nature of intelligence and if machines had any. In the 1950s, Allen Newell, Herb Simon and Cliff Shaw developed the first AI program — well before AI was even a thing. Called Logic Theorist, it demonstrated the problem-solving skills required to prove theorems and underscored that yes, these new things called computers were indeed intelligent.

Since then, intelligent computers have come to pervade our lives, mostly thanks to computer science. For most people, AI is a normal part of their day. You might not have Rosie from "The Jetsons" doing your laundry, but your phone's virtual assistant may help you navigate a tricky route to an unfamiliar destination. Your thermostat might automatically adjust based on your schedule and habits. Social media and online retailers use algorithms to display the news and on-sale items most relevant to your interests.

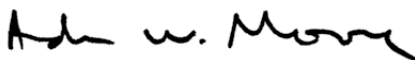
In short, AI is changing how we live.

Newell and Simon didn't just create the first AI. They also joined with Alan Perlis to define computer science as "the study of the phenomena surrounding computers." AI clearly fits into that definition, and as the birthplace of both CS and AI, CMU has an obligation to remain the top place in the world to study both. As such, under the keen eye and minds of Manuela Veloso, Jaime Carbonell and Martial Hebert — three world leaders in AI — SCS is developing an ambitious strategy to study and create new frontiers in AI. We must continue pioneering ways to make AI safe. To create the operating system of autonomy. To not merely understand the ethical questions posed by AI, but to take action on those questions. And finally, to hit the AI jackpot: to generate the technology that will negotiate on our behalf, make legal decisions transparent, and in which software checks itself for faults and automatically makes improvements.

SCS is nothing without CMU, and we're not alone in our AI efforts. While it's still early to determine how it will impact the School of Computer Science, the university recently announced a $10 million gift from K&L Gates LLP to establish the K&L Gates Endowment for Ethics and Computational Technologies at Carnegie Mellon. This, combined with our own SCS-led initiative, almost guarantees that CMU will be THE AI powerhouse in the future.

That's a big claim, but we can back it up. Research is always a priority, of course, but Carnegie Mellon is foremost an educational institution. While there were many compelling reasons to take this job two years ago, what brought me back to SCS was that our students are here because of the impact they can make. When you talk to our undergraduates, they really care about not just algorithms, but how they're used in the world. We're training the people who will improve all our lives through technology, and who have taken responsibility for what happens in the rest of the century. And this year, we're training more of them, and in almost even numbers of men and women. (See more about this on page 22.)

Exposing these hugely talented human beings to the best AI resources and researchers means one thing: a future we can't even imagine. But it's one I can't wait to experience.



Andrew W. Moore
Dean, School of Computer Science

Introducing SCS Moonshots

The first search engine. The first wired — and a decade later, wireless — campus. The nation's first robotics institute and the advent of artificial intelligence. All of these initiatives started in the School of Computer Science. Each has transformed our lives.

Today, a new SCS Moonshots initiative continues this rich history of boundary-breaking innovation. While research projects abound in all seven SCS academic units, those selected as Moonshots have been presented to an interdisciplinary team of faculty and staff who have deemed them the most likely to significantly impact the world in the years to come. SCS Moonshots receive the financial support and resources necessary for taking risks and achieving success from the Dean's Innovation Fund, and are vetted by the SCS College Council and Alumni Advisory Board.

In keeping with CMU's legacy of world-changing innovation, the Moonshots projects will prove that when the best and brightest minds focus on a common goal, amazing things happen.

This story, first in a series to be featured in The Link, introduces you to one of those Moonshots: FarmView.

For more information about SCS Moonshots projects, email moonshots@cs.cmu.edu.

By the year 2040, there will be more people than food to feed them. SCS researchers are using AI to change that.

FarmView Uses AI To Feed a Growing Planet

Linda Schmitmeyer

A sustainable solution to the emerging world food crisis may be sprouting in an unlikely place — an artificial intelligence lab in the basement of Carnegie Mellon University's Robotics Institute.

Grain sorghum, a coarse dry grass that originated in Egypt more than 4,000 years ago, grows in Senior Systems Scientist George Kantor's laboratory, where he and other researchers monitor the plant's growth.

Kantor is part of FarmView, a multidisciplinary SCS research endeavor to develop a comprehensive system of sensing, robotics and artificial intelligence technologies that will improve plant breeding and crop-management practices through automated, data-driven decision tools.

"By the year 2040 there will be more people than food to feed them," Kantor said. "If we could increase the yield of grain sorghum by 50 percent, we could make a tremendous difference in food production worldwide."

But why sorghum? With more than 42,000 known varieties, sorghum has huge genetic potential that can be exploited to create a new high-yielding, high-protein variety that does well with minimal care on marginal lands in varying climates. It's drought- and heat-tolerant, and grows in famine-prone parts of the world.

And why would a world-renowned computer science school — rather than a land-grant university — conduct research on grain sorghum? Because by using the advances in these new technologies, plant scientists can understand crop growth in ways once unimaginable.

In Kantor's lab, for example, a four-wheeled robot travels slowly between rows of sorghum, collecting data that computers will analyze and use to make decisions about breeding a high-yield plant. The robot is equipped with a camera, a laser scanner to measure the plant's geometry, and a multispectral camera that looks at non-visible radiation bands and measures plant function. In field plantings, the CMU researchers use drones and stationary sensor networks to measure plant growth on a macro scale. Researchers also use artificial intelligence to understand how a plant's genetics and environment affect its growth.

"These technologies are helping grain sorghum breeders develop a variety that will result in optimum yield," Kantor said. "By precisely measuring all the parameters, breeders and plant geneticists can better select for traits such as high yield, disease resistance and drought tolerance."

This past August, CMU's four-wheeled robot traveled from its Pittsburgh lab to South Carolina to collect data and measure sorghum plant function. CMU's lead partner on this is Clemson University.

Carnegie Mellon's FarmView researchers are collaborating with a number of large public universities with expertise in agriculture and plant sciences, including Texas A&M, Penn State, Colorado State, Washington State, the University of Maryland and the University of Georgia. South Carolina's Clemson University is the lead partner on the grain sorghum project.

Farming smarter

Agricultural land use is near capacity worldwide, and soil degradation, climate change, expanding population centers and competition from energy crops are expected to reduce available acreage even further. Water is another problem, with agriculture using 87 percent of the renewable fresh water supply. To feed the two billion more people expected to be alive in 2040, food production must become more efficient.

"We need a paradigm shift in how we grow food," Robotics Research Professor Sanjiv Singh (CS 1991, 1995) recently told the audience at a CMU-organized, National Science Foundation-funded workshop on vertical farming, where researchers explored ways to increase crop yield and decrease water consumption both by a factor of 10. "The path we are on is unsustainable," he said.

Carnegie Mellon's FarmView team is confident that the coarse dry grass growing in the basement lab in Pittsburgh will make a difference.

"We need a paradigm shift in how we grow food. The path we are on is unsustainable."

— Research Professor Sanjiv Singh

Growing horticulture and nursery crops in controlled environmental agricultural systems, like vertical farms and greenhouses, produces greater yield and uses less water, but specialty crops are labor intensive. Vineyards and orchards also require a great deal of care.

"Part of what FarmView is about is developing automation systems that can support specialty crop management," said Stephen Nuske, a systems scientist in the Robotics Institute. "One of our goals is to develop inexpensive robotic systems that small- to medium-scale growers can afford to implement."

Nuske's research includes using robotics in orchards and vineyards, where they detect the size, number and quality of the fruit. Other CMU-designed robots are being tested in greenhouses to rotate plants, transplant seedlings and map the canopies of hydroponic plantings.

"We're beginning to study plant foliage in orchards and vineyards and how it intercepts light," Nuske said. "That analysis is also being applied to growing grain sorghum."

Using robots, Nuske maps the number and size of the sorghum leaves, as well as the architecture of the plants' canopies.

"We're seeing that the orientation and angle of the leaves is indicative of how well a plant is growing," he said. "The breeders will select sets of plants based on these phenotypes, these characteristics, and next year they'll plant new varieties that have been crossed with this year's selection."

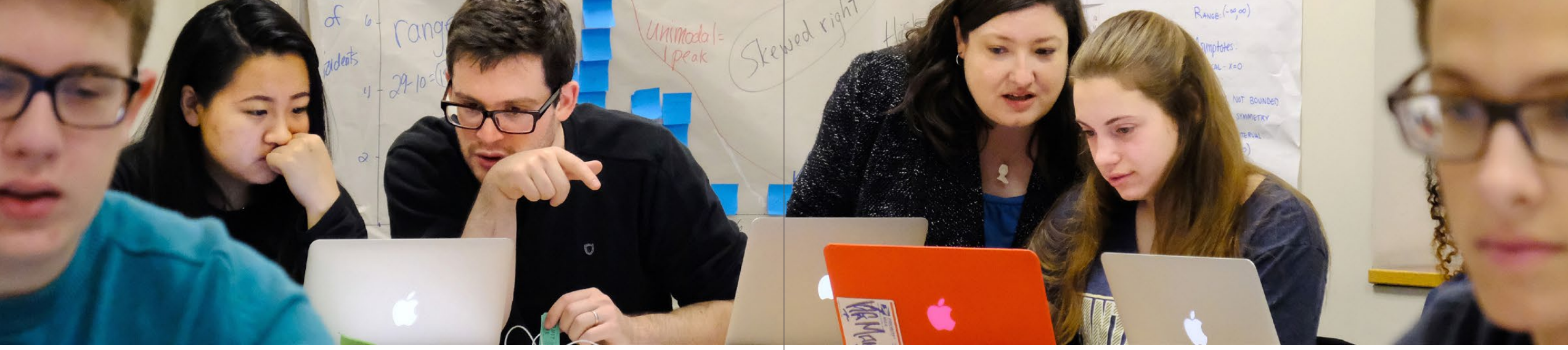
Although there is no timeline for increasing the yield of grain sorghum, bioenergy sorghum breeders have reported that they expect to double plant yield in five years.

Investing wisely

"Investment in agricultural research has traditionally gone into foods costlier than sorghum," Kantor said. "With farmers growing sorghum the same way for centuries, the amount of sorghum they're getting hasn't changed. If we can breed a better variety, farmers can produce more food without updating their infrastructures or changing how they farm."

According to the United Nations' Food and Agriculture Organization (FAO), one in nine people lacks the food they need to be healthy and lead an active life. And that number will only increase as the population curve outpaces the food production curve. FAO research also shows that an investment in agriculture is five times more effective in reducing poverty and hunger than an investment in any other sector.

The FarmView team believes that the coarse dry grass growing in the basement lab in Pittsburgh could make all the difference.



Team Teaching for Tech

Meghan Holohan

CS professionals and high school teachers are revolutionizing CS education through TEALS.

As the CEO and founder of the Pittsburgh startup App Certain, Spencer Whitman (CS 2007, E 2012) learned firsthand how important it is to introduce high school students to computer science. Sure, he could find talented programmers for his company, but he worried about how many computer scientists were in the pipeline, and if that talent would dry up. And while his career progressed and he transitioned to Google and then to his current role as general manager at Rent Jungle, one thing remained constant: the small number of future computer scientists in Pittsburgh.

"I became very passionate about seeing Pittsburgh grow its technical capability and watching the number of startups grow and flourish," said Whitman, who earned his bachelor's degree in computer science and a master's in ECE. "I have a chip on my shoulder that Pittsburgh should be more of a tech community than it is today, and a big part of that is starting CS education earlier."

Enter SCS Assistant Dean for Outreach Mark Stehlik, who told CS alumni (Whitman included) about the school's new partnership with Microsoft to offer the **Technology Education and Literacy in Schools (TEALS)** program in the Pittsburgh Public Schools.

Initially launched as a partnership between Microsoft and the University of Washington, TEALS pairs volunteer computer science professionals with high school teachers, who may or may not have experience in computer science, to team-teach CS classes. The collaboration is mutually beneficial — the teacher learns computer science fundamentals from the CS professional, while the computer scientist learns classroom management from the teacher. Over the course of two years, the teacher uses what they learn from their CS teaching assistant to gradually take full responsibility for the class. The result is a strong cadre of empowered teachers ready to train the next generation of computer scientists.

While TEALS originated in the Pacific Northwest, it soon began expanding to locations across the country. Carnegie Mellon became involved this past February, when SCS realized that it needed to be more involved in early computer science education and Microsoft was looking to establish a TEALS program in Pennsylvania.

"We recognized that the earlier you can expose people to the discipline, the more likely they are to have an interest," Stehlik said.

Five Pittsburgh Public Schools — Allderdice, Brashear, CAPA, Carrick, and the Science and Technology Academy — now offer one of three classes: introduction to computer science, computer science principles or AP computer science.

Whitman immediately jumped at the chance to volunteer. "When the TEALS opportunity came along, it totally aligned with my feelings," he said.

But Whitman represents only one part of what makes TEALS so successful. The other parts are Jessica Nebgen, a University of Pittsburgh alumna who co-TAs the class with Whitman, and CAPA math teacher June Beighley.

"I haven't taught computer science for a long time, maybe 12 years. I wanted to teach the course, and while I thought I would be able to figure out the programming, I was really nervous about the computer science principles," she said. "It's wonderful to have the support in the classroom."

By introducing students to computer science professionals — people who program, build robots and design apps — TEALS also helps students gain a true understanding of what it takes to build technology.

"We are a bridge between industry and education," said Nathaniel Granor, lead program manager of the TEALS East region, who, along with Pittsburgh TEALS manager Courtney Hodge, worked with CMU and the Pittsburgh Public Schools to launch the program. "The need here is really great. Tech companies are eager to fund pipeline initiatives and are looking for ways to grow more talent."

But TEALS goes beyond simply increasing interest in computer science majors and minors.

"We also believe that computer science is a foundational skill set, just like reading, and for the 21st century for whatever industry or role you are in, there is potential for you to use computer science and critical thinking," Granor said.

That philosophy reflects President Obama's Computer Science for All initiative, which aims to empower all American students to learn computer science and have the computational thinking skills they need to be creators in the digital economy, and to be active citizens in a technology-driven world.

Stehlik hopes TEALS will bring that kind of computational thinking to groups that remain underrepresented in computer science. Improving access to CS at the high school level helps schools like CMU and its peers recruit more diverse students, which remains essential for the future of the industry.

"The more our workforce mirrors the customer base, the more successful the products are," Stehlik said. "We get better results with more viewpoints at the table."

Interested in becoming a TEALS volunteer? Email thelink@cs.cmu.edu for more information.

CMU and Pittsburgh lead the way in developing autonomous vehicles — and in making their software and hardware as safe as possible.

How Safe Is Your Self-Driving Car?

Scott Fybush

The next time time you try to cross Forbes Avenue, look closely at the cars speeding past. Few other locations on earth offer such an excellent opportunity to spot vehicles operating autonomously—controlled not by the human at the wheel, but by sophisticated software and hardware that combine to dodge obstacles and perhaps even improve traffic flow. That's because researchers across a variety of disciplines at Carnegie Mellon are not only building that hardware and software, but are also working hard to keep it safe from anyone who would try to use it maliciously.

One of the autonomous vehicles you might see on the Pittsburgh roads is a Cadillac SRX developed by Raj Rajkumar, the George Westinghouse Professor of Electrical and Computer Engineering, who has a courtesy appointment in the Robotics Institute. After spending five years testing self-driving vehicles on public roads in Pittsburgh and Cranberry Township (and more recently in Washington, D.C., and Harrisburg), Rajkumar says that primary safety concerns include both physical security and cybersecurity.

"Even though more and more computers are being introduced into vehicles, it's been assumed that any data introduced was valid," he said.

That trusting attitude harkens back to the early days of the internet. "It was a very friendly, collaborative community," Rajkumar said. "In those days, everyone knew who was using the internet. Now it has become a medium in which security attacks and malware happen, because security was not built into it. We have tried to learn from those attacks, deploying security technology from the start in autonomous vehicles."

Rajkumar notes that autonomous vehicles already feature obvious cybersecurity precautions, like using encryption and signatures in data being transmitted within a vehicle, from vehicle to vehicle, and from the outside world. But he also notes that there's a focus on authentication and data freshness. Someone can access data and replay it to confuse a self-driving car. Or an intermediary can inject itself into a trusted communications channel and insert incorrect data. The goal is to ensure that the vehicle can identify such data and ignore it.

On the physical security side, there's also an emphasis on verification. "If laser sensors are being used, for instance, people can fake them with fake laser signals," Rajkumar said. "But in the physical world, laws of physics have to be obeyed. A speed cannot be more than, say, 150 miles per hour, for instance, so you can use those physical constraints."

Professor Raj Rajkumar's Cadillac now roams a 33-mile stretch of Pittsburgh roads. It has also hosted test drives for state and federal officials — all with a human driver ready to take over just in case.

"What's really great is that at CMU we have the right mix of people to talk to for our research…"

— Associate Professor of Computer Science André Platzer

Those crosschecks with reality have helped CMU scientists in their real-world work with autonomous vehicles. Associate Professor of Computer Science André Platzer recalls an incident where GPS data failed. "One of our collaborators was driving along and the GPS claimed he was suddenly no longer in Pittsburgh, but had jumped to Shanghai," he said. "So your system has to be robust and know those things can't really happen."

Platzer is involved in DARPA's High-Assurance Cyber Military Systems (HACMS) project to learn from the military's experience in developing hardened technology for controlling those systems. His work includes research on safety assurance technology for autonomous ground robots and air-traffic control — challenges that parallel research into self-driving cars.

"One of the things we've looked at over the years is whether you can add a clever form of pervasive adaptive cruise control into cars, so that on highways it makes sure cars stay safely separated," Platzer said. "It's so two cars don't crash into each other, but also so there are no ripple factors." Those ripple factors, Platzer said, could lead to two self-driving cars inadvertently creating a sudden roadblock that prevents cars further down the road from driving safely.

Platzer's research has shown that in controlled circumstances, these challenges can be solved. In the real world, though, autonomous vehicles will share the road not only with human-driven vehicles that may be less predictable, but also with other autonomous vehicles from different manufacturers that can't talk to each other.

That presents another challenge. If a self-driving car is programmed to respond too conservatively to too many possible problems, it could be self-defeating.

"It is imperative that safety controllers actually maintain safety, but it also won't help people if as soon as they turn on the safety feature in their car, it simply refuses to move," Platzer said.

The more information that's moving back and forth within and among autonomous vehicles, the better they work, Rajkumar says — but the greater the potential for danger.

"Vehicles that are driving themselves can benefit from communicating with other vehicles. They can tell you what they're seeing and you can tell them what they're seeing. You can literally talk to the infrastructure around you, and you can do it at a longer distance than any of the sensors in the car can see," Rajkumar said. "But once you're able to communicate to the outside, it means others can use that as a portal to an attack."

That's one reason Rajkumar and Platzer both stress the continued importance of keeping a human alert and ready behind the wheel. Rajkumar's Cadillac now roams roads in Oakland, Squirrel Hill and Cranberry Township. It has also hosted test drives for federal, state and city officials — all with a human driver ready to take over just in case.

"The technology has been progressing very rapidly, but there's still some way to go in having cars without any operators that can freely roam urban streets with dense traffic, cyclists and the like," Rajkumar said.

"What's really great is that at CMU we have the right mix of people to talk to for our research," Platzer said. "On the one hand, there's verification results, assurance techniques, a lot of math behind that. On the other hand, it's also great to have people in robotics and engineering to talk to who are building many of these self-driving cars … so we're asking real questions that matter to them."

Guy Blelloch

Jason Togyer (DC 1996)

Computer Science Professor Guy Blelloch joined the CMU faculty in 1988, after earning his bachelor's degree at Swarthmore and his M.S. and Ph.D. from MIT. His research focuses on parallel programming languages and algorithms, including work on parallel algorithms for sorting, computational geometry and graphs, and developing the NESL programming language. He has served as the general chair for the ACM Symposium on Parallelism in Algorithms and Architectures, and is a fellow of the Association for Computing Machinery. He chaired the committee that created the Gates and Hillman Centers, and in 2016 was named SCS associate dean for undergraduate programs.

You might recognize Jason Togyer, who wrote this article, as the former editor of The Link. Jason played a pivotal role in the School of Computer Science, not only editing The Link for eight years, but also providing video and photography services, project management, wordsmithing and writing — basically any communications task you can think of. He made the decision to move on to new adventures this past summer, and we thank him for the dedication, passion and commitment he brought to SCS and to Carnegie Mellon University every day of his CMU career. Thanks, Jason, for being such an important "link" in the School of Computer Science.

You were born in England and moved to the U.S. in middle school. Was there culture shock?

Oh, yes! All of a sudden, people wanted to talk about baseball, and I wasn't even sure what baseball was!

When did you become interested in computing?

When I was an undergrad, majoring in physics. I had a summer job creating cognitive tutors that could teach high school students geometry. It was the very early age of the PC and we were working in an obscure programming language called Forth. The other programming language I had learned was APL. I didn't start with the standard languages of the day, such as BASIC, PASCAL or C, and in some ways, it's affected how I've thought about computer programming ever since.

What about computer science appealed to you?

There were so many directions you could go, and so many avenues you could explore. A friend of mine said you could view open problems as a wall of cubbyholes. In physics, 90 percent of those cubbyholes were filled, but in computer science, 90 percent of them were open.

When did you become interested in algorithms and parallel processing?

While I was at MIT, I worked during the summers for a company called Thinking Machines, which built one of the first massively parallel machines. It had 64K processors, much larger than any other at the time. Ultimately, the company wasn't successful, but it was exciting to work for a company that was involved right at the beginning of parallel computing.

You mentioned that working in Forth and APL gave you a somewhat unusual outlook on programming languages. What does that mean?

In APL you work at a high level with aggregate data and arrays, as opposed to BASIC and PASCAL, where you're writing in loops and with single elements. One of my most cited papers is on the power of doing scan operations in parallel — a scan operation takes a sequence of values and for each position returns the sum of all previous elements — and I first got interested in the scan operation using APL.

Your current research is on developing algorithms for parallel machines. Why can't we just use the same techniques that worked on single-processor machines and run them on however many cores?

If you have 100 different sets of numbers that you want to sort and 100 processors, you can do that easily. That's what they call an "embarrassingly parallel program." But what if you have only one very large set of numbers and 100 processors? Then it becomes much more complicated because what the processors do is not independent at all. You have to be able to break the set into pieces and figure out how to coordinate and communicate among the processors.

Why? What sorts of problems arise when those processors are interdependent?

The potential for bugs increases greatly with parallelism. There is, for instance, the concurrency problem, where one processor is affected by the values written by another processor. You can get different answers if your processors are not exactly synchronized. If you run your program at one time, and one processor finishes earlier than another, you might get one answer. If you run it at a different time, you might get a different answer. The cost of algorithms using parallel computers is also different than those using sequential processors. And while there's a long tradition of analyzing algorithms for sequential machines, it's less clear how to analyze the costs of using parallel machines.

What kinds of data do you work with?

Anything that can be processed. Most recently, I've worked on graph algorithms — social networks, for instance, where the nodes of the graph are individuals, and the friendship relationships are the links between the nodes, or the edges of the graph. These graphs can get very big — we may be talking about more than a billion users. Graphs have many applications besides social networks. In engineering, graphs are used to represent finite element meshes, where a physical structure can be represented approximately as elements connected together in a graph. Again these can be very large.

How is computer science education adapting to the rise of parallel computing?

It has become even more important to be careful and prove that your programs are correct, and to work in programming languages that are safe, and which, to the extent possible, protect you from problems such as concurrency bugs. We now teach parallelism in Introduction to Data Structures, and we teach a style of parallelism where students cannot create those concurrency problems. At the end of that class and in later classes, we describe what to do when you're moving outside of safe languages and programming styles and have to deal with concurrency issues.

What do you enjoy outside of computer science?

I enjoy architecture — buildings, not machines. That's why I became involved in the design of the Gates and Hillman Centers. Architecture, like computer science, is a mix of elegance and engineering. In architecture, you have to make sure the building stays up, but at the same time you're trying to achieve a measure of elegance. Some people think of computer science as just "hacking" to solve a problem, but as with architecture, there's beauty in a good algorithm or good code beyond just getting the job done. With algorithms and code, if something is long, messy and inelegant, it's almost certainly going to be hard to understand, hard to maintain and hard to extend.

In addition to your teaching, you recently took on the role of associate dean for undergraduate programs. SCS used to enroll about 130 students in the undergrad program each year, but this year you increased it to a goal of 175. What was some of the reasoning behind that decision?

We have huge demand for our program, no shortage of qualified students and the best undergraduate CS program in the country. So we'd like to be able to educate more students in the program. However, we will need to balance growth with available resources, and this will take some careful planning.

Meet Your Souped-Up Smartwatch

Thanks to new functionality developed by Human-Computer Interaction Institute researchers, your smartwatch could soon recognize objects and activities by monitoring the vibrations that occur when you hold something or use a tool.

It could even be used to help tune a guitar. All that's required is a software upgrade that repurposes the device's existing accelerometer, allowing it to act like a vibrational microphone.

This new technology, dubbed ViBand, was developed by Ph.D. students Gierad Laput and Robert Xiao — both members of the HCII's Future Interfaces Group — and their adviser, Assistant Professor Chris Harrison. Rather than detecting sounds transmitted through the air, ViBand works with the body to detect bio-acoustic signals. A ViBand-enabled watch can tell if someone is tapping on the forearm, palm or back of the hand. It can detect finger flicks, scratches and other motions. It can also sense if a person is holding various mechanical and electrical tools, such as an electric toothbrush, power drill or handsaw.

"It's as if you're using your hand as a detection device," said Laput, suggesting totally new uses for smartwatches. "The hand is what people use to interact with the world."

The team presented a paper describing their work in October at the Association for Computing Machinery's User Interface Software and Technology (ACM UIST) Symposium, where they took Best Paper honors.

A recipient of the Mark Stehlik SCS Alumni Undergraduate Impact Scholarship reflects on his time at CMU and looks ahead.

Ananya Kumar

Aisha Rashid (DC 2019)

School of Computer Science senior Ananya Kumar joined the Carnegie Mellon community four years ago, determined to make the most of his time on campus. His story so far shows that it's almost mission accomplished.

It helped that he had a jumpstart in programming, which the Singapore native picked up in his early teens. He spent his last two years of high school at the National University of Singapore High School of Mathematics and Science, where he learned subjects like data structures and algorithms. Even before he stepped on the CMU campus, he'd participated in programming competitions and was involved in graph theory research.

Once he arrived at CMU, Kumar began traveling the path that would lead him to be named one of this year's recipients of the Mark Stehlik SCS Alumni Undergraduate Impact Scholarship, which is awarded annually to undergraduate SCS students who strive to make a difference not only in the field of computer science, but also in the world around them.

Beyond his work in the classroom, Kumar's been making that difference primarily in two ways: undergraduate research and his work as a TA for Great Theoretical Ideas in Computer Science.

As a junior, Kumar's research focused on programming language theory — specifically, understanding and analyzing programs related to arrays. In fact, his paper on parallel functional arrays was recently accepted to the Principles of Programming Languages Conference in France. This year, Kumar is taking graduate-level courses and performing research for his senior thesis. The work, which he's undertaking with Computer Science Professor Avrim Blum, centers around machine learning, which he chose because it's at the intersection of fun and application. "There's much to explore, because we don't know which algorithms work in which context," Kumar said.

In addition to performing research, Kumar has also served as a TA for 15-251: Great Theoretical Ideas in Computer Science. "It was the class I saw people learning the most in, and was probably one of the most challenging core classes," he said. "It aims to teach you how to think better, which is one of the most critical things you need as a computer science major: learning how to think better and to deal with hard problems."

Kumar attributes his ability to make the most of his CS education to his advisers and professors. After spending time with them, he was motivated to expand his learning experiences beyond the classroom.

With just one semester left in SCS, this Stehlik Scholar plans to pursue a Ph.D. after graduation and focus on core research problems in the field. At the same time, he makes sure that he paces himself and enjoys the fruits of his labors.

"I think at CMU there's a strong tendency to take a lot more than you can handle, and that's not wise because people come in with different experiences," he said. "We should focus on making sure we enjoy ourselves, too — we have a long way to go, even after CMU."

Women Make Up Almost Half of the SCS Class of 2020

Women make up more than 48 percent of incoming first-year undergraduates this fall in SCS, setting a new school benchmark for diversity. A 38 percent increase in the number of women who applied for admission with SCS as their first choice contributed to this year's record enrollment, said Guy Blelloch, associate dean for undergraduate programs.

"Even though we've increased enrollment, our admissions have become more competitive," Blelloch said, noting that average SAT scores, grade point averages and class rank were up for this year's incoming class. "For example, the average combined math-reading SAT score for women went from 1537 last year to 1552 this year. It's identical to that for men and significantly higher than the overall average SATs at top schools such as MIT, Harvard and Stanford."

Women and men are judged by the same standards for admission, and retention rates historically have been the same for both, he noted.

"Parity in numbers, record SAT scores, class rankings and retention!" said Lenore Blum, professor of computer science. "This is an amazing milestone and the happy outcome of CMU taking the leadership role in increasing the participation of women in computer science, particularly in the most rigorous undergraduate CS program on the planet."

SCS has long been a national leader in increasing the participation of women in computer science. Blum was instrumental in establishing Women @ SCS, a faculty/student organization that helps women make connections across the school, and in recognizing that it's the computer science culture — not the curriculum — that needs to change to accommodate women.

This year's class of 166 first-year undergraduates is about 30 percent larger than previous classes. SCS decided to expand undergraduate enrollment in response to the growing need for computer scientists in industry.

President Obama Visits Campus for White House Frontiers Conference

In October, President Barack Obama made his fifth visit to Carnegie Mellon for The White House Frontiers Conference — a gathering of national thought-leaders to discuss building America's capacity in science, technology and innovation.

The conference, co-hosted by CMU and the University of Pittsburgh, included discussions about new technologies, challenges and goals in areas ranging from artificial intelligence and robotics to "smart" communities, health care and space exploration. Science and technology demonstrations were also on display, including CMU driverless vehicles and drones, a snake robot, service robots and a socially aware robot assistant.

SCS conference participants included SCS Dean Andrew Moore; Robotics Professor Stephen F. Smith; Astro Teller (CS 1998), captain of Moonshots at X; Red Whittaker, University Professor of Robotics and chairman and chief science officer for Astrobotics; and Jeannette Wing, vice president of Microsoft Research and a consulting professor of computer science.

"Pittsburgh has been revitalizing itself through technology for a very long time," President Obama said. "The Steel City is now home to groundbreaking medical research and world-class universities. It's the birthplace of some of the most advanced artificial intelligence and robotics systems the world has ever seen."

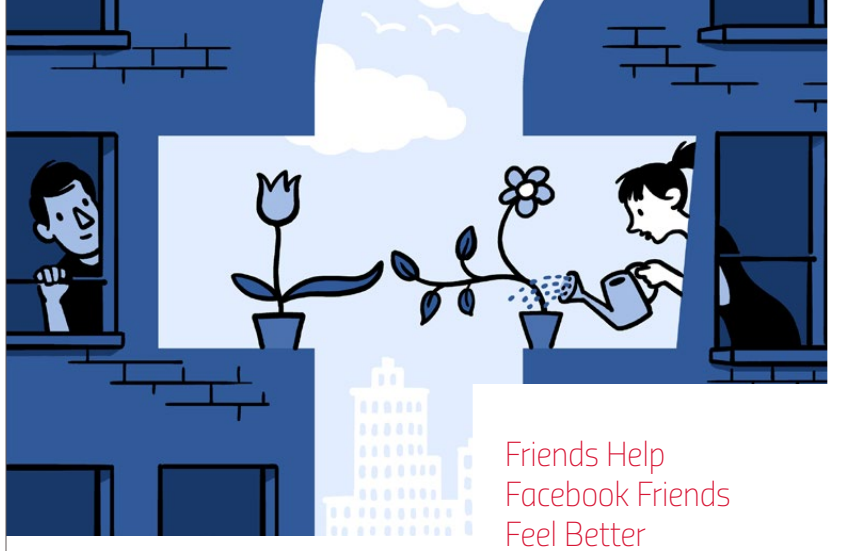
SCS Launches Undergrad Major in CompBio

SCS will offer a new bachelor's degree program in computational biology next fall, complementing the Computational Biology Department's existing Ph.D. and master's degree programs. The program will prepare students for high-demand positions in the biotechnology and pharmaceutical industries, as well as for medical school and graduate studies across the spectrum of computation and biology.

"Computer science increasingly is driving the research agendas in any number of disciplines, including biomedical research," said SCS Dean Andrew Moore. "That's why it's especially important for a degree program in computational biology to be within our school, providing students with the rigorous computational perspective for which we are famous."

Though SCS offers numerous master's and Ph.D. programs in a variety of general and specialized computer science areas, the new bachelor's degree in computational biology will be just the second undergraduate program within the school, joining the Computer Science Department's bachelor's degree program that began in 1989. Admitted students in computer science will also have the option to add computational biology as a minor or second major.

"With the new program, we are providing a curriculum designed to train students to tackle the biomedical problems of the next century through rigorous training within one of the leading computer science institutions in the world," said Robert F. Murphy, head of the Computational Biology Department. "An important goal in designing the curriculum was to retain the outstanding grounding in computer science associated with the CS major, while making room for coursework in biology and computational biology."



Carnegie Mellon Featured on "60 Minutes"

When CBS's "60 Minutes" decided to do a two-part report on artificial intelligence, they came to Pittsburgh to see the state of the art and talk with SCS Dean Andrew Moore about where AI is taking humankind. That report, by correspondent Charlie Rose, aired Oct. 9. (You can watch it at www.cbsnews.com/videos/artificial-intelligence.)

In addition to Rose's interview with Moore, the report also featured the National Robotics Engineering Center's autonomous boat; the CHIMP disaster response robot; and the Computer Science Department's Gabriel, a wearable cognitive assistant.

Carnegie Mellon was also highlighted in an online-only "60 Minutes Overtime" report, in which the university is described as a "wonderland of innovation."

Friends Help Facebook Friends Feel Better

Leaving a comment on a friend's Facebook post may seem trivial, but a study from CMU and Facebook researchers shows that those comments can have a big impact on your friend's feelings — as much as a big life event such as getting married or having a baby.

But not just any interaction has these positive effects. Reading posts or "liking" something won't move the needle. What really makes people feel good is when someone they know and care about writes personalized posts or comments. Sixty comments from close friends in a month were associated with increases in users' psychological well-being as large as those associated with major life events.

"We're not talking about anything that's particularly labor-intensive," said Moira Burke, a research scientist at Facebook who earned a Ph.D. in human-computer interaction at CMU and completed the study with the Herbert A. Simon Professor of Human-Computer Interaction Robert Kraut. "This can be a comment that's just a sentence or two. The important thing is that someone, such as a close friend, takes the time to personalize it. The content may be uplifting, and the mere act of communication reminds recipients of the meaningful relationships in their lives."

Android App Lets Visually Impaired Listen to Texts in Native Languages

Millions of visually impaired people in India may benefit from free, open-source software for Android devices that converts electronic text written in Indian languages into messages they can hear.

Text-to-speech software is commonplace in the United States and many parts of the world, but good quality TTS for Indian languages is difficult to find, difficult to use or unaffordable. Language Technologies Institute Professor Alan Black and his research team developed a system that enables the creation of a baseline TTS after recording two or three hours of clear, consistent speech from a native speaker. The app converts text to speech in real-time without internet access, as most people in India either do not have continuous internet access or cannot afford it.

"Making it available as free, open-source software thus was a key goal," Black said. "People should be able to download this and it should just work. We put a lot of effort into making this accessible and easy to use."

The software, called Hear2Read, can be downloaded for free from Google Play.

Algorithm Detects Online Fraudsters

Fraudsters, watch out! A new algorithm developed at CMU makes it easier to tell if someone has faked an Amazon or Yelp review, or if a person with a huge Twitter following may have bought and paid for that popularity.

The method, called FRAUDAR, makes it possible to see through the camouflage that fraudsters use to make themselves look legitimate, said Christos Faloutsos, professor of machine learning and computer science. In real-world experiments using Twitter data for 41.7 million users and 1.47 billion followers, FRAUDAR fingered more than 4,000 accounts not previously identified as fraudulent, including many that used known follower-buying services such as TweepMe and TweeterGetter.

"We're not identifying anything criminal here, but these sorts of frauds can undermine people's faith in online reviews and behaviors," Faloutsos said. He noted most social media platforms try to flush out such fakery, and FRAUDAR's approach could be useful in keeping up with the latest practices of fraudsters.

Computer Out-Plays Humans in "Doom"

If you've played the classic first-person shooter video game "Doom," you know that kill or be killed is the name of the game. But an artificial intelligence agent developed by two LTI students has proven to be the game's ultimate survivor — outplaying both the game's built-in AI agents and human players.

The students, Devendra Chaplot and Guillaume Lample, used deep-learning techniques to train the AI agent to negotiate the game's 3-D environment, still challenging after more than two decades because players must act based only on the portion of the game visible on the screen.

In late September, the Visual Doom AI Competition, in which AI agents played against each other in deathmatches, announced that the duo's agent had placed second to a team from Facebook in one track and second to a team from Intel in the competition's other track.

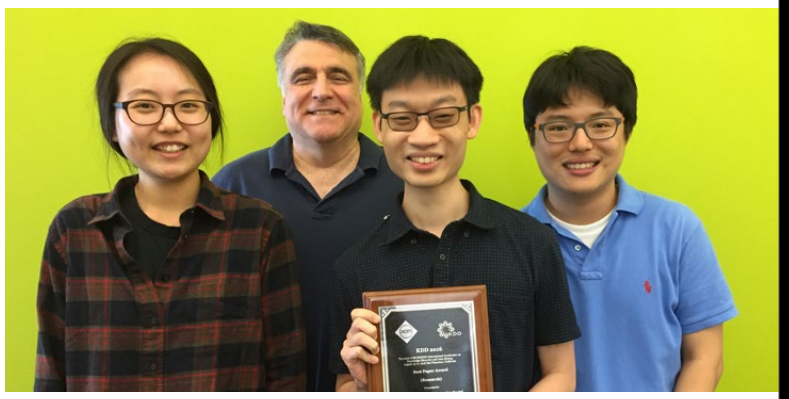
"The fact that their bot could actually compete with average human beings is impressive," said Ruslan Salakhutdinov, an associate professor of machine learning. Simply navigating a 3-D world, much less competing successfully in this game environment, is a challenge for such AI agents, he noted.

Omnidirectional Mobile Robot Has Just Two Moving Parts

More than a decade ago, Robotics Professor Ralph Hollis invented the ballbot, an elegantly simple robot whose tall, thin body glides atop a sphere slightly smaller than a bowling ball. The latest version, SIMbot, has an equally elegant motor with just one moving part: the ball. The only other active moving part of the robot is the body itself.

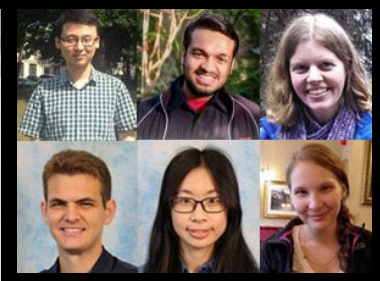
The spherical induction motor (SIM) invented by Hollis and Masaaki Kumagai, a professor of engineering at Tohoku Gakuin University in Tagajo, Japan, eliminates the mechanical drive systems that each used on previous ballbots. Because of this extreme mechanical simplicity, SIMbot requires less routine maintenance and is less likely to suffer mechanical failures. The new motor can move the ball in any direction using only electronic controls. These movements keep SIMbot's body balanced atop the ball.

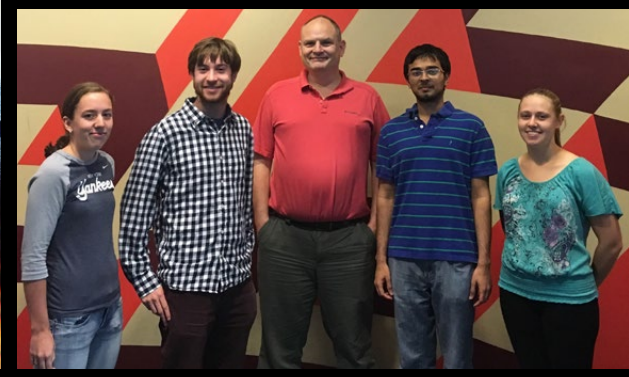
"SIMbot has demonstrated impressive performance," Hollis said. "We expect SIMbot technology will make ballbots more accessible and more practical for wide adoption."



Hyun Ah Song, Christos Faloutsos, Bryan Hooi and Kijung Shin were part of the research team that developed FRAUDAR, a fraud-detection algorithm that won Best Paper at the 2016 Conference on Knowledge Discovery and Data Mining.

Names in the News





Jean Yang (above left) who joined the Computer Science Department faculty this semester, was named to MIT Technology Review's annual list of Innovators Under 35. Yang's research helps programmers reason about how information flows through programs.

A team of sophomore computer science majors at Carnegie Mellon Qatar was one of 12 winning teams in the first-ever online CS50x Coding Contest, hosted by Harvard University this past summer. Team members were Abubaker Omer, Julian Sam, Mohammed Hashim Qusai and Mohammed Abdullah.

EM-Sense, a technology that identifies an electrical or electromagnetic device a person is touching, won the student category of Fast Company magazine's Innovation by Design Awards. The technology was invented by a team that included HCII Ph.D. students Gierad Laput and Robert Xiao, HCII Assistant Professor Chris Harrison, and Disney Research's Alanson Sample and Chouchang Yang.

Raj Reddy, the Moza Bint Nasser University Professor of Computer Science and Robotics, delivered the talk "Too Much Information and Too Little Time" at the Heidelberg Laureate Forum this fall. The forum brings together students and early-career researchers with winners of the Turing Award and Nevanlinna Prize in computer science, and the Abel Prize and Fields Medal in mathematics.

Six graduate students with ties to SCS have been named to the 2017 class of Siebel Scholars. The program recognizes exceptional students in the world's leading graduate schools of business, computer science, bioengineering and energy science. This year's recipients include Jingkun Gao, Akash Bharadwaj, Kristen Gardner, Timothy Lee, Anqi Li and Jennifer Olsen (above left)

Mary Shaw (above right), the Alan J. Perlis University Professor of Computer Science, received the annual George R. Stibitz Computer and Communications Pioneer Award for "seminal and pioneering contributions to software architecture and computer science curricula."

SCS Seniors Kimberly Kleiven, Ananya Kumar, Benjamin Lichtman and Ariana Weinstock (above, bottom) have been named ACS Scholars by CMU's Andrew Carnegie Society.

Ashley Patton and Niccole Atwell

HAVING A BALL
IN THE OFFICE OF ENGAGEMENT
AND ANNUAL GIVING

It's been about a year since Niccole Atwell and I joined the School of Computer Science as the newly formed Office of Engagement and Annual Giving, and to borrow from "Hamilton" (for any of you Broadway fans out there), it's been nonstop since then.

We've learned a lot this year, but one of our first lessons was that computer science alums are FUN! In what other universe would the director of our Alumni Advisory Board have us jump in Google's ball pit for a photo op?

We've met so many of you, on campus and around the country. We've traveled to meet you in Silicon Valley. In Boston, New York City, Seattle. Silicon Valley again. We've learned that you really like swag, but — all kidding aside — that you also want to learn about what's going on at CMU. You want to know what kind of research is happening on campus, and you want to meet the faculty members you remember and ones who might be new to you. You want to talk to our students and hear about their CMU experiences. You want to feel connected.

You've also shown us so much this year. Your spirit of volunteerism and community involvement shined through in your response to our request for participants in both the student mentoring program we began, and in the TEALS tutoring program we're piloting in the Pittsburgh Public Schools. (See the story on page 10.) Some of you have worked with your employers to help sponsor events, and even more of you have chosen to financially support SCS and our students directly. We've recognized these donors in the special section beginning on page 30, and have included a card in this issue to make giving as convenient as possible. You can also make a gift at http://bit.ly/scsgiving2016.

Above all, you've welcomed us into the CMU SCS alumni universe this year and taken us in as part of the family, and that's been incredibly rewarding.

We hope we've provided you with more of the types of interactions with your alma mater that you'd like to have. And while we know that some of you have stronger ties to CMU than others, we're working to strengthen those ties across the board. We have big plans for 2017. We're working on a more robust website that will easily connect you with opportunities to engage with SCS. We're planning events that respond to your feedback and needs. We're working harder to connect you with students, and to help ensure that from the time they enter the Gates Hillman Centers, they feel the same warm welcome into the SCS family that we've experienced this past year.

It sounds like a huge challenge. Sure. But that's our job, and we love to do it.

Ashley Patton
Director of Engagement and Annual Giving
School of Computer Science
Department of Electrical and Computer Engineering
awpatton@cs.cmu.edu

2016 Donor Recognition

July 1, 2015 – June 30, 2016

With 2016 soon coming to a close, we offer special thanks to our donors for their time, engagement with CMU and the School of Computer Science, volunteerism, and donations to SCS-related funds during fiscal year 2016. We've enjoyed connecting and reconnecting with many of you, and we sincerely appreciate your ongoing or first-time support.

Legend

- ❹ Member of CMU's Order of the May, recognizing individuals who demonstrate an extraordinary degree of loyalty and support by giving to Carnegie Mellon each fiscal year (July 1 – June 30); circled numeral indicates years of consecutive support
- ■ Donated to SCS-related funds during fiscal year 2016
- ■ Volunteered time and assistance during fiscal year 2016
- ■ Attended CMU and/or SCS events during fiscal year 2016
- ■ TEALS: Volunteering with Technology Education and Literacy in Schools (TEALS), which helps high schools build sustainable computer science programs by pairing trained computer science professionals — from across techology industries — with classroom teachers to team-teach computer science in high schools throughout the United States. www.tealsk12.org
- ■ Firsthand: Volunteering as an online career mentor for current SCS and ECE students. cmu.firsthand.co
- ■ SCS AAB: Member of the School of Computer Science Alumni Advisory Board

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Twum Kwesi Djin E'11
& Denise Twum ❹
Szilvia Ildiko Dobscha S'85, S'87
Carl R. Doersch CS'10, CS'13, CS'16 ■
Michael Beatty Donohue CS'01 ❼ ■ ■ ■
Charles G. Doomany
& Joan Doomany ❾ ■
Christopher David Dornfeld CS'01, DC'01 ⓬
Richard P. Draves CS'94
& Martha Moran Draves E'86 ❸ ■
David Alan Drinan CS'07, TPR'16
Kavin Du CS'01 ❾
Miguel Duarte CS'10 ■ ■
Geet Singh Duggal CS'15
& Darya S. Filippova CS'16 ■ ■
Richard Duke
& Deborah G. Duke ❼ ■
Michael Thomas Duke E'04, MET'06 ■
Townsend Duong CMU'03 ❹ ■
Eric J. Dusenbury S'88 ⓳
Raka Dutta CS'08 ❾ ■ ■
Robert H. Earhart CS'98
& Rebecca L. Anderson ❷ ■
Jeffrey T. Eaton CS'01
& Connie Deighan Eaton DC'99 ❻
David A. Eckhardt CS'92, CS'02
& Xiaolin Zang ■
David Caram Eklund S'76
& Louise Carol Eklund S'70 ㉜

Christopher Michael Ellison E'10 5
Jonathan L. Elsas CS'11
Sterling Barclay Ely A'03 14
Yi Luen Eng CS'10 6
Edward Rhoads Engler S'86
& Connie Engler
Eric T. Espenhahn S'87 11
Ethan Z. Evans E'91 3
Ningxin Fan CS'15
Carl Farber CS'04 5
Adam R. Farley CS'06 6
Henry Farley 14
Eric Farng CS'98 2
Marc Fasnacht S'98, CS'02, S'03
& Vidhya Ramachandran S'96, S'99 4
Marina Fedner CS'06
& Yuriy M. Goykhman E'05 2
Julian Feldman TPR'59
Richard Dean Fennell S'75 11
Adam Christopher Ferrall-Nunge CS'04
& Elizabeth Ferrall-Nunge CS'07
Raymond Alan Ferrer CS'94
John H. Ferris CS'11
William Onslow Ferry E'98, CS'98 5
Thomas Filardo 4
David A. Fisher S'64, S'70 2
Jason Nelson Flinn CS'01 6
John Michael Flowers CS'11
Wing Yu Christine Fok CS'06
Peter D. Foldes CS'11 2
David A. Fontaine CS'06, S'06 5
Clifton Lloyd Forlines A'99,
MET'01, CS'01
Jodi L. Forlizzi A'97, CS'07 15
Camille F. Fournier CS'01
& Christian Kaiserlian 10
Marshall Edward Fox CS'13
Asa K. Frank CS'15 2
Diane Frank 7
Edward H. Frank S'85
& Sarah Gay Ratchye A'83 22
William Frankenstein E'16
Robert E. Frederking S'87 2
Dan Patrick Freeman CS'11 7
Lawrence A. Freeman
& Suzanne Freeman
John D. Frens CS'14 3
Eduardo Gustavo Frias CS'94 2
Andrew Michael Friedland CS'10 5
Peter M. Friedman CS'10
Earl Fry & Joy Fry
Ping Fu CS'94 4
Talia Fukuroe CS'97 3
Stanislav Funiak CS'07, CS'10
& Sanako Mitsugi DC'08, DC'11
Phani Srinivasa Gadde CS'13
John Michael Galeotti CS'05, CS'07
& Amanda Galeotti 3
Chen Gao CS'13
Lili Gao TPR'13, CS'16, TPR'16
Tan Gao E'12 3
Adrienne Garber CS'05 7
Elmer Garduno CS'12 4
Aseem Vikas Garg CS'03, DC'03
& Anjuli Garg CS'03 6
Philip M. Garrison CS'15, S'15
David Thomas Gauthier CS'99 9
Tanay Gavankar CS'13 2
Jeffrey Gee CS'14
Gesly Abraham George INI'06 10
Darren Robert Gergle CS'05,
CS'06 9
Dean W. Germeyer S'88
Aleksey Gershgorin
& Tatyana Vorokhova 5
Joseph Andrew Giampapa CS'98
& Anna Maria Berta 3
Philip Wells Gianfortoni CS'09, CS'12
Gregory Dean Gibbons S'73
Garth A. Gibson 2
David Stephen Gillen CS'92 3
Jonathan Giloni CS'04, DC'04 6
Daniel R Glaser-Garbrick CS'13
Todd C. Gleason CS'96 3
Brighten Godfrey CS'02 6
Dan Goetz & Laurie Goetz 3
James H. Golden S'88 3
David Scott Goldman S'86 13
Aaron Gideon Goldstein CS'00
Shirley L. Goldstein 42
Hannah Vera Gommerstadt CS'16 2
Ivan E. Gonzalez CS'06 6
Michael Goodman
& Janet Goodman
Richard Thomas Goodwin CS'93, CS'96
Gulsharan Goraya CS'08 2
Michael Daniel Gordon CS'07 4
James Arthur Gosling S'83, S'83
& Judith Borcz 13
Jonathan Goulden
& Kwok Wah Lau 2
Adell Graham E'09
Eric Douglas Grant S'81 17
Thomas Gratzer
& Adeena Gratzer 2
Tammy Green CS'95 4
Lawrence E. Greenfield CS'01 8
Steven Jay Greenfield E'71 21
John F. Gregorski CS'00
Scott Dean Griffin E'12
& Rebecca Griffin
Terri Lynn Griffith TPR'86,
TPR'89 5
Dennis Gronim
Samuel C. Gruber BCSA'14 2
Brian Matthew Grunkemeyer CS'98
Lie Gu CS'09, CS'09
& Yi Zhou CS'07 2
Lingyun Gu CS'07, CS'10 2
Qingyun Gu CS'08 4
Ralph Jeffrey Guggenheim DC'74, S'79
& Marsha Guggenheim 23
Yady Guitana CS'05
Junius A. Gunaratne CS'02 14
Tao Guo CS'15
Yuyang Guo CS'14 2
Anoop Gupta S'82, S'86
& Yumi Iwasaki S'88 4
Ashwin Gupta CS'06
& Ady Gupta A'06, DC'06
Bhavana Gupta CS'11 5
Pravir K. Gupta CS'05 3
Satish Chandra Gupta S'79, S'82
& Sharon Elsbeth Edwards
TPR'82 2
Varun Gupta CS'06 7
Marta Habermann 3
Sean J. Hallgren CS'94 6
Nathan Ryan Halstead CS'04 7
Ian Alan Hamilton CS'99 3
Kevin William Hamlen CS'98
& Rebecca A. Hamlen 8
Kenn Brooks Hamm CS'03 4
Jenny Xue Han CS'10
Mei Han CS'01 & Wei Hua
Xiao Han CS'16
John Arthur Hancock CS'99 8
Scott Hand
Frederick Marion Haney S'68 5
Shawn Karl Hanna CS'14
Emil Lawrence Hanzevack E'71
& Teresa Hanzevack 5
Paul A. Harada CS'02
Samuel Pollock Harbison S'80 4
Mor Harchol-Balter 5
Nicholas Andrew Harper CS'11 6
Michael G Harris CS'15
Evan Haruta & Pau-San Haruta
Robert James Havey DC'95,
HNZ'99 2
Paul S. Heckbert 2
Nicholas T. Heckman CS'08
& Amanda Heckman 7
Douglas R. Heckmann DC'13
Charles Locke Hedrick TPR'73,
TPR'75 16
Cecily Heiner CS'05
Alexander C. Heinricher CS'13 3
Andre T. Heinz
Don Eric Heller S'71, S'77
& Mary D. Heller S'73 25
Amalya Henderson CS'15
Andrew Thomas Hendrickson CS'05
Laine D. Herron CS'15 2
Bruno Hexsel CS'10
Allan Heydon CS'92
& Dina Berkowitz 3
Susan Karen Hinrichs CS'92, CS'95
Laurie Satsue Hiyakumoto CS'08 7
Jeffrey Beng-Hee Ho CS'95
& Pamela Torres 21
Bridget Catherine Hogan CS'11 4
Evan Matthew Hoke CS'07 5
Junki Hong CS'16
Philip M. Hong CS'06, S'06, TPR'09
Roger I. Hong CMU'01, CS'01 2
Bruce Lawrence Horn CS'91,
CS'93 8
Michael L. Horowitz S'88 5
Andrew G. Hoskins CS'02 4
David Jeffrey Housman TPR'05, E'14 7
John David Hrivnak E'78 11
Crystal H. Hsiung CMU'04, CS'04
Goang-Tay Hsu CS'93 7
Chunlin John Hu CS'06
Jefferson Hu E'01, E'01, CS'01 5
Norbert Y. Hu CS'02
& Jenny Lo CS'01
Qifan Hu CS'12
Jiaming Hua & Yanbei Ni
Bilei Huang HNZ'15
Kai Huang CS'03, S'04
Shengjun Huang CS'05 8

Ginger Huang HNZ'92
& Xuedong Huang 10
Wing Hing Huen S'74 15
Fabian Hueppi CS'07 6
Debbie Y. Hugh CMU'05, CS'05
Christine Chi-May Hui CS'97 9
Dale Y. Hui CS'07
James Humphrey
& Holly Humphrey 3
Matthew Z. Humphrey CS'07,
TPR'08
Andrew Thomas Hundt CS'09 6
James Jacob Huttner S'74 2
Jeffrey T. Hutzelman CS'98 2
Max Chia-Hsing Hwang CMU'05 8
Anthony L. Iams S'87
& Christine M. Rosen A'88 5
Savina Naomi Imrhan CS'07 3
Christian Iniguez CS'05, DC'05 3
J. Renato Iturriaga S'64, S'67 5
Dana Hausman Izenson S'88
& Martin D. Izenson 25
Carmen M. Jackson CS'07 3
Richard Jacobs & Janet Jacobs 4
Andres I. Jager CS'06
& Lyndsey Jager E'12 6
Akshay Kumar Jain CS'13
Chandni Jain CS'06
Siddharth Jain CS'09
& Andrea KJ Davis
Sunil K. Jain
Usamah Jamaludin CS'05 4
David R. Jefferson S'80 2
Barbara K. Jensen CS'00 2
David Daniel Jensen CMU'05 10
Filipa Jervis CS'08 6
Peng Jia CS'02
Yan-Bin Jia CS'93, CS'97 2
Chun Jin CS'02, CS'06 2
Zhenlan Jin CS'05 3
Hope W. Johansen CS'01
Alexandra L. Johnson CS'14 3
Andrew Edie Johnson CS'95, CS'97 8
Craig Karl Johnson CS'97 18
David C. Johnson S'87 2
Howard Wayne Johnson
& Elisabeth Adams Johnson 2
Tomasz Johnson
Ajay Juneja CS'04
Rohit Kabadi E'15
Eric C. Kadehjian CS'01 6
Seth Daniel Kadesh CS'94 2
Abhinav R. Kadiri CS'10
Matthew Alan Kaemmerer CS'11 3
Michael Steven Kahn CS'12 4
Kathryn E. Kalas E'06, CS'06
Dirk Lee Kalp S'73 42
Chitra Malini Kalyanaraman CS'04 5
Dheeraj Reddy Kambam CS'14
Arnold A. Kamis S'87 9
Ammiel Kamon S'90 3
Hongwen Kang CS'09, CS'12 2
John Kang CS'13 2
Ruogu Kang CS'13, CS'15
Sing Bing Kang CS'92, CS'94 4
Poornima Kaniarasu CS'13 3
Joel Kanter & Ricki Kanter 11
Jonathan Kantrowitz CS'10 5
Anukul Kapoor CS'97
& Dana C. Siler E'98
Ian A. Kash CS'04
Anna Michele Kasunic HNZ'12 5
Andrew Joseph Katona CS'07 3
Frederick Franklin Kautz E'11
Jennifer Sheila Kay CS'93, CS'96 2
Michael Leon Kazar S'85
& Rebecca Foster 20
Robert K. Kedoin S'87
Michele L. Kee S'87 9
Ariana Keeling
John Ronald Kender S'81 8
Patrick Gunnar Kennedy CMU'07
Marc J. Khadpe CS'00 10
Dia Kharrat E'11
Yik Lin Khoo CS'00, CS'00 3
Alex Khripin CS'06
Alexander Khutoretsky
& Irina Khutoretsky 4
Chang Hyuk Kim CS'96
Duk Kyoo Kim CS'06
Jaepyoung Kim CS'04 3
Jin Seop Kim CS'12 4
Raphael Kim E'14, CS'14, E'15
Taek Goo Kim CS'08
TJ Kim CS'01 10
Won Kee Kim CMU'04 2
Woo Tae Kim CS'05, CS'07
Michael Kimmett CMU'06
& Jennifer Kimmett 9
Nick Kindberg CS'13 2
James Cornelius King S'70 14
Jennifer E. King CS'04, CS'15
Carleton Lee Kingsford 2
Prathamesh Ganesh Kini CS'14
Peter Borman Kinney CS'11, MET'13
Chris M. Kirby CS'93
Latika Kirtane CS'05
James Jay Kistler CS'93 8
Steven D. Klee CS'14, CS'15
Carey Kevin Kloss E'95, E'97 4
Frederick Colville Knabe CS'91,
CS'95 11
Andrew J. Ko CS'08
Myung-Joo Ko CS'04 3
Steven R. Koenig
& Tamberly L. Koenig 6
David Ryan Koes CS'01, CS'06, CS'09
& Mary J. Koes E'02, CS'02,
CS'04 3
Sonia Koesterer A'04, CS'04 5
David William Kohlbrenner CS'11
& Nina Chen 2
Paul William Kohlbrenner S'84
& Marianne Elise Vakiener S'77,
TPR'83 12
Angela Kolosky A'14 3
Saranga Komanduri CS'11, CS'16
Anna Konyukhova CS'12
Sanjeev Jagannatha Koppal CS'05, CS'09
& Eakta Jain CS'09, CS'12
Sergey Kornilov
& Elena Kornilova 4
Douglas Havens Korns S'72 6
David Scott Kosbie CS'90 3
John Richard Koslow S'82 26
Constantin Kostenko CMU'02 14
Amar Kota CMU'04 5
Linda Post Kraai 3
Danielle Elaine Kramer CS'09 7
Brian David Krausz CS'09 2
Marcin Marek Krieger CS'00 4
Akshay Krishnamurthy CS'14, CS'15
George Kuckel 4
Timothy Kuehn CS'14
Ranjitha Gurunath Kulkarni CS'12
Ganesh Kumar CS'07
Manu Kumar E'95, CS'97 9
Nandhita Kumar CS'13
Gaurav Kumkar CMU'03
William D. Kunz CS'02
Ripudaman Singh Kushwah CS'12
Hwan Jun Kwon CS'07 2
Aapo Tuomas Eerikki Kyrola CS'14
Momchil Dimitrov Kyurkchiev E'11
Jay Steven Laefer CS'93 10
Emily Hannah Laiterman CS'13
Alexander Z. Lam CS'14 3
Danny Lam CS'02, S'02 4
James Neil Lampe TPR'00 6
William Andrew Lancaster CS'01 3
James Anthony Landay CS'93, CS'96
& Eileen T. Landay 13
Bridgette Julia Landers CS'96
& Christopher John Mega DC'96 3
Darren Schuyler Lane CS'13
Dirk Langer CS'97 8
Amy Lynn Langlois S'85 4
Stephen Lanier
Hugh Conrad Lauer S'67, S'73 3
Sarah Tann Lautzenheiser E'10 5
Tom B. Lauwers E'03, CS'06, CS'10
& Kristina M. Lamothe Lauwers
S'01 4
Samuel Palumbo Lavery BHA'12, CS'13 4
Anthony S. Lazar CS'09 6
Andrew Adam Lazes CS'94
Christian J. Lebiere CS'90, CS'98 28
Brenda Y. Lee CS'13
Donghee Lee & Eunah Kim 2
Dongryeol Lee CS'05, S'05
Han S. Lee CS'07 6
Janet C. Lee CS'08
Joon S. Lee & Grace Lee 4
Michael Lee
Susan L. Lee HNZ'95
& Peter Lee 2
Robert Seon Wai Lee CS'11, S'11 4
Shannon J. Lee CS'15 2
Stephanie Wan-Ruey Lee CS'08
Ting-Yen Lee E'13 2
Matthew J. Legowski CS'99 4
Philip L. Lehman S'78, S'84
& Jill E. Lehman S'87, CS'89 30
Bo Lei CS'14
Michael John Leibensperger S'82 6
Charles Eric Leiserson S'82
& Wendy Leiserson 6
Richard Allen Lerner CS'91
& Barbara Jean Staudt Lerner CS'89
Chaiyawut Lertvichaivoravit CS'13 3
Derek Leung CS'04 9
Bruce Wallace Leverett S'81 3
Roy Levin S'77 & Jan Thomson

Michael E. Lewis CS'02 & Grace Alexandra Lewis CS'01 14
Kelly Lexa
John T. Ley & Michele G. Ley
Anna Leyderman CS'94 15
Lucy Li CS'11 4
Pengfei Li CS'11 2
Runxin Li CS'10
Shiu Fai Frankie Li CS'04, S'04, S'07, S'11
Shuangshuang Li CS'14
Yiming Li CS'05
Zeyuan Li CS'13 2
Zhizhong Li CS'14
Jason Licht CMU'06
Stephen L. Lieman S'72 2
Kelvin Chenhao Lim CS'05, CS'08 & Margaret Szeto A'07, CS'07 6
Brent Lim Tze Hao CS'12 & Jerene Z. Yang CS'12, S'12
John Lima
Alex Wilhelm Limpaecher CS'13 2
Jialiu Lin CS'13
Weihao Lin CS'09 7
Yibin Lin CS'13 3
Chin Ling CS'03 & Hui Lin Chin CMU'05, CS'05, TPR'05
Elizabeth M. Lingg CS'07, DC'07
Jim Litsas S'77, S'77 25
Kevin Matthew Litwack CS'05
Ariel V. Liu CS'13 2
Cong Liu CS'12 3
Joseph Liu CS'07 2
Karen Liu CS'10
Liu Liu CS'10
Ming Liu CS'11 2
Yandong Liu CS'11 2
Yue Liu CS'13 2
Yufeng Liu S'99, CS'03, S'03 2
Doug Locke S'86 9
Stuart Renwick Locklear CS'99 15
Yee Chuan Loh CS'03, TPR'04 6
Kiran Lokhande CS'13 2
Ralph Leslie London S'60, S'64 19
William G. Long DC'01, CS'02 2
Yan Sheng Long & Zi Ying Long
William James Lovas CS'10
Yucheng Low CS'08, CS'10, CS'13 3
Xiaoxu Lu CS'16
Yong Lu CS'08 & Tao Chen TPR'03, TPR'08 2
Rachel Anne Lucas CS'14
Kevin Wayne Luo CS'12 2
William D. Lusen S'87
Kevin Michael Lynch CS'96 & Yuko Lynch
Nathaniel M. Lyons CS'14
Qiang Ma & Fang Ma 3
Andrew Lee Maas CS'09
Anshul Madan CS'10
Kenneth John Magnes CS'93 14
Rishi Maharaj CS'14, TPR'14 & Nidhi Prasad 2
Austin Patrick Maher S'85 6
Vinod Maheshwari & Prerna Maheshwari

Kai Zhen Mai CMU'05 & Shuai Quan
Suvrajit Maji CS'12
Mun-Thye Mak CS'09 3
Vincent Howe Mak CS'98 & Ru-Chun Amy Fuh S'97 18
Martin S. Makowiecki CS'02 2
Sahan Malagi CS'11
Donna Mithra Malayeri CS'05, CS'09 4
Richard Malehorn & Nancy Sax 4
Bradley A. Malin S'00, CS'02, HNZ'03, CS'06 & Sara Zimmerman Malin DC'00, HNZ'05 13
David Maltz CS'01 4
Pratyusa Kumar Manadhata CS'07, CS'08 & Sargam Garg 4
Naju George Mancheril E'06, CS'06, CS'07 & Rowena Mancheril 5
Leonore Hess Mandelbaum MM'55
Amit Manjhi CS'06, CS'08 22
John Randolph Mann & Susan Williams Mann
Anand Vijay Marathe CS'00
Dimitris Margaritis CS'03 12
Mei Marker CS'93, CS'96 8
Joshua Joseph Marks CS'95 3
Victor Manuel Marmol CS'11, E'13 5
Martin Marra S'85
Chris Martens CS'08, CS'15 3
David S. Martin S'87 & Jacqueline Martin 6
Erik Michael Martin CS'05 12
Nathan James Martin E'13 3
Jacqueline Y. Martinez S'87
Philip Howard Mason S'67, S'76 12
Santosh A Mathan CS'96, DC'00, CS'03 6
Gregory F. Mathis CS'02 7
Auldyn Matthews CS'13
Thomas Braun Mattson S'55, S'57 3
Daniel Ignacio Maturana CS'14
Philip Matuzic E'09
Bruce A. Maxwell CS'96 3
Alexander Kan May E'09, CS'10 & Erin Marie May S'10 7
Carlos Estuardo Mazariegos HNZ'14
Brian Patrick McBarron CS'96 14
Benjamin John McCann CS'06, TPR'06 11
Daniel McCarriar CS'00 & Margaret E. Schervish CS'13 6
Michael J. McCarthy S'88 3
Catherine Dianne McCollum S'81 & Robert McCollum 26
George Angus McCollum CS'95 & Tara Zane McCollum DC'96
Michael McConville & Janet McConville 4
Collin Walter McCormack S'12
John McCortney & Lynette McCortney
Ian Makemson McCullough A'00, MET'01 8
Michael P. McDonnell A'90 5
Patrick F. McGehearty S'80 10
Andrew Abraham McGuier CS'09 & Natalie S. McGuier S'10

David M. McKeown 4
Jason S. McMullan CS'96
Laurie Lee McPherson S'85 3
Maija E. Mednieks CS'14 3
Brendan R. Meeder CS'07, CS'15 & Ariel R. Levavi S'07 10
Patrick Meehan S'84 7
Carl N. Meister CS'00
Andrew O. Mellinger CS'10 3
Michael Grey Merideth CS'05, CS'09 7
Gregory Michael Methvin CS'11 5
Kent Edward Meyer CS'91 3
Phillip Daniel Michalak CS'98 10
Gary Edward Middleton S'86 2
Victor Joseph Milenkovic S'88 5
Lauren Violet Milisits E'13, CS'14 6
Ashley McKnight Miller CS'04 9
Kevin C. Miller CS'01 & Rebecca Leigh Miller E'04 7
Paul P. Miller BCSA'13 2
Danielle M. Millett CS'09 7
Parker Henry Mills CS'04, S'04, S'11 3
Edward A. Miner S'88
Edwin Miranda E'10 6
Jeffrey Scott Mishler CS'94 6
Julian K. Missig CS'06, DC'06 & Alice Ching CS'06 4
Andrew P. Mittereder CS'14 2
Roman W. Mitz CS'01 & Kelli Ireland 6
Jayanth Krishna Mogali CS'16
V. Joseph Mohan S'80, S'84 & Shantha Mohan TPR'82, TPR'85
Thomas Gong Mon CS'94
Robert T. Monroe CS'95, CS'99 7
Andrew W. Moore & Mary S. Lee 2
Mathew Alexander Mooty CS'11 5
Cristina Morales
Deryck Austin Morales CS'02, CS'06 & Natalia T. Guevara CMU'03, HNZ'05 2
Geoffrey Peter Morgan CS'12
Aaron Christopher Morris CS'03, CS'07 & Hana H. Morris CMU'06, DC'06 3
James H. Morris S'63 & Susan Morris MM'66 32
Pedro Mota CS'09
Prashant Shashikant Motewar CMU'07
Mohith Reddy Muddasani CS'13
Christine G. Mular S'88 4
Stefan Klein Muller CS'15 2
Ketan D. Mulmuley S'85
Rob R. Murcek CS'13 2
Timothy Murphy & Sue Murphy 3
Kenton William Murray CS'13
Kary L Myers DC'99, CS'02, DC'06 6
Brad A. Myers & Bernita Myers 23
Elizabeth A. Myers S'84, TPR'88 2
Dzyuba Mykola CMU'07
Robert Naaktgeboren & Susan Birch 7
Anushaa Nagarajan CMU'05 9
Armaghan W. Naik S'02, CS'13 2
Reggie V. Nair E'11 4
Nisha Narayan CS'09
Usha Narayanan CMU'07
Venkat N. Narayanan CS'02 2

Cliff Needham & Katharine Needham 3
Kami B. Neely S'81 & David Karl Neely E'81
Daniel Bertrand Neill CS'04, CS'06 9
Greg Holger Nelson CS'95 11
Edward W. Neubecker CS'02 12
David J. Neville CS'10 5
Theo Nicholas HNZ'01
Christopher T. Niessl CS'10
Edward Niessl & Hana Niessl 10
Kamal Paul Nigam CS'99, CS'01 & Milena Koziol Nigam DC'00
Maya Nigrosh CS'03, A'07
Tanachat Nilanon CS'12 4
Frances Jen-Fung Ning E'02, CS'02, E'03 4
Alex Nizhner CS'01, INI'05 14
Andrew Noh E'11, CS'11, E'12 3
Michael J. Nollen CS'04 6
Robert Louis Nord CS'92 5
Donna Norling
Carol Lucile Novak CS'92 28
Steven Michael Novick CS'09, TPR'10 & Ariel Gold Novick 8
Charles Senti Nyame CMU'05, DC'05
Leah B. O'Brien CS'02
Brendan O'Connor CS'12 & Heather Pon-Berry
Chris C. O'Rourke CS'97 & Stephanie Ellen O'Rourke 3
Arsa Oemar CS'05, TPR'10 2 n n
Kemal Oflazer S'87 2 n
Amy Elizabeth Ogan CS'03, CS'08, CS'11 & Christopher Harrison CS'13 2 n
Paul Taylor Ogilvie CS'03, CS' 5
Kyung Chul Oh CS'03, CS'06
Ronald Bert Ohlander S'75
Koustubh D. O33a 9 n
Yogesh K. Oka CS'04 & Ripple Sharma 10
Jennifer Kaitlyn Olsen DC'10, CS'15 2
Adam Michael Olshansky E'14
Steven J. Onorato E'04, CS'04 13
David R Orr CS'14 3
Jaime Oviedo Silva CS'04 2
Berend Ozceri E'95
Daniel J. Paciulan CS'01 12
Hilary Packer CS'94 8
Vasudeva Pai Melgangolli CS'14
Scott Pakin CS'92 6
Martha Palmer
Michael Konstantinos Papamichael CS'15
Sivaparamesh Parameswaran Ravindran CS'07
Rebecca L. Paren CS'15 2
Jean-Luc Hoon Park CS'94, TPR'98 6
Scott M. Parker CS'01 4
Matthew Pavelle CS'98 5
Marie Colantoni Pechet S'84, TPR'91 20
Brian T. Peck 2
Jorgen David Pedersen E'95, CS'98
Chen Peng
Adam G. Pennington CS'01, E'03 9
Crispin Stone Perdue S'77 7
Francisco Machado Aires Pereira CS'07 7

Mark L. Perlis & Ruth Lis
Adele C. Peterson CS'03 & Carl Robert Peterson E'03, DC'03 2
Marko Petkovsek CS'91 6
Todd E. Phillips S'02, CS'09 7
David R. Pierce CS'93
John Pigeon
Brian R. Pilnick E'06, E'06 6
Ana Gabriela Pinczuk E'10 2
Mary B. Pinkerton 4
Christy Marie Pino MM'66 3
Hunter Alexander Pitelka CS'11 6
Clifford D. Platt CS'98 & Tiffany P. Platt E'01 7
Cheryl N. Platz CS'02 9
Andre Platzer 2
David C. Plaut CS'91 & Marlene Behrmann
Vahe V. Poladyan CS'04, CS'08 & Heather Poladian
Mark D. Pollard CS'96 8
Michael D. Poole E'99, CS'99 & Erika Eve Poole E'00 13
Mikhail Popov DC'13 2
Mark H. Potter CS'14
Mark R. Power
Jakub Poznanski CS'11
Basab Pradhan
Udbhav Prasad CS'15
Katherine Anne Prevost CS'00
George Walter Price 14
Greg Price CS'06 & Margaret Barusch 6
James J. Price S'88
Keith Edward Price S'77 32
William Robert Price S'74
Ariel Procaccia
John M. Przyborski CS'14
Robert J. Punkunus CS'01 8
Jie James Qi CS'09, S'09 6
Liangsheng Qian CS'04 8
Zhi Qiao CS'06 2
Shannon Qiu CS'99
Yan Qu DC'94, CS'01 10
Siong Kar Quek CS'00, TPR'00 6
Joshua M. Quicksall DC'12 4
Mariena E. Quintanilla CS'05 & Jose Quintanilla 5
Amy Mija Catalina Quispe CS'16 3
Paul Raff CS'04, S'04, S'05 & Audria C. Stubna S'06 8
David Earl Rager S'91
Chandrasekaran Ragothaman CS'12 3
Dinesh Ramadoss CS'10 2
Sricharan Amand Ramanujapuram CMU'05 8
Kannan Ramaswamy CS'00
Ramesh Ramiah CS'13
Chenyang Ran CS'16
Navneet Naresh Rao CS'14
Vibha Rao CS'14
Vishal Rao CS'00 13
Robert Stephen Raposa CS'97 3
Antoine Roland Raux CS'09 7
Barbara J. Ray 13
Scott Michael Raymond CS'98 19
Rajesh C. Reddy CS'98 7

Douglas Allen Reece CS'92 & Carole Warner Reece
Robert Wilson Reeder CS'08 7
Douglas R. Rees S'80 8
John A. Rentzepis S'88 8
James L Reyes CS'14
Margaret E. Richards CS'08 4
John Malcolm Ricker A'73 6
Glen Meyers Riley S'81 32
Matthew Riley E'08, CS'08 & Melitta Riley CS'07 2
Renee Nicole Rivas Davis CS'07 & Mark D. Davis E'07
Jose German Rivera CS'95
Meghan P. Rivera CS'06 & Michael A. Rivera E'07 7
George Gordon Robertson S'78 14
Thomas Lee Rodeheffer S'85 10
Christopher J. Rodriguez CS'00, CMU'07 10
Douglas Lee Taylor Rohde CS'02 8
Kathleen A. Romanik S'85 12
Michael J. Rondinelli CS'01 & Kousalya Valluripalli E'10 7
Jerome David Rosen E'93, CS'93, E'95 5
Martin J. Rosenberg E'08 3
Paul Simon Rosenbloom S'78, S'83 7
Ronald Rosenfeld CS'91, CS'94 & Ilana Diamond
Michael Hayden Rosenthal CS'97 3
Manuel A. Rosso-Llopart CS'92 & Catherine A. Llopart 10
David Christian Rothenberger CS'93, CS'96 6
Steven Michael Rubin S'74, S'76, S'78 32
Ivan Ruchkin CS'14 2
Hotze Rullmann
John Joseph Rusnak S'90, S'90, E'09 4
Paul Martin Russo S'86 & Allison G. Russo AM'88 5
Thomas W. Ruttle CS'08
Olatunji O. Ruwase CS'13 3
Michael David Rychener S'77 7
Bob Rychlik E'97, E'97 8
Ignacio Saavedra CS'16
Engin Cinar Sahin CS'06, CS'08 & Duygu Basaran Sahin 3
Merline Saintil CMU'05 10
Jevan D. Saks CS'03 & Ling Xu CS'04, CS'08, CS'11 6
Had Salman
Erica F. Sandbothe CS'09 & Evan C. Wright INI'08 5
Michael F. Sandbothe CS'12
Akanksha Saran CS'14 2
Cindy Saroha CS'15
Shigeru Sasao CS'09
Mahadev Satyanarayanan S'79, S'83 & Deborah C. Kelly HNZ'94 24
James Benjamin Saxe S'78, S'86 9
Steven R. Schaffer CS'01, S'01
William L. Scherlis & Ann Gibbons Scherlis 7
Robert Blake Schmidt TPR'86 & Patricia J. Schmidt 22
Joshua P. Schnarr CS'06 2

Timothy K. Schneekloth CS'03 & Janice S. Schneekloth CS'01, CS'03 9
Edward Anton Schneider S'70, S'76 4
Gregory C. Schohn CS'00 2
Kyle J. Schriver CMU'02, DC'02 & Michelle Schriver 6
Jeffrey J. Schroder CS'08
Brian J. Schuster CS'99 7
Russell S. Schwartz 10
Peter Martin Schwarz S'79, S'84 17
Edward Lloyd Screven S'86
Ross Edward Scroggs S'74
Arthur Todd Sedano CS'96, CS'99
Alexa Selwood
Natarajan Senuvasan CMU'08 7
Prasanna Seshadri CMU'15 2
Karim A. Shaban CS'08, TPR'11
Ilari Alexander Shafer CS'13 3
Ami Jitendra Shah CS'94 & Nimesh R. Shah
Devang S. Shah CS'00
Suruchi Shah CS'15
Syed Umair Ahmed Shah CS'01
Michael I. Shamos & Julie V. Shamos 2
Yang Shan CS'10, MET'11
Zhen Shan TPR'02 & Jimin Liu TPR'02 9
Edwin Shao TPR'09 2
Paul Y. Shao CS'00 6
Sharad Sharma E'11 4
Jason Michael Sharp CS'10 6
Mary M. Shaw S'72 & Roy Weil E'70 32
Sergey Alexander Shchukin CS'05 2
Matthew Sheby CS'99 5
Qian Shen E'01, CS'01 2
Xiang Shen CS'07
Yixiao Shen CS'11
Andrew D. Sheng CS'13 3
Donald Shepard & Emily A. Maitin 12
Alexander Benjamin Sher CS'14
Mark S. Sherman S'79, S'83 8
Ben Shi & Guilan Chen 3
Hideki Shima CS'06, CS'15 & Mie Shima 2
Byoung-Chul Shin CS'07 8
Anton Shokhrin E'14
Biao Shou & Xiaoyin Chang
Timothy J. Showalter CS'98
Geeta Shroff E'08, CS'08, CS'10 & Divyanshu Vats E'09, E'11 2
Jefferey Allen Shufelt S'90, CS'93, CS'96 & Stacey Lynne Jacobs TPR'90, TPR'93 11
Heung-Yeung Shum CS'96 7
Rhonda Shumate
Parthiban Siddharthan CS'11
Robert J. Siemborski CS'03 & Jennifer Kathryn Smith CS'03, MET'05 10
Daniel P. Siewiorek & Karon Siewiorek 18
Mark Brian Silverman CS'97 7
Robert J. Simmons CS'09, CS'12 4
David Anthony Simon E'87, CS'93, CS'97
Tanmay Sinha CMU'06, CS'06, TPR'14 3
Shafeeq Sinnamohideen E'00, CS'10 6
Elizabeth Howard Slate S'87, DC'88, DC'91 14
Donald J. Slater 15
Timothy Sloane
Jean Marie Sloat TPR'14, A'15 & Marc Benjamin Zinck CS'02 3
Lisa Marie Smith CS'00 & Joshua J. Smith E'00 4
Lori A. Smith S'85, DC'92 6
Michael Francis Smith & Maria R. Smith
Sylvia J. Smith 2
Aaron Butler Snook CS'12 4
Boris Sofman E'05, CS'05, CS'07, CS'10
Selvamraju Somalraju CS'13 3
Hyeonho Son CS'08
Mingyang Song CS'14 2
Nan Song CS'06, S'06 & Zhanwu Liu DC'07
Sheng Song CMU'07 9
Yanze Song CS'14
Miguel E. Sotolongo & Maria I. Sotolongo
Luis Miguel Sousa CS'09 7
Richard Duane Spear E'86, TPR'89 & Kathryn Louise Spear S'86 9
Alfred Z. Spector 11
Byron G. Spice 10
Daniel John Spoonhower CS'09 & Katherine Ann Copic 3
Ashish Srivastava CS'12
Jesse Lee St Charles CS'12
Gloriana St. Clair 18
Matthew Luchak Stanton CS'14
Matthew K. Steedle CS'11 4
David Cappers Steere CS'92, CS'97 & Jody Steere
Mark Stehlik & Sylvia Stehlik 4
David M. Steier S'86, CS'89 8
Christopher Ryan Stengel CS'93, TPR'00 7
Craig A. Stephen S'88 & Christina Stephen 2
Benjamin Stephens CS'09, CS'11 4
Jeffrey R. Stephenson CS'99 7
Katherine Marie Stepp CS'08 2
Michael A. Stevens CS'07 & Sarah Nacey 12
Anna Stickel 2
Diane L. Stidle 15
Michael Storey & Valentina Storey
Cort William Stratton CS'01, MET'03
David A. Strauss CS'05 9
Dow M. Street CS'97 6
Edward Stritter & Leilani Stritter
Ashley Stroupe CS'00, CS'03 5
Eric F. Stuckey CS'97 & Mia K. Markey S'98
Jeffrey Su CS'11 4
Neeraja Subramanian CMU'08 & Murali Gopal 5
Noor Rosyida Sudin CS'96 & James J. Ruggiero TPR'96
Rahul Sukthankar CS'97 & Gita Reese Sukthankar CS'00, CS'07
Bruce Summers & Mary L. Summers 3
Bryce W. Summers CS'16 4
Yongxing Sun & Ruilan Yan 3
David Dahwei Sung S'71 & Linda L. Ma Sung S'70 12
Kishore Sunkeswari Prahallad CS'10 3
Joshua S. Sunshine CS'13
Preethi Sureshkumar CS'14
Alan Lawrence Sussman CS'91 13
Brandon Atsushi Suzuki CS'96
Selva Bharathi Swaminathan E'12
Charles W. Swanson CS'14 3
Daniel Scott Swanson E'85 & Karen L. Swanson E'85 25
David Reeve Sward CS'95 21
Syahrul Nizar Syahabuddin CS'97 7
Desney Swee-Leong Tan CS'04 6
Chun How Tan E'12, E'12, CS'12 4
Mark Lao Tan E'13
Ming Tan CS'89, CS'91 & Minghui Xie 3
Paul C. Tan & Josephine Kwan Tan 2
Donald Tang CS'03 2
Paul Tanner CS'09 2
David Read Tarditi CS'97 11
Daniel J. Tasse CS'08, CS'15 6
James A. Tawa & Mary Beth Tawa 4
Stephen J Tawa CS'12 3
Anita A. Taylor CS'07 12
Krishan A. Taylor CS'10
Michael David Taylor CS'11 4
Christopher D. Tchou CS'99
Omari D. Teel CS'02 4
Ming Han Teh CS'12
Ronald Y. Teng CS'01 & Sandy Yong 6
Chye Liang Vincent Teo CS'11, CS'12 3
Leong Hwee Teo CS'99, CS'99, CS'11 3
Michael Teper CS'97
Thomas Terrill CMU'08 8
Matthew A. Tesch CS'11, CS'13 4
Avadis Tevanian S'85, S'88
Ermine A. Teves TPR'08, HNZ'14 7
Pratyush Tewari CS'14
Brian E. Thompson CS'06 9
Brian K. Thompson S'87
David Ross Thompson S'84, DC'87 & Betty Weiss S'85 2
Kathleen Ong Thompson CS'01 & Brandon Thompson 13
Sang Tian CS'13
Scott Phillips Tietjen S'82 8
Daniel Jon Tilkin CS'99, S'99 15
Robert Elliott Tillman CS'10, DC'11 3
Ethan Jeremy Tira-Thompson CS'02, CS'04 & Sylvia Arifin TPR'03 3
Daniel Ross Tobias S'86 28
Gilman Edwin Tolle CS'03 & Diane Marie Loviglio BHA'05 3
Zeynep Tolon TPR'08 & Ryan W. O'Donnell

Wesley J. Tom CS'02 10
Jack Tomayko 8
Paul David Tompkins CS'01, CS'05 4
Tianqi Tong CS'14 & Ziwei Hu CS'14
Boriska Toth CS'03
William Benjamin Towne CS'12
Brian Trong Tran E'12
Chanh-Duy N. Tran CS'02 4
Jonathan Douglas Tran E'06, CS'06 3
Christopher M. Tremonte CS'02 10
Sukit Tretriluxana CMU'07 9
Reginald Trinidad & Marseille Manansala 2
David Tu CS'10 5
Venkata Shyam Kiran Tumuluri HNZ'12 2
Christopher L. Tuttle CS'02 6
Julia Elizabeth Tuttle CS'11 5
Puneet Uppal & Abhilasha Uppal
Vignan Uppugandla CMU'15
Vijay Sai Vadlamudi CS'04, TPR'13 & Sailakshmi Vadlamudi 7
David Vail 2
Karen L. Van Dusen S'87, TPR'00 & Peter P. Su S'87
Richard Van Horn CMU'07
Walter van Roggen S'82
Kathryn Louise Van Stone CS'03 & Robert P. Smith
J. Michael Vandeweghe CS'02 6
Timothy A. Vaughan CS'13 2
Alexandre Vauthey CMU'06 & Valerie Orsoni 4
Raul Alejandro Vejar Llugany CS'09
Robert Anthony Veltre CS'91, TPR'00 4
Conrad M. Verkler CS'14
Kyle E. Verrier CS'13
Jean-Philippe Vidal CS'89
Sumeet S. Vispute E'04
Kaushik Viswanathan CS'08 4
Jorge L. Vittes CS'03 3
Mauricio Vives CS'98 & Laura H. Vives DC'97 9
Daniel Music Vogel S'02 8
Robert Irwin Voigtmann CS'09, TPR'10 & Janice Lee Chen E'13 7
Luis A. Von Ahn CS'03, CS'05
Jocelyn P. Vopni A'00 4
Ryan M. Voss E'04, E'04 & Randi L. Voss E'04 8
Richard M. Voyles CS'97
Robert Dorman Waaser E'11, CS'11, INI'12 3
Richard Wagner & Marlo Wagner
Robert Alan Wagner S'69 16
Aaron Wald CS'98 & Ann Wald CS'98 5
Jacob Charles Walker CS'14
Keith Michael Walker E'10
Kevin Rathbun Walker CS'96, CS'00
Corinne Michelle Walters CS'11
Eugene S. Wan 13
Nathan Lap-Yan Wan E'11, CS'11
Alan Y. Wang & May Wang 3
Bo Wang HNZ'12 2
Carl Wang CS'06 9
Chen Wang CS'14
Haibo Wang CS'14
Haiyan Sophie Wang CS'09
Jue Wang CS'05 9
Lei Wang E'13, CS'15
Robert Y. Wang CS'04 6
Ye-Yi Wang DC'92, CS'98 6
Yuchun Peter Wang E'04 & Abra Wang 11
Yun Wang CS'12
Zijun Wang E'16
Mary C. Ward S'85 12
Anthony I. Wasserman & Susan Wasserman 7
Ronald Watzman & Anne Watzman
Jason P. Weill CS'02 10
Scott Abraham Weiss CS'92 3
Jon Bruce Weissman S'84 2
Justin David Weisz CS'03, CS'07, CS'09 6
David A. Weitzman CS'07 9
William Claude Welch CS'95 2
Carl K. Wellington CS'05 5
Connie S. Wen CS'14 2
James Wallace Wendorf S'87 & Roli Garg Wendorf S'86 17
Andrew Michael Wesie CS'11 6
Michael J. West S'87
Alex Robert N. Wetmore CS'96 4
David S. Wettergreen S'87, E'89, CS'95 & Dana R. Wettergreen S'87
Matthew Weyant E'00, CS'07 & Elizabeth R.M. Weyant DC'00 3
Mark Damon Wheeler CS'93, CS'96 3
Bradley William White S'88 & Barbara White 2
Spencer M. Whitman CS'07, E'12
Joseph Skeffington Wholey S'84, CS'89, CS'91 6
Andrew P. Widdowson CS'05
Karl A. Wieman S'88 4
Stephanie Williams 2
Todd Andrew Williamson S'91, S'91, CS'94, CS'98 5
Max Willsey CS'16 3
Robert Max Willsey & Lisa Shumate-Willsey 4
Gail D. Wilson CS'16 3
Lambert E. Wixson S'88 6
Adam A. Wolbach CS'06, CS'08 8
Benjamin Scott Wolf CS'10
Hao-Chi Wong CS'95, CS'00 4
Theodore Ming-Tao Wong CS'01, CS'04 10
Wesley Sei-Ching Wong E'11 4
Richard R. Wongsonegoro S'87 19
Daniel Colin Wood S'83 3
Gareth Wood CS'01
Glenn Wood E'11 2
James Mark Wright S'81 & Pamela J. Wright DC'85
Eric Anyao Wu CS'12
Gang Wu CS'15
Jiazi Wu CS'15
Leejay Wu CS'98, CS'05 13
Pang Wu E'11 2
Xiaoming Wu CS'15
Tian Xia CS'14, DC'14, S'14
Jiaye Xie CS'14
Minjie Xin E'13 2
Song Xiong CS'15
Hanze Xu CS'15
Lan Xu CS'12
Min Xu CS'12, CS'15
Ming Xu CS'99 13
Shuchun Xu CS'14 2
Tom Z. Xu CS'14
Andrew S. Yang A'01, CS'01
Bo-Chieh Yang CS'99 3
Dewey Yang CS'07 4
Jeffrey Shiann Shuey Yang CS'94
Julia Yang TPR'16
Ke Yang CS'02, CS'04 3
Zhengrong Yang CS'01 5
Bennet Sze-Bun Yee CS'94 5
Chei Charles Yeh E'84 & Mary Mannling Yeh
Thomas Yeh & Jessica C. Yeh 4
Thomson Yeh CS'16
Carl Edward Yeksigian CS'09 & Alexandra M. Kontopoulos DC'10 5
Mark Yeksigian & Patricia T. Yeksigian 10
Chandrashekhar Yeleshwarapu CMU'08
Peter S. Yi S'87
Michael Stephen Yin CS'07 6
Jacky Chun-Kit Yip CS'10 2
John S. Yocca S'87 3
Gary Dalton Young CS'98, S'98 2
Kathleen Yu E'14, CS'16
Jianghe Yuan & Guichun Han 7
Ling Yuan E'14, CS'14
Timothy J. Zak S'86 & Leslie V. Zak 2
AnnMarie Zanger 4
Hormoz Zarnani CS'09
Amelia J. Zgraggen CS'07, CS'11 10
Guido Zgraggen CS'09 7
Chengxiang Zhai DC'95
Biao Zhang CS'13
Jing Zhang CS'01
Judy Zhang E'13 3
Lu Zhang CS'14
Peng Zhang CS'12 3
Shengguo Zhang & Zhihua An
Shikun Zhang CS'14 3
Tom C. Zhang CS'14 2
Yin Zhang CS'13
Ying Zhang HNZ'16
Ariss Xin Zhao CS'02, TPR'02 2
Bing Zhao CS'03, CS'07 2
Fuyao Zhao CS'12 2
Liang Zhao CS'98, CS'01
Yu Zhao CS'13 2
Tian Zheng CS'15
Wei Zhong E'14 & Yongqing Yang
Yihuan Zhou CS'14, S'14 3
Yuhong Andy Zhou CS'00 & Hui Hsien Fu
Zhou Zhou & Hong Jun Alice Fu 2
Bryant Zhu CS'13 2
Yangbo Zhu CS'08 & Betty Zhu 7
Chad E. Ziccardi
Monte Zweben S'85

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School of Computer Science

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SCS alums have teamed up with instructors in five Pittsburgh Public Schools to teach computer science classes through Microsoft's TEALS program.
Read the full story on page 10.

calendar of events

Jan. 17
Spring 2017 Classes Begin

April 20–22
Spring Carnival

May 10
Meeting of the Minds Undergraduate Research Symposium

May 21
Commencement

May 22
Summer Semester Begins

Summer 2017
Regional Alumni Events
Locations TBA

Aug. 28
Fall Semester Begins