Dear Computer Science Alumni and Friends,

Every four years, without fail, three significant events come to pass: the Olympic Games, a U.S. Presidential election, and a new Chair of the Stanford Computer Science Department. I became the 11th CS Department Chair in January 2009, just a week before the inauguration of the 44th President of the United States. Strangely, my swearing-in and inaugural speech were surrounded by somewhat less fanfare than Obama’s.

Just a few months before taking on my new role in the department, I was exploring the world with my family. Together with my CS faculty colleague (and husband) Alex Aiken and our two preteen children, we shunned work and school for a full year and lived every traveler’s dream. (Our travels are documented on the Aiken/Widom Family Year Off website, infolab.stanford.edu/~widom/yearoff.html.) When I returned to work, there were numerous suggestions that my “batteries are recharged,” which is code for “we’re about to hit you up for a big service job.” Being at the helm of the CS Department is rather different from being at the helm of a sailboat in the Andaman Ocean, but it’s no less exciting.

Like elsewhere at Stanford and beyond, we are facing departmental budget challenges due to the worldwide economic crisis, but we’ll weather the rough seas one way or another. By all other measures, the department is stronger than ever: We’ve hired two superb new faculty members; the department continues to house cutting-edge research in traditional and emerging areas of Computer Science; we’ve rolled out revolutionary changes to our undergraduate curriculum; our faculty, staff, and students have garnered a multitude of prestigious awards; we’re seeing significant increases in undergraduate enrollments and declared majors; and as always, we attract the best and brightest students from around the world. This newsletter covers these and more highlights primarily of the 2008–09 academic year.

New and Promoted Faculty
We are delighted to welcome two new faculty members, Fei-Fei Li and Sachin Katti, to the department. Fei-Fei and Sachin bring exciting new strengths in Computer Vision and Wireless Networks, respectively. Their bios and short descriptions of their research programs are included at the end of the newsletter.

Congratulations are due to Christos Kozyrakis and Andrew Ng, who were both promoted this year to the rank of Associate Professor with Tenure. Andrew and Christos have been terrifically productive as junior faculty, and they are wonderful colleagues—we’re just delighted they’ve sailed over the tenure hurdle and are now with us for good. Their bios and research programs are briefly covered at the end of the newsletter.
Tragic Loss of Professor Rajeev Motwani
In far less happy news, a tragic accident on June 5 took the life of Professor Rajeev Motwani. Rajeev was a leading figure in our department. He was the Director of Graduate Studies, a renowned researcher in many areas of data management and theoretical computer science, and a strong liaison to the world of entrepreneurship. Although news reports about Rajeev focused on his early mentoring of the Google founders, that’s only the tip of the iceberg—many of Rajeev’s PhD students have embarked on highly distinguished academic careers, and Rajeev inspired generations of CS majors with his extraordinary teaching of the undergraduate Automata and Complexity Theory class. Rajeev is greatly missed throughout the department, Silicon Valley, and the worldwide Computer Science community. A memorial website has been created at www.stanford.edu/~ashishg/cgi-bin/RememberingRajeev.

Courtesy and Consulting Faculty
If you’ve examined our web page listing department faculty members (cs.stanford.edu/People/faculty), you may have wondered about the mysterious categories of “courtesy” and “consulting” faculty. These are folks who are not regular faculty members in our department, but who contribute in continuing and significant ways, through teaching, advising students, and/or administrative roles such as admissions and hiring committees.

Courtesy faculty are those with appointments in other departments at Stanford. Currently we have courtesy faculty whose primary departmental affiliations span a wide gamut: Bioengineering, Chemistry, Civil Engineering, Communication, Education, Electrical Engineering, Genetics, Linguistics, Management Science & Engineering, Medical Informatics, Music, and Structural Biology. Incidentally, we also have quite a few “joint faculty” in our department—faculty who are appointed partly in CS and partly in another department. We have faculty with joint appointments in Developmental Biology, Electrical Engineering, Linguistics, and Surgery.

Consulting faculty are those with a primary affiliation outside of Stanford (typically in industry), but again with significant involvement in Stanford CS. Our current consulting faculty are Kurt Akeley from Microsoft Research, Federico Barbagli from Hansen Medical, Gary Bradski from Willow Garage, Pei Cao from Google, Kathleen Fisher from AT&T, and Prabhakar Raghavan from Yahoo! Research.

Department Growth
You know the old good news—bad news dichotomy. We have some very good news: The university has granted approval for the CS Department to increase in size by up to ten regular faculty members, finally bringing us close to the size of departments at our “peer” (sometimes known as “rival”) institutions such as MIT, UC Berkeley, and Carnegie Mellon. The bad news: In these rocky economic times, we need to raise funds to support the growth. Each additional faculty position requires raising an endowment of $2.5 million, to be augmented by $1.5 million of School of Engineering funds for a total of $4 million per new position. Aided by a $2.5 million gift from Google, we created the first of the new endowed chairs in the memory of Professor Rajeev Motwani. Rajeev continues to inspire us as we work hard to raise funding for the remaining chairs.
Research Activities
As always, a tremendous amount of exciting research is going on in the department. In an attempt to keep this newsletter to a reasonable length, I’ve decided to highlight just three research activities, of widely different styles. I must say it was difficult to select among the many options. Please visit the CS Department website (cs.stanford.edu/) to learn about ongoing research across the entire field.

Computational Billiards
Our department has a long tradition of researchers applying their innovative algorithms and theories to real-world problems. By doing so, not only can we solve important practical problems, but we also put our theoretical frameworks to a reality stress-test. Recent work from Professor Yoav Shoham’s group (robotics.stanford.edu/~shoham/) is a perfect example. Yoav has been working in the area of game theory, both within its traditional confines and beyond. Specifically, as Yoav puts it: “We aim to transcend some of the idealizations built into the formal apparatus of game theory.” Recently, his idealization-transcending techniques were applied to the problem of Computational Billiards, with significant success: Yoav’s team (led by postdoc Alon Altman and PhD student Chris Archibald) won the gold medal at the Computational Pool Competition. The competition was held by the International Computer Games Association at the 2008 Computer Olympics in Beijing (following the lesser-known Olympics—those involving human athletes). Computer programs participated in a round-robin 8-ball simulated pool competition, complete with a realistic physics simulator and an imperfect-control element. The computer program entered by Yoav’s group, which won the competition decisively (i.e., they slaughtered the second-strongest entry), incorporated techniques from AI-style search, Markov Decision Problems, robotics path planning, and opponent modeling. For more discussion of computational billiards, and more generally of what Yoav terms “game theory pragmatics,” see Yoav’s publication page (robotics.stanford.edu/~shoham/YoavPublications.htm).

How the Human Genome Does Its Thing
A different flavor of Artificial Intelligence is found in reverse-engineering the works of nature. Our genome is a vast digital repository of instructions we pass on to our progeny, while proteins are the workhorses of every cell in our body. We can now read most all gene sequences in our genome that tell a cell exactly how to build every protein it needs. But our understanding of the DNA codes that tell each cell when, where, and how much of each protein to make is in its infancy. Professor Gill Bejerano and his group (bejerano.stanford.edu/) are working to fill this void. Gill, who has a joint appointment in Computer Science and Developmental Biology, notes: “Imagine attempting to comprehend an elaborate software system by being allowed to look only at its variable assignments. We and others are getting first glimpses of the genome’s control flow—the ifs, the fors, the go tos. And it is breathtaking.” Using machine learning, statistical reasoning, and algorithmic optimization methods, Gill’s group is building what they glibly refer to as “weapons of mass discovery.” Their suite of tools is used to annotate the vast regulatory landscape, and to generate unique hypotheses about its contribution to human disease and to our species’ unique evolution. In earlier work, Gill and his colleagues discovered ultraconservation, arguably the most puzzling phenomenon in our genome: DNA stretches that for no clear reason are independently maintained exactly identical in species as divergent as human and chicken. In current work, Gill’s group is attempting to decipher when the control layer contributes to human disease; for example, when a patient’s genes are intact but the DNA instructions that turn them on and off are misspelled. Gill is certain that many more genomic treasures are now coming within our reach, for the first time in human history.
**Goodbye Disk, Hello RAM**

When you think of large-scale online storage you probably think of magnetic disks. Disk has dominated the storage universe since it displaced magnetic tape in the 1970s. However, disk’s reign may be coming to an end. Flash memory has become widely used for handheld devices, and now a group of Stanford faculty is exploring an even more radical concept called **RAMCloud**, which is intended for large datacenters. A RAMCloud consists of the aggregated main memories of thousands of commodity servers, where all data is kept in fast DRAM all the time. “We believe that a RAMCloud can provide 1000x faster latency and 1000x greater throughput than today’s best disk-based storage systems,” notes Professor John Ousterhout (home.pacbell.net/ouster/), who leads the ambitious project. “This performance is essential for the massive Web applications of the future.” The RAMCloud project is just getting underway. It includes a diverse group of faculty in addition to Professor Ousterhout: Professors Christos Kozyrakis, David Mazieres, Subhasish Mitra, Balaji Prabhakar, and Mendel Rosenblum, and numerous graduate students. The team will have to solve a number of interesting research problems to make RAMCloud a reality, such as how to guarantee the durability and availability of data in DRAM, and how to design datacenter networks fast enough to match the performance of the RAMCloud servers.

**Rollout of New Undergraduate Curriculum**

In last year’s newsletter, previous Department Chair Bill Dally (who, by the way, is currently on leave as Chief Scientist at Nvidia) reported on the significant effort underway to redesign our undergraduate curriculum. We’re pleased to report that the curriculum revision is complete, we’ve just finished rolling out all of the changes, and so far they have been a huge success! We’ve received a great deal of positive feedback from students and industry alike. In fact, in meetings, Microsoft Chairman Bill Gates, Intel CEO Paul Otellini, and a number of executives from one of our best hiring “customers,” Google gave the curriculum high marks and were very encouraging about the directions we are pursuing.

In brief, the new program provides a set of core courses covering foundational concepts in computing (including programming and systems development, as well as theoretical computer science and mathematics), followed by a set of “tracks” (concentration areas) that students may choose from. Tracks serve two purposes: They give students flexibility in their studies, and they delineate areas in which Computer Science is having significant impact on other fields. Enrollment in our new courses has far exceeded our expectations, and the number of students choosing to major in Computer Science has increased dramatically.

**Nationwide Uptick in Computer Science**

The first half of this decade saw significant declines in undergraduate Computer Science enrollments and majors at just about every U.S. university. By 2005 there had been nearly a 50 percent drop nationally from peak enrollments in 2001. We are happy to report that Stanford’s recent enrollment increases are indicative of a nationwide trend. Preliminary data from the Computing Research Association (CRA) shows that enrollments in undergraduate CS programs nationally grew nearly 10 percent from Fall 2007 to Fall 2008 (cra.org/statistics/). We are particularly thrilled that at Stanford the number of students declaring CS as their major increased 25 percent in this past year alone.
Freshman Seminars and Senior Projects
In addition to the curricular changes discussed earlier, we’ve been doing some exciting things at both ends of the undergraduate educational experience. We continue to offer a range of Freshman Seminars—small discussion-oriented courses that give undergraduates close faculty contact and early exposure to intriguing problems. Here are the seminars we offered in 2008–09:

• David Dill – Digital Dilemmas
• Hector Garcia-Molina – Computers and Photography: From Capture to Sharing
• Marc Levoy – The Science of Art
• Yoav Shoham – Can Machines Know? Can Machines Feel?
• Gio Wiederhold – Business on the Information Highway

At the other end, all CS majors engage in a Senior Project, either independently or as part of a group. Group projects are demonstrated during a high-energy Software Project Faire put on each spring, typically attracting a bunch of industry folks. (Contact Bob Plummer at plummer@cs.stanford.edu if you’re interested in receiving an invitation to next year’s Faire.) Here is just a tiny sample of this year’s projects:

• Using the iPhone to detect strokes in high-risk individuals
• An automated music improvisation program that analyzes the style of music played on a MIDI keyboard and generates improvisation in real-time with the learned style
• An interactive system for teaching math and computer programming to middle school students
• Geoblogging, a way to let friends experience your trip, complete with fly-through

Stanford Engineering Everywhere
Stanford Engineering Everywhere (SEE) (see.stanford.edu/) is a new initiative being prototyped by the School of Engineering to make some of Stanford’s most popular engineering courses available online, free of charge. Unlike some of our peer institutions, Stanford’s free online courses include not only lecture videos, but also reading lists, course handouts, quizzes and tests, and a means of communicating with other SEE students. Currently, six CS courses are available through SEE: three introductory courses (CS106A, CS106B, and CS107), as well as Robotics, Natural Language Processing, and Machine Learning. As of Spring 2009 there were well over a quarter-million downloads of these courses. With the content clearly a hit, the school is now working on a viable business model for the project. In related news, the Stanford iPhone Applications course we made available through Apple’s iTunes University (www.apple.com/education/mobile-learning/) had a record-setting one million downloads in its first month!

KAUST Alliance
Stanford has a policy of not opening satellite campuses. However, Stanford does consider it part of its mission to support new academic centers in developing nations, when they are committed to academic excellence and serving the broad population. Recently, the CS Department engaged in an “Academic Excellence Alliance” with the new King Abdullah University of Science and Technology (KAUST) in Saudi Arabia (www.kaust.edu.sa/). KAUST has established agreements with several top universities in order to rapidly establish international-caliber curricula and research programs. The CS Department has been working with KAUST to identify top faculty candidates, develop its CS curriculum, and conduct collaborative research. Once the university is open, several of us will travel to KAUST to give short courses and research seminars.
So far, KAUST has recruited over 60 faculty members and has an incoming class of over 350 graduate students. A full 25 percent of these students are women, more than many engineering schools in well-established universities. KAUST’s brand-new campus is located on the Red Sea. As of the mailing of this letter, the campus will just have opened, with a celebration attended by King Abdullah along with our own Professor Jean-Claude Latombe.

Awards and Honors for Faculty and Staff
Once again we have a wealth of awards to report, with distinguished honors coming in for faculty and staff alike. One of my first executive orders when I became Department Chair was to institute a monthly wine-tasting and appetizers event for celebrating awards. (For those of you who remember the student-run weekly “TGIF” events featuring 6-packs of beer and ripped-open bags of chips, this is sort of the faculty and staff version of the same thing.) Please don’t worry about fiscal irresponsibility in a tight budget year. We have some very resourceful staff members who deserve an award for putting together these celebratory events at minimal cost.

So far we’ve had significant new awards to be toasted every single month. Here’s a selection of major awards received by faculty:

• Bill Dally and Mendel Rosenblum – Elected to the National Academy of Engineering
• Yours Truly – Elected to the American Academy of Arts & Sciences
• Dawson Engler – ACM Grace Murray Hopper Award
• Alex Aiken, Pat Hanrahan, John Mitchell, and Mendel Rosenblum – Elected ACM Fellows
• Subhasish Mitra and Tim Roughgarden – Presidential Early Career (PECASE) Award
• Andrew Ng – IJCAI Computers and Thought Award, Technology Review Magazine TR35
• Nick McKeown – IEEE Koji Kobayashi Computers and Communications Award
• David Dill – Computer-Aided Verification Award
• Gill Bejerano – Microsoft New Faculty Fellow
• Ed McCluskey – IEEE Computer Pioneer Award; SIGDA Pioneering Achievement Award

We have superb administrative staff who keeps the department running like clockwork. Three of them won well-deserved major awards this year:

• Peche Turner (department manager) – Stanford University Marsh O’Neill Award for supporting research
• Claire Stager (student services officer) – School of Engineering Kay Bradley Award for outstanding service to students
• Jam Kiattinant (administrative associate) – School of Engineering Shah Award to an outstanding staff member

Student News
As usual, our students have been doing outstanding work.

Undergraduate research – Sergey Levine won the Wegbreit Prize for Best CS Undergraduate Honors Thesis. His thesis work, advised by Professor Vladlen Koltun, developed an automatic prose-based body language generator for graphical avatars. This novel work was also recognized with a university-wide Firestone Medal for Excellence in Undergraduate Research.
**Master’s research – Karan Mangla** won the Christopher Stephenson Memorial Award for Best CS Master’s Research Report. Karan, advised by Professors David Dill and Mark Horowitz, addressed problems in the emerging field of Systems Biology in his report titled “Robustness to Timing Delays in Biological Systems.”

**Student teaching and service** – Master’s student **Steve Marmon** won the CS Forsythe Memorial Teaching Award. He was praised effusively by students and faculty alike in the several courses for which he was a Teaching Assistant. PhD student **Adam Beberg** won the CS Student Service Award for his untiring work on student committees and events, and his organization of a university-wide seminar aimed at preparing PhD students for academic careers.

**National recognition** – PhD student **Maria Kazandjieva** and Master’s student **Tracy Chou** were selected as finalists for the nationwide Anita Borg Memorial Scholarship for Women in Technology. As part of the award, they will participate in a scholars’ retreat sponsored by Google this summer.

**ACM Programming Contest** – Stanford again hosted the ACM Northwest Regional Programming Contest under the direction of CS lecturer Jerry Cain. Stanford clinched the top two places out of 85 teams. The team that took top honors, composed of CS undergraduates **An Nguyen, Jaehyun Park**, and **Jeffrey Wang**, advanced to the World Finals in Stockholm, where they placed a respectable 20th out of over 100 finalists worldwide.

**More winners** – In the spirit of entrepreneurship, CS undergraduates **Kayvon Beykpour, Ben Cunningham**, and **Felipe Pimentel** (joined by economics major Aaron Wasserman) took the Grand Prize in AT&T’s “Big Mobile on Campus” Challenge. The team’s winning entry, which also received a mention in *Time* magazine, was a suite of iPhone applications (called *iStanford*, naturally) that enables students to sign up for courses, search campus maps, and perform a myriad of other useful Stanford administrative tasks. Now, no student with an iPhone has any excuse for being late to class.

**CourseRank** – Three CS undergraduates, **Benjamin Bercovitz, Filip Kaliszanz**, and **Henry Liou**, have also been making life easier for Stanford students. Working under the supervision of Professor Hector Garcia-Molina, they developed a course evaluation and planning system. After two years in operation, CourseRank (courserank.stanford.edu/CourseRank/main) is used regularly by over 9,000 Stanford students—nearly the entire undergraduate student body. The website includes course-related schedule-planning and social-networking features, as well as access to official university information such as grade distributions and evaluations. This level of transparency keeps students well-informed and faculty on their toes.

**Computer Forum News**

The Computer Forum (forum.stanford.edu/) is our long-standing industrial affiliates program, facilitating connections between Stanford’s CS and EE departments and over 60 companies worldwide. Computer Forum activities span the range from research collaborations to recruiting events. While the Computer Forum has predictably seen a slide in membership due to the current economy, the fact that the vast majority of companies have elected to remain members is a testament to the value of the Forum.
The Computer Forum runs an annual meeting with hundreds of participants from Stanford and member companies. This year’s meeting included several engaging faculty speakers, a panel on cloud computing, and a well-attended appetizer hour featuring 60 student posters. Focused workshops were held before and after the main event: one associated with the new POMI 2020 project (cleanslate.stanford.edu/research_project_pomi.php), and the ever-popular annual Computer Security Workshop.

**Staying Connected**

Please visit our CS Department website (cs.stanford.edu/) regularly for updated information about the department. From this site, you can link to many sources for detailed information about our faculty, students, research programs, and teaching initiatives. I welcome your suggestions regarding the department’s directions and activities, and I encourage you to visit us to see firsthand our facilities and programs.

I hope that you will remain an active member of our alumni community by keeping us apprised of your activities and whereabouts. You can log on to the school’s Engineering Alumni Update page soe.stanford.edu/alumni/update.html to update your contact information. Thank you for keeping in touch.

Until the next newsletter, have a terrific year.

Jennifer Widom
Fletcher Jones Professor
Chair, Department of Computer Science
New and Promoted Faculty Bios and Research Information

Fei-Fei Li joined us in June from the Princeton Computer Science Department, where she has been a faculty member for the past 2½ years. Prior to Princeton, she was on the faculty at the University of Illinois, Urbana-Champaign, after receiving her PhD from Caltech. Fei-Fei’s meteoric rise in the academic world is supported by her even more meteoric research contributions in the area of Computer Vision. Fei-Fei’s research group develops algorithms that perform important visual perception tasks such as object recognition, scene categorization, integrative scene understanding, human motion recognition, and material recognition. Her group also studies Human Vision, in particular the underlying neural mechanisms that enable the human visual system to perform high-level visual tasks with amazing speed and efficiency. Visit Fei-Fei’s home page (vision.stanford.edu/).

Sachin Katti (a joint appointment with Electrical Engineering) will join us in January 2010. Sachin received his PhD from MIT in 2008, and has since been doing postdoctoral work at UC Berkeley. Sachin’s research is in the area of networks, with an emphasis on wireless systems. His seminal thesis work comprised the design and implementation of a network coded wireless architecture, where he demonstrated through analyses, implementations, and evaluations how, if network coding is used, different layers can cooperate to exploit the physical characteristics of the wireless medium and significantly improve performance. Sachin has also made strong contributions in the area of secure systems, specifically on protecting the identity and data of users on the internet. A common thread throughout Sachin’s research is the harnessing of theoretical techniques from varied disciplines to solve practical problems.

Christos Kozyrakis (joint appointment with Electrical Engineering) works on architectures, runtime environments, and programming models for parallel computer systems. His research group has made significant contributions in transactional memory, a technology that simplifies application development for the multi-core chips that are now standard in all computers. His group is also developing robust security mechanisms that protect software against attacks ranging from buffer overflows to SQL injections. They are currently developing modeling, benchmarking, and design techniques that minimize energy use in datacenters. Christos joined Stanford in 2002 after receiving his bachelor’s degree from the University of Crete and his PhD in Computer Science from UC Berkeley. Visit Christos’ home page (csl.stanford.edu/~christos/).

Andrew Ng’s research interests include machine learning, robotics, and broad-competence AI. Using machine learning, his group has developed the world’s most advanced helicopter controller, capable of flying spectacular stunts (you can see the videos at heli.stanford.edu/). He is also known for his work on the STanford AI Robot (STAIR) project, which seeks to develop the technology to put a general purpose robot in every home, capable of such tasks as fetching/delivering, cleaning, and tidying up. Toward the goal, STAIR integrates methods drawn from all areas of AI, including machine learning, vision, navigation, manipulation, planning, reasoning, and speech. This is in contrast to the 30-year trend of working on fragmented AI subfields, and is a vehicle for driving research toward true, integrated AI. Visit Andrew’s home page (robotics.stanford.edu/~ang/index.html).