

Fall 2016

Dear Computer Science Alumni and Friends,

These are exciting times in computer science, with research, education, and the industry continuing to evolve at a rapid and seemingly increasing rate. The role of computer science is also changing, shifting from being a dynamic, exciting intellectual field driving technological change to becoming a dynamic, exciting intellectual field that is a significant component of many other fields of inquiry as well as a major social and cultural force. The effects of these changes on academic computer science departments, at least in the United States, are well known: soaring enrollments at all levels; a major expansion of research efforts, particularly in collaborations with other fields; and the stresses associated with trying to adapt and grow to meet these challenges and opportunities.

The CS department at Stanford has been riding this wave with excitement and enthusiasm—and sometimes exhaustion! In this newsletter, I'll talk about some of the changes that are taking place. A key part of this process has been discussions with the alumni and friends of the department; many of you have helped by sharing your thoughts with me and other faculty, for which we are sincerely grateful.

Faculty Hiring

The School of Engineering and the department have agreed that the CS department will grow by a net of 10 full-time faculty positions, from about 40 full-time positions today to about 50. Many of you will no doubt recognize that this won't change our hiring rate (we've been hiring as fast as we can for several years), but it will allow us to take a step back and think about the future composition of the department.

We expect many of these hires to be joint appointments, half in CS and half in another department, to help catalyze and maintain the interdisciplinary research relationships at the boundaries of CS and other fields where many new discoveries are likely to be made. As a result of the joint appointments, the 10 positions will likely translate into 15 or 16 new faculty appointments. Of course, that many additional faculty will mean adding additional PhD students, postdocs, and staff, with implications for our teaching and for space in Gates, but these are good problems to have.

Because of retirements and other departures, this growth will be realized gradually over the next several years, but we made progress this year with a number of great hires:

Clark Barrett, who joins us as a research professor, received his PhD from the department under David Dill and was most recently a professor at New York University. The modern method for implementing rich and automated logic engines is known as *Satisfiability Modulo Theories*, an approach pioneered by David and Clark. Clark is also well known as the designer of the CVC4 SMT solver.

Emma Brunskill is currently an assistant professor at CMU and will join the department later in the 2016-17 academic year. Emma's research is in machine learning, and particularly reinforcement learning with applications to large-scale societal issues, such as improving education through individualized tutoring.

Omer Reingold is a new full professor. Omer was formerly a professor at the Weizmann Institute and also a research staff member at Microsoft's former Silicon Valley Research Center and then at Samsung Research. Omer is famous for his contributions to complexity theory, particularly his fundamental contributions to our understanding of the role of randomness in computation.

Mary Wootters comes to us after a postdoc at CMU and a PhD from the University of Michigan. Mary is a theoretical computer scientist who is interested in understanding the fundamental limits of what we can learn from noisy data. In her work she draws on a combination of CS and EE techniques (such as signal processing), and in fact Mary is a joint appointment with the EE department.

Matei Zaharia works in computer systems and is well known for his work designing Spark, a very widely used programming system for large-scale data analysis, and Mesos, a datacenter resource manager. Matei received his PhD from UC Berkeley in 2014 and has spent time in industry and at MIT immediately prior to joining our faculty.

We've also been actively hiring lecturers in an effort to increase the department's teaching capacity to help meet the demand for CS classes. We were very fortunate this year to recruit two outstanding lecturers to augment what is already one of the top groups of professional teachers anywhere.

Victoria Kirst received her undergraduate degree from the University of Washington, where she discovered she loved to teach (and that students really enjoyed having her as a teacher!). After working for a number of years as a software engineer at Google, Victoria is excited to be back in academia.

Chris Gregg received his BS from Johns Hopkins University and his Master of Education from Harvard. After a stint teaching high school physics, Chris went back to school to get his PhD in computer science from the University of Virginia. He was most recently a lecturer at Tufts University, and is also a Commander in the U.S. Naval Reserve.

Retirements

David Cheriton switched to emeritus status in September after 35 years on the Stanford faculty. David, a recipient of ACM SIGCOMM's lifetime achievement award for his technical contributions, has been a major force and leading figure in distributed systems research throughout his career. He is also well known for activities in industry and particularly for his skill in helping translate academic research into successful commercial products.

Peche Turner, the CS department manager for 20 years, retired in April. Department chairs come and go every few years, but a change of department manager, who handles all CS staff and the department's finances, is a big deal. Peche worked with seven CS chairs: John Hennessy, Jean-Claude Latombe, Jeff Ullman, Hector Garcia-Molina, Bill Dally, Jennifer Widom, and finally me. She was very highly respected across campus and won numerous campus-wide awards for her service. I could say that Peche is gone but not forgotten, but that wouldn't be quite true, as she has been spotted every week or two stopping in to chat with our ...

New Department Manager

The new CS department manager is **Debby Inenaga**, who previously worked in the office of the Vice Provost for Undergraduate Education. Debby's financial background and deep knowledge of Stanford has helped her step into the role of department manager relatively easily, and while she claims she still has a lot to learn, thanks to both Debby and Peche the transition has been remarkably smooth.

The CS Major

Another significant change this year is that after almost a decade of rapid growth, the number of CS majors and enrollments in CS classes both appear to have plateaued. CS classes grew only 1% overall this past year. Of course, the plateau is a high one, with CS currently by far the most popular major on campus and with a number of CS classes among the largest at Stanford.

Major Initiatives

One of the ways the research environment has been changing is in the emergence of large, interdisciplinary initiatives in which computer science plays either a central or a key supporting role. Here are three recent examples:

The Stanford Cyber Initiative is one of three centers nationwide supported by the Hewlett Foundation (the other two are at Berkeley and MIT). Stanford's center focuses on cyber-social systems that combine machines and people; the range of work includes everything from issues of individual privacy on up to trying to understand what policies can help mitigate and discourage full-fledged cyberattacks by nation states. **Dan Boneh** is a co-director of the Stanford Cyber Initiative.

Just after last year's newsletter went to press, Toyota announced it was making a large donation to **start a new center at Stanford** focused on advancing AI research. The center, directed by **Fei-Fei Li**, supports a very broad range of AI-related research (e.g., work on self-driving cars, robotics, modeling human behavior) involving many faculty both within and outside the CS department.

The most recent new initiative is a **collaboration between the CS department and SLAC National Accelerator Laboratory** to build a computer science research group within SLAC focused on exascale computing and the data analysis challenges of modern experiments. The unique machines SLAC builds and runs have all become different forms of digital sensors designed to gather lots and lots of data—everything from cameras for advanced telescopes to hard x-ray lasers. Increasingly, obtaining meaningful scientific results depends on computer science advances in managing and analyzing all of that experimental data.

Research Activities

The purpose of all the initiatives and collaborations is to enable specific research advances by faculty and students. Here is just a taste of what happened this year in the department's research:

Ocean One is a humanoid diving robot designed, built, and programmed by **Oussama Khatib's** Robotics Laboratory. This past April, in a historic first, Ocean One descended 100 meters into the Mediterranean to the shipwreck **La Lune** and retrieved a vase that had been submerged for over 450 years. Ocean One was developed and built at Stanford with the support of Meka Robotics and KAUST, tested and debugged at

the Stanford pool (apparently open swim hours were unusually interesting last year!), and flown to France for its maiden underwater archeology mission in collaboration with the French Ministry of Culture. Ocean One's success using a combination of automated systems and intuitive human control through a haptic interface was a particularly clear illustration of how robots can give people safe access to dangerous and otherwise unreachable parts of the planet. Stay tuned—more underwater expeditions are planned!

Neural networks have enjoyed a renaissance in recent years due to both new ways of using them and the availability of huge amounts of data to train them. At their core, neural nets are just functions that are learned from input-output examples with a particular method for fitting the data points. Standard representations of neural nets tend to be space intensive, however, which makes them difficult to deploy on memory-constrained devices like phones and sensors. **Bill Dally** and his graduate student **Song Han** have developed a method to reduce the size of a neural network by a factor of 30x without measurably perturbing the function it represents. This technique, called *deep compression*, recently won a best paper award at ICLR. An extension of the technique can be used to improve the accuracy of most neural networks.

Another distinct trend of the past decade has been the rise of new programming models for massively parallel, distributed computers, with the MapReduce/Hadoop family being perhaps the best known example. Anecdotally, while these models have proven to be excellent for certain common patterns of computation, for slightly more complex problems people have struggled to find good ways to implement important calculations. **Tim Roughgarden**, his graduate student **Joshua Wang**, and collaborator **Sergei Vassilvitskii** (Stanford PhD '06) recently provided the first formal proof that these difficulties are no accident. Specifically, Tim showed that a cluster of machines each with small memory (much less than the input size) requires a super-constant number of synchronized computation rounds to solve many problems of interest, such as graph connectivity. The [paper](#) won the best paper award at the most recent SPAA.

New CS Master's Track in Education

Eric Roberts may have retired, but he hasn't stopped contributing to CS education. Eric's latest idea stems from the observation that the competition for computer scientists has reached a point where many colleges, particularly smaller liberal arts colleges, are having difficulty hiring even a single faculty member qualified to teach computer science at a time when demand for CS courses is at record levels. At the same time, there are new PhDs in other fields who have prepared for a teaching career but find there are few job openings. On Eric's initiative, the department proposed a one-year CS master's track in education to prepare people who already have a PhD in another discipline to teach introductory CS classes. The two-year pilot was approved in record time at all levels of the university—just in time for the first cohort of students to matriculate this fall.

Outreach

CS106A in Turkey: In June, a group of current and former members of the department taught a two-week residential summer camp for high school students at Koç University in Istanbul. The camp is funded by a small nonprofit called CS Bridge, established by Nick & Asena McKeown to teach CS to high school students in countries with a strong education system but an undeveloped software industry. Now in its third year, the camp is a condensed two-week version of Stanford's extremely popular CS106A.

Chris Piech, one of our CS lecturers who recently finished his PhD in the department, has led the teaching of the program since its inception.

The Stanford team worked with our very own EE Professor Emeritus **Umran Inan**, now president of Koç University, who generously helped host the camp, with support from Professor Baris Bozkurt at Koç. This year the program attracted 200 high school students from all across Turkey, 50% of whom were girls. The Turkish students made a fun video of course highlights that you can find [here](#).

An Instructional Odyssey: After **Jennifer Widom** stepped down from being the School of Engineering's senior associate dean for faculty affairs this summer, she decided to take a sabbatical with a unique twist: She's on a year-long instructional odyssey to teach short courses on topics in Big Data and conduct d.school-inspired problem-solving workshops in parts of the world where there is limited local expertise in these subjects. She started her tour in Sri Lanka and as of this writing is teaching in Colombia, soon to be followed by a trip to Thailand and Bhutan as well as many other countries in Southeast Asia, South America, and Africa. More information, including links to a blog and social media sites, can be found at professorwidom.org.

Faculty and Staff Awards and Honors

Many members of the department received major awards this past year:

- **Serafim Batzoglou** – Innovator Award, International Society of Computational Biology
- **Michael Bernstein** – Sloan Foundation Fellowship
- **Dan Boneh** – National Academy of Engineering
- **Bill Dally** – Funai Achievement Award
- **David Dill** – Alonzo Church Award for Outstanding Contributions to Logic and Computation, jointly awarded with his former PhD student Rajeev Alur, professor of computer science at the University of Pennsylvania
- **Oussama Khatib** – IEEE Robotics and Automation Society George Saridis Award
- **Don Knuth** – Honorary Member of the London Mathematical Society
- **Jure Leskovec** – CRT Foundation's Lagrange Prize
- **Fei-Fei Li** – J.K. Aggarwal Prize
- **Nick McKeown** – NEC C&C prize, together with Nick's former PhD student and current consulting faculty member Martin Casado
- **Chris Ré** – MacArthur Award
- **Tim Roughgarden** – Kalai Prize in Game Theory and Computer Science
- **Greg Valiant** – Sloan Foundation Fellowship

Professor Emeritus of Electrical Engineering **Martin Hellman** and former member of the Stanford Artificial Intelligence Lab **Whitfield Diffie** received the **ACM Turing Award** for their contributions to public key cryptography and key exchange.

Many former residents of Gates Hall will remember **Christine Fiksdal**, the CS department's building manager. Christine received the School of Engineering's Safety Award this year for her long and spotless record of efficient and proactive work maintaining a safe and productive environment in a constantly evolving, 600-occupant facility.

Student News

CS students were recognized with a number of department, school, and university awards.

- The Ben Wegbreit Prize for the best undergraduate CS honors thesis went to **Catalin Voss** for his thesis *Social Interaction Recognition in the Real World: Developing an At-Home Learning Aid for Treatment of Mental Disorders*, advised by Terry Winograd. Catalin also won two university awards, a Firestone Medal and the Kennedy Thesis Prize, as well as a [Lemelson-MIT award](#).
- **Ranjay Krishna**'s *Visual Genome: Crowdsourced Visual Knowledge Representations* won the Christofer Stephenson Award for the best CS master's research report. Ranjay's advisers were Fei-Fei Li and Michael Bernstein.
- **Chinmay Kulkarni** won the Arthur Samuel Thesis Award for the best PhD thesis of the 2015-16 academic year. His dissertation is *Structuring Peer Interactions for Massive Scale*, and he was advised by Michael Bernstein and Scott Klemmer.
- **Greg Bodwin** and **Okke Schrijvers** both received the Student Service Award for outstanding service to the CS department.
- The Forsythe Teaching Award went to **Isabel Bush** and **Krister Johnson**. Isabel and Krister both also won School of Engineering Centennial TA Awards, as did **Ilan Goodman**.

Staying Connected

The department website at cs.stanford.edu is the best source for current information about the department, including faculty, students, research programs, and teaching initiatives. As I've said before, I am always interested to hear from our alumni and welcome any thoughts and suggestions you may have about the department and its direction, and I am grateful for the interactions I've had with many of you.

Finally, as always, I want to thank the many alumni and friends who support the department and school. We look forward to your continued engagement in the years to come. Until the next newsletter, have a terrific year.



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