The Annual Report is published by the School of Computing and Informatics in the Ira A. Fulton School of Engineering at Arizona State University. For more information about the School of Computing and Informatics, visit sci.asu.edu on the Web. For details about the programs or research highlighted in this magazine, please contact the editor or sources directly.

Production Note: Sustainability is the simple idea that, as human beings, we place a high value on our own quality of life and that of future generations. To be sustainable, our actions must reflect what is important to us – qualities such as clean air, clean water, health, security and prosperity.

In keeping with the spirit of ASU President Crow’s Sustainability Initiative, we are producing a more “sustainable” Annual Report. The paper we are using is highly recycled, compared to both foreign and domestic grades (50 percent overall, 25 percent post-consumer), and the mill at which it is produced is a “clean mill” with a sustainability charter.

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Director’s Welcome

Dear Colleagues,

It is a delight to share the exciting developments in our School of Computing and Informatics (SCI) in the Ira A. Fulton School of Engineering at Arizona State University (ASU). Our school exemplifies the spirit of transdisciplinary research and education that permeates ASU under the dynamic leadership of our president Michael Crow.

SCI builds on a robust Computer Science and Engineering (CSE) department, a national caliber Biomedical Informatics Department (BMI) and new Informatics programs. We recruited seven outstanding faculty in the past year. SCI faculty includes joint positions with the Biodesign Institute, Arts, Media and Engineering program, College of Public Programs, School of Human Evolution and Social Change, Department of Psychology, Banner Health and Mayo Clinic. The accomplishments of our faculty include memberships of National Academy, Fellowship of professional societies, EIC’s/editorship of prestigious journals and chairs of conferences. Our BMI Chair, Prof. Greenes will receive the Morris Collen award from the American Medical Informatics Association for lifetime achievements and significant contributions to Biomedical Informatics.

We have made significant strides in research within a short time, reflected by over a 20% growth in awards and expenditures as well as significant increases in the quality and quantity of proposals. For example, Prof. Patel from our BMI department received a $4.5M James F. McDonnell Foundation award and Prof. Vrudhula was awarded a $2M collaborative project with Raytheon funded by Science Foundation Arizona (SFAz). SCI has more than doubled the number of publications in high quality peer reviewed journals, conferences and books over the past five years. SFAz research awards and fellowships have augmented our research capacity and increased top quality graduate student recruitment.

CSE department has 800 undergraduate (CS and CSE), 200 Masters and 150 Ph.D. students and continues to attract and retain excellent students. New M.S. and Ph.D. programs in BMI were launched in Fall 2007 and Fall 2008, respectively. We also launched an Informatics certificate for students from different disciplines across the University. We are already working on launching a model undergraduate BMI program along with Masters and Ph.D. programs in interdisciplinary informatics within a year. Our undergraduate research scholarship program, summer camps and high-school outreach programs help attract the brightest students to our graduate and undergraduate programs. We continue to expand our on-line and distance program offerings.

SCI faculty have strong collaborations inside and outside the University. External partners include, Mayo Clinic, Translational Genomics Institute (TGen), Intel, Raytheon, Motorola, Microsoft, Barrow Neurological Institute (BNI), and Banner Health. Our BMI department is now housed in the new Arizona Biomedical Collaborative building in the Phoenix Biomedical campus and is co-located with the University of Arizona College of Medicine, Phoenix.

We look forward to continued acceleration of our trajectory of rapid progress while focusing on excellence in all aspects of academic endeavor and contributing to the vision for a New American University at ASU. I invite you to visit us in the valley of the sun and also to check us out at http://sci.asu.edu.

Sethuraman Panchanathan
Director, School of Computing and Informatics
Year In Review

The Future of Informatics at SCI

BMI Graduate Program Completes First Year

New Center for Information Assurance

Community Outreach

Faculty Awards and Honors

Distinguished Lectures

Events
Informatics @ SCI

Complex problems confront us everyday. Many of these challenges can be solved only with novel technological strategies and an array of new resources. For instance, organizing emergency relief efforts for Hurricane Katrina victims involved collecting and interpreting vast amounts of data from many disparate sources, planning coordinated responses among different agencies in real time and monitoring the overall effects of their action. Likewise, planning and building sustainable cities requires analyzing data on housing and traffic, making zoning and construction decisions and tracking the results of these choices over time.

Informatics is an emerging discipline that applies computing and information technology to address such challenges. Informatics builds upon computer science theory, tools and practice, but differs in its problem-centered, system-level and human-centered approach to technology. This applied focus makes informatics inherently interdisciplinary, cutting across traditional academic boundaries. The School of Computing and Informatics (SCI) at ASU is uniquely positioned as a leader in this important and promising field.

Our dynamic global society requires effective producers and knowledgeable consumers of information and the technologies used to acquire, manage and interpret that information. A workforce trained to build informatics systems, to adapt them to new contexts, and to develop the next generation of policies and practical applications will meet these challenges. In response to this need, SCI offers an Informatics Certificate and plans to launch innovative new interdisciplinary graduate and undergraduate degree programs. The Bachelors of Science in Informatics will prepare students with the skills needed to succeed in the information technology workforce, the Masters of Science will train advanced specialists with deeper informatics knowledge and skills, and the Ph.D. program will educate the next generation of informatics researchers and faculty.

The curriculum revolves around core informatics functionalities not just specific information technologies. For example, relational databases and web search engines operate on different technological principles, but both can be used to extend and augment human memory. Spreadsheets and diagnostic software rely on distinct mechanisms, but both inherently involve reasoning and inference. Recommender systems and route finders differ in detail, but both help inform complex decision making. Students will master the principles that underlie these informatics systems, gain experience in their use and learn to design, analyze and evaluate them in applied contexts.

The School of Computing and Informatics is also building strong connections with industry and other community entities to complement the academic programs. Collaborations such as those at ASU’s SkySong, the Scottsdale Innovation Center and funding from private and public sources will provide SCI students with fellowships, internships and applied research experiences to prepare them as future leaders and entrepreneurs.

It is the mission of SCI to produce the next generation of computer and information scientists and engineers, who apply their user-inspired education and fundamental research contributions to solve real-world problems and impact society. We believe that our research and academic programs in informatics are the strong foundation that will secure this goal.
School of Computing and Informatics joined the ranks of institutions like Columbia University, University of Utah and University of Pittsburgh with the addition of the new master’s and doctoral programs in biomedical informatics. This new master’s program made its debut in the fall of 2007 with an inaugural class of thirteen students. While providing graduate level preparation in acquiring, representing, retrieving and analyzing biomedical knowledge and data, the new program built on the prior educational and work experiences of the pioneers in this first class. Faculty, staff and students forged alliances and built relationships both inside and outside the Department of Biomedical Informatics (BMI) to make the first year a success.

The academic core began with innovative new courses such as Introduction to Biomedical Informatics, Human Computer Interactions in Biomedical Informatics and Problem Solving in Biomedical Informatics. Throughout the academic year, the students attended the Biomedical Informatics Colloquium Series which provided them with opportunities and exposure to the latest biomedical informatics trends from visiting professors and practitioners. Several students, such as Tarek Saleh, excelled and achieved 4.0 GPAs. This pioneering first class will be joined in the fall by additional masters students and the first five students in the Ph.D. program. The new doctoral program will build on the hard work of the faculty including their significant new research projects, industry collaborations and on the successes of the first year.

Just after the start of the 2007-2008 academic year, BMI celebrated the grand opening of its home, the Arizona Biomedical Collaborative Building I in downtown Phoenix. The facility is a unique research and instructional partnership between Arizona State University and University of Arizona College of Medicine. At the event, ASU President Michael Crow referred to the partnership as a “epicenter of endeavors to help spawn a new era in advancing modern medicine”. Arizona Board of Regent President Fred Boyce and Regent Gary Stuart hailed the project as a critical step forward in this “historic and powerful collaboration” between the universities, cementing a partnership that “is dedicated to improving the human condition.”

This partnership has already fostered significant new relationships with hospitals and organizations that are now funding BMI research as well as providing student internship and career opportunities. Examples of those partnerships are with organizations such as the Mayo Clinic, the Arizona Health Care Cost Containment System, Maricopa Integrated Health System, Banner Health, Barrow Neurological Institute and Emerge MD.

“Our first year was a resounding success, with launch of the Department, recruiting well-recognized leaders to our faculty, opening of our beautiful new building, start of our M.S. degree program and approval of a Ph.D. program, in-depth involvement in a unique program of instruction of the first-year medical students at the College of Medicine-Phoenix, and achievements of our faculty and students in obtaining a number of grants, publishing papers, and obtaining recognition through several significant awards.”

Robert Greenes, Ira A. Fulton Chair, Department of Biomedical Informatics
In the same way that computers need to be reliable, information systems connected through various types of networks need to be trustworthy. Information assurance grows every day in its importance as entities in both private and public sectors struggle to keep their valuable information safe. According to the National Security Agency, information assurance is defined as the set of measures intended to protect and defend information and information systems by ensuring their availability, integrity, authentication, confidentiality and non-repudiation.

The new Information Assurance Center (IAC) addresses the broad range of issues in developing trustworthy information systems through engaging academic curricula, internships, collaborations with industry and other universities on various research projects. IAC received recognition as a National Center of Academic Excellence in Information Assurance Education by the National Security Agency and the Department of Homeland Security last year. SCI Professor Stephen Yau, director of IAC, oversees the development of research and educational outreach activities.

IAC has several research projects in information assurance. For example, Yau has projects on improving data security for collaborative work, innovative design of software with multiple quality of service, especially security. SCI Associate Professor Gail-Joon Ahn has research projects on vulnerability and risk management and access control. SCI Professor Sandeep Gupta and SCI Associate Professor Partha Dasgupta have projects on integrated security infrastructure for personal identifies and consumer computing.

In April 2008, IAC organized a workshop on Information Assurance Research and Education focusing on emerging technologies to address important information assurance issues, as well as innovative educational and training programs for information assurance. Gail-Joon Ahn states, “I strongly believe that our IA program would enhance economic and social impact of research activities at ASU, through the proactive technology transfer and broader collaboration with business partners, including the Phoenix community.”

An information assurance concentration is available to students pursuing their bachelor’s, master or doctoral degrees. Devon O’Brien, a Computer Systems Engineering, SCI senior, was awarded one of the 50 scholarships offered by the Department of Defense. As part of this award, Devon will intern at the Department of Defense. Devon, who became interested in information assurance after taking a Cryptography class, states, “This scholarship will help provide stability in my further education as well as ensuring a job when I graduate and enter the workforce.”

Over the next year, the center plans to expand the research activity, improve the information assurance curriculum and outreach programs in the community.
SkySong and SCI Unite to Create Student Opportunities

Students and faculty in SCI wishing to combine research with industry and cutting-edge technology now have a new place to pursue these interests. Within a short distance from ASU’s Tempe campus is SkySong, a collaborative project between the university, the City of Scottsdale, and various industry partners. The project provides an environment for researchers and entrepreneurs to collaborate both academically and professionally. Current SkySong collaborators include large global enterprises, start-up and midsize technology companies, investors and service providers representing international entrepreneurs from countries such as Canada, China, Germany, India, Ireland, Japan, Singapore and Turkey. The School of Computing and Informatics has been key to SkySong’s recruiting efforts, and operates several programs in this exciting new facility.

One of these programs is CampGame, a gaming laboratory which allows high school students to help build interest in careers involving science, math and technology. SCI instructors taught the 2008 summer camp in the gaming classroom developed by SCI at SkySong. The camp was made possible by a $50,000 grant from the Women and Philanthropy program at the ASU Foundation, and $17,500 in investments by SkySong.

Ashish Amresh, an SCI lecturer and coordinator of CampGame, works closely with the researchers and industry partners at SkySong. Amresh is one of the faculty from SCI who actively seeks to recruit new industry partners with a relevant interest gaming and other related research. Amresh has also helped to place several interns with gaming companies who have a presence in SkySong.

Currently, the SkySong project consists of two buildings and an outdoor social area. The second building includes classrooms and other academic resources for SCI researchers and students. Eventually, the complex will expand to include four buildings dedicated to academic and entrepreneurial pursuits, a four-star hotel and a 500 to 600 apartment home community.

SkySong has evolved from unique collaboration between ASU and Scottsdale that will foster Research and Economic Development through a blending of entrepreneurship, technology, art and education.

Jeremy Rowe, Associate Director for Strategic Initiatives and Special Partnerships
SCI’s two summer outreach programs for high school students successfully took place in the summer of 2008. The first summer program, Robotics Camp, provides high school students with hands-on experience building an operational robot that can perform tasks on command. Thirty-five students, up from the twenty-three students who participated in 2007, enrolled for the 2008 program with the goal of learning the basics of college-level computer science and programming. This year’s program, held Monday through Friday, from June 23 through July 3, was sponsored by the U.S. Department of Education, Arizona Science foundation, Intel Corporation and ASU.

Dr. Yinong Chen, Calvin Cheng, Jay Elston and Larry Xu provided instruction to the students as they worked in teams to build the best moveable robot. Students worked in groups within the American League, National League or US League teams. Six teams made up each league and the goal was to send the best team to the “world championship” competition. This year’s world champions were Devin Seeley, Natalya Hankewych and Joann Wang of the Apple Pie Yogurt team. The winning team was decided based on the ability of their robot to demonstrate computer controlled maneuvers, intelligence and fighting.

CampGame held a similar competition for high school students, but the challenge was to build a well-designed video game employing the fundamentals of video game creation, visualization and production. This program introduced fifteen students, twelve male and three female, to the production side of the video game industry. The students spent the first three weeks with instructors who possessed advanced industry experience in video game production. Then the students dedicated their time in the last three weeks building a video game in teams. The final project’s goal simulates the collaborative work environment of the gaming industry. This year’s winning team was Benjamin Temple, Kathy Garcia, Taliesin Goeson, John Anderson and Kyle Doherty of the Raven Fedora team. CampGame was made possible with funding from ASU Skysong, the Women and Philanthropy program at ASU Foundation and student tuition. The director of Robotics Camp, Yinong Chen, and director of CampGame, Ashish Amresh, work year-round to make both of the annual summer camps successful service-oriented learning opportunities for high school students interested in programming.
Year In Review

Greens receives top award in Biomedical Informatics field

Robert Greenes, chair of the Department of Biomedical Informatics, was selected to receive one of the highest honors in the field of biomedical informatics. He will be presented the Morris F. Collen Award by the American College of Medical Informatics during the American Medical Informatics Association’s annual symposium in November 2008 in Washington, D.C. The award recognizes lifetime achievement and significant contributions to biomedical informatics.

Faculty Awards & Honors

Biomedical Informatics professor and vice-chair of the department, Vimla L. Patel, Ph.D., D.Sc, received a five-year, $5 million dollar grant from the James S. McDonnell Foundation for a collaborative study on research titled, “Cognitive Complexity and Error in Critical Care.” Patel’s research will be coordinated with medical teams from Banner Healthcare in Phoenix, University of Texas in Houston and Washington University in St. Louis.

SCI professor Karam S. Chatha and computer science Ph.D. student Sushu Zhang received the William J. McCalla IEEE/ACM Best Paper Award at the 2007 International Conference on Computer-Aided Design for their paper entitled “Approximation Algorithm for the Thermal-aware Scheduling Problem”.

For a third straight year, the award for best research paper presented at the international Medicine Meets Virtual Reality conference was co-authored by a team consisting of Kanav Kahol, SCI assistant professor, Anushu Sridaran, a recent graduate from the Department of Computer Science and Engineering, Marshall L. Smith, director of the Simulation and Innovation SimET Center WT-1 for Banner Good Samaritan Medical Center in Phoenix and Sethuraman Panchanathan, director of the School of Computing and Informatics.

The Center for Health Information and Research, led by professor William G. Johnson, received Arizona State University President’s Medal for Social Embeddedness during an April 16 ceremony. The Social Embeddedness award recognizes the community benefits of the center’s work for Arizona. Specifically, the center is being recognized for development of the Arizona HealthQuery, a data bank providing Arizona with community-level information on the health of its residents and on the nature of the health care that they receive.

Sarma Vrudhula, SCI professor, and electrical engineering master’s student Amit Goel, were selected for the Best Paper Award for their work entitled, “A methodology for characterization of large macro cells and IP blocks considering process variations.”

Computer Science and Engineering emeritus professor David Pheanis and Ted Chua, who received his Ph.D. in computer science from ASU, were recently awarded the Best Paper Award at ICNS 2007, the Third International Conference on Networking and Services. The paper, entitled, “Application-Level Adaptive Congestion Detection and Control for VoIP” was presented at the conference held in Athens, Greece.

SCI professor Guoliang Xue and Weiyi Zhang, who received his Ph.D. in computer science from ASU, were recently awarded a Best Paper Award at the IEEE Global Telecommunications Conference. The paper, entitled, “Multiconstrained QoS routing: Greedy is good” was presented at the conference held in Washington, D.C. and was the best paper from the Internet Protocol Symposium.

ASU was recently certified as a National Center of Academic Excellence in Information Assurance Education for 2007-2012, recognizing that ASU has made, “a significant contribution in meeting the national demand for information assurance education, developing a growing number of professionals with information assurance expertise in various disciplines, and ultimately contributing to the protection of the national information infrastructure.” The Information Assurance Center in the School of Computing is a multi-disciplinary center focusing on both the research and educational activities to address the broad issues of information assurance, especially regarding trustworthy information systems and ensure the quality of information being stored, processed and transmitted by information systems and networks.
Distinguished Lectures

Bridges and Myths: Brain Science and Education
Nov. 1st, 2007

John T. Bruer, Ph.D.
President, James S. McDonnell Foundation in St. Louis
Adjunct Professor of Philosophy, Washington University

In Education and the Brain: A bridge too far (Bruer 1997) and The Myth of the First Three Years (Bruer 1999), Bruer argues that developmental neurobiology was not relevant to educational practice. On the positive side, Bruer claimed that the brain science most likely to have implications for education in the future would be cognitive neuroscience. Cognitive psychology currently remains the primary candidate for a basic science of teaching and learning.

Geometric Algorithms for Layered Manufacturing
Nov. 15th, 2007

Professor Ravi Janardan
Professor of Computer Science & Engineering, University of Minnesota-Twin Cities

Layered Manufacturing (LM) is a relatively new technology that makes it possible to build a physical prototype of a 3D part directly from its digital model, using a “3D printer” attached to a personal computer. In essence, the process involves orienting the digital model suitably, slicing it into parallel layers, and “printing” each layer on top of the previous one. LM is used extensively in the automotive, aerospace, and medical industries, among others, to accelerate the design and verification cycle and reduce the time and cost to bring a product to market.

Privacy and Security in a Medical Center
Nov. 29th, 2007

Soumitra Sengupta, Ph.D., Columbia University
Information Security Officer
New York-Presbyterian Hospital and Columbia University Medical Center

Information privacy and security in academic medical centers are complex undertaking reflective of institutional organization, risk posture, regulations, and technological innovation. In the past few years, significant growth in digital data collection and dissemination of health information has fundamentally changed how care, research and education are practiced.

Evaluating Clinical Decision Support for Personalized Risk Assessment
May 14th, 2008

Lucila Ohno-Machado, M.D., Ph.D.
Associate Professor of Radiology and Health Sciences and Technology, Harvard-MIT
Director, Decision Systems Group, Brigham and Women’s Hospital

Medical decision support tools are increasingly available on the Internet and are being used by lay persons as well as health care professionals. The goal of some of these tools is to provide an “individualized” prediction of future health care related events such as prognosis in breast cancer given specific information about the individual. These tools are usually based on models synthesized from data with a fine granularity of information.
Events

BODYNETS CONFERENCE
SCI director Sethuraman Panchanathan and professor Sandeep Gupta chaired BodyNets 2008, the Third International Conference on Body Area Networks. The conference, which took place at ASU from March 13-15, was hosted by SCI with attendees from across the globe.

PROGRAMMING COMPETITION
Programming Competition 2008, an ASU annual contest, was held on March 22. Forty-nine students making up 24 teams participated in the challenge, which was held at SCI. This is the sixth year that the programming competition has been held. The teams (consisting of one to three students each) were given four hours to answer 10 programming problems using programming languages Java, C++, C# or C. They were judged by engineers from the companies that sponsored the competition, including Lockheed Martin, General Dynamics, Microsoft, Google and GoDaddy. The judges included several ASU and SCI alumni. Computer science sophomore student Josh Wolfe won the competition and Randy Compton, a senior in computer science, placed second. Third place was claimed by Team Polymorphic which consisted of computer science seniors Dan Fearing and Pierre Arakelian.

SCI NIGHT
SCI’s annual awards ceremony and dinner, SCI Night, was held at the Tempe Mission Palms Hotel on April 11. The event recognized outstanding students, faculty and staff. The evening's keynote speaker, Dr. William Harris, the president and CEO of the Science Foundation of Arizona, was introduced by Ira A. Fulton Dean Deirdre Meldrum. The following awards were presented:

- Distinguished Undergraduate Seniors: Kartik Talamadupula and David Weber
- Undergraduate Student Leadership: Joyce Tang
- Outstanding M.S. Student: Kaichi Zhou
- Outstanding Ph.D. Students: Donglin Xia and Zheng Zhao
- Graduate Student Leadership: Sudheendra Murthy
- Outstanding Teaching Assistant: Michael Verdicchio
- Programming Competition Winners: 1st: Josh Wolfe, 2nd: Randy Compton
- Researcher of the Year: Kasim Selcuk Candan
- Teacher of the Year: Yinong Chen
- Service Faculty of the Year: Vimla Patel
- Young Investigator of the Year: Karamvir Chatha
- Staff Excellence: Annelise Cole and Deborah Paterick
- Retiring Faculty Recognition: William Lewis, Pearse O’Grady, Joseph Urban and Susan Urban

SCI STUDENTS PRESENT FURI RESEARCH
The Fulton Undergraduate Research Initiative (FURI) program offers opportunities for students to experience research through hands-on applications. Fulton undergraduates find a mentor and perform research. The School of Computing
and Informatics had six students participating in FURI for the Spring 2008 term and three students who were awarded the CSE Undergraduate Research Scholarship, a faculty-nominated award. Undergraduates receive funding for their research topics and earn money while participating in these programs. These students presented their fully-funded 10-week research projects at the FURI Undergraduate Student Research Symposium on April 22.

GRADUATING STUDENT RECEPTIONS
The School of Computing and Informatics hosted graduating student receptions for students graduating in the Fall 2007 and Spring 2008 terms. The event gave the students the opportunity to say goodbye to classmates, faculty and staff. Dr. Panchanathan, Director of the School of Computing and Informatics, welcomed the students and wished them luck in the future, with hopes that each graduating student will stay connected to SCI by becoming active in our growing alumni outreach program.

TECH TALKS
During “tech talks”, unique mini-classes sponsored by the SCI Advising Center, undergraduates have the opportunity to learn from company representatives and find out about employment and internship opportunities. It’s a great opportunity for students to discover technical, “behind the scenes” information from the most knowledgeable sources. Companies that have provided tech talks include Microsoft, Flypaper and Google.

SCI JOB FAIRS
The semiannual job fair provides graduate and undergraduate students with the opportunity to meet with representatives from both local and national companies to discuss career possibilities specifically related to computer science and engineering. Participating companies may have full-time, part-time or internship opportunities available. Companies often invite selected students to participate in on-campus interviews. Companies that have attended the SCI job fair: Charles Schwab Corporation, Cerner, Freescale, Garmin, GoDaddy, Google, IAESTE, Intel, Interactive Alchemy, JDA Software, Lockheed Martin, MediServe, Microsoft Corporation, PayPal - an eBay Company, Raytheon, Software Architects and Tektronix.

“Microsoft has a strong history of hiring ASU undergrad and graduate students into software development positions as both full-time employees and interns. We expect to continue recruiting from ASU for a pipeline of talented engineers.”
Kim Birds, Microsoft hiring representative
As we begin the second year of existence of our Department of Biomedical Informatics, I am writing to reflect on what we have accomplished and our plans for the future. The Department of Biomedical Informatics at Arizona State University was formed in March 2007, with a strong research mandate, but with a twist that takes advantage of its unique situation and setting. The department is part of the School of Computing and Informatics in the Ira A. Fulton School of Engineering, but is located on the downtown Phoenix campus of the University of Arizona College of Medicine. It is also next door to Translational Genomics Research Institute (TGen), in a rapidly developing biomedical enterprise zone in downtown Phoenix.

Our beautiful new building, which had its grand opening on October 15, 2007, has over 44,000 sq. ft. devoted to BMI, and is equipped with high speed networking, video conferencing, including a state-of-the-art “medpresence” telesuite, and many flexible spaces. Most important is the spirit of innovation and adventure. A new curriculum for the medical students integrates informatics concepts, methods, and applications from the outset. The M.S. program in biomedical informatics began in Fall 2007, and a Ph.D. program begins in Fall 2008.

Thanks to a generous startup budget, we are gearing up rapidly in all the major areas of BMI, with several new additions to our faculty and others planned over the next couple of years. Research programs are already underway in bioinformatics, imaging informatics, clinical informatics, public health informatics, and cross-cutting areas such as data mining/predictive modeling, knowledge representation, cognitive science, medical simulation, and embedded sensors/sensor networks.

The growth that has been occurring all around us can only be considered extraordinary. The enthusiasm, shared vision, and eagerness to collaborate by clinical partners both nearby and across Phoenix and Arizona, including Banner Health, Barrow Neurological Institute, TGen, Maricopa Integrated Health System, the Veterans Administration, and Mayo Clinic, as well as several state agencies and other entities, have resulted in the initiation of a number of research partnerships and joint educational ventures. We are pleased to report that in our first year, the BMI faculty have already received $9.1 M in research funding commitments.

We look forward to this second year, and to continued development and expansion of our programs. Watch this space!

Robert A. Greenes
Ira A. Fulton Chair, Department of Biomedical Informatics
In 1999, the consequences of medical error began to receive increased public attention when the Institute of Medicine reported that medical errors kill between 44,000 and 98,000 people each year in the United States. These mistakes amount to more deaths each year than the total number of people who die annually from breast cancer, HIV/AIDS and motor vehicle accidents combined. SCI professor Vimla L. Patel, Ph.D., D.Sc, seeks to understand the factors that contribute to medical errors through her research.

Patel received a five-year, $5 million dollar grant in the fall of 2007 from the James S. McDonnell Foundation for a collaborative study on research titled, “Cognitive Complexity and Error in Critical Care.” The main project goal is to provide research that will form the basis of a more comprehensive understanding of medical error. Aerospace pioneer James S. McDonnell established the James S. McDonnell Foundation in 1950. Founded to “improve the quality of life,” the foundation provides funding for research in cognition and neuroscience research.

Although assigning error to a single individual seems to be the trend in many medical-related lawsuits, the reality is more complicated. This grant allows Patel and her research team to explore what human action, or lack of action, prefaces preventable medical errors. “What happens at those moments? What causes them?” asks Patel. “Is it the hospital policy? Is it the workload? Or is it lack of knowledge? We believe that human cognition and behavior is the key to everything.” From this premise, Patel and her research team are looking for possible solutions to some of the problems. Patel's research is coordinated with medical teams from Banner Healthcare in Phoenix, University of Texas in Houston and Washington University in St. Louis.

The research team consists of cognitive scientists, critical care clinicians, simulation experts, biomedical informaticians and complex systems scientists. Patel serves as the project’s principal investigator (PI). The project’s co-PIs are BMI assistant professors Trevor Cohen, M.D., Ph.D., and Kanav Kahol, Ph.D. Joanne Olsen, a third year doctoral student in the College of Nursing at ASU, is also part of the team. Olsen began working with Patel in 2006 by studying the effect of time pressure on medical errors. “I believe this research will contribute to our knowledge on the best methods to design acute care environments to achieve a safer healthcare system,” Patel stated. Five graduate students working on the project are from varied background, such as psychology, computer science, nursing and medicine.

Patel has long believed that medical training techniques could be improved. Decision Making and Cognition, is a multi-disciplinary research unit, where Dr. Patel is the director, devoted to the study of medical decision-making, cognitive foundations of health behaviors and the effective use of computer-based information technologies.

The abstract of the project’s proposal notes that, “Medical error is only rarely the result of the actions of a single person, and several leading researchers have raised the importance of systemic causes of medical error. Human error will always be a factor, but recurring systemic weaknesses are amenable to intervention and correction. A productive approach to error reduction and management requires a contextual understanding of when and how errors occur.” A key element of the research is to use models of complexity and distributed cognition that can both predict and prevent future errors. This research has the potential to benefit society with fewer medical errors, increased medical productivity and fewer deaths resulting from medical errors. It will generally improve the culture of safety in health care.
Collecting and maintaining information proves to be cumbersome for many hospitals seeking to organize their patient’s health information. The Center for Health Information and Research (CHIR) addresses this challenge by pursuing research that will allow health care practitioners to better organize patient information about their patients.

AZHQ is a data system that combines health information from more than 60 partners who voluntarily share their health data. This system is unique in its ability to link patients across discrete systems and through time and to provide large quantities of continuously updated health care information. As a result, the U.S. Secretary of Health and Human Services Michael Leavitt selected CHIR as one of six pilot sites for a U.S. initiative called the Better Quality Improvement for Medicare Beneficiaries (BQI) project designed to develop measures of health care quality.

AZHQ and CHIR have been extremely successful in their research and outreach. In the past year, support was received from dozens of sources including the Centers for Medicare and Medicaid Services and the Agency for Healthcare Research and Quality, for an initiative utilizing both public and private health care data to determine the value of received Medicare assistance. CHIR further expanded its outreach efforts by collaborating with St. Luke’s Health Initiatives to hire a consultant with the primary task of recruiting hospital partners outside of Maricopa County and adding physician practices to AZHQ. AZHQ expanded into Pima County with several new data partners: University Medical Center, Tucson Medical Center, University Physicians Healthcare and El Rio Community Health Center.

CHIR also maintains an active role in this line of research by providing feedback and expertise to both the sponsors and other pilot sites. Working together, CHIR and AZHQ have drawn national attention and inquiries from the Louisiana Health Care Quality Forum, Health Care Excel, the Brookings Institution and Robert Wood Johnson Foundation for their work with BQI. With the assistance of the Arizona Medical Association and the Arizona Osteopathic Medical Association, CHIR created an expert physician panel.

These physicians, nominated by their respective associations, represent a variety of specialties and subspecialties from across Arizona.

William G. Johnson, director of CHIR, said that when AZHQ began, critics were certain that it could not be done. “Part of what CHIR has done is build a community health data system that has health care information about more than 200 million health care encounters and more than 9 million individuals who have received health care in Arizona,” Johnson said. “We basically represent a public health component of the biomedical informatics department and SCI with interests in community-level data and questions of epidemiology and healthcare effectiveness.” Johnson credits the regional medical community for the impact of CHIR, “AZHQ has succeeded because of the willingness of members of the Arizona community to share information in a secure setting to promote the health and well being of the citizens of Arizona.”

With the CHIR’s help, AZHQ expanded to include health care information on more than 200 million health care encounters and more than 9 million individuals who have received health care in Arizona. CHIR also expanded its outreach activities by collaborating with St. Luke’s Health Initiatives to hire a consultant with the primary task of recruiting hospital partners outside of Maricopa County and adding physician practices to AZHQ. The center’s on-going research and outreach projects were recognized when the center received the ASU President’s Medal for Social Embeddedness in April 2008 for their work with Maricopa County. CHIR’s current research pathway is likely to spawn future research partnerships to develop better analytic tools and techniques. To this end, CHIR is well placed to address important public health and public policy to improve the ways in which health information is organized.
Biomedical informatics refers to the development and application of methods for acquiring, representing, retrieving and analyzing biomedical knowledge and data. The Master’s in Biomedical Informatics (M.S.) program is designed to meet the rapidly growing need for professionals with expertise in informatics, computer sciences and statistics in addition to a knowledge of the biomedical sciences and the clinical environment of the healthcare professions.

The program features a sequence of courses specifically designed to bring together clinicians, biomedical scientists, computer scientists and information technology professionals to learn about and gain experience in applying new developments in informatics theory, clinical practice and biomedical research. This program, now in its second year, is enhanced by participation of collaborators including the University of Arizona College of Medicine Phoenix Program, Mayo Clinic, Barrow Neurological Institute, Banner Health, Maricopa Integrated Health System, the Veterans Administration and Arizona state health care agencies.

Students enter the biomedical informatics program from a variety of fields, including:

- Bioengineering
- Medicine (M.D.)
- Psychology
- Computer Science and Engineering
- Biophysics
- Biology
- Information Technology

Academic Programs

Master’s Degree

Graduates from this program will:

- Understand theoretical foundations and current applications of informatics in health sciences and health care delivery systems.
- Understand how to evaluate, select and deploy informatics solutions in health care sciences and health care delivery systems.
- Understand information management issues and become intelligent users of data management systems.
- Understand how to acquire, convert and organize biomedical data into relevant diagnostic, therapeutic or research information.
- Demonstrate skills in team dynamics, communication and project management.
- Understand the legal and ethical aspects of biomedical informatics.
- Understand the use of quantitative and qualitative tools for decision support and data analysis.
Doctoral Degree

The Ph.D. program includes the requirements of the M.S. core curriculum but also requires the students to select an area of concentration of study in order to prepare graduates to assume advanced informatics research-and-development and leadership roles. The core program features five courses specifically designed to bring together clinicians, biological scientists and informatics researchers to apply new developments in informatics theory to clinical practice or biomedical discovery. Beyond the curriculum for the M.S. program, the added concentration courses in an area of focus and emphasis on independent research are intended to place these students at the leading edge of the field. We expect applicants to the Ph.D. program to have similar backgrounds to applicants for the M.S. degree, but they must also show evidence of a strong commitment to and potential for research. The Ph.D. program has admitted its first students in Fall 2008.

Our strong collaborative relationships with a variety of health care organizations as well as bioscience, industry and government agencies provide an unparalleled opportunity for doctoral students to explore and contribute to advances in bioinformatics, informatics related to imaging, clinical medicine and public health, with special focus on cross-cutting areas such as cognitive science, data mining, predictive modeling, embedded sensors and simulation.

“I absolutely believe that the strength of the Department is its faculty, we have got experienced faculty who have been in the field for decades now and also the industry relations are tremendous which gives us a lot of exposure about what’s happening outside the academic realm.”
Deepa Madathil, BMI graduate student

BMI Student Patents His Research

Robert Yao is one of seven graduate students in SCI’s new Ph.D. program in BMI. He completed his undergraduate studies with a bachelor’s of science in biology and started his graduate training in medicine in Chicago. While on leave from his medical studies, Yao strengthened his proficiency in computers. He then took medical information learned from his lectures and created a template for disease management. He applied that template to other diseases and conditions. After several people saw the template that he developed, he realized that his work was within the field of biomedical informatics. From that point, Yao decided he needed to do two things. The first thing was to get a patent for the template he created to organize information about disease management. The second was to apply for admissions to graduate programs in biomedical informatics.

He noticed in his application process that several of the key faculty members were leaving their departments and almost all of them were coming to ASU. Yao explained, “I decided to come to ASU simply because it seemed like all the top people in the field were being attracted here.” Today Yao is a member of the inaugural BMI Ph.D. class with a patent pending on his software application on disease management. His previous coursework in biology in courses like genetics helped provide the foundation for Yao’s interest. “What fascinated me most about genetics is that it was computer programming on a biological level. The genetics classes used the same “if.. then” statements that computer programmers use. I ended up picking a biology route that was very much like computer programming,” said Yao. His previous training gives him added perspective about the tools physicians and health care providers need to organize health information. In the coming year, he will be working as a research assistant under BMI Chair Robert Greenes. He adds, “I would like to take advantage of the partnerships ASU is forming and continue my medical education and training while doing research here in Arizona.” Now he has his research on information management for disease to look forward to in route to achieving his goal of obtaining a M.D. and Ph.D.
After becoming chair, I became closely aware of the extensive accomplishments, the visibility and the honor, recognition and respect our faculty command in their fields. I would like to highlight them below.

Each one of our research groups (AI, Databases, Embedded Systems, Information Assurance, Graphics and Multimedia, Networks, Theory and Bioinformatics) is well funded and internationally visible.

The AI group with nine faculty has two AAAI fellows and two Cognitive Science society fellows, three past or present editorial board members of JAIR, and a recent AAAI co-program chair. They publish extensively in AAAI and IJCAI, as well as in the major area specific conferences ICAPS, KR, ICML and KDD. For example, IJCAI 2007 had eight papers from CSE faculty and students. The Embedded Systems faculty includes an associate editor of ACM Transactions on Design Automation of Electronic Systems and IEEE Transactions on CAD. It publishes regularly in DAC, DATE, and ICCAD. Information assurance and computer security faculty includes a fellow of IEEE and AAAS, and faculty with DOE and NSF CAREER awards. The Graphics and multimedia faculty includes the editor in chief of the CAGD journal, editor-in-chief of the multimedia magazine who is also an IEEE fellow and associate editor of several other multi-media related journals, and faculty who have published multiple textbooks and monographs. Historically, it has been our signature research group and regularly publishes in CVPR, ACM Multimedia, CHI and SIGGRAPH. It continues to be strong with the addition of younger faculty, one of them with an NSF CAREER award. The network group with six faculty is uniformly strong with an NSF CAREER awardee and regular publications in top network conferences and journals. One of them is the TPC co-Chair of INFOCOM’10 and another is the TPC Chair of BodyNets’08 and the co-Chair of GreenCom’07. A Theory faculty working on combinatorics is the recipient of the Euler medal and has solved many-a-longstanding open problems including one related to a 1782 problem of Euler on mutually orthogonal Latin squares. Theory faculty have recently published in conferences such as SODA and PODC. The Bioinformatics group publishes in the top Bioinformatics conferences and journals such as ISMB, ECCB and PSB and collaborates closely with the BMI department, TGen and Mayo-Scottsdale. We elaborate on our Database group in the next page.

The above is a short glimpse and I invite you to explore this annual report and our web pages for more details, and discover the exciting developments here that are not always reflected in the external rankings.

Chair’s Welcome

Gail-Joon Ahn, Associate Professor
Ph.D. George Mason University 2000

Xuerong Feng, Lecturer
Ph.D. University of Texas at Dallas 2005
Research interests: Algorithms design and analysis, Computational biology

Kurt VanLehn, Professor
Ph. D., Computer Science, MIT, 1983
Research interests: Applications of Artificial Intelligence to Education, Human Learning, Cognitive Science

Chitta Baral
Chair, Department of Computer Science and Engineering
Our database group is making a big impact on the data and information management research, with an increasing number of highly visible publications appearing in the most prestigious data management venues.

The three top conferences in data management are the ACM Conference on Management of Data (SIGMOD), Very Large Data Bases (VLDB) conference, and IEEE International Conference on Data Engineering (ICDE). These three conferences are among the top four ranked conferences according to their impact ranking. This ranking comes from the approximately 500 “Knowledge and Data Management” conferences in the survey.

In the past three years, SCI’s database group has published twenty-five research papers in SIGMOD, VLDB and ICDE. In 2006, SCI professor K. Selcuk Candan published four papers at VLDB and Yi Chen published two papers at ICDE. SCI professor Subbarao Kambhampati contributed to the group’s publications with his 2006 paper at ICDE. Their publication records are outstanding accomplishments because VLDB and ICDE have a publication acceptance rate that is approximately fifteen percent.

In 2007, as a team, the database group published four papers in SIGMOD, three papers in VLDB, and two papers in ICDE. In 2008, the group published three papers in SIGMOD, three papers in VLDB, and three papers in ICDE. Aside from these three venues, the database group’s recent publications include those in other high visibility conferences such as CIDR (Conference on Innovative Database Research), World wide web conference (WWW), and Workshop on Web and databases (WebDB), and high impact journals (such as VLDB Journal [ISI impact factor:3.8], ACM Transactions on Information Systems [ISI impact factor:1.96], and IEEE Transaction on Knowledge and Data Engineering [ISI impact factor: 1.89]) in the area. All the above publications involved Candan, Chen, Kambhampati and Davulcu. The group’s publications in top venues shows that the group is a leader in database management, especially in stream processing, data integration, handling uncertain data and imprecise queries, web services and workflows.

In addition, SCI professors Huan Liu and Jieping Ye published in the top venues in the related areas of Data Mining and Machine Learning, such as Knowledge Discovery and Data Mining (KDD), and SCI professors Chitta Baral and Joohyung Lee published in the top Logic Programming conferences.

The group’s research impact to the community is further evident in the roles that the faculty holds in top database organizations. For example, Candan is on the VLDB journal editorial board that is ranked 4th in all computer science by ISI and 2nd in “Information Systems” journal categories. He was a publicity chair of SIGMOD in 2006 as well. His leadership role also encompasses acting as a 2008 PC chair of ACM Multimedia, the top conference in the area of multimedia research. Kambhampati gave a tutorial on information integration at AAAI 2007. In 2007, Davulcu was the winner of prestigious CAREER award from the NSF Information & Intelligent Systems (IIS) division. In 2009, Chen will serve as a publicity and proceeding chair for ACM Symposium on Principles of Database Systems (PODS), the premiere international conference on the theoretical aspects of database systems.
In 1979, faculty from the Electrical and Computer Engineering Department, Industrial and Management Systems Engineering Department and Mathematics Department at ASU recommended the creation of a new department especially focused on computer science and computer engineering programs. The Department of Computer Science and Engineering (CSE), known then as the Computer Systems Engineering track of Engineering Special Programs, officially began in the spring of 1980. Since that time, hundreds of students have received their bachelor’s, master’s and doctoral degrees.

Since 1980 seven faculty members have been department chair. Those leaders have paved the way for both students and faculty to advance CSE as a leading department in the country.

“Our CSE department has made significant strides towards becoming a top notch academic department in the country. The faculty, research, students and academic programs are truly world-class”
Sethuraman Panchanathan
Director, School of Computing and Informatics
Undergraduate Degrees

The Bachelor of Science in Engineering (B.S.E) in Computer Systems Engineering emphasizes the design and production of hardware and software components comprising a computer system. It includes courses on computer organization and architecture, system programming, operating systems, embedded micro systems and digital hardware design. Although the program addresses numerous application areas, a unique focus on embedded systems sets it apart.

The Bachelor of Science (B.S.) in Computer Science provides a solid background in computing principles and enables students to customize their degrees with 21 hours of computer science and technical electives. More than 30 senior-level courses are offered within the department. Students may also select courses in mathematics, other engineering areas and biology to meet requirements. This degree also offers a software engineering concentration consisting of four courses in which students have an opportunity to master software development techniques while working in teams, as well as a 15 credit hour concentration in Information Assurance.

Undergraduate research opportunities exist for students in both degree programs. The department provides scholarships to encourage undergraduate research, which can culminate in an undergraduate thesis through the university’s Barrett Honors College. Last year, the department awarded seven scholarships. The Fulton Undergraduate Research Initiative program offers opportunities for students to participate in such research.
Master’s Degrees

The **Master of Science (M.S.) in Computer Science** is a research-oriented degree targeted at students with an undergraduate education in the science of computation. It provides advanced course work and emphasizes student research as well as offers numerous opportunities for interdisciplinary study. Within this degree, a concentration in Arts, Media and Engineering (AME) is offered in collaboration with faculty in the Department of Electrical Engineering and the Herberger College of the Arts. M.S. students can also pursue concentrations in Information Assurance and Biomedical Informatics.

The **Master of Computer Science (M.C.S.)** is an advanced degree targeted at students with undergraduate education in computer-related disciplines who can benefit from further breadth and background. The M.C.S. also provides an opportunity for students employed in industry to seek advanced education in computer science. M.C.S. students can also pursue a concentration in Information Assurance.

Admission to both degrees is highly competitive. The graduate-level course work emphasizes research topics of current interest, such as embedded systems; information assurance and computer security; multimedia and the arts; database systems; algorithm design and analysis; bioinformatics; sensor and ad-hoc networks; data mining; information integration; optical networks; and computer aided-geometric design. Independent study in research is encouraged as part of the M.S. program. The Consortium for Embedded Systems, a partnership of ASU, Intel and Freescale, supports work that applies academic research to industrial problems in embedded systems and networks. This is one of the many ways the M.S. and M.C.S. programs combine academic excellence and relevance to industry.

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Doctoral Degree

The **Doctor of Philosophy (Ph.D.) degree** in Computer Science prepares students to undertake fundamental and applied research in computer science in academia, government and industry. Having matured as a discipline in its own right, computer science is now developing deep interactions with other fields, not just in engineering and science, but throughout the arts and humanities, education, law, medicine and business. While computers have become essential tools in these areas, the depth of interaction of fundamental computer science with each is rapidly evolving.

Strong collaborations with the six other engineering departments in the Ira A. Fulton School; the Department of Mathematics and Statistics; the School of Life Sciences; the W. P. Carey School of Business; the Herberger College of the Arts; the Consortium for Embedded Systems; and the Translational Genomics Research Institute (TGen), provide a wealth of experience for our doctoral students. The interdisciplinary strength of the Ph.D. degree is enhanced by a concentration in Arts, Media and Engineering (AME), as well as a concentration in Information Assurance.
Consortium for Embedded Systems: Changing Future of Computers

Objects ranging from an iPod to an automobile use advanced computer technology commonly concealed by a metallic or decorative cover. Advanced technology of this nature usually operates through an embedded computer system. The Consortium for Embedded Systems (CES) researches the inner workings of embedded computer systems. A simplified explanation of embedded systems is that they are special purpose computer systems designed to perform one or a few dedicated functions and are part of a complete device including hardware and mechanical parts. Although most people do not realize it, they use some form of embedded systems in their daily interactions at work and at home.

Since its beginning in 2001, CES actively conducts research in order to build an eco-system of knowledge and expertise in embedded systems. Twenty-five students have held internships coordinated through CES along with two dozen other master’s and doctoral students who work on CES research projects. CES consists of a large network of professors who mostly have an expertise in Computer Science and Engineering. The research focus of the group splinters into the five core areas of power, energy and thermal aware design, robust IC and system design, software design for embedded systems, advanced processor architectures and networked and distributed embedded systems. Sarma Vrudhula, Director of Consortium for Embedded Systems and SCI faculty Karam Chatha, Yann-Hang Lee and Aviral Shrivastava form the core of CES at ASU. Approximately fifteen professors collaborate throughout the year within CES on a variety of research projects.

Vrudhula’s main research interests are in robust very-large-scale integration (VLSI) design, power energy and thermal management for multi-core systems and high performance low power VLSI design. One of his current research projects involves his research interest in robust embedded IC design. The project entitled “Power and Performance Analysis with intra-die and inter-die process variations” addresses the issue of statistical static timing analysis. This research paves the way for future chips embedded within nano systems to perform more efficiently. Thus far, his research appears in two pending publications. In 2007, this project’s work resulted in the publication entitled, “A Fast and Accurate approach for Full Chip Leakage Analysis of Nano-scale circuits considering Intra-die Correlations” in the Proceedings of the IEEE International VLSI Design Conference. Also in the same year, this research was featured in Proceedings of the ACM/IEEE International Conference on Computer-Aided Design under the title, “A Framework for Statistical Timing Analysis using Non-Linear Delay and Slew Models.” In 2008, the Science Foundation Arizona awarded Vrudhula and other SCI professors with a $2 million grant to support their research on computer processing capabilities. They will carry out their research jointly with engineers at Raytheon Missile Systems. The project will explore ways to maximize the computational power of multi-core processor systems.

Chatha’s research interests centers around multiprocessor system on-chip design and application development and network on chip design. A current research project, “Network-on-Chip: CAD techniques, architectures and performance models,” seeks to meet the needs of industry leaders facing challenges with nanoscale semiconductor technology. In essence, this research provides a solution for the problem of creating a small machine to perform at high levels without being too hot or too slow. Projects like Vrudhula’s and Chatha’s both serve the academic community’s need to understand embedded systems as well as the need for industry to have systems that perform better. Day by day researchers within CES collaborate to further their research aims for the betterment of the academic and industrial communities.

“Five years ago, a desktop personal computer (PC) consisted of a single microprocessor, such as the Intel Pentium. In the next five years, the main chip on a desktop PC is expected to have upwards of 16 processors. In the not so distant future, desktop PCs will have hundreds of processors.” Sarma Vrudhula, Director of Consortium for Embedded Systems
Research Themes

Algorithms and Theory Research

The algorithms and theory group conducts research in areas ranging from applied algorithms to fundamental research on the limits of computing. Our applied research focuses on combinatorial design and its application to hardware and software design. Application areas also include the use of algorithmic techniques for computational biology. Fundamental research in algorithms addresses graph algorithms as well as search techniques and approximation algorithms. Our research includes resource localization, routing, caching and streaming algorithms for networks, in addition to combinatorial design theory, security issues and fault tolerance in sensor networks and distributed systems.


Faculty Contacts: Rida Bazzi, Charles Colbourn, Goran Konjevod, Seungchan Kim, Andrea Richa, Arun Sen, Guoliang Xue

Computer Security

Security of computer systems and networking has become an issue of extreme importance due to the proliferation of the internet and the sophistication of attackers. The scope ranges from personal computers to corporate servers, from e-commerce sites to government systems. At ASU, the researchers in this arena are working on a variety of topics and developing protocols and systems that harden computers against attacks.

Subcategories: Anonymity, Authentication for Humans, Consumer Computer Security, Data Privacy and Confidentiality

Faculty Contacts: Gail-Joon Ahn, Rida Bazzi, Karam Chatha, Partha Dasgupta, Sandeep Gupta, Dijiang Huang, Guoliang Xue, Stephen Yau

Data, Information and Artificial Intelligence

Researchers address problems in database systems, information management, information integration and intelligent agent design. Data management research addresses techniques for replication, indexing, security and query processing in databases and systems for sensor data management, scientific data management and web data. Information management investigates the use of events, rules, queries and transactions in workflows over data services. Information integration combines techniques from distributed query processing and artificial intelligence for retrieval of data from distributed sources. Artificial intelligence research investigates automated planning, scheduling, constraint satisfaction, reasoning, logic programming, multi-agent systems, information extraction and the semantic web.

Subcategories: Automated Planning and Scheduling, Data Description and Management, Data Mining, Data Stream Management, Information Integration, Knowledge Representation and Reasoning, Machine Learning

Faculty Contacts: Chitta Baral, K. Selcuk Candan, Yi Chen, Hasan Davulcu, Subbarao Kambhampati, Seungchan Kim, Pat Langley, Joohyung Lee, Baoxin Li, Huan Liu, Hari Sundaram, Kurt VanLehn, Jieping Ye
Hardware Architectures and Embedded Systems

At the heart of personal, health care, homeland security, education and transportation applications is a computing system that performs the essential functions of sensing, computing, control and communication. Such computing systems that are immersed in their application domains are known as embedded systems. Design technologies for embedded systems are facing twin challenges of silicon and system complexities, and a cross-cutting challenge of increased power consumption. Faculty are engaged in cuttingedge research that addresses these design challenges of embedded computing technologies.


**Faculty Contacts:** Karam S. Chatha, Yann-Hang Lee, Aviral Shrivastava, Violet Syrotiuk, Sarma Vrudhula

Networks, Operating Systems and Compilers

The networks, operating systems and compilers cluster of SCI consists of researchers working on many core problems in these areas. Network research focuses on the investigation of issues such as routing, quality of service and reliability in optical networks, sensor networks, wireless and mobile ad hoc networks. Operating systems research investigates efficiency and scalability over large networks and diverse applications with projects that range from large address space operating systems to peer-to-peer computing architectures. Research in the area of compilers is developing novel compilation techniques to exploit innovative architectural features to help achieve important design goals of system power, performance and reliability.

**Sub-categories:** Compilers, Integrated Infrastructure for Identity Assurance, Networks, Operating Systems

**Faculty Contacts:** Rida Bazzi, K. Selcuk Candan, Charles Colbourn, Partha Dasgupta, Sandeep Gupta, Dijang Huang, Goran Konjevod, Yann-Hang Lee, Donald Miller, Andrea Richa, Arun Sen, Aviral Shrivastava, Violet Syrotiuk, Guoliang Xue, Stephen Yau

Multimedia, Visualization and Modeling

Mathematical data modeling and visualization research leads to development of sophisticated new analysis tools for multimedia data. Multimedia research focuses on computational models for experiential systems, multimedia communication systems, ubiquitous multimedia computing, integration of database/internet technologies, digital media/arts, face/gait analysis and recognition, media processors, multimedia technologies for education and multimedia document authoring. Modeling research includes urban/terrain modeling, point cloud fitting and geometric modeling of cloud interface surfaces. Visualization research concentrates on volume visualization based upon isosurface extraction.

**Sub-categories:** Data Modeling, Computer Graphics, Media Processing and Analysis, Media Processing Workflow Management, Media Semantics Multimodal Systems for Learning, Assistance and Rehabilitation, Visualization

**Faculty Contacts:** K. Selcuk Candan, Karamvir Chatha, Gerald Farin, Gregory Nielson, Baoxin Li, Sethuraman Panchanathan, Hari Sundaram, Peter Wonka

Software Engineering

Research in software engineering covers component-based software development; adaptable service-based software; software architecture; context- and situation-aware software; QoS-aware software; simulation-based design; distributed co-design; collaborative modeling; software process improvement; formal methods; embedded software; middleware; web-based software engineering; distributed workflow analysis; and modeling methodologies.

**Sub-categories:** Customized Software Processes, Development of Adaptive Software, Simulation-based Software Engineering, Software Process, Environment, and Automation Research (SPEAR) Area

**Faculty Contacts:** James Collofello, Hessam Sarjoughian, Wei-Tek Tsai, Stephen Yau
Biomedical informatics is an interdisciplinary research field that requires collaboration among computer scientists, cognitive, social and decision scientists engineers, mathematicians, biologists and clinicians to advance information technology, data and knowledge management and analysis methodologies and computational and informatics tools to improve our understanding of health care practice, public health and biological systems. Goal of the research is to enhance patient care and human health in general, by expediting the process of transferring basic biomedical research to clinical use effectively and safely. Analysis/cognitive modeling of human behavior in real world health care environment, mathematical modeling of population health, analysis of human-computer interaction andcomputational modeling of living systems all play important role in these research activities.

**Sub-categories:** Bioinformatics, Clinical Informatics, Cognitive Sciences, Imaging Informatics, Public Health Informatics

**Faculty Contacts:** Chitta Baral, Trevor Cohen, Valentin Dinu, William Johnson, Kanav Kahol, Seungchan Kim, Vimla Patel, Howard Silverman

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Cyberinfrastructure is best defined as “the coordinated aggregate of software, hardware and other technologies, as well as human expertise, required to support current and future discoveries in science and engineering.” The challenge of cyberinfrastructure is to integrate relevant and often disparate resources to provide a useful, usable and enabling framework for research and discovery characterized by broad access and “end-to-end” coordination. Often viewed in layers, cyberinfrastructure has fundamental computing technologies (processing, storage, communication) at the bottom most layer, and community specific knowledge environments for research and education (collaboratories, e-science communities) at the top layer. The challenge lies in the creation of the services between these two layers, often referred to as “middleware”.

**Sub-categories:** High Performance Computing: Systems, software, and middleware, Knowledge Environments, Collaborative Communities

**Faculty Contacts:** Goran Konjevod, Sandeep Gupta

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The research in information assurance focuses on the broad issues of developing trustworthy information systems and ensuring the quality of information being stored, processed and transmitted by these systems. In addition, IA faculty members are participating in the Information Assurance, a National Center of Academic Excellent in Information Assurance Education (CAEIAE) certified by NSA/DHS.

**Sub-categories:** Data Security and Privacy, Digital Identity, Network Security, Security and other Assurance Mechanisms in Service-based Systems, Trust Management in Distributed Systems

**Faculty Contacts:** Gail-Joon Ahn, Chitta Baral, Rida Bazzi, K. Selcuk Candan, Charles Colbourn, Partha Dasgupta, Hasan Davulcu, Sandeep Gupta, Dijiang Huang, Huan Liu, Hessam Sarjoughian, Arunabha Sen, Wei-Tek Tsai, Gouliang Xue, Stephen Yau
**Modeling and Simulation**

Advances in modeling and simulation, grounded in disciplinary to transdisciplinary subject matters, are central in carrying out research in numerous computing and informatics topics. Modeling and simulation theories, flexible and high-performance software tools and practices are indispensable in understanding and creating engineered and natural network systems. The objective of the modeling and simulation theme is to serve as a foundation and enabler for developing multi-scale, multi-purpose data intensive computational models of complex systems. New kinds of hybrid simulated and physical systems make possible innovative simulation-based science and engineering in domains as diverse as supply-chain enterprises, command and control systems, environmental phenomena and e-businesses.

*Sub-categories*: Model Composability, Simulation-based System Design and Testing, Software Development Process Modeling

*Faculty Contacts*: James Collofello, Gerald Farin, Huan Liu, Hessam Sarjoughian, Wei-Tek Tsai, Peter Wonka, Stephen Yau

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**Pervasive and Ubiquitous Computing**

Pervasive and ubiquitous computing researchers come from diverse core areas and are working on various aspects of developing computing infrastructure that are intuitive to use in everyday scenarios irrespective of where and how they are invoked. Specifically, various faculty members are working on developing intuitive interfaces and pervasive media processing to support sensor data management, developing multimedia software to help blind people to easily search text in library, developing biomedical sensor-based middleware for pervasive health monitoring, developing mobility-tolerant and mobility-aware protocols for seamlessly integrating mobile devices into the wired infrastructure and developing light weight security solutions for pervasive commercial applications. These research works are being conducted in various labs and centers under various interdisciplinary projects funded by various sources such as NSF, Intel Corporation and MediServe Corporation.

*Faculty Contacts*: K. Selçuk Candan, Sandeep Gupta, Dijiang Huang, Sethuraman Panchanathan, Hari Sundaram

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**Service and Enterprise Systems**

There are significant challenges that exist in the design, specification and development of intra-organizational enterprise systems as well as business-to-business and business-to-customer enterprise systems. To address these challenges, this research group addresses new directions in service-oriented computing, service-oriented architectures and service-oriented software development. Researchers focus on process modeling and service orchestration together with middleware for event processing and service execution. Additional research addresses scalability and performance of enterprise systems as well as semantic description of services and the manner in which semantics can assist in the design and implementation of service-oriented applications.

*Sub-categories*: Enterprise Computing, Service-Oriented Computing, Service-Oriented Computing Curriculum and Education Related Research

*Faculty Contacts*: K. Selçuk Candan, Yinong Chen, James Collofello, Yann-Hang Lee, Hessam Sarjoughian, Wei-Tek Tsai

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**Social Science Informatics**

Social science informatics contains a variety of cross-disciplinary activities between the faculty and social, cognitive and behavioral scientists. Social science driven activities contain the computational simulation of social phenomena such as governance of common pool resources and ancient societies, the integration of data from social science research activities, the social analysis of electronic documents and communication and tools for social scientists to analyze spatial explicit information. Informatics driven activities develop interfaces and improve the accessibility of information. Applications include tools developed for those who are blind or visually impaired.

*Sub-categories*: Computational Social Network Analysis, Geospatial Intelligence, Human-Computer Interfaces, Social Science Data Integration, Social Simulation

*Faculty Contacts*: K. Selçuk Candan, Hasan Davulcu, Nicholas Findler, Baoxin Li, Huan Liu, Hessam Sarjoughian, Hari Sundaram, Subbarao Khambampati, Peter Wonka
Institute for Computing Information Sciences and Engineering (InCISE)
http://incise.asu.edu
The mission of InCISE is to foster computer science and applications of data acquisition, analysis and management, security, modeling, visualization and interpretation in interdisciplinary research, education and entrepreneurship. InCISE has successfully fostered interdisciplinary research using this informatics and computer science foundation and has contributed to creation of a new School of Computing and Informatics (SCI), composed of Computer Science and Biomedical Informatics Departments and a program in informatics. InCISE ROI is 6.3:1 based on an investment of $450K and $2.7 M Expenditures, $4.4M Awards and $40.6 M in collaborative proposals submitted in FY 08.

Center for Cognitive Ubiquitous Computing (CUbiC)
http://cubic.asu.edu
The Center for Cognitive Ubiquitous Computing (CUbiC) is an inter-disciplinary research center focused on advancing research in the area of human-centered multimedia computing (HCMC). Most HCMC research is focused on designing devices, technologies and solutions for the general population. At CUbiC, it is our belief that a complete understanding of the issues surrounding HCMC requires capturing a complementary, yet enriching, perspective through inspirations drawn from studying human disabilities, deficits and impairments. Over the past five years, researchers have primarily focused our research on designing assistive devices for individuals who are blind or visually impaired. These include a portable reading assistant, wearable social interaction assistant, information assistant, accessible shopping environment and multimodal assistive and rehabilitative (visual, audio, haptic) interfaces. CUbiC’s core research has already resulted in innovative solutions for individuals with other disabilities and to the general population. Examples of such interesting projects include virtual surgery training interfaces, rehabilitation of patients with neurological impairments and fall prevention for the elderly. Current research focus of CUbiC encompasses diagnostic, rehabilitative and assistive technologies for a variety of physical, cognitive and neural impediments, such as individuals who are blind, visual and auditory impaired, children with autism, patients with Alzheimer’s, elderly care and prosopagnosia. Research projects in CUbiC are funded by NSF, NIH, State of Arizona and industry. Clinical partners include Mayo Clinic, Barrow Neurological Institute and Banner Health.

Information Assurance Center
http://ia.asu.edu
The Information Assurance Center focuses on both research and educational activities to address the broad issues of developing trustworthy information systems (TIS) and ensuring the quality of information being stored, processed and transmitted by these TIS. Center researchers are currently studying foundational, network, system and application aspects of developing TIS, including formal model, security policies, innovative mechanisms and toolkits for adaptive TIS; composition methods; measuring, modeling, monitoring, analyzing, verifying and testing of TIS; steganography; facial recognition, video surveillance, multimedia data processing and survivable network design; dynamic and deterministic quality of service management; data mining for security and privacy in data management; situation awareness; digital identify and privacy management for large-scale enterprise TIS; and cyber crime analysis for network-centric TIS. The center received certification as a National Center of Academic Excellence in Information Assurance Education by the National Security Agency and the Department of Homeland Security in June 2007 and currently offers concentration programs in the B.S., M.C.S, M.S., and Ph.D. degree programs in computer science and engineering. The center is also actively engaged in continuing education for industry as well as assisting IA educational activities in community and minority colleges.

Center for Health Information & Research
http://chir.asu.edu
The Center for Health Information & Research (CHIR) is an interdisciplinary research group that provides actionable information about health care in our community. An Arizona Board of Regents (ABOR) designated center, CHIR houses the Arizona HealthQuery (AZHQ), a nationally unique data warehouse of comprehensive, patient-centric health information, including 200 million records for 9 million individuals, which supports longitudinal tracking of health outcomes for individuals across providers and insurers. Additionally, CHIR houses the Arizona Health
PRISM's 3D models of George Washington at ages 19 and 57

Care Workforce dataset - an expanding resource of physician, nurse and pharmacist information used to help boost planning and decision making efforts for our community health care workforce leaders.

CHIR's series of community health care reports reflect their deep ties to the Arizona community and the commitment of over 40 of organizations that voluntarily share their data to create AZHQ. CHIR was awarded the President's Medal for Social Embeddedness in 2005 and received the award again in April 2008. CHIR is nearing the end of its second year as a national demonstration site for a Centers for Medicare and Medicaid Services initiative to improve the quality of health care for Medicare beneficiaries. In 2007-2008, grant and contract expenditures totaled more than $1.1 million. Proposal submissions totaled more than $15 million. CHIR faculty authored eight refereed articles, one community report and one community brief with an additional five manuscripts in process.

Partnership for Research in Spatial Modeling
http://prism.asu.edu

The Partnership for Research in Spatial Modeling (PRISM) is ASU’s focal point for research involving 3D data acquisition, modeling, visualization and analysis. PRISM is co-directed by Dan Collins (Fine Arts) and Gerald Farin (Computer Science) and involves interdisciplinary collaborators from throughout the university including SCI researchers Peter Wonka and Jeremy Rowe. PRISM’s origins date to 1997, becoming an official center soon after with initial funding from an NSF KDI grant ($2.3M). PRISM’s applied research involves 3D data archiving, 3D data query, 3D face recognition, 3D de-aging of a George Washington face bust, 3D telesculpture, brain imaging and visualization for urban planning. Theoretical research is about isosurfaces from Marching Cubes, Voronoi diagrams, curve and surface design and real-time rendering in a computer graphics context. PRISM research includes 3D data acquisition, data modeling, data visualization and 3D rapid prototyping.

Consortiums and Collaboratives

Arts, Media and Engineering Program (AME) http://ame.asu.edu

Engineering, arts and science disciplines involved in media research and training have come together to create AME. The program’s mission is research and education in the integrated development of media systems. AME’s specialized focus is the study and development of experiential media systems. These are defined as systems that integrate computation and digital media with the physical-human experience to produce enhanced physical-digital experiences.


CES was established as an industry/university partnership dedicated to developing a globally recognized center for embedded technologies. The charter members of CES are ASU, Intel Corporation and Motorola Incorporated, who have been working together to build an eco-system of knowledge and expertise in embedded systems. CES programs have provided direct industry involvement and feedback towards initiating faculty research projects, improved curriculum and laboratories, and provides students with access to real-world work experiences.

Decision Making and Cognition http://cognitive.asu.edu

Decision Making and Cognition is a multidisciplinary research unit devoted to the study of medical decision-making, cognitive foundations of health behaviors and the effective use of computer-based information technologies. The research is steeped in theories and methods of cognitive science with a particular focus on the analysis of medical error, models of naturalistic decision-making, development and use of clinical guidelines and evaluation of human-computer interactions. These studies are guided by a concern for improving performance of individuals and teams in the healthcare system. Towards this end, we focus on the cognitive characteristics involved in learning, instruction and in the design of decision-support and other health information technologies for safe use in clinical environments.

Enabling Technologies for Intelligent Information Integration Program (ET-I3)

ET-I3 is a collaborative program that addresses the challenge of information integration. ET-I3 is developing enabling integration technologies for scalable “Do What I Mean” (DWIM) processing for sources and services over the internet. DWIM-integration involves using the higher-level information goals of the user to decide what sources and services on the available information web are directly or indirectly relevant. After accessing these sources, the system efficiently composes the relevant services to answer requests. Technologies to support DWIM-integration will be critically important for high-profile areas, such as bioinformatics and ebusiness, and useful in other disciplines.

Fulton High Performance Computing Initiative (HPCI) http://hpc.asu.edu

HPCI serves as the hub for parallel and grid scientific computing on the ASU Tempe campus, maintaining centrally managed high performance computing systems for more than 1,000 processors across campus. HPCI provides state of the art machine room facilities, system administration, expertise in parallelization of scientific and engineering codes and training to ASU researchers. The mission of the HPCI is to maximize the utility of high-end computing resources deployed by ASU researchers.
### Research Awards

**Total Expenditures**

- **Professors**: 46%
- **Associate Professors**: 20%
- **Assistant Professors**: 20%
- **Other Faculty**: 18%

### Overall SCI Expenditures

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<tr>
<th>Year</th>
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### Submitted Proposals

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### Award Amounts Received

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### FACULTY | CO-PI | TITLE | SPONSOR | DATES | AWARD |
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<td>BANNISTER</td>
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<td>Arizona Health Query Data and Valley Fever Among Persons with Community Acquired Pneumonia in Arizona</td>
<td>University of Arizona-Valley Fever Center for Excellence</td>
<td>7/15/07-8/14/07</td>
<td>$5,175</td>
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<td>Scottsdale Healthcare Community Health Needs Assessment</td>
<td>Scottsdale Healthcare</td>
<td>4/1/08-10/31/08</td>
<td>$63,554</td>
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<td>BARAL</td>
<td>Y. Chen, Gonzalez, Joshi</td>
<td>CAA: Generalized Text Extraction from Life Science and Biomedicine Abstracts: Empowering the CBioC Mass Collaborative Curation and Reasoning Systems</td>
<td>Science Foundation of Arizona</td>
<td>3/30/07-9/30/08</td>
<td>$138,749</td>
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<td>Lee</td>
<td>Compiling AnsProlog to first-Order Theories - An Approach to Integrate AnsProlog Knowledge Bases with First-Order Knowledge Bases</td>
<td>DOD-Navy</td>
<td>9/30/06-12/31/07</td>
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<td>Kambhampati, Langley, Mcbeath</td>
<td>Effective Human Robot Interaction under Time Pressure through Natural Language Dialogue and Dynamic Autonomy</td>
<td>DOD-Office of Naval Research</td>
<td>10/1/07-6/30/12</td>
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<td>Gonzalez</td>
<td>Integrating Knowledge based Reasoning, Common Sense Reasoning and Natural Language Semantics in a QA System</td>
<td>DOD-Navy</td>
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<td>Gonzalez</td>
<td>Knowledge Representation, Reasoning and Problem Solving in a Cellular Domain*</td>
<td>NSF- Directorate for Computer and Information Science and Engineering</td>
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<td><strong>BURLESON</strong></td>
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<td>Game as Life - Life as Game</td>
<td>NSF-Directorate for Computer and Information Science and Engineering</td>
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<td>Hodges, Robinson</td>
<td>HCC: Collaborative Research: Affective Learning Companions: Modeling and Supporting Emotion During Learning</td>
<td>NSF-Directorate for Computer and Information Science and Engineering</td>
<td>10/1/07-9/30/08</td>
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<td><strong>CANDAN</strong></td>
<td>Davulcu, Hedgpeth, Li, Sundaram</td>
<td>MAISON: Middleware for Accessible Information Spaces on NSDL</td>
<td>NSF-Division of Undergraduate Education</td>
<td>1/1-08/12/09</td>
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<td>Haag, Hedgpeth, Panchanathan</td>
<td>Ubiquitous Environment to Facilitate Access to Textbooks &amp; Related Materials for Individuals who are Blind or Visually Impaired</td>
<td>ED-U.S. Department of Education</td>
<td>1/9/06-12-31/07</td>
<td>$374,452</td>
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<td><strong>CHATHA</strong></td>
<td>Stanzione</td>
<td>CAREER: System-Level Design of Network-On-Chip Architectures</td>
<td>NSF-Directorate for Computer and Information Science and Engineering</td>
<td>3/15/06-2/28/10</td>
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<td>CHEN, S Rosenberg</td>
<td>Collaborative Research: Statistical Methods and Algorithms for Genomic Data</td>
<td>NSF-Division of Mathematical Sciences</td>
<td>8/15/07-7/31/11</td>
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<td><strong>CHEN, Yi</strong></td>
<td>Chatha, Gupta</td>
<td>Designing and Evaluating Protocol Query Languages</td>
<td>University of Pennsylvania (NSF)</td>
<td>12/1/07-11/30/08</td>
<td>$33,011</td>
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<td>Chatha, Gupta</td>
<td>CNS-SGER Integrated Security Infrastructure for Personal Identities and Consumer Computing</td>
<td>National Science Foundation</td>
<td>5/1/06-10/31/08</td>
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<td><strong>DAVULCU</strong></td>
<td>Chatha, Gupta</td>
<td>CAREER: A Logic-Based Dynamic Policy Model for Adaptive Workflow Management</td>
<td>NSF-Directorate for Computer and Information Science and Engineering</td>
<td>1/16/07-2/28/11</td>
<td>$413,112</td>
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<td>FARLEY Dietrich</td>
<td>AZ ASU Alzheimer's Research Center Project-Year 10</td>
<td>Arizona Alzheimer's Disease</td>
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<td>FARLEY Dietrich</td>
<td>Splines Over Iterated Voronoi Diagrams*</td>
<td>NSF-Directorate for Computer and Information Science and Engineering</td>
<td>12/15/03-11/30/07</td>
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<td><strong>FRIDSMA</strong></td>
<td>U Pitt Subcontract: A Standards-based Tool for Clinical Trials Protocol Authoring</td>
<td>University of Pittsburgh</td>
<td>9/26/07-8/31/08</td>
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<td><strong>GREENES</strong></td>
<td>BMI-AHCCCS Interagency Service Agreement-Task Two</td>
<td>Arizona Health Care Cost Containment System (AHCCCS)</td>
<td>3/1/08-6/1/09</td>
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<td>Committe Chair of the ACR Imaging Network Informatics Subcommittee</td>
<td>HHS-NIH-NCI-National Cancer Institute</td>
<td>9/1/07-12/31/07</td>
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<td>TRIF: ASU Biomedical Informatics Portal Development</td>
<td>University of Arizona</td>
<td>1/1/08-12/1/08</td>
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<td>GUPTA</td>
<td>Dasgupta, Stanzione, Vrudhula</td>
<td>CAA: Building Greener Datacenters in Arizona</td>
<td>Science Foundation of Arizona</td>
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<td>Dasgupta, Stanzione</td>
<td>CES: Exploring Multicore-Based Hardware/Software Architecture for</td>
<td>Consortium for Embedded Systems</td>
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<td>Mobile Computing Edge Devices (MCED)</td>
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<td>HEDGPETH</td>
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<td>HCC: The iCare Ambient Interactive Shopping Environment</td>
<td>NSF-Directorate for Engineering (ENG)</td>
<td>10/1/07-9/30/08</td>
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<td>JOHNSON</td>
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<td>AHCCCS Intergovernment Services Agreement</td>
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<td>Arizona Physician Trends: Out of State Physicians &quot;Reason for Leaving</td>
<td>Arizona Hospital and Healthcare Association</td>
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<td>Russell</td>
<td>Carondelet NAOMI Project</td>
<td>Carondelet Health Network: Carondelet Community Trust</td>
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<td>Catholic Healthcare West</td>
<td>Catholic Healthcare West-East Valley: Chandler Regional Hospital &amp; Mercy Gilbert Medical Center Community Health Needs Assessment</td>
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<td>St. Luke's Health Initiatives</td>
<td>3/7/08-4/6/09</td>
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<td>Physicians Workforce Study Project</td>
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<td>Phoenix Healthcare Value Measurement Initiative</td>
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<td>KAMBHAMPATI</td>
<td>ASU Subcontract of LMCO Proposal to DARPA IL Program</td>
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<td>DOD-Defense Advanced Research Projects Agency</td>
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<td>Supporting Partial Satisfaction Planning &amp; Replanning in Expressive</td>
<td>DOD-Office of Naval Research</td>
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<td>and Mixed Initiative Domains</td>
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* These awards also include a Research Experience for Undergraduates (REU) component. Funded by the National Science Foundation, REUs support research participation by undergraduate students.
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<td>KIM</td>
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<td>A New Therapeutic Paradigm for Breast Cancer Exploiting Low Dose Estrogen-Induced Apoptosis</td>
<td>DOD-U.S. Department of Defense</td>
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<td>Integrating Genomic Data &amp; Biological Knowledge to Learn Context-Specific Gene Networks</td>
<td>HHS-NIH-NLM-National Library of Medicine</td>
<td>6/1/08-6/30/10</td>
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<td>CAA: Hypothesis-Centered Biological Knowledge Bases</td>
<td>Science Foundation of Arizona</td>
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<td>Kambhampati</td>
<td>Computational Approaches to Creativity Through Goal-Directed Cross-Domain Analogy</td>
<td>NSF-Directorate for Computer and Information Science and Engineering</td>
<td>9/15/07-8/31/09</td>
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<td>Mental Simulation and Learning in the Icarus Architecture</td>
<td>DOD-Office of Naval Research</td>
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<td>Software Integration for Computational Cognitive Models in Virtual Environments</td>
<td>SET Corporation (DOD-AFRL)</td>
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<td>ASU Response to RFP: BAE-07-07 for Participation in the Software Assurance Research Program - extension of existing Subcontract.</td>
<td>NASA-National Aeronautics and Space Administration</td>
<td>7/27/07-12/30/07</td>
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<td>Electronics and Telecommunications Research Institute</td>
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<td>A Systematic Approach to 3D Imaging and Visualization for Enhancing Target Detection and Discrimination</td>
<td>Intelligent Automation, Inc.</td>
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<td>Stereoscopic Visualization and Haptic Virtual Exploration of Gastrointestinal Endoscopic Images for Improved Diagnosis</td>
<td>Mayo Clinic Scottsdale</td>
<td>1/1/07-6/30/08</td>
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<td>Woodward</td>
<td>Blog Trackers: Combining Domain Knowledge and Novel Search Capabilities for Assessing Political Risks</td>
<td>DOD-Office of Naval Research</td>
<td>1/29/08-11/30/08</td>
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<td>Deep Search for Modeling Group Interaction using Open Data Sources</td>
<td>DOD-Air Force Research Laboratory-IFKA</td>
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<td>Link Mining of Textual Data</td>
<td>The MITRE Corporation</td>
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<td>DOD-Air Force Office of Scientific Research</td>
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<td>Analysis of Implicit Modeling of Complex Geometric Environments</td>
<td>DOD-Army Research Laboratory</td>
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<td>Geometry Processing for IsoSurfaces</td>
<td>NSF-Directorate for Computer and Information Science and Engineering</td>
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<td>Special Project: Building Relationships with Asia to Foster Research Exchanges and Student Training in Scientific Data Visualization and Modeling</td>
<td>NSF-Directorate for Computer and Information Science and Engineering</td>
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<td>PANCHANATHAN</td>
<td>Homa, Kahol</td>
<td>Investigation of Spatial Memory Formation and Retention in Patients with Early Alzheimer’s Disease</td>
<td>Mayo Clinic Scottsdale</td>
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<td>ITR: ILEARN: IT-Enabled Intelligent and Ubiquitous Access to Education Opportunities for Blind Students (includes REU)</td>
<td>NSF-Directorate for Computer and Information Science and Engineering</td>
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<td>PATEL</td>
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<td>Bioscience Research Integration Software Platform</td>
<td>Biofortis, Inc. (NIH)</td>
<td>7/6/07-6/30/10</td>
<td>$251,124</td>
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<td>Cohen, Kabol</td>
<td>Cognitive Aspects of Mental Disorders Diagnosis and Treatment in Primary Care</td>
<td>Science Foundation of Arizona</td>
<td>7/1/08-6/30/09</td>
<td>$427,000</td>
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<td>Cohen, Kabol</td>
<td>Cognitive Complexity and Error in Critical Care</td>
<td>McDonnell (James S.) Foundation</td>
<td>1/1/08-1/1/13</td>
<td>$4,724,573</td>
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<td>Image Mining for Comparative Analysis of Expression Patterns in Tissue Microarrays</td>
<td>UMDNJ - Robert Wood Johnson Medical School</td>
<td>9/30/07-9/29/11</td>
<td>$68,110</td>
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<td>Usability Evaluation of AHLTA</td>
<td>University of Texas Health Science Center at Houston (DOD-Army)</td>
<td>2/11-8/2-10/09</td>
<td>$80,850</td>
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<td>Li</td>
<td>Shared Vision: Embedded Technology for Military Operations in Urban Terrain</td>
<td>DOD-Army Research Office</td>
<td>8/1/06-8/14/09</td>
<td>$304,592</td>
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<td>SHRIVASTAVA</td>
<td></td>
<td>Low Power Compilation in Phoenix</td>
<td>Microsoft Corporation</td>
<td>10/11/07-10/10/08</td>
<td>$50,000</td>
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<tr>
<td>STANZIONE</td>
<td></td>
<td>Intel High Performance Computing Graduate Assistships at Arizona State University: Programming from One Thousand to One Hundred Thousand Threads</td>
<td>Intel Corporation</td>
<td>8/21/06-3/31/08</td>
<td>$129,258</td>
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<td>Goodnick</td>
<td>Paradigms for Parallel Computations</td>
<td>DOD-Army Research Laboratory</td>
<td>6/5/07-9/4/08</td>
<td>$256,500</td>
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<td>Shared and Distributed Memory Parallelization of SystemC in Support of System VSIPL</td>
<td>Pentium Group, Inc.</td>
<td>9/5/06-8/31/07</td>
<td>$134,753</td>
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<td>The iPlant Collaborative: A Cyberinfrastructure-Centered Community for a New Plant Biology</td>
<td>NSF-Directorate for Biological Sciences (BIO)</td>
<td>2/1/08-1/31/09</td>
<td>$263,873</td>
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<td>World Class Science through World Leadership in High Performance Computing</td>
<td>NSF-Office of Cyberinfrastructure</td>
<td>10/1/06-9/18/08</td>
<td>$1,305,906</td>
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<td>STRACUZZI</td>
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<td>Transfer Learning in Integrated Cognitive Systems</td>
<td>Institute for the Study of Learning and Expertise (ISLE) - DOD-AFRL</td>
<td>11/1/06-4/30/09</td>
<td>$691,537</td>
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<tr>
<td>SUNDARAM</td>
<td>Candan</td>
<td>CES: Design of Dense RFID Systems for Indexing in the Physical World across Space, Time, and Human Experience</td>
<td>Consortium for Embedded Systems</td>
<td>9/19/07-9/18/08</td>
<td>$50,000</td>
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<tr>
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<td>Candan</td>
<td>Collaborative Research: Design of Dense RFID Systems for Indexing in the Physical World across Space, Time, and Human Experience</td>
<td>NSF-Directorate for Computer and Information Science and Engineering</td>
<td>9/15/07-8/31/10</td>
<td>$174,000</td>
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<td></td>
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<td>Context Aware Expertise Closure</td>
<td>Avaya Labs Research</td>
<td>12/1/05-8/14/08</td>
<td>$118,103</td>
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<tr>
<td>TSAI</td>
<td>Bitter, Chen, Collofello, Lee, Miron</td>
<td>Preparing High School Teachers for Service-Oriented Computer Science Education</td>
<td>ED-U.S. Department of Education</td>
<td>11/1/06-12/31/09</td>
<td>$793,818</td>
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</table>

Source: PRIDE Monthly Research Pivot Table Report, not including ASU Technology and Research Initiative Fund (TRIF) projects or non-sponsored gift awards.
<table>
<thead>
<tr>
<th>FACULTY</th>
<th>CO-PI</th>
<th>TITLE</th>
<th>SPONSOR</th>
<th>DATES</th>
<th>AWARD</th>
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<tbody>
<tr>
<td>VRUDHULA</td>
<td></td>
<td>Membership Agreement: Raytheon Company: Consortium for Embedded Systems Membership</td>
<td>Raytheon</td>
<td>1/1/08-12/31/08</td>
<td>$50,000</td>
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<tr>
<td>Chattha, Dasgupta, Shrivastava</td>
<td></td>
<td>An Integrated Design Framework for Application Development on Multi-core Processors</td>
<td>Science Foundation of Arizona</td>
<td>5/16/08-7/31/10</td>
<td>$2,000,000</td>
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<td>WONKA</td>
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<td>Collaborative Research: Synthesis, Verification and Testing for Nano-CMOS and Beyond using Threshold Logic</td>
<td>NSF-Directorate for Engineering (ENG)</td>
<td>10/1/07-9/30/10</td>
<td>$200,000</td>
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<td>Razdan, Wentz</td>
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<td>SEI(GEO): Visual Geo-Analytics</td>
<td>NSF-Directorate for Computer and Information Science and Engineering</td>
<td>8/1/06-7/31/09</td>
<td>$610,335</td>
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<td>XUE</td>
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<td>ITR Collaborative Research: Fault Tolerance in WDM Optical Networks: Multifailure Recovery and Multilayer Survivability</td>
<td>NSF-Directorate for Computer and Information Science and Engineering</td>
<td>9/15/03-8/31/08</td>
<td>$162,500</td>
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<td>Numerical Algorithms for Location Problems Arising in Wireless Sensor Networks and Other Applications</td>
<td>NSF-Directorate for Computer and Information Science and Engineering</td>
<td>5/27/07-7/31/08</td>
<td>$12,000</td>
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<td>Numerical Algorithms for Location Problems Arising in Wireless Sensor Networks and Other Applications</td>
<td>NSF-Directorate for Computer and Information Science and Engineering</td>
<td>7/15/08-7/31/08</td>
<td>$200,000</td>
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<td>Robustness and Survivability Issues in Wireless Ad Hoc Networks</td>
<td>DOD-Army Research Office</td>
<td>9/1/04-8/31/08</td>
<td>$255,734</td>
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<td>WN: Collaborative Research: Cross-layer Optimization for Dynamic Spectrum Access Wireless Mesh Networks</td>
<td></td>
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<td>NSF-Directorate for Computer and Information Science and Engineering</td>
<td>9/1/07-8/31/09</td>
<td>$100,000</td>
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<tr>
<td>YAU</td>
<td>Xue</td>
<td>Collaborative Research: CT-T Security and Survivability of Real-Time Systems with MANETs</td>
<td>NSF-Directorate for Computer and Information Science and Engineering</td>
<td>9/1/05-8/31/08</td>
<td>$200,000</td>
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<tr>
<td>Sarjoughian, Ye</td>
<td></td>
<td>SoD: Design of Service-based Software Systems with Qos Monitoring and Adaptation and Adaptation</td>
<td>NSF-Directorate for Computer and Information Science and Engineering</td>
<td>8/1/07-7/31/10</td>
<td>$800,000</td>
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<td>Trustworthy Data Sharing and Management for Collaborative Pervasive Computing Applications</td>
<td>NSF-Directorate for Computer and Information Science and Engineering</td>
<td>9/15/04-8/31/08</td>
<td>$320,000</td>
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</table>

“Our goal is for ASU to be a leading center for interdisciplinary science and technology research, as well as a pioneer in discovery and scholarship in computing and informatics.”

Rick Shangraw
ASU vice president of research, economic affairs
<table>
<thead>
<tr>
<th>Co-PI (Contribution)</th>
<th>Title</th>
<th>Sponsor</th>
<th>Dates</th>
<th>Award</th>
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<tbody>
<tr>
<td>Candan, Panchanathan, Sundaram (SCI 10%)</td>
<td>IGERT: An Arts, Sciences, and Engineering Research and Education Initiative for Experimental Media</td>
<td>NSF-Directorate for Education and Human Resources (EHR)</td>
<td>10/1/05-9/30/08</td>
<td>$599,169</td>
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<tr>
<td>Candan, Farin, Li, Panchanathan, Sundaram (SCI 15%)</td>
<td>CISE RI: An Interdisciplinary Research Environment for Motion Analysis</td>
<td>NSF-Directorate for Computer and Information Science and Engineering</td>
<td>9/1/06-8/31/08</td>
<td>$94,997</td>
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<tr>
<td>Wonka (SCI 50%)</td>
<td>Geometry Based Feature Extraction and Analysis of Geo Data</td>
<td>National Geospatial-Intelligence Agency (NGA)</td>
<td>7/29/05-6/28/09</td>
<td>$174,094</td>
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<tr>
<td>Wonka (SCI 40%)</td>
<td>ATIC-ASU component of Kutta Consulting, Inc’s submission to Dept. Homeland Security STTR, Phase II</td>
<td>DHS-Department of Homeland Security</td>
<td>5/15/08-6/15/10</td>
<td>$200,000</td>
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<tr>
<td>Panchanathan, Ye (SCI 25%)</td>
<td>Computational Analysis of Gene Expression Pattern Images</td>
<td>HHS-NIH-NHGRI-National Human Genome Research Institute</td>
<td>7/11/07-1/30/10</td>
<td>$2,955,716</td>
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<tr>
<td>Konjevod, Stanzione, Liu (SCI 10%)</td>
<td>CAA: Environmental and Economic Impacts of Material Used in Future Urban Development</td>
<td>SFAZ</td>
<td>3/30/07-9/30/08</td>
<td>$399,280</td>
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<tr>
<td>Richa (SCI 8%)</td>
<td>Academic and Professional Development for Upper-Division Computer Science, Engineering, and Mathematics Students -II: Transition to Research...</td>
<td>NSF-Directorate for Education and Human Resources (EHR)</td>
<td>9/1/07-8/31/11</td>
<td>$600,000</td>
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<td>Burleson (SCI 15%)</td>
<td>EEE 498/591: Electronics and Instrumentation for Extreme Environment Systems</td>
<td>NASA-National Aeronautics and Space Administration</td>
<td>7/31/07-7/20/08</td>
<td>$20,000</td>
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<tr>
<td>Richa (SCI 33%)</td>
<td>Academic and Professional Development for Computer Science, Engineering, and Mathematics Students: Transitioning to Upper Division, Research, Graduate</td>
<td>NSF-Directorate for Education and Human Resources (EHR)</td>
<td>8/1/04-7/31/08</td>
<td>$399,968</td>
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<tr>
<td>Chatha, Vrudhula (SCI 75%)</td>
<td>CSR-EHS: Analytical Techniques for Global Energy Minimization of a System of Interacting Components</td>
<td>NSF-Directorate for Computer and Information Science and Engineering</td>
<td>8/1/05-1/31/09</td>
<td>$400,000</td>
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<tr>
<td>Chen, Yi (SCI 50%)</td>
<td>Collaborative Research: SEI+II ProtocolDB: Archiving and Querying Scientific Protocols, Data and Provenance</td>
<td>NSF-Directorate for Computer and Information Science and Engineering</td>
<td>8/15/06-7/31/09</td>
<td>$6,000</td>
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<tr>
<td>Chen, Yi (SCI 50%)</td>
<td>Collaborative Research: SEI+II ProtocolDB: Archiving and Querying Scientific Protocols, Data and Provenance</td>
<td>NSF-Directorate for Computer and Information Science and Engineering</td>
<td>8/15/06-7/31/09</td>
<td>$321,814</td>
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<td>Rowe (SCI 5%)</td>
<td>Decision Center for a Desert City (DCDC): Science and Policy of Climate Uncertainty</td>
<td>NSF - Directorate for Social, Behavioral/Economic Science (SBE)</td>
<td>6/15/04-8/31/09</td>
<td>$6,900,000</td>
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<td>DEPARTMENT OF INDUSTRIAL ENGINEERING</td>
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<tr>
<td><strong>Richa (SCI 5%)</strong></td>
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<td>Academic and Professional Development for Computer Science, Engineering, and Mathematics Students</td>
<td>NSF-Directorate for Education &amp; Human Resources (EHR)</td>
<td>9/15/06-8/31/10</td>
<td>$500,000</td>
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<th>DEPARTMENT OF MATHEMATICS AND STATISTICS</th>
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<td><strong>Farin (SCI 14%)</strong></td>
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<td>AZ ASU Alzheimer’s Research Center Project - Year 10</td>
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<tr>
<td><strong>Chen, S. (SCI 3%)</strong></td>
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<td>An Interdepartmental Computing Environment for Statistical Research</td>
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<td><strong>Stanzione (SCI 7%)</strong></td>
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<td>An Interdepartmental Computing Environment for Statistical Research</td>
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<th>GLOBAL INSTITUTE FOR SUSTAINABILITY</th>
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<tr>
<td><strong>Candan, Davulcu, Kambhampati (SCI 50%)</strong></td>
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<tr>
<td>AOC: Archaelogical Data Integration for the Study of Long-Term Human and Social Dynamics</td>
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<th>SCHOOL OF ARCHITECTURE</th>
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<tr>
<td><strong>Wonka (SCI 50%)</strong></td>
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<tr>
<td>Pilot: SOUZOU - Creativity through Procedural Modeling</td>
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<tr>
<td><strong>Candan, Davulcu, Kambhampati (SCI 20%)</strong></td>
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<td>Digital Antiquity: Planning a Digital Information Infrastructure for Archaeology</td>
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<td><strong>Janssen (SCI 50%)</strong></td>
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<td>Dynamics of Rules in Commons Dilemmas</td>
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<td><strong>Gupta (SCI 3%)</strong></td>
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<td>Peer Relationships and School Readiness</td>
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<td><strong>Kim (SCI 12%)</strong></td>
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<tr>
<td>Targets to Therapeutics in Pancreatic Cancer</td>
</tr>
<tr>
<td><strong>Kim (SCI 20%)</strong></td>
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<tr>
<td>Chemoprevention of Skin Cancer</td>
</tr>
<tr>
<td><strong>Kim (SCI 10%)</strong></td>
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<tr>
<td>Center for High-Throughput Minimally-Invasive Radiation Biodosimetry - Core C</td>
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<tr>
<td><strong>Kim (SCI 15%)</strong></td>
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<tr>
<td>A New Therapeutic Paradigm for Breast Cancer Exploiting Low-Dose Estrogen-Induced Apoptosis</td>
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<tr>
<td><strong>Kim (Lead PI, SCI 10%)</strong></td>
</tr>
<tr>
<td>Bioinformatics Software for Integrative Cancer Genomic Analysis</td>
</tr>
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</table>
Directory

Department of Biomedical Informatics

Department of Computer Science and Engineering

School of Computing and Informatics

Emeritus Faculty

Advisory Council
Department of Biomedical Informatics

Trevor Cohen, Assistant Professor
Ph.D. Columbia University 2007
Email: trevor.cohen@asu.edu
Research interests: Latent semantic analysis, Comprehension and medical expertise, Distributed cognition and medical error

Valentine Dinu, Assistant Professor
Ph.D. Yale University 2007
Email: valentin.dinu@asu.edu
Research interests: Biomedical informatics, Translational research, Integrative disease association analysis, Genome wide association studies, Entity-attribute-value database modeling

Douglas Fridsma, Associate Professor
Ph.D. Biomedical Informatics Stanford University 2003
M.D. University of Michigan Medical School 1990
Email: Fridsma@asu.edu
Research interests: Development of computational tools to study patient safety, Clinical work processes, Collaboration between healthcare providers

Graciela Gonzalez, Assistant Research Professor
Ph.D. Computer Science University of Texas at El Paso 2000
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Research interests: Multimedia Databases, Human-Computer Interaction, Artificial Intelligence

Robert A. Greenes, Ira A. Fulton Chair
Ph.D. Harvard University 1970
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Research interests: Modeling of clinical decision making, Knowledge representation, Knowledge management, Clinical decision support, Personal biosensors, Human-computer interaction, Group collaborative work

William Johnson, Professor
Ph.D. Economics Rutgers University 1971
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Research interests: Development of computational tools to study patient safety, Clinical work processes, Collaboration between healthcare providers

Kanav Kahol, Assistant Professor
Ph.D. Arizona State University 2006
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Research interests: Haptic user interfaces, Multimedia, Human computer interaction, Surgical simulation, Assistive and rehabilitation systems

Craig Parker, Associate Research Professor
M.S. Computer Science Brigham Young University 2005
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Research interests: Clinical data architectures, Clinical decision support, Clinical information standards

Vimla L. Patel, Vice Chair
Ph.D. Educational Psychology McGill University, Canada 1981
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Research interests: Medical cognition, Decision-making and reasoning, Patient safety and medical errors, Socio-cognitive studies of human-computer interaction, Cognitive assessment of learning and instruction

Edward H. Shortliffe, Professor
Ph.D. Medical Information Sciences Stanford University 1975
M.D. Stanford University 1976
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Research interests: Clinical decision-support systems, Collaborative technologies, Role of internet in health care, Informatics research policy

Affiliated/Adjunct Faculty

Chitta Baral, Chair
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Kenneth Bobis, Chief Technology Officer
Mayo Clinic Scottsdale

Andrew Bordner, Faculty Member
Mayo Clinic Scottsdale

Yi Chen, Assistant Professor
Department of Computer Science and Engineering, ASU

Christopher Chute
Mayo Clinic Scottsdale

Gerald Farin, Professor
Department of Computer Science and Engineering, ASU

Keith Frey, Adjunct Faculty
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Sandeep K.S. Gupta, Professor
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Seungchun Kim, Assistant Professor
Department of Computer Science and Engineering, ASU

Bradford Kirkman-Liff, Professor
School of Health Management and Policy, ASU

Steve Langer, Director of Imaging Informatics
Mayo Clinic – Radiology

Laurence Miller, Professor of Medicine
Mayo Clinic College of Medicine

Sethuraman Panchanathan, Director
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Shahram Partovi, Medical Director
Division of Neuroradiology, Barrow Neurological Institute

Renault Rosemary, Director
Computational Biosciences Program, ASU

Kimberly Shea, Assistant Professor
College of Nursing and Health Innovation, ASU

Howard Silverman, Clinical Faculty
Department of Biomedical Informatics, ASU

Ron Weinstein, Adjunct Faculty
Department of Biomedical Informatics, ASU

Raymond L. Woosley, President
The Critical Path Institute

Jieping Ye, Assistant Professor
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Department of Computer Science and Engineering

**Dirk Colbry**, Assistant Research Professor  
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Research interests: Pattern recognition, Biometric security, Computer vision, Robotics, Cognitive science, Artificial intelligence

**Debra Calliss**, Lecturer  
Ph.D. Arizona State University 1991  
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Research interests: Computer science education, Programming languages, Software maintenance

**Ashish Amresh**, Lecturer  
M.S. Computer Science Arizona State University 2007  
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**Janaka Balasooriya**, Lecturer  
Ph.D. Georgia State University 2006  
Email: janakab@asu.edu  
Website: http://www.public.asu.edu/~jbalasoo/  
Research interests: Distributed, Internet and grid computing, Web service coordination primitives and system architectures, Biological data integration and interoperability, Middleware and embedded software

**Chitta Baral**, Chair  
Ph.D. University of Maryland 1991  
Email: chitta@asu.edu  
Website: http://www.public.asu.edu/~cbaral/  
Research interests: Artificial intelligence, Knowledge representation and reasoning, Declarative programming, Bioinformatics, Autonomous agents, Logic programming, Cognitive robotics, Multimedia, Visualization of databases

**Rida Bazzi**, Associate Professor  
Ph.D. Georgia Institute of Technology 1994  
Email: bazzi@asu.edu  
Website: http://www.eas.asu.edu/~bazzi  
Research interests: Distributed computing, Fault tolerance, Security

**Kevin Burger**, Lecturer  
M.S. Computer Science University of Kansas 1988  
Email: burgerk@asu.edu  
Website: http://www.public.asu.edu/~kburger2  
Research interests: Embedded systems, Introductory programming, Data structures and algorithms, Computer architecture and organization, Web development

**Yinong Chen**, Lecturer  
Ph.D University of Karlsruhe (Germany) 1993  
Email: yinong.chen@asu.edu  
Website: http://www.public.asu.edu/~ychen10/  
Research interests: Service-oriented computing, Embedded systems, Fault-tolerant computing, Distributed computing

**Chitta Baral**, Chair  
Ph.D. University of Maryland 1991  
Email: chitta@asu.edu  
Website: http://www.public.asu.edu/~cbaral/  
Research interests: Artificial intelligence, Knowledge representation and reasoning, Declarative programming, Bioinformatics, Autonomous agents, Logic programming, Cognitive robotics, Multimedia, Visualization of databases

**Kasim Candan**, Associate Professor  
Ph.D. University of Maryland 1997  
Email: candan@asu.edu  
Website: http://www.public.asu.edu/~candan/index.htm  
Research interests: Database systems, Storage/Querying/Retrieval of multimedia and web data, Heterogeneous information integration and retrieval, Assistive technologies for information and data access, Distributed multimedia systems, Multimedia document authoring

**Karamvir Chatha**, Associate Professor  
Ph.D. University of Cincinnati 2001  
Email: karamvir.chatha@asu.edu  
Website: http://www.eas.asu.edu/~kchatha/  
Research interests: Computer-aided design (CAD) for embedded and VLSI systems, System-on-Chip (SoC) Design, Network-on-Chip design, Hardware software co-design, Reconfigurable and adaptive computing

**Yi Chen**, Assistant Professor  
Ph.D. University of Pennsylvania 2005  
Email: yi@asu.edu  
Website: http://www.public.asu.edu/~ychen127  
Research interests: Data management in web and scientific applications, Data modeling, Storage and query optimization, Data streams, Information integration

**Yinong Chen**, Lecturer  
Ph.D University of Karlsruhe (Germany) 1993  
Email: yinong.chen@asu.edu  
Website: http://www.public.asu.edu/~ychen10/  
Research interests: Service-oriented computing, Embedded systems, Fault-tolerant computing, Distributed computing

**Charles Colbourn**, Professor  
Ph.D. University of Toronto 1980  
Email: charles.colbourn@asu.edu  
Website: http://www.public.asu.edu/~ccolbou  
Research interests: Network reliability, Combinatorial design theory

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