CHAMPIONING DIGITAL PROTEOMICS
CEO/CTO NATALIE CASTELLANA (MS '10, PHD '12)

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LETTER FROM THE PRESIDENT

We’re rounding off another great school year at UC San Diego. I am excited to showcase the accomplishments of our students, faculty, staff, and alumni this year in the quarterly newsletter. We just finished elections for the vacancy on the Alumni Advisory Board as well. I’m proud to announce that we have added Taurin Tan-atichat (MS ’08) to the board this spring! Taurin Tan-atichat joined Google as a software engineer in 2008 at their Mountain View, CA headquarters. After three years of working on their Platforms team, which designs Google’s energy-efficient data centers, he transitioned to New York for a role in Site Reliability Engineering. His responsibilities now include scaling highly-consistent distributed systems that are the skeleton of the vast majority of Google’s services. As an undergraduate in CSE, Taurin was involved with Teams in Engineering Service (TIES) from its inaugural Fall 2004 quarter.

We began the summer with some exciting events over Alumni Weekend in early June. In addition to a BBQ and demos of CSE 125 multiplayer 3D networked computer games, CSE’s team participating in the annual Triton 5K race ran away with the prize for the largest team and most money raised. We’ll be hosting our annual Alumni/Intern BBQ on Saturday August 22nd in San Diego, Seattle, Mountain View, and now New York! Rick Ord will be bringing his now famous (or maybe infamous?) talk “You don’t buy a computer that understands how to do recursion, inheritance, or polymorphism (and other infamous sayings)” to Seattle and Mountain View! Stay tuned to the CSE Dept Facebook page for dates!

Looking forward to seeing you all at a summer alumni event!

LINDSEY FOWLER (BS ’05)
UCSD CSE Alumni Advisory Board President

MS PROGRAM SURVEY
WHAT DO YOU THINK?

Competition to enter the MS program is fierce, with only one in 10 applicants from an elite pool accepted and enrolled in CSE’s master’s program each year. With each graduation, a new crop of students joins the ranks of our powerful network of distinguished and successful alumni. Yet, computer science and computer science education are dynamic fields, and UC San Diego must invest in the program to ensure the continued success of our students. This fall’s class won’t know the “A.P.E. Lab” many alumni may remember. Instead, they will be welcomed by huge, naturally lit, open-plan collaborative areas with ample break-out spaces and ubiquitous whiteboards. We’re planning to use advanced educational technology to augment and enhance, not replace, traditional educational tools. And our curriculum is constantly evolving to remain at the forefront of the discipline. We’d like to better understand the path that our MS graduates have taken since graduation and leverage what they have learned since then to enhance the MS program and keep us on top. Alumni who earned an MS degree from CSE (either as a terminal degree or en route to completing a PhD) are invited to take 10 to 15 minutes to fill out an online survey about their career and experience with the MS program at UCSD. Even if you cannot respond to all of the questions, please complete as many as you can.

To take the survey, visit: http://bit.ly/1LcDopE. Thanks for your willingness to help us enhance the MS program in CSE at UC San Diego. Congratulations for all that you are accomplishing, and we’ll be sure to keep you posted on the changes you will influence by participating in this anonymous survey.

Regards,

GREGORY KESDEN
Director, MS Program
Computer Science and Engineering Department

MARK YOUR CALENDAR

CSE ANNUAL ALUMNI/INTERN BBQ

Mark this date on your calendar as we expand the tradition of a summer BBQ to one more city. We are adding New York City to the list that already included San Diego, Seattle, and Mountain View. For details, follow us on the CSE Dept Facebook page.
Alumna Catherine Wah (PhD ’14) is now a software engineer at Google, with research interests in computer vision, machine learning and human computation. She was front and center at the Winter Conference on the Applications of Computer Vision (WACV) in Hawaii. At the 2015 conference, Wah presented a paper on "Learning Localized Perceptual Similarity Metrics for Interactive Categorization" in the Vision and Learning session. The paper was jointly co-authored with University of Massachusetts-Amherst assistant professor Subhransu Maji and Wah’s former doctoral advisor, then-CSE Prof. and current Cornell NYC Tech Prof. Serge Belongie. In Wah’s prize-winning paper, she proposed a novel approach to interactive categorization that leverages multiple perceptual similarity metrics learned from localized and roughly aligned regions across images, reporting “state-of-the-art results and outperforming methods that use a single, non-localized similarity metric.” Wah and her collaborators used examples of bird images compiled by the Caltech-UC San Diego Visipedia project, including a dataset that Wah herself helped create, in hopes of determining a method for computers to recognize different species of bird exclusively through computer vision, or including an element of human crowdsourcing, which could eventually be extrapolated to more robust computer vision systems.

Alumnus and CSE lecturer Gary Gillespie (BS ’90) became only the second CSE faculty member to win the university’s Academic Integrity Faculty Award. He picked up the award in mid-April at the 5th annual awards ceremony, following in the footsteps of emeritus CSE lecturer Paul Kube, who took home the integrity award two years earlier. The award is presented to a faculty member who has contributed significantly to creating a culture of academic integrity through research, teaching and/or service. Gillespie considers himself a strong supporter of academic integrity, having sent many students through the process. “I talk with them in my office and try to help them make better decisions for the betterment of their future,” he says. “It’s not always a pleasant process, but if students can better consider their decisions, they’ll be better ambassadors for UC San Diego and CSE when they eventually graduate.” With school out of session, Gillespie headed back to iboss Network Solutions, the company founded and led by CSE alumnus Paul Martini (BS ’01). Gillespie works as a consultant for iboss during the summer, before returning to the classroom in the fall.

Graduate student Narendran Thangarajan (MS ’15) received the award for best CSE poster on display at the 2015 Jacobs School of Engineering Research Expo. Runners-up for the award who received Honorable Mentions included the posters of Oscar Beijbom, Mulong Luo, and Devon James Merrill, who were respectively in the groups of professors David Kriegman, Andrew Kahng and Steven Swanson. The winning poster focused on Thangarajan’s analysis of social media to characterize HIV at-risk populations in San Diego. The researcher, advised by CSE research scientist Nadir Weibel, went beyond existing research on the feasibility of using Twitter to study HIV spread in the United States. He took the approach further, “identifying and characterizing HIV at-risk populations locally in the San Diego area at a more granular scale in terms of both demographics and communities.” Thangarajan, who graduated in June, used dynamic visualizations, social network analysis, graph algorithms and machine-learning techniques to combine information from Twitter and data on HIV-infected patients provided by UC San Diego’s AntViral Research Center. His goal? “To learn how actual HIV-infected users behave on Twitter and build a computational model that can then be applied to other users to investigate similarities in their behaviors,” said Thangarajan.

PhD student Natalie Larson has wrapped up her year-long duties as the only CSE representative on the executive board of the Graduate Student Association (GSA) at UC San Diego. She was elected Chief of Staff for the 2014-15 academic year, a position in which she helped facilitate communication between the GSA, department staff contacts and the graduate student body. “Many students don’t know the ability the GSA has to influence campus-wide policies regarding, for example, health insurance, transportation, housing, and funding for student groups,” says Larson. “I can help increase awareness of the work the GSA does, so that everyone who wants to can have a voice in these decisions and take advantage of GSA’s resources.” Larson is so busy that she recently had to turn down an invitation to speak at a European Union conference in Brussels on Internet measurement and net neutrality. Meanwhile, she is working on an ongoing CAIDA-MIT project to map Internet connectivity and congestion (the primary focus of her PhD work) with CAIDA director and CSE faculty-affiliate K.C. Claffy. She is also co-authoring a white paper on Internet policy for the European Parliament (jointly with a graduate student from the Oxford Internet Institute). Larson doesn’t have to worry about how to pay for her education. In 2014 she received a prized Science, Mathematics and Research for Transformation (SMART) Fellowship from the Department of Defense. To repay that support, she committed to working two summers and then three years in a DoD research facility. Larson did art at Grinnell College for her undergraduate degree, then got a second bachelor’s degree, majoring in math and computer science at Vanderbilt University. She enrolled in CSE after graduating from Vanderbilt in 2012.
RESEARCH HIGHLIGHTS
CENTER FOR VISUAL COMPUTING

The new Center for Visual Computing is one of four new ‘agile’ research centers created by the Jacobs School of Engineering, and the only one based in the CSE department. Launched at Research Expo in April, VisComp had its official unveiling when its founding director, CSE Prof. Ravi Ramamoorthi, outlined the center's current challenges and future ambitions. He also confirmed that VisComp has lined up Sony as its lead sponsor, with additional partners Qualcomm, Pixar and Adobe. Ramamoorthi said the center hopes to grow membership to at least six companies from a variety of industries, including communication, entertainment, health, 3D printing and more. On the faculty side, VisComp includes Ramamoorthi, CSE professors David Kriegman and Henrik Jensen, Qualcomm Institute research scientist Jurgen Schulze, and Zhouchen Tu, an expert in computer vision from Cognitive Science. “The motivation for this agile research center is that computer vision, graphics and imaging are still at a formative stage,” said Ramamoorthi, “and they affect all areas of the computing stack from hardware to software to output, and they will have a major impact on our everyday lives.”

WHAT COMPUTER SCIENCE MEANS FOR GREEN ENERGY

CSE Prof. Vineet Balfo was on the roster of experts who spoke at the Green Revolution 2.0 symposium March 12-13 organized by the California Center for Algal Biology and the Center for Food and Fuel for the 21st Century. The bioinformatics expert addressed the “Ecology of Open Algae Ponds for the Production of Biofuels,” noting that algae are great feedstocks for biofuels and other products, but the challenge is to get yield at low cost. (In principle, microalgae may produce between 10 and 100 times more oil per acre than traditional crops, but that has not been achieved in an industrial setting.) “There is a general understanding in ecology that diversity is good for productivity, and that precept might be useful for industrial production,” explains Bafna. “But we don’t know that these ecological ideas can work in an industrial setting.”

PROJECT ROSELINE

UC San Diego and four other universities shared in a $4 million NSF award for the Roseline project, a radical rethinking about the concept of time that will be required as the world shifts to sensor networks and the Internet of Things (away from the current model of time on computer networks). Carnegie Mellon, UCLA, UC Santa Barbara and the University of Utah are collaborating with the UCSB team led by CSE chair Rajesh Gupta. Their goal: to enable robust, secure and efficient knowledge of time across the system stack. Why? Because accurate and reliable knowledge of time is fundamental to cyber-physical systems from the perspective of sensing, control, performance, and energy-efficient integration of computing and communications. The researchers have come up with the concept of Quality of Time (QoT), a notion of time whose accuracy can be specified, controlled and achieved.

"Roseline will drive accurate timing information deep into the software system," said CSE’s Gupta, co-principal investigator on the Roseline project. "It will enable robust, distributed control of smart grids, precise localization of structural faults in bridges, and ultra-low-power wireless sensors."

CHANGING NATURE OF INTERNET TOPOLOGY

CSE faculty-affiliate and alumna Kimberly Claffy (MS ’91, PhD ’94) is a principal investigator on a new $1.2 million NSF grant to measure and quantify the changing nature of the Internet’s topology and what it means for the web’s future in terms of design, operations, scientific study and public policy. “From both the scientific and policy perspectives, much of the Internet’s evolving ecosystem is largely uncharted territory,” says Claffy, director of the Center for Applied Internet Data Analysis (CAIDA) at the San Diego Supercomputer Center (SDSC). “As the Internet expands to satisfy the demands and expectations of an ever-increasing percentage of the world’s population, profound changes are occurring at myriad levels: from interconnection structure and traffic dynamics to creating new economic and political issues that need to be addressed. These changes also pose broader challenges for technology investment and future network design, so a key goal of this project is to establish a baseline against which to evaluate future Internet architecture designs and implementations.” The project, joint with MIT’s Computer Science and Artificial Intelligence Laboratory, is called “Mapping Interconnection in the Internet: Colocation, Connectivity and Congestion.”
NON-VOLATILE MEMORIES: ‘DEEPER, MORE INTERESTING AND MORE CHALLENGING PROBLEMS’

Approximately 220 researchers from academic, industry and national labs were at UC San Diego in early March for the sixth annual Non-Volatile Memories Workshop. The annual event is co-organized by CSE’s Non-Volatile Systems Laboratory, Calit2’s Qualcomm Institute, and the Center for Memory and Recording Research (CMRR). The two-day workshop brought together scientists and engineers working on advanced, non-volatile storage devices and systems. “We expanded the program this year to reflect the strong set of submitted papers we received,” says CSE Prof. Steven Swanson, who co-founded the annual workshop and organized the 2015 event with ECE Prof. Paul Siegel and Technion Prof. Eliran Yaakobi. “It’s been very exciting to see the community expand to tackle the wide range of challenges that non-volatile memories present. You can really see the evolution in the problems people are addressing.”

“As a community we have tackled many of the ‘low-hanging fruit,’” he added, “and we are moving onto deeper, more interesting and more challenging problems.”

According to Swanson, high points of the 2015 workshop included keynote presentations by top people from Samsung, Intel and Seagate on topics ranging from the way NAND-based technology is transforming the data center; to prospects for a “world with persistent memory.” Two parallel conference tracks packed the agenda with more than 40 paper presentations by researchers from around the world – a substantial number of them working in industry, including at HP Labs, Sandisk, HGST, San Jose Research Center, IBM Research in Zurich, Intel and Samsung.

DISAGGREGATING DATA CENTERS

Large-scale Internet data centers host tens or hundreds of thousands of servers, powering sites such as search engines, social networks, streaming video services, shopping and healthcare. The cost and energy demands of such facilities depend heavily on how efficiently the servers can work together, which in turn depends on the quality of the network interconnecting them. “As servers get faster and faster, the demands placed on the data center network get increasingly hard to meet,” said CSE Prof. George Porter at the conclusion of a workshop in March on photonic technologies for disaggregated data centers. “Industry is increasingly moving to fiber optics and photonics as a technology that can meet these incredible bandwidth requirements. A major topic of our workshop involved understanding how to develop next-generation photonics to power the requirements of data center networks.”

The workshop also grappled with understanding the networking requirements for building disaggregated data centers – which, according to Porter, “re-evaluates the entire concept of what a server is. “Today a server represents a fixed combination of compute, memory, storage, and I/O,” he explained. “As we look at the requirements for next-generation data centers, we see that the applications run in them have very dynamic requirements.” Porter cites the case of Facebook, which may need servers with tons of memory that can be used to analyze billion-node graphs. Alternatively, they may need servers with significant amounts of network I/O that can power a caching layer. “Rather than build these as separate systems, with a disaggregated design, the individual components making up a server can be put directly on the network itself,” noted Porter. “Then a ‘server’ is simply a temporary binding of these resources together to work for a specific purpose. When those requirements change, different combinations of resources can be formed. This vision is very powerful, but puts incredible strain on the network.”

The workshop was supported by the NSF-funded Center for Integrated Access Networks (CIAN), and held in conjunction with the annual Optical Fiber Conference.

EARLY RESEARCH SCHOLARS

CSE’s Early Research Scholars Program places first- and second-year CSE students in research apprenticeships with active research projects in the department. “We are trying to build community between early undergraduates and grad students and faculty,” says CSE Prof. Christine Alvarado. “This way, students can not only see the relevance of what they are learning in their early courses, but they also form a deeper sense of belonging within CSE.” The program was well represented at UC San Diego’s 28th Annual Undergraduate Research Conference in late April, with more than a dozen scholars from the 2014-15 program among CSE students showcasing their research.

Alvarado and CSE faculty-affiliate KC Claffy crafted a session on “Computer Networks.” Undergraduates Huayan Zhou and Luis Sanchez talked about “Characterizing the Performance of Cloud Computing Services.” Other two-person teams included Tiffany Allen and Aaron Hurtado as well as Andrew Jabasa and Kelsey Ma, who reported on a two-part study of network traffic analysis. In addition, Edgar Lopez-Garcia and Mingzhan Wang talked about their joint research on the optical circuit switching-based REACTor network.

Jordan Yoshihara recounted her research in an elementary-school classroom during the winter quarter. She used the educational technology tool ALEKS to explore which technologies and techniques work best in the classroom, and which don’t. Her goal was to use her findings in a future effort to develop new educational software for fostering improved learning in mathematics.

Three other female CSE students presented on their respective solo research projects. Ilse Tse and Antonella Wilby (both advised by CSE Prof. Ryan Kastner) presented research that grew out of the Engineers for Exploration program: Tse outlined ways to make structure-from-motion modeling more efficient, while Wilby talked about her stereo camera rig for nautical cyber-archaeology. For her part, Jennifer Tran (advised by CSE Prof. Steven Swanson) presented her gadget project, specifically, on automating the process of synthesizing electronic gadgets. Kastner also nominated Zachary Blair to speak at the conference; his talk was on “Mapping Powerful Graphics Processing Algorithms to Low-Power Embedded Devices.”

The growing role that computer science plays in the development of health and medical innovations was evident in the roster of CSE speakers participating in the Technology & Medicine panel. Mayram Abajian, Rachel Lee and Emma Roth presented their research on heart rate variability, while two other teams split the work on “Adapting the Top Trading Cycles Algorithm for Live Kidney Exchange”: Rachel Kelzrou and Steven Stone worked on one part of the project, with Raina Ahuja and Aasha Camper Singh on part two. The latter four students were all advised by CSE Prof. Mohan Patrani.
ALUMNI PROFILES

Natalie Castellana: Not Her Grandfather’s Mass Spectrometry

Natalie Castellana remembers that her grandfather worked with mass spectrometry at Westinghouse. He measured the molecular components of different compounds.

“There is an American Society for Mass Spectrometry, and I attended a conference where they put up a wall showing the origins of the field,” she recalls. “There was a photo of the first meeting of the society, and there he was, my grandfather, in the picture.”

Today Castellana (MS ’10, PhD ’12) is carrying on the tradition, but it’s not her grandfather’s mass spectrometry any more.

She is CEO and chief technology officer of Digital Proteomics, LLC, which is co-owned by three Computer Science and Engineering faculty members — Pavel Pevzner, Vineet Bafna, and Nuno Bandeira — who are also the company’s technology advisors. The professors were at the forefront of the computational proteomics software revolution for analyzing mass spectrometry, and became founders of the Center for Computational Mass Spectrometry at UC San Diego.

Castellana grew up in a Virginia suburb of Washington, D.C., and did her undergraduate degree in computer science at Carnegie Mellon. It was in her junior year that she caught the bioinformatics bug, and in 2006, she enrolled in the PhD program at UC San Diego.

“Computer science was exciting but the applications in biology and medicine were even more compelling, plus, there is so much data coming out of bioinformatics that it’s hard not to get excited about it,” explains Castellana. “I came here thinking I was going to do genomics, specifically associating variation in the genome with different diseases, but I ended up switching to proteomics, which seemed to be where the exciting problems were.”

While mass spectrometry is an old technology, more recently it has become an important tool for studying proteins. “Genomics is a static picture, where it’s relatively easy to read a sequence,” says Castellana. “By contrast, proteins are the active substances of the cells, and much harder to read.”

Proteomics involves converting from the mass spectrum — the raw read-out from the instrument — to something that explains the biology that produced the particular spectrum.

“With proteomics, you have to find the signal in the noise,” she adds. “It’s the diamond in the rough.”

As she was finishing up her PhD dissertation on proteogenomics to significantly improve peptide identification using mass spectrometry, Castellana worked with the owners of Digital Proteomics to win a Small Business Innovation Research grant from the National Institutes of Health. The funding was sufficient to cover her full-time work as CEO and chief technology officer, at least to get started.

From its early days, when the company sold its software only to Genentech, today Digital Proteomics does business with four of the world’s five Big Pharma companies, usually working with divisions that do high-risk, high-reward research.

Digital Proteomics takes a more targeted approach than others in the industry. “We’re more interested in specific questions relevant to biomedical research drug development,” notes Castellana. “So it’s taking those key components that were developed here at UCSD, and putting them together in a way that’s going to further drug discovery. As a result, we fit into multiple places in the [drug discovery] pipeline.”

In diseases such as cancer where there is a lot of genetic variation, the available reference genomes (one of which happens to be the personal genome of another UCSD alumnus, Craig Venter) is really not a good benchmark for studying tumor cells. “We have tools that help us identify the key mutations or insertions in the genome represented in a proteome,” says Castellana.
Digital Proteomics’ most popular product, Valens, is for antibody sequencing when you don’t have the cell that produced a particular antibody (“the source cell may have died when the freezer thawed out,” explains Castellana). The product is based, in turn, on Spectral Networks, an algorithm developed by professor Nuno Bandeira, which now forms the basis of the company’s proteomic approach to antibody sequencing.

The focus on antibody sequencing could not have come at a better time. “With the recent Ebola outbreak, a company in San Diego had an antibody-based drug that was the only successful drug to combat Ebola,” says Castellana. “But antibodies are, by design, highly variable because they need to adapt and bind to whatever antigen is present. So the antibodies have to adjust, and they do that by mutating at a very high rate.”

Since winning the SBIR grant, Digital Proteomics has been able to sustain its growth organically -- without borrowing or raising money in the capital markets. The company has remained small by design, relying on research coming out of the bioinformatics group in CSE, while Castellana spends one-third of her time doing software development to turn the research results into marketable products. She splits the remainder of her time between sales and marketing on one hand, and providing services on the other.

“When we started, we thought we would just be doing software licensing,” she explains. “But some of our tools are very computationally intensive and they rely on mass spectrometry data. There is a need for running the tools in an expert way, and we have the compute resources, and the mass spectrometry resources, to be the whole solution. So our customers don’t have to invest heavily in any of those areas. They can essentially outsource their bioinformatics needs to us, at least in the proteomics realm.”

As a co-owner of Digital Proteomics and her PhD advisor, professor Vineet Bafna says Castellana has helped make the company a success. “Running a startup like this one, she juggles many roles, writing grant proposals, talking to executives and scientists in different companies, managing contractors across the globe, while still staying current on the research,” observes Bafna. “I don’t know many people who could have done it.”

Looking to the future, Castellana believes the biggest growth for Digital Proteomics will come in areas where companies don’t yet know that mass spectrometry can be useful to them. “We are looking to metabolomics, lipidomics -- there’s a whole host of molecules for which this technology can be useful,” says Castellana.

For her part, the CSE alumna also hopes that the company can move its products closer to the clinic. “I would love to see the research move closer to being used to help patients,” she argues. “We are still in the drug discovery pipeline, but proteomics is what identifies us as individuals, so there is a lot of medicine that could use proteomics better in the clinic.”

Growth for the sake of growth is not on Castellana’s agenda. “We want to be impactful,” she stresses. “Whether with 30 people or 300 people, we prefer to keep it highly talented with a group that works well together. We’re very close to our customers, which makes it feel more like a collaboration.”

Castellana also has a close collaborator at home. Her husband, Ryan Kelley, is a UC San Diego bioengineering alumnus (PhD ’09) and senior manager of bioinformatics at Illumina. “He does genomics, while I do proteomics,” says Castellana. “We’re not competitive, but our interests are close enough so we can talk about work at home.” Which raises the prospect of whether their 14-month-old son, Rowan, could one day keep bioinformatics all in the family, perhaps even growing up to work with mass spectrometry like Castellana and her grandfather did before her.

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**CHRIS BARGROVER (MS ’10, PHD ’14)**

Alumnus Chris Bargrover (MS ’10, PhD ’14) developed a new Introduction to Robotics (CSE 190) and taught the inaugural course during the Winter 2015 quarter. He handled his lectures and office hours while holding down a full-time job in SPAWAR’s Unmanned Systems group (where he works on computer vision and perception for robotics). During the second half of the quarter, students worked on robot projects that accounted for 50 percent of their final grades in the class. Bargrover arranged to provide low-cost Turtlebots IIIs to each four-person team to integrate into a more complex system, including at least two peripherals. One of the teams chose to develop “Autonomous Tracking and Following of Indoor RC Helicopter.”

Computer engineering majors Frank Bogart, Mike Lara and James Lee as well as computer science junior Kenny Yokoyama competed the BLYL project (pronounced Billy, and derived from the first letters of the students’ last names). They split up the work by area, including vision, embedded systems, navigation and networking. The system combined a do-it-yourself personal robot and open-source software with a Kinect and netbook. Students also used Qualcomm DragonBoards to gain hands-on experience with the Robot Operating System. The Kinect was used to detect the helicopter in 3D space using its RGB camera in conjunction with its depth-sensing capabilities. The students also implemented an LED array to display the relative position of the RC helicopter in the frame of the Kinect’s camera in real time. The resulting autonomous robot follows around a tiny, remote-controlled quadcopter, and if the copter starts moving away, the robot accelerates in its direction to maintain an ideal distance between the two devices. With the robotics course now behind him, in the spring quarter Bargrover switched to teaching a course in the Jacobs School’s Master of Advanced Studies program on Wireless Embedded Systems. The course – Introduction to Embedded Systems Design (WES 237A) – was developed for working professionals, and it involved a full day of lectures and labs every other Friday.

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**SARAH MEIKLEJOHN (PHD ’14)**

Alumna Sarah Meiklejohn (PhD ’14) did her dissertation under CSE professors Mikhail Borella and Stefan Savage. Her topic: “Flexible Models for Secure Systems.” Now Meiklejohn has been selected to receive the 2015 Chancellor’s Dissertation Medal. According to Borella, the findings in her thesis have shaped government policy, and her methods have been adopted by law-enforcement agencies to track real-world cyber criminals. In her dissertation, Meiklejohn introduced an experimental technique for tracking Bitcoins that proved the cyber currency is easier to track than previously thought. Her landmark findings about user anonymity (or rather, the lack of it) in the Bitcoin network show that Meiklejohn could combine publicly available information with minimal data gathered by hand to prove that the average Bitcoin user experiences “a fairly low level of anonymity” – making the currency less attractive for use in criminal activity such as money laundering.
FACULTY HONORS

CSE Prof. Shachar Lovett is the only University of California computer science professor to be honored with a 2015 Sloan Research Fellowship. In all, only 16 computer scientists from the U.S. and Canada made the cut this year. Lovett is an expert in computational complexity. He studies the foundations of computer science, and how computational problems can be efficiently solved. “As the scientific, engineering and life sciences communities continue to be transformed by new, ever larger data sets, the motivation for designing very efficient algorithms to manipulate, store and transfer data is becoming ever more clear,” explains Lovett. “Specifically I study how the interplay between structure and randomness plays a central role in algorithm design and analysis.” The Sloan Research Fellowships seek to stimulate fundamental research by early-career scientists and scholars of outstanding promise. The two-year fellowships were awarded this year to 126 researchers to recognize their distinguished performance and unique potential to make substantial contributions to their field in the future, in Lovett’s case, computer science. Other UC San Diego researchers named Sloan Fellows alongside Lovett came from biology, economics, chemistry, and neurosciences. Other 2015 recipients include at least one recent CSE alumnus: Thomas Ristenpart (PhD ’10). Ristenpart is now an assistant professor of computer science at the University of Wisconsin-Madison. He also maintains close ties with his alma mater, collaborating frequently on cyber security or cryptography papers with UC San Diego professors Hovav Shacham, Mihir Bellare or Stefan Savage.

TEST-OF-TIME AWARD IS DÉJÀ VU

For the second time in five years, CSE Prof. Victor Vianu is the recipient of the ACM PODS Alberto O. Mendelzon Test-of-Time Award. The annual award goes to the author or co-authors of a paper published in the proceedings of the Principles of Database Systems (PODS) ten years earlier. The award goes to the paper that had “the most impact in terms of research, methodology, or transfer to practice over the intervening decade.” After winning the Test-of-Time Award in 2010, Vianu was honored at the 2015 SIGMOD PODS conference in May, when he accepted the award, which refers back to his influential 2005 paper, “Views and Queries: Determinacy and Rewriting.” The paper explored a scenario that is not uncommon in query processing, security and privacy, data integration and query pricing. “The paper considers a seemingly simple question,” explains Vianu, who shares the award with co-author Luc Segoufin from France’s INRIA. “Suppose you know the answer to a query Q on a database and you wish to answer another query R. Does Q provide enough information to answer R? If so, how can the answer to R be obtained from Q?” According to Vianu, the problem turned out to be unexpectedly challenging even for the simplest queries used in relational database systems, and some of the basic questions raised in 2005 remain open today. “[Our 2005] paper spawned a whole line of follow-up research on this and related problems,” continues Vianu, noting that this year’s Best Student Paper at the 18th International Conference on Database Theory (ICDT) cited his 2005 paper and contributed to the same line of research. “I think our paper received the award because the questions it raised were novel and widely relevant, and some of the answers it provided challenged conventional wisdom by going against widely accepted ‘folklore’ assumptions.”

CSE Prof. Ronald Graham was honored in June 2015, at a celebration of his work and upcoming 80th birthday which took place which took place at Simon Fraser University in Vancouver. Organizers give credit in large part to Graham for the central role that discrete mathematics plays in modern mathematics. With five decades, over 300 published papers, five books and service as president of two largest professional associations of mathematicians on his CV, Graham was celebrated for his work in number theory, graph theory, discrete geometry, Ramsey theory, combinatorics, and algorithms. [More information about the celebration at https://sites.google.com/site/connectionsindiscretemath/]

CSE Prof. Fan Chung Graham and 30 others worldwide have been named as the Class of 2015 Fellows of the Society for Industrial and Applied Mathematics (SIAM). She was cited for her contributions to “combinatorics, graph theory and their applications,” with applications including Internet computing, communication networks, software reliability and more. The Distinguished Professor has joint appointments in CSE and Mathematics, where she holds the Paul Erdos Chair in Combinatorics.

CSE Prof. Christine Alvarado was honored in late May at the Summit on Women and IT organized by the National Center for Women & Information Technology (NCWIT). Alvarado (who is now an assistant teaching professor and lecturer in CSE) and three former colleagues at Harvey Mudd College shared in NCWIT’s Engagement Excellence Award. The annual award recognizes authors whose curricular materials have been submitted to the elite EngageCSEdu collection. Winners must demonstrate excellence in computer-science content and pedagogy while also using research-based engagement practices to make computer science relevant and meaningful for students. “The work I did with my colleagues at HMC was both about rethinking curriculum as well as creating a supportive and relevant structure and community in which students can learn,” says Alvarado, noting that the award-winning work is also reflected in various efforts that she has undertaken at UC San Diego, including the Summer Program for Incoming Students, whose computer-science curriculum is modeled on the Harvey Mudd course.

Pictured (top-down): Ron Graham; Fan Chung Graham; Christine Alvarado (in blue) among winners of Engagement Excellence Awards in 2015
FELLOWSHIPS

NSF GRADUATE FELLOWSHIPS

Three current CSE students are among the 2,000 nationwide to be offered 2015 Graduate Research Fellowships from the National Science Foundation (NSF). Graduate students Rachel Marty and Alexandrea Shearer and graduating senior Max Shen were selected from among roughly 16,500 applicants this year. Shearer is in CSE Prof. Ryan Kastner’s research group, which is already home to three current NSF graduate fellows: Dustin Richmond, Perry Naughton, and Alric Althoff.

Shearer works on applications in heterogeneous computing. The NSF stipend will cover her primary expenses in the fall through completion of her PhD in 2018. Shearer arrived at UC San Diego in 2013 after getting her BS in computer science and engineering from Santa Clara University’s School of Engineering, where she graduated as the top senior in computer engineering. Shearer also received a new campus research award this spring (see below).

Fellowship recipient Rachel Marty (BS ‘14) is finalizing her PhD plans with CSE Prof. Vineet Bafna her likely advisor. She has done internships at Thermo Fisher Scientific (and Life Technologies, which it acquired) as well as Illumina, where she developed an application to centralize the experience of gene exploration for researchers. She expects to complete her doctorate in 2019. (For more on Marty, see p. 12.)

The third recipient of an NSF fellowship, Max Shen, works in the bioinformatics group of CSE Prof. Pavel Pevzner. He graduated this June with a BS in computer science and specialization in bioinformatics. Shen is a research assistant in Pevzner’s group, and for the past year has been a content contributor to the group’s Rosalind platform for teaching bioinformatics and programming to online learners through problem-solving. For Rosalind, Shen designs and implements bioinformatics programming assignments onto a live website with randomized input generation and scoring. The system is used in undergraduate bioinformatics courses, and by students enrolled in Pevzner’s massive open online courses on Coursera, including a course on bioinformatics algorithms. Shen has also been a TA and tutor in CSE, and a research assistant in the School of Medicine’s Radiology Imaging Laboratory, thanks to which Shen may be the only computer science student who is also certified to operate a magnetic resonance imaging (MRI) machine.

The NSF fellowships provide three years of financial support within a five-year fellowship period ($34,000 annual stipend and $12,000 cost-of-education allowance to the graduate institution) for graduate study that leads to a research-based master’s or doctoral degree in science or engineering.

Shearer’s expenses between now and the start of her NSF fellowship will be covered by a new campus Frontiers of Innovation Scholars Program (FISP), in which Shearer is one of five CSE graduate students awarded grants up to $25,000 each. The FISP award will allow her to continue her work on aerial LIDAR scanning of Mayan ruins through the summer, in addition to some travel costs. Another student in Ryan Kastner’s group, Quentin Gautier, received a FISP to do 3D modeling for underwater archaeology. Other recipients include Jagannathan Venkatesh, a PhD student working with CSE Prof. Tajana Rosing, and Nandran Thangarajan, who worked in the winter and spring quarters with CSE research scientist Nadir Weibel. “The Frontiers of Innovation funding allowed me to spend more time on research, which in turn helped our research project to advance and reach our envisioned goal,” said Thangarajan, who graduated with an MS in computer science this year. A fifth graduate student is yet to be named, but the award went to Qualcomm Institute research scientist Jurgen Schulze, who will work with a CSE grad student on virtual-reality systems.

The Frontiers of Innovation program also awarded 100 scholarships worth $3,000 each to help faculty employ undergraduate students on research projects. At least three are going to CSE students, and possibly double that number (faculty have until the fall to assign the grants to specific students). The named undergrads from CSE include senior Antonella Wilby (majoring in computer science) and Jorge Pacheco (a junior in computer engineering), who are part of a four-person team under professor Kastner in his capacity as co-director of the Engineers for Exploration program. Also funded: CSE undergrad Jennifer Lu, who will work with ECE Prof. Gert Lanckriet on a multimodal machine-learning framework for activity and mood recognition using mobile and stationary sensors.
Nearly half of the student startups in the Moxie Incubator prior to the Moxie Center shutdown in June, when all companies in the incubator were transferred to The Basement incubator, had at least one co-founder from the CSE department, and for CSE students with the itch to create their own companies, now is one of the best times to seek advice or round up funding for a venture. The entrepreneurial ecosystem on the UC San Diego campus is thriving. Despite the loss of the Moxie Center, the ecosystem now includes the NSF Innovation Corps (I-Corps), the UC San Diego Entrepreneur Challenge, the von Liebig Entrepreneurship Center, The Basement (for student startups, located in Mandeville Hall), The Triton Fund, UC Venture Capital, and now the Qualcomm Institute Innovation Space. Opening in April, the Innovation Space allows students or faculty members to lease office space in Atkinson Hall for private ventures, and most of the initial seven tenants include founders who are faculty, staff or students at UC San Diego – allowing them to have their startup business offices in short walking distance from their academic labs.

It has also never been easier to raise money for a planned venture, thanks to crowdfunding platforms such as Kickstarter and Indiegogo, and newer ventures such as Benefunder. CSE senior Daniel (Chesonga) Lee co-founded Hush Technology with students from structural and mechanical engineering. Promising to develop the “world’s first smart earplugs,” Hush sought to raise $100,000 on Kickstarter, but within six weeks, the company had raised nearly $500,000 on the crowdfunding platform. Pointing to Hush as a prime example, CSE chair Rajesh Gupta said, “CSE has been a source of talent, amplified by the ecosystem with its ability to reach out to talent beyond computer science too.” Hush was also admitted into a Bay Area accelerator program after winning $25,000 in a San Diego competition organized by the Plug and Play accelerator.

Many student startups remain cash-poor, but some are moving closer to being able to raise money. They include the award-winning Cocon Cam venture, led by Pavan Kumar; Meego Tech (formerly US Key), which is prototyping what co-founder and CSE senior Jorge Landaverde calls “the smartest motion-activated laptop theft prevention system”; and CollegeFlick (formerly iPassStore), a startup led by three CSE students (Devin Qi, Yu Xia and Zijian Tao) who aim to provide a web platform for college and university students to share their secrets anonymously. Other startups may not reach fruition before the founders graduate. And while they may have to seek full-time employment elsewhere, CSE student Hieu (Jake) Pham recently graduated (BS ’14) and put his startup Datalock on hold to become a software engineer at Northrop Grumman, and his co-founder, Kelly Lim (BS ’15), graduated in June, so the company promoting the use of QR codes to help sell real estate may have to disband.

The CSE Alumni Advisory Board hosted a panel with six alumni experts as well as entrepreneurship expert Jay Kunin. The alumni included Taner Halicioglu (BS ’96), Jennifer Arguello (BS ’00), Chris Schulte (MS ’05), Aaron Liao (BS ’05), Erik Buchanan (BS ’07), and Justin Allen (BS ’10), several of whom also sit on the alumni board. Justin Allen worked for Teradata after graduation, then joined a Bay Area startup called WebAction in 2014. He now works remotely from San Diego on purpose-built analytics applications in the growing real-time data streaming space. “I’m still a field engineer but I’m working on analytics applications and I get to live in San Diego while working for a startup,” said Allen. “It’s the best of both worlds.”

Jennifer Arguello worked at four startups over the course of eight years. The last one (Tellme Networks) was acquired by Microsoft, where she worked for nearly five years before becoming a product manager at Mozilla. She says that she found a unique opportunity in a hybrid venture, combining some for-profit venture capital with non-profit activities to create positive social impact (along with economic value). Arguello calls her current employer, the Kapor Center for Social Impact, a “non-profit, social-good startup,” where she is a Senior Tech Advisor. Asked whether doing a non-profit startup is different from a for-profit venture, Arguello first points to what they have in common. “In both cases you’re begging for money,” she says, only half-jokingly. “In fact, social entrepreneurship can be even more flexible and easier to do if it’s for profit.” Arguello also sits on the advisory boards of organizations that promote programming education, including Yes We Code, and Globaloria.

When it comes to startups, advised Kunin, both non-profits and for-profit companies need money in the bank. “Either way,” he said, “you need some kind of revenue model.”

Chris Schulte was working at SAIC when he began to think about starting a company. “I was able to work on a startup in my spare time, mainly in the evening, while I was also working full-time for SAIC,” said Schulte. He became CTO and cofounder of MyCase, Inc., which made management software for law practices. Schulte stayed on when the company was acquired in 2012 by AppFolio. Recently, he left the company to think about the future. “Now I’m on an unspecified vacation,” he told the CSE students.

Alumni Board president Fowler, who works for online retail giant Amazon, warned students to be careful about working on a startup from the comfort of a full-time company job: “You have to make sure that your employer doesn’t have any claim on your idea,” said Fowler, “especially if the future business is in some way related to your current job.”

After graduating with a major in computer engineering, Aaron Liao worked at Microsoft for six years. He is currently the “evangelism director” at BitTorrent, and once again, he’s “starting to look for new startup opportunities.” Liao and others were asked about the biggest difference between working for a startup and working at a large, established company. “In a startup you wear many hats,” said Liao. “At Microsoft my job was very defined.”

“A startup company also means that you really own the company’s success or failure — you’re more invested in what happens,” added Erik Buchanan, engineering lead and “startup entrepreneur” at Connectifier, who worked at multiple large enterprises before the startup, including Microsoft, Intuit, and Google. “What happens at a big company still matters, but you don’t feel it so personally.”
ALUMNI NOTES

THE LITTLE ROBOT THAT COULD RUKU

Daryl Stimm (BS ’14) is the envy of many recent alumni. He holds down a day job at GoPro, the maker of popular action cameras that have suddenly made it one of the largest camera manufacturers in the world. At the same time, Stimm still spends much of his free time working on a robot that he hopes will one day get thousands of students hooked on science. As seniors, Stimm and then-electrical engineering major William Mutterspaugh built the original prototype for the Ruku Robot in CSE Prof. Ryan Kastner’s CSE 145 embedded systems course. “We built it to be the perfect robotics kit for any STEM classroom,” says Stimm, referring to school programs focused on Science, Technology, Engineering and Mathematics (STEM). “It’s a fun, interactive teaching tool for every school’s STEM workshop or after-school STEM program. Our robot is a great way for kids to get involved.”

Most school robotics clubs tend to focus on so-called battle bots or race cars, both of which appeal primarily to boys. But when Stimm and his collaborators did a Ruku demo in a middle school, more girls came up afterwards to ask questions. “That’s when we realized that Ruku could fill a gap because it is equally attractive to female and male students,” said Mutterspaugh.

A Kickstarter crowdfunding campaign fell short of its $50,000 target, which forced Stimm and Mutterspaugh to rethink where to go next. Ruku teaches the basics of programming motors, and how things interact. Once the robot is built, the iPhone app detects the colors of the cube and determines the fastest way to solve it. Then it sends instructions to the motors, which turn the cube as needed, and the prototype is able to solve a Rubik’s Cube in as little as 20 seconds. The app can also run without the robot (but the user is required to rotate the cube manually so it can detect the color sequences on each side using computer vision).

The robot’s circuit board is a universal motor driver with six programmable stepper motor drivers. Instructions and lesson plans provided with Ruku make it possible for students as young as 11 years old to build the robot from scratch. “Ruku will allow students to see their programming come to life and see their work in real life,” said Stimm. “By the time they’re done, they’ll be able to say that they built a robot. And if the user gets tired of solving Rubik’s Cubes, Ruku can be disassembled, and its parts reused and reprogrammed to produce other types of robotic devices.”

INTERACTION DESIGN
SPECIALIZATION ON COURSERA

Alumni anywhere in the world will have the opportunity to enroll in a sequence of courses on Interaction Design developed primarily by CSE Prof. Scott Klemmer for the Coursera online learning platform. The specialization involves a sequence of seven courses – some as short as three weeks, some as long as nine – starting June 25 and running through August 20. The first course is Klemmer’s own course on Human-Computer Interaction Design, which teaches students how to design great user experiences. After completing all seven courses, students will be asked to apply their skills to a capstone project in which they design a creative, end-to-end user experience (UX) using professional interaction design and UX tools. The capstone project is only available to students who pay to take the full sequence of Interaction Design courses – and only paying students can qualify for a verified certificate from UC San Diego and Coursera at the end of the sequence. To make the capstone project more appealing to students, Klemmer (who has a parallel appointment in the Cognitive Science department) has recruited a partner from industry: Instagram co-founder Michel (Mike) Krieger, who has agreed to provide feedback to students about their projects. For students who don’t intend to do a capstone project and don’t need a certificate, the sequence of seven courses is free of charge.

Register for the course at:
https://www.coursera.org/specializations/interaction-design

Alumni Advise Students at CSE Day 2015

At CSE Day in January, one of the popular sessions was the Alumni Panel, which gave current students an opportunity to ask alumni for tips on interviewing, presenting, seeking internships, and so on. Speakers included Patrick Johnson (BS ’07), now a software engineer at Google; Qualcomm staff engineer and CSE lecturer Garo Bourouchian (BS ’05, PhD ’14); McKenzie Vella (BS ’13), who portrayed a summer internship into a year-long internship and, most recently, a full-time job working on network security, all at ViaSat; and CSE Alumni Board member Justin Allen (BS ’10), who recently joined WebAction, a Palo Alto-based company in the real-time data streaming space.

Among their recommendations in response to student questions:

- Go to career fairs;
- Get involved in student organizations (and student government, as Bourouchian did as a former president of the Graduate Student Association);
- Make yourself known to faculty members so they can remember you when they are asked to recommend a student for hire;
- Participate in the Jacobs School’s Team Internship Program (like McKenzie Vella did at ViaSat);
- Attend any event where you can get feedback and a critique of your resume;
- Consider studying a year abroad, preferably as a sophomore (Justin Allen spent his year abroad in Scotland, and he said it was invaluable); and
- Become a CSE Tutor. It’s rewarding and looks great on your resume.

CSE and Cognitive Science Professor Scott Klemmer records online lecture
AROUND THE DEPARTMENT

HOOPS, TRITONS AND COMPUTER SCIENCE

Meet Marissa Hing. The 18-year-old high school senior was on campus to attend Triton Day, when over 15,000 accepted students and their families converged on UC San Diego to get a taste of everything the university offers to its students-to-be. Despite her 5½-inch height, Hing is also coming to play basketball on an athletic scholarship for the NCAA Division II team, after starring since her freshman year at Pinewood High School in Los Altos, CA. She has started for four years as a guard on the Pinewood team, and was just selected by the San Jose Mercury-News as its girls basketball player of the year for northern California. The paper noted that she played a leadership role in helping Pinewood reach the CCS Open Division championship game this season.

The newspaper was also impressed with what she plans to study at UC San Diego: Hing says she wants to major in computer science, even while juggling a career on the basketball court. “As of right now my major is cognitive science because the computer science major was too full,” says Hing. “But I will be trying to change my major to computer science when I can.”

Hing says she is attracted to computer science because she likes to know how things work. “It also lets you be creative while also being logical at the same time, which is something that not a lot of other fields offer,” says Hing. “It helps you understand how things work instead of just assuming they do.”

Given the demands of both b-ball and CS, it may seem an unusual pick on both counts. But someone has proved that it can be done.

Indeed, Hing is not the first girls’ basketball star from Pinewood to major in computer science at UC San Diego. Former Pinewood player Rachel Marty arrived in 2016 and went on to play NCAA varsity basketball on the UCSD team while pursuing a degree in CSE with a specialization in bioinformatics. She graduated magna cum laude in four years, despite also playing ball.

Marty says she played on the UCSD squad with fellow Pinewood graduate Miranda Seto, and she knows Marissa Hing well through the “Pinewood connection.” “After I came to UCSD, our Pinewood coach formed a good relationship with the UCSD coaches,” explains Marty. “But I have to admit that I didn’t know Marissa was planning to study computer science. I can claim the basketball recruitment, not the computer science recruitment, but I’m really excited about it!”

Now a PhD student in CSE since 2014, Marty says she did recruit one of her fellow basketball team members, Taylor Tanita, to switch to computer science. “I’m a big fan of the program,” she observes.

Marty continues to be a strong career example for young women, athletes and computer scientists (whether from Pinewood High School or not). Last week, she was one of only three UC San Diego computer science graduate students selected in 2015 to receive NSF Graduate Research Fellowships, a three-year award carrying a stipend of $34,000 per year (plus a $12,000 annual cost-of-education allowance that goes directly to the campus). Some 16,500 students nationwide competed for roughly 2,000 fellowships.

The CSE alumna is pursuing her PhD in bioinformatics, and her research interests include cancer genomics, genomic algorithms and population genetics. Marty has done bioinformatics internships at Thermo Fisher Scientific (and Life Technologies, which it acquired) as well as at Illumina, where she developed an “application to centralize the experience of gene exploration for researchers.” She has also done research with both CSE Prof. Vineet Bafna (in the field of genomic algorithms) and with Hannah Carter at the UC San Diego School of Medicine’s Division of Medical Genetics (on cancer genomics). “I will likely choose one of them to be my advisor at the end of the year,” she says. That’s when the rotation period of her doctoral program ends.

But Marty has also won fans off the court and away from bioinformatics. CSE Prof. Andrew Kahng recommended her for the fellowship. She took an algorithms class with him as an undergraduate, and Kahng also supervised an independent study project when she interned at Life Technologies. “He has played a prominent role in getting me where I am,” says Marty. She plans to finish her PhD in 2019.

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**BY THE NUMBERS**

$37,020,000
Approximate amount of R&D spending by UCSD CSE in fiscal 2013, ranking CSE #10 among all U.S. computer science departments. By contrast, UC San Diego overall is #5 among U.S. institutions of higher learning, topping $1 billion in the same period.  
(Source: Higher Education Research and Development Survey)

$68,000,000
Total funding from industry for R&D at UC San Diego overall in 2013 (Source: Higher Education Research and Development Survey)

#13
National ranking of UC San Diego’s computer engineering program, tied with UCLA and USC [Source: 2015 U.S. News & World Report Graduate School Rankings]

$140,600
Average mid-career salary of CSE alum 15 years after graduating with PhD in computer science [Source: 2014-15 PayScale College Salary Report]

$115,500
Average mid-career salary for CSE alum with BS in computer science after 15 years [Source: 2014-15 PayScale College Salary Report]