Dear Computer Science Alumni and Friends,

It's been a busy year for the Stanford CS Department, which I suppose is my excuse for being later than usual with this newsletter! The department continues to grow in faculty, students and breadth of activity. I can't hope to cover everything, and so as usual I've tried to focus on a few highlights that will give you a sense of the activity in the department. The department made progress on many fronts last year, and as always the involvement and advice of many alumni has been an important component in helping us move forward.

Faculty Hiring

Last year we hired a record six new faculty, and everyone assumed that was a fluke that we would not soon repeat. Well, this year we hired six more new faculty! No predictions about what will happen this coming year, but no one expects this pace of hiring to be sustained. In the meantime, we can appreciate the outstanding hires we made this year:

Jeannette Bohg is an expert in grasping, one of the fundamental problems in robotics. She received her Ph.D. from KTH in Stockholm, Sweden, was most recently a senior research scientist in the Autonomous Motion Department of the Max Planck Institute in Tübingen, Germany, and joins us as an Assistant Professor. Technically we hired Jeannette last year, but too late to make it into last year's newsletter – which is why there are actually seven new faculty listed here!

Zakir Durumeric received his Ph.D. from Michigan this year and will join us as an Assistant Professor in 2018. Zakir's research is in computer security, where he has pioneered techniques for rapidly scanning the entire internet, with applications to empirically quantifying aspects of the security not just of individual sites but of all of cyberspace.

Kayvon Fatahalian was most recently an Assistant Professor at CMU, and before that was one of our own, graduating from Stanford with his Ph.D. in 2011 (advised by Pat Hanrahan). Kayvon's work blends systems and graphics; he is currently working on visual computing systems that can scale data analytics to enormous quantities of still image and video data.

Tengyu Ma will join us as an Assistant Professor in 2018; he is currently spending a year with Facebook’s AI Research group. Tengyu’s research areas span machine learning and algorithms, with a focus on foundations. Tengyu received his Ph.D. from Princeton in 2017. Tengyu will also be the department’s first joint appointment with Statistics.

Aviad Rubinstein will also join the department as an Assistant Professor in 2018. Aviad just completed his Ph.D. at Berkeley and is currently on a postdoctoral year at Harvard. Among other things, he has research interests in using techniques from theoretical computer science to study questions in areas such as evolution, economics and stopping theory.
Dorsa Sadigh also just completed a Ph.D. at Berkeley and joined Stanford this fall as a joint appointment between CS and EE. Dorsa’s research interests lie at the intersection of algorithmic human-robot interaction and control theory, stemming from the simple observation that if robots are to work safely and reliably with humans, they need to model humans and anticipate humans’ actions as part of their own decision making.

Li-Yang Tan is currently completing a term as a Research Assistant Professor at the Toyota Technology Institute after finishing his Ph.D. at Columbia in 2014. Li-Yang works in theoretical computer science, and particularly in complexity theory. He will also join the department in 2018.

Retirements and New Appointments

David Dill became Professor Emeritus in September of this year, almost exactly 30 years after he joined the department in 1987. David is a member of the National Academy of Engineering and the American Academy of Arts and Sciences. He is well known in the computer science research community for his contributions to the theory and practice of formal verification, including the theory of timed automata, fundamental work on verifying the correctness of cache coherence protocols, and the invention of SMT solvers, the current workhorse systems in automated logic. But to the broader public, David is best known for being one of the first to sound the alarm about the security of electronic voting systems, and for his tireless work through the Verified Voting Foundation that he started in 2003 to improve the security and verifiability of elections at the local, state and national levels. Within the department David served for many years as an effective Ph.D. Program Director, keeping a watchful and sympathetic eye on the progress of hundreds of CS Ph.D. students. The hardest part of retiring was perhaps giving up the endowed chair he held, the Donald Knuth Chair, which David always referred to as the “best named chair in Computer Science.”

Noah Goodman is an Associate Professor of Psychology at Stanford, where he studies human cognition using computational models. Within computer science Noah is very well known as a founder of Probabilistic Programming Languages, which has been a major topic of research in both the programming languages and AI research communities in recent years. Noah has collaborated almost continuously with a number of CS faculty since he joined Stanford in 2010. Noah officially became a joint appointment between Psychology and CS in September.

New President, Provost and Dean

It will be a surprise to no one that the last year has been a major transition period for the University and the School of Engineering. To recap, last year John Hennessy stepped down as the President of Stanford after a remarkable 16-year run. While John is no doubt missed in the University’s administrative circles, it is nice to see him again as a regular attendee at faculty lunch! John isn’t done with administrative commitments, however, as he is the first director of the new Knight-Hennessy Scholars program, whose inaugural class will be admitted this year. John Etchemendy also stepped down as Provost after staying on for a short period to help with the transition to the new administration.

The new President, Marc Tessier-Lavigne, relatively quickly conducted a search and named the then Dean of Engineering, Persis Drell, as the new Provost, which of course resulted in yet another search for a new dean. Our own Jennifer Widom became the 10th Stanford Dean of Engineering last March.

The CS Major

Last year I reported that the enrollments in CS classes and the number of CS majors appeared to have plateaued. That was premature – while enrollments are no longer increasing by double-digit annual percentages, the latest estimate is that we are still experiencing 2-3% growth per year (after factoring out the significant quarter-to-quarter variation in enrollments), and CS majors were up 3.8% over last year. Just before spring commencement the department had over 1,000 undergraduate CS majors for the first time. A total of 567 students received a B.S., M.S. or Ph.D. degree at this year’s CS commencement, and over 500 attended the ceremony!
Research Activities

As always there is a wide range of research going on in the CS department. The following is just a small sample of current activities – see if you can spot the theme!

**Christos Kozyrakis** and his students have recently focused on using machine learning to simplify and optimize the management of cloud platforms, taking the view that operators and users should simply set overall performance, reliability and cost efficiency goals for cloud platforms and applications. These goals drive algorithms based on machine learning models that automate complex but critical tasks such as rightsizing applications, selecting cloud instance types, setting hundreds of application parameters, managing interference between applications and reacting to load changes. Christos’ group has used classification techniques, similar to those used for recommendations on e-commerce sites, to develop accurate and detailed models of application behavior. In addition to optimizing performance and cost for applications deployed on public and private clouds, their recent ASPLOS paper applied these models to showcase elusive denial-of-service attacks for cloud applications and to design resilient mitigation techniques.

Many algorithms in machine learning (e.g., training deep neural networks) involve optimizing complicated non-convex functions. Stochastic gradient descent (a very efficient form of classical gradient descent) is the algorithm of choice for these optimization tasks, although it runs the risk of getting stuck in spurious local minima (a spurious local minimum is one that would eventually disappear in larger data sets for the same problem). Adding noise seems to help in practice, but an understanding of why is lacking. **Moses Charikar, Percy Liang** and postdoc **Yuchen Zhang** recently analyzed the Langevin Monte Carlo method, which is a principled way to add noise to stochastic gradient descent, showing that the time to reach an approximate minimum is polynomial in many settings. Further, this algorithm escapes spurious local minima, making it more powerful than stochastic gradient descent for non-convex optimization. This work won the best paper award at COLT.

Machine learning systems have seen incredible success in the last few years, but their impact outside large technology companies is still in its infancy. A barrier to deploy machine learning systems more widely is the scarcity of training data, the data from which machine learning approaches learn to make conclusions. **Chris Ré** and his students have created a system called **Snorkel** in which one programs not by building models, but by creating training data. The training data produced by this technique is far from perfect; it can be biased and correlated. Using noisy training data in machine learning systems poses fundamental practical and theoretical challenges, which are the core of the research. This technique builds on the efforts to democratize machine learning through the Stanford **DAWN project**, featuring professors **Peter Bailis, Matei Zaharia** and **Kunle Olukotun**. On the theoretical side, Snorkel’s underlying theory is an example of a burgeoning topic of learning from weaker forms of supervision, a core topic of the recently formed **statistical machine learning group** that features professors **Emma Brunskill, John Duchi** (Statistics and EE), **Stefano Ermon, Percy Liang** and **Greg Valiant**. This young, exciting group accomplished the unheard-of feat of winning best paper awards at all five top-tier machine learning conferences in 2017.

Gates News

Discussions of department growth inevitably turn into discussions about space, as in, “Where are we going to put everyone?” It’s a good question, and planning for the current and future space needs of the department has been a major ongoing activity for years.

In the short run, we’ve been renovating portions of Gates to both make more efficient use of space and in some cases literally create new space for department activities. In a complex sequence of moves, we cleared out one of the department’s machine rooms in the basement, converted that area into our new loading dock, and then renovated the old loading dock as space for the **Brown Institute for Media Innovation**. The result is a spacious suite and a very attractive indoor/outdoor conference room in the back of the 1B Wing.
Overlapping with that project is a major renovation of almost the entire 3A wing, widening the hallways and adding glass and open areas to let in more natural light and create a more collegial, collaborative environment. While the 3A renovation will continue in stages for a good part of the 2017-18 academic year, parts are already finished and in use and the result is stunning – this is not the Gates building you remember! Kudos to **John Ousterhout** who led the 3A renovation.

And in 2018 we’re planning a major renovation of the 4th floor Fujitsu Lounge, enlarging it to create a useful meeting space and lunch room (when frankly the current space is neither).

But it is a small project that we did last year that has gotten the most attention. Since Gates was first occupied in 1996, and for reasons that are lost to history, only one of the two doors facing Serra Mall has opened from the outside. For 21 years the right-hand door was permanently locked closed, with a helpful “Use Other Door” notice written on its glass. The Gates doors were even featured in HCI classes as examples of poor user interface design. But no more; after, shall we say, some effort (it wasn’t easy!), you can now enter through *both doors*. I have received more comments on this one change from alumni and current students than anything else that has happened while I’ve been department chair.

So, the next time you stop in Gates take a look around the building – you may be surprised at how much parts of it have improved. In the longer run we are working on plans for a significant expansion of space for the department, including eventually a full renovation of Gates.

**Faculty Awards and Honors**

Members of the department received an array of significant awards again this year:

- **Dan Boneh** — ACM Fellow
- **Bill Dally** — Tau Beta Pi Teaching Award
- **Leo Guibas** — National Academy of Engineering
- **Oussama Khatib** — IEEE Technical Field Award (TFA) in Robotics and Automation
- **Christos Kozyrakis** — ACM Fellow
- **James Landay** — ACM Fellow
- **John Mitchell** — American Academy of Arts and Sciences
- **Tim Roughgarden** — Guggenheim Fellow
- **Yoav Shoham** — Feigenbaum Prize, and Fellow of the Game Theory Society

**Student News**

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

- The Arthur Samuel Thesis Award for the best CS Ph.D. of the 2016-17 academic year was awarded to **Hristo Paskov** for his dissertation *Learning with N-Grams: From Massive Scales to Compressed Representations*. **John Mitchell** was Hristo’s advisor.

- **Martina Marek**, advised by **Oussama Khatib** and **Silvio Savarese**, received the Christofer Stephenson Award for the best CS Master’s research report, *Perception for Underwater Exploration: Application on OceanOne*.

- This year’s Ben Wegbreit Prize for the best undergraduate CS honors thesis went to **Catherine Wong** for her work titled *Feature-conditioned Neural Network Pre-training for Skin Cancer Classification*, advised by **Sebastian Thrun**.

- **Griffin Dietz** won the Kennedy Thesis Prize, a University-level honor for an outstanding undergraduate honors thesis. Griffin was advised by **James Landay** and **Hyowon Gweon**
(Psychology) on her thesis *Children’s Use of Decomposition in Problem Solving as an Early Introduction to Computer Science*.

- Every year the School of Engineering gives the Ford Scholar Award to the graduating engineering student with the highest GPA. This year there was apparently a tie! Christopher Sauer and Kensen Shi, both from CS, won the award.

- The Forsythe Teaching Award went to Nicholas Troccoli. Nicholas also won the Centennial TA Award from the School of Engineering, as did Anton Apostolatos.

- The Student Service Award for outstanding service to the CS Department went to Will Crichton, Mark Miller, Jerry Lin and James Thomas.

**Staying Connected**

The CS Department website is the best source for current information about the department, including faculty, students, research programs and teaching initiatives. 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. Until the next newsletter, have a terrific year.

Alex Aiken  
Alcatel/Lucent Professor  
Tencent Chair, Department of Computer Science