We have been making continual progress in our mission while enduring the difficult economic times. The faculty, staff, and students have been making sacrifices to maintain the quality as well as the visibility of our program. The economic downturn has impacted our resources and raised new challenges. However, we strive for enhancing the quality of our education, research, and service.

Last year we had another successful recruitment effort. We were able to attract Dr. Todd J. Green, who graduated from the University of Pennsylvania in the area of data management systems. After a one-year deferral, Dr. Ilias Tagkopoulos also joined us starting July 2009. He graduated from Princeton University and works in the area of computational biology. Please join me in welcoming Ilias and TJ to our campus community. In addition, Professors Francois Gygi and Raissa D’Souza, who were already on campus, joined the department on a 50% appointment.

Our faculty has been making exceptional progress in their research efforts. The research expenditures during the 2008-09 fiscal year grew again. The total research expenditure is now at about $9.4 million per year. Activities related to proposals and projects have gone up significantly and our faculty must be commended for their continued efforts.

We continue to observe an increase in the number of incoming undergraduate students. The size of our graduate program has stabilized at around 200. Among other activities, we are planning on revamping our undergraduate curriculum by including areas of specialization that can be optionally pursued by the students. We are also in the process of formalizing the Senior Design Projects so our graduates will be better prepared to meet the needs of the industry and future of academia.

Involvement and support from our alumni will help us in a multitude of ways. I sincerely request our alums to email me their feedback and suggestions on how we can do better.

I invite you all to browse through our web site (www.cs.ucdavis.edu) and email me your suggestions and comments.

Sincerely,

Prasant Mohapatra
prasant@cs.ucdavis.edu
Bucher Family Endows Chair in Computer Science

Prasant Mohapatra has assumed what is known as an administrative chair - the Tim Bucher Family Chair of Computer Science - contributed by electrical engineering alumnus Tim Bucher and his wife, Mary Louise, to support the department and promote entrepreneurship.

Mohapatra, an expert in wireless networks, sensor networks and Internet protocols, has held visiting scientist and visiting professor positions internationally and in private industry, and receives support from an array of public and private sources. He has served on numerous panels and technical program committees and publishes widely at competitive conferences and in journals.

Tim Bucher, a software executive who grew up on a farm in Healdsburg, California, came to UC Davis because he was interested in designing tractors. However, the aspiring engineer’s career goals abruptly changed when he took a required computer class during his freshman year.

“I didn’t know I would have to take computer science to do what I wanted to do,” Bucher explains. “But I quickly became fascinated by the subject and realized that this was something I might want to pursue further.” Like everything else about Davis, he recalls, the experience opened new doors.

In fact, it led to a career in which Bucher helped to develop innovative consumer products for such giants as Apple and Microsoft. The iMac, Mac mini, the iPod and WebTV are just some examples that bear the imprint of Bucher’s leadership and technical creativity.

Most recently, Bucher was founder and CEO of a Mountain View, California, start-up company called ZING Systems, which developed technology that connects consumers to their favorite music and entertainment services via wireless networks. Sirius Satellite Radio, SanDisk, and other corporations have used ZING technology to deliver innovative products to market. In 2007, Dell purchased ZING Systems where Bucher remains as the chief product officer.

Bucher, who serves on the College of Engineering Dean’s Executive Committee, is a generous volunteer and donor to the College of Engineering. The Cal Aggie Alumni Association recently recognized his achievements and professional contributions to the community and the University with their Outstanding Alumnus Award.

Meanwhile, Bucher is also active in the olive oil and wine industries, activities that allow him to stay close to his agricultural roots. “It keeps me grounded in this high-tech profession of mine,” he says. “And I still get some of my best new high-tech ideas while driving my tractors.”

Left to right: College of Engineering Dean Bruce White, Tim and Mary Louise Bucher; Prof. Mohapatra, Chancellor Larry Vanderhoef, and Meg Stallard, past chair of the Davis Foundation.
Promoting Ocean Literacy through CAMEOS: Coastal-Atmospheric-Marine Environmental Observing Studies

Eight UC Davis graduate student fellows - including computer science grad student Michael Byrd – and high school teachers and students in nine schools in Sonoma County are partnering to study how plastic from land ends up in the ocean, where it can be mistaken for food by albatrosses and other sea life. Classes are taken into the field where they collect litter and log statistics about that litter. That data is later uploaded using Google documents (keeping the cost of infrastructure free or nearly free) where researchers can then create webpages showing graphs and maps and the collaborative efforts of these young adults.

The CAMEOS program at the Bodega Marine Laboratory (BML) promotes science understanding by connecting graduate student research and grade 7-12 science curricula to Ocean Literacy principles, marine laboratory resources, and environmental technology. Graduate Fellows and Teachers receive training in inquiry-based learning, science content, environmental observing technology, and cyber-infrastructure. They then develop and implement motivational research projects for high school and middle school students that provide field experiences in coastal environments and access to start-of-the-art sensor networks and data portals. Students are presented with science role models and opportunities to practice all tasks performed by professional scientists, from creating research questions and collecting data to sharing results at scientific conferences.

The next stage of the process is to have students develop their own projects that relate to questions about the oceans. It’s a very exciting process that gives the fellows an opportunity to teach and learn a lot about inquiry based learning.

Role of the “cyberfellow”

CS grad student Michael Byrd’s role as the “cyberfellow” is to manage all parts of each of the other seven fellows’ projects that do not directly relate to ocean science. He ensures that the data moves around the Google documents in a user friendly, completely automated way and is later presented with minimal work from the other fellows.

Currently the students collect the debris from the wilderness where they aggregate the data on paper. The data is later entered into a Google spreadsheet by the fellow in charge of that class. The document is shared with a fellowship Google account. From there, through a series of python scripts, the following automatic dataflow is created:

The spreadsheet is located and aggregated into a master summary sheet also kept on Google docs. From here Google visualization APIs are leveraged in the production of a webpage that visualizes the data for the students. To make things easy for the fellows and lead scientists involved, a simple email-based web page generator is being written so that on demand webpage visualizations can be created from simple queries on the data. This allows the fellows and students to have access to a full range of options that might otherwise be too technically cumbersome to use. As the project grows, Byrd plans to continue to utilize youth friendly web technologies to facilitate data entry (e.g. Twitter, Facebook groups).

This system is created with ease of automation and minimal need for hardware in mind for the next 4 years of the grant. The researchers are considering packaging the software with lesson plans so that classes everywhere can use it to help the environment and learn about litter migration.

To learn more about the CAMEOS project please see: http://www-bml.ucdavis.edu/cameos/description.html

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In 2006 the Department of Energy established a number of Centers through their Scientific Discovery through Advanced Computing (SciDAC) program. The DoE SciDAC Visualization and Analytics Center for Enabling Technologies (VACET) is a collaborative effort between UC Davis, the University of Utah, Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory and Oak Ridge National Laboratory, and was established to address the large, complex datasets emerging from SciDAC scientific partners. The Center, funded at $10.1 million over five years, utilizes and develops analytics and visualization software technology to that addresses the scientific discovery effort in large-scale scientific simulations. The effort at UC Davis is centered in the Department’s Institute for Data Analysis and Visualization (IDAV).

It is widely accepted that one of the bottlenecks in contemporary science is the need to gain insight from vast collections of complex data. Over the past three years, the Center has been extremely successful in supporting scientific analysis efforts in climate modeling, accelerator modeling, adaptive mesh refinement (AMR) visualization, flow visualization, and fusion modeling. In these areas, Center researchers have created and deployed effective data understanding technology, much of it publically available through the VisIt visualization software environment. This environment works on a variety of system architectures, from PCs to the world’s largest supercomputers.

Recently, Hank Childs of IDAV and Lawrence Berkeley Laboratory, led a team of researchers from VACET who ran a set of experiments demonstrating that VisIt, running in a parallel environment, could be used on massive data sets ranging from 500 billion to four trillion zones running on four of the world’s 12 most powerful supercomputers. This effort demonstrated that VisIt’s parallelism approach can take advantage of the growing number of cores powering these advanced supercomputers, and that our analytics and visualization software could address data sets larger than those produced by today’s computational simulations. Using this tool then, enables VACET’s data analysis and visualization technology to be used on extremely large scientific problems, running on the world’s most powerful computers.

For more information on VACET and IDAV, contact IDAV Director Ken Joy (kjoy@ucdavis.edu) or Hank Childs (hchilds@lbl.gov), or access the VACET website at http://vacet.org
CS Welcomes New Faculty

Ilias Tagkopoulos

Professor Tagkopoulos’ interests span a variety of topics related to evolutionary biology, synthetic and systems biology, computational biology and bioinformatics. He is particularly interested in the modeling, simulation and experimental validation of biological hypotheses regarding the emergence of microbial behaviors in complex environments, the effect of environmental correlation-structure to genotypic and phenotypic characteristics, and the design and implementation of computational tools, both in hardware and software, for synthetic and systems biology. Professor Tagkopoulos is also a faculty member of the UC Davis Genome Center. Prior to joining UC Davis he was a post-doctoral fellow in Princeton’s Lewis-Sigler Institute for Integrative Genomics and a relationship manager in Credit Suisse’s LOCuS group (DIT-SRA). He earned a Dipl.-Ing. in Electrical and Computer Engineering from University of Patras, a MSc in Microelectronics from Columbia University and a PhD in Electrical Engineering from Princeton University in 2001, 2003 and 2008 respectively.

Todd J. Green

Todd received his Doctorate of Philosophy in Computer and Information Science from the University of Pennsylvania in Fall 2009. He previously studied computer science at Yale University (B.S.) and the University of Washington (M.S.), and worked in industry for six years as a Software Design Engineer and Development Lead at Microsoft and Xyleme. His research interests include data management systems and principles for collaborative data sharing, data provenance, data integration, data exchange, and probabilistic databases. He received the Best Student Paper Award at ICDT 2009.

The Hive Mind: Applying a Distributed Security Sensor Network for GENI

Dr. Sean Peisert and Prof. Matt Bishop, along with colleagues from Pacific Northwest National Laboratory and CA Labs, have been awarded a 3-year, $520,000 grant from the Global Environment for Network Innovations (GENI) Project Office/BBN Technologies and the National Science Foundation to research and develop security infrastructure for the GENI testbed.

Their project, titled “The Hive Mind: Applying a Distributed Security Sensor Network for GENI,” seeks to define and prototype a security layer underlying GENI that will allow providers of the system to collaboratively defend against attacks and misuse of GENI resources. Specifically, it seeks to investigate the reporting requirements that GENI will need to provide to support certain forms of networking and security experiments. To do this, they will use decentralized security algorithms (in the form of “agents,” “sentinels,” and “supervisors”) that communicate between sensors, in some sense simulating the function of an ant hive.

The result of this will enable GENI to support experiments where there is communication between internal nodes (sensors or routers). In the context of networking, such experiments might be used to test if bandwidth usage can be improved through the communication of capacity and usage information between routers. In the context of security, such experiments might be used to test the tradeoffs among different approaches to exchanging security information between sensors, and where that information might affect firewall rules or proactive, forensic logging efforts.
Rotating Scans for Systematic Error Removal

Grad student Fatemeh Abba-sinejad presented a paper at the Eurographics Symposium on Geometry Processing, called “Rotating Scans for Systematic Error Removal,” that won the second-best paper award. The other authors were Yong Joo Kil, Andrei Sharf and Professor Nina Amenta. SGP has in recent years become the best venue (after Siggraph) for geometric modeling papers.

The paper is about using a laser range scanner to build computer models of real objects. Combining lots of captured data - tens or hundreds of times as much as is usually captured - can not only improve the resolution of the models, but also eliminate coherent errors introduced by the scanning process. Fatemeh is beginning her third year at UCD, and will be taking her quals soon.

Figure 1: Removing systematic error from a scanned relief of a wall in Persepolis. In the close-up, upper right, we see an extra ridge to the right of the spear. Errors at depth discontinuity edges perpendicular to the triangulation baseline are typical of optical triangulation laser scanners. Below, capturing four depth maps at different orientations and combining them using our novel anisotropic filter removes these systematic errors.

DESSERT- Empirical Software Engineering at Davis

Profs Prem Devanbu, Vladimir Filkov and Raissa D’Souza are collaborating on an inter-disciplinary project studying software engineering processes, both in commercial and open-source projects. Thanks to the public enactment of open source software development, as well as increased attentiveness to data gathering in commercial projects, software engineering researchers have been enjoying a torrent of data concerning a variety of phenomena, including software evolution, social interactions, and defect reporting and elimination. The UC Davis team brings a unique combination of skills to the analysis of this data. Filkov is a bio-informatician, with broad and deep experience in analyzing large, complex, multi-dimensional datasets. D’Souza is an authority on the structure and evolution of complex networks.

Devanbu has several decades of industry and research experience in practical software engineering problems.

Their 3-year collaboration has resulted in several publications in leading conferences and journals in Physics and Software Engineering. A recent paper, in CACM Research Highlights (in collaboration with researchers from Microsoft) studied the effect of globalized development on software quality; the paper reported that the effect was rather minimal. Another paper, in this year’s ACM SIGSOFT ESEC/FSE, studied the quality of defect data that had been used in several prior studies. The study found that the data had several significant types of statistical bias and the type of bias was likely to have affected the results of the studies using this data.
Assistant Professor Michael Neft has received the NSF CAREER award for his project titled “Generative Models for Character Animation and Gesture in the New Age of Art and Electronic Interaction.” This research will develop new models of human movement to be used in character animation applications such as movies, games, and online worlds.

Earl Barr, a graduating PhD student in Professor Raju Pandey’s Lab, has been awarded a prestigious I3P Post-Doctoral fellowship to support his proposed work on computer security. Upon graduation, he will be conducting the proposed research in Prof. Su’s group.

Professor Phil Rogaway has been awarded an $850K grant from NSF for his project titled Reimagining Cryptography by Identifying its Culturally-Rooted Assumptions. “Like all scientific communities, the cryptographic community has a very particular disciplinary culture,” said Dr. Rogaway. “This culture profoundly shapes the set of problems that tend to get noticed and the style of solutions that subsequently emerge. In this work we describe a variety of cryptographic problems that were identified by challenging culturally-rooted assumptions about what cryptography is and how it should be done.”

The Office of Naval Research has funded the basic research of Associate Professor Ian Davidson for $355,000 over 2.5 years. The research will fund Davidson and two graduate students exploring the design of autonomous data mining algorithm and the analysis of performance bounds. ONR aims to apply these techniques to problems of predicting adversarial behavior.

Hank Childs, architect of VisIt, one of the most popular frameworks for data analysis and scientific visualization has joined the Computer Science Department as a Professional Researcher. He will be working in the Department’s Institute for Data Analysis and Visualization, working on new large scale visualization and analysis methods for scientific problems. Childs, who holds a half-time appointment at Lawrence Berkeley National Laboratory, comes to UC Davis after nearly a decade at Lawrence Livermore National Laboratory, where he was a member of the original VisIt development team. More information about Hank can be viewed at http://vis.lbl.gov/~hrchilds.

Dr. Sean Peisert and Professor Matt Bishop have been awarded a 3-year, $300,000 grant from the U.S. Department of Energy to work on research in intrusion detection on massively parallel supercomputers and ultra high-speed networks. This work will be performed in conjunction with colleagues from Lawrence Berkeley National Laboratory and the International Computer Sciences Institute, and will investigate the unique security properties and usage patterns of high performance systems and networks, develop formal models of those, and leverage the models to increase security capabilities.

PhD students Debalina Ghosh and Ashima Gupta worked with their advisor Professor Prasant Mohapatra for publishing their paper “Adaptive Scheduling of Prioritized Traffic in IEEE 802.16j Wireless Networks,” that has won the Best Student Paper award at the IEEE International Conference on Wireless and Mobile Computer Networks and Communications (WiMob), 2009.

Professor Prem Devanbu has been selected to receive an IBM Faculty Award of $20,000 to support his research in Empirical Software Engineering. The letter from IBM states: “This award is highly competitive and recognizes the quality of your program and its importance to our industry.”

Wei-Hsien Hsu, Jianqiang Mei, Carlos Correa, and Professor Kwan-Liu Ma of the VIDI (Visualization and Interface Design Innovation) research group received the best paper award at ArtsIT 2009. This conference is planned to be a place where people in arts, with a keen interest in modern IT technologies, meet with people in IT, having strong ties to arts in their works.

A team of researchers from UC Davis join Penn State in launching a new interdisciplinary research center focused on the science of communication networks with approximately $35.5 million in funding over 10 years from the Army Research Laboratory. Other partners in the center include the University of California at Santa Cruz, University of Southern California and the City University of New York. Several institutions will also be collaborating with the center including the University of California at Riverside, North Carolina State University, Stanford University and BBN Technologies. Prasant Mohapatra is the PI for UC Davis. The Communication Networks Research Center, part of the new Network Science Collaborative Technology Alliance, will perform foundational research on network science. The research focuses on the interplay among the social/cognitive, information and communication networks.
In a recent NSF-funded study, CS graduate student Yelena Frid and her faculty advisor Dan Gusfield succeeded in solving the long open theoretical problem of speeding up the classical algorithm for computing two-dimensional RNA structures. Their contribution is of both theoretical and practical importance, since the basic RNA-folding problem is often solved multiple times in the inner-loop of more complex algorithms, and for long RNA molecules in the study of RNA virus genomes.

The problem of computationally predicting the secondary structure (or folding) of RNA molecules was first introduced more than thirty years ago and yet continues to be an area of active research and development. RNA molecules are ubiquitous in biological systems, and have a wide range of vital biological functions. The genomes of many pathogenic viruses are made up exclusively of RNA, rather than DNA, and the understanding of the importance of RNA molecules has exploded in the last decade with the discovery of critical new biological functions for RNA. The biological function of an RNA molecule is largely predicted by its three-dimensional structure (how the molecule folds in three dimensions), and even its two-dimensional structure is highly informative. The two-dimensional structure of an RNA molecule is specified by which specific nucleotides in the molecule hybridize, or pair with each other, to form two-dimensional structures such as stems, hairpin loops, bulges, etc. (figure 1). Constraints on which nucleotide pairs are permitted to hybridize, and the distinctive two-dimensional structures that are created by hybridization, make the problem of predicting the two-dimensional structure of an RNA molecule, from its sequence alone, seem solvable. Computers, mathematics and sophisticated computer algorithms are at the heart of such efforts.