Department of

# Computer Science and Engineering

The Ohio State University

```
void deskey(key, edf)
unsigned char *key;
short edf;
{
        register int i, j, l, m, n;
        unsigned char pc1m[56], pcr[56];
        unsigned long kn[32];

        for ( j = 0; j < 56; j++ ) {
                l = pc1[j];
                m = l & 07;
                pc1m[j] = (key[l >> 3] & bytebit[m]) ? 1 : 0;
                }
        for( i = 0; i < 16; i++ ) {
                if( edf == DE1 ) m = (15 - i) << 1;
                else m = i << 1;
                n = m + 1;
                kn[m] = kn[n] = 0L;
                for( j = 0; j < 28; j++ ) {
                        l = j + totrot[i];
                        if( l < 28 ) pcr[j] = pc1m[l];
                        else pcr[j] = pc1m[l - 28];
                        }
                for( j = 28; j < 56; j++ ) {
                        l = j + totrot[i];
                        if( l < 56 ) pcr[j] = pc1m[l];
                        else pcr[j] = pc1m[l - 28];
                        }
                for( j = 0; j < 24; j++ ) {
                        if( pcr[pc2[j]] ) kn[m] |= bigbyte[j];
                        if( pcr[pc2[j+24]] ) kn[n] |= bigbyte[j];
                        }

                }
        cookey(kn);
        return;
```


## 2003 - 2004 Annual Report

*Congratulations to E. J. Sexton, CIS Undergrad.*

*E. J. designed the winning submission in the annual cover contest. We know he will do well in his future.*

# Contents




**The Department of Computer Science & Engineering**
**The Ohio State University**
**395 Dreese Labs 2015 Neil Ave**
**Columbus, Ohio 43210**

http://cse.ohio-state.edu

## Vision Statement

*CSE will impact the information age as a national leader in computing research and education.*

## Mission Statement

*We will prepare computing graduates who are highly sought after, productive, and well-respected for their work, and who contribute to new developments in computing technology.*

*We will give students in other disciplines an appropriate foundation in computing for their education, research, and experiences after graduation, consistent with computing's increasingly fundamental role in society.*

*In our areas of research focus, we will contribute key ideas to the development of the computing basis of the information age, advancing the state of the art for the benefit of society, the State of Ohio, and The Ohio State University.*

*We will work with key academic partners within and outside of OSU and with key industrial partners in pursuit of our research and educational endeavors.*

THE OHIO STATE UNIVERSITY

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*Dear Colleagues and Friends,*

*A new name and continued strength characterized our department this past year. We now are the Department of Computer Science and Engineering (CSE), a name that reflects our activities and mission well, and is less confusing to many who associate CIS with a more business-oriented and less technically-oriented focus. Our programs have not changed as a result of the name change (though they continue to evolve to keep up with changing times). Our influence in our discipline continues to grow, and our faculty is increasingly active and prominent in leadership roles in their areas of expertise.*

*During the past year, our research productivity, as measured by expenditures on externally funded projects, was up by 20%. Major research grants included ITRs from NSF, significant DARPA funding, two NSF CAREER awards, and two DoE ECPI awards. We also were a major partner in the successful proposal for a new Wright Center of Innovation in Advanced Data Management and Analysis, awarded to Wright State University this past year.*

*We hired two new faculty members again last year. Both of our new hires will be joining us in autumn 2005. Dr. Imrich Chlamtac will join Ohio State as the Ohio Eminent Scholar in Networking and Communication Research. Imrich is a pioneer in the area of mobile computing, and currently is president of Create-Net Research Consortium in Trento, Italy and is Professor and Distinguished Chair in Telecommunications at the University of Texas, Dallas. He will hold a joint appointment in the Department of Electrical and Computer Engineering when he officially joins CSE. Also joining us in fall 2005 as Assistant Professor is Dr. Yusu Wang. Yusu received her Ph.D. from Duke University this past year and will be working as a postdoctoral researcher at Stanford University during 2004-05. Her research is in computational geometry as applied to bioinformatics.*

*In addition to research grants, our faculty, staff and students had other nice recognitions. Leon Wang became an IEEE Fellow. Tamal Dey and Han-Wei Shen won College of Engineering Lumely Research awards. Tamal and Paul Sivilotti were promoted. Peg Steele won an outstanding advisor award from the National Academic Advisors Association. Scott Pike won both a Graduate Student Leadership Award and a Graduate Teaching Associate Award. Read about these and other accomplishments in the Highlights section of this report.*

*Demand for our undergraduate programs continued a downward trend last year. For many of the previous years, I reported about the continued growth in our undergraduate program demands, and our need to put serious clamps on who can get into these programs. With the recent downturn, we've greatly eased the GPA restrictions on entrance into our major, and are again able to serve those students who want to study computer science as either a major or minor. Our experience at Ohio State mirrors the national scene, and as a result of my activities with the Computing Research Association, I've received a lot of phone calls from various broadcast and print media to explain the new enrollment trends. It's basically about the job*

*market. The dot.com crash, the overall economic slump starting early this decade (from which we haven't yet recovered) and the increased interest in off-shoring all have contributed to making prospective students wary of the computer science major. The good news is that forecasts for jobs in our field remain very strong. The information technology area is among the best in terms of expected jobs over the next 8 years, according to Bureau of Labor Statistics estimates. We do need to remind students and their parents that we prepare graduates for jobs well beyond the commodity activities that are most likely to be affected by these market forces.*

*Applications to our graduate program also were down considerably this past year, but that was from an all-time high during the previous two years. The main reason for this is the immigration policies of the U.S., which have made international students especially nervous about trying to come to the United States. We still filled our roles with outstanding graduate students, and our admissions committee was appreciative of having to sift through many fewer applications. However, this trend is not good for the country, and we had better be careful lest the U.S. lose its status as the country of choice for graduate education worldwide.*

*We initiated a new diversity program this past year by launching a chapter of ACM-W, the ACM program on women in computing. It is essential for the continued health and vitality of our discipline that we attract and retain more women, and this chapter is another component of our department's efforts to do so.*

*Starting July 1, 2004, we will have a new Dean in the College of Engineering. Bud Baeslack returns to Ohio State after serving as Dean of Engineering at RPI for five years. Many of us know Bud from his days as Associate Dean of Research and Interim VP for Research at OSU. We all are looking forward to working with him as leader of the College.*

*I thank Tamera Cramer for organizing the production of this annual report. Please keep in touch with us and let us know how we can continue improving. We welcome your suggestions and comments.*

*Sincerely,*

*Dr. Stuart Zweben*

# FACULTY & STAFF HIGHLIGHTS

## National Science Foundation Awards

**Drs. Srinivasan Parthasarathy**, **Han-Wei Shen**, and **Chris Brew** have all earned NSF CAREER Awards. The Faculty Early Career Development (CAREER) Program is a Foundation-wide activity that offers the National Science Foundation's most prestigious awards for new faculty members. The CAREER program recognizes and supports the early career-development activities of those teacher-scholars who are most likely to become the academic leaders of the 21st century. CAREER awardees are selected on the basis of creative, career-development plans that effectively integrate research and education within the context of the mission of their institution. NSF encourages submission of CAREER proposals from new faculty at all CAREER eligible institutions. Such plans should build a firm foundation for a lifetime of integrated contributions to research and education.

## DOE Awards Two Faculty Members

The Office of Advanced Scientific Computing Research (ASCR) of the Office of Science (SC), U.S. Department of Energy (DOE) awarded **Hakan Ferhatosmanoglu** and **Han-Wei Shen** their Early Career Principal Investigator Awards. These are in the area Applied Mathematics, Collaboratory Research, Computer Science, and High-Performance Networks.

The research of Dr. Ferhatosmanoglu is entitled "Scalable Storage and Efficient Retrieval of Large-scale, High Dimensional Scientific and Biomedical Data." The award gives him $306,300 over the next three years.

Dr. Han-Wei Shen's work is titled "An End-to-End Processing Pipeline for Large Scale Time-varying Data Visualization" with a likewise financial reward.

## New IEEE Fellow Named

The Institute of Electrical and Electronics Engineers, Inc. (IEEE) has bestowed the honor of Fellow on **DeLiang (Leon) Wang**. The IEEE Board of Directors confers this award upon people who have an extraordinary record of accomplishments. Dr. Wang received this distinction "for contributions to advancing oscillatory correlation theory and its application to auditory and visual scene analysis."

## Lumley Engineering Research Awards

Both **Dr. Tamal Dey** and **Dr. Han-Wei Shen** received Lumley Engineering Research Awards from the College of Engineering. The Lumley Engineering Research Awards go to a select group of outstanding researchers in the College of Engineering who have shown exceptional activity and success in pursuing new knowledge of a fundamental or applied nature. This $1,500 award is in honor of John H. Lumley, Ceramic Engineering 1927. The John H. and Mildred C. Lumley Engineering Endowment Fund was established with $747,000 from the Lumley estate and is intended to promote and enhance research within the College of Engineering.

*Tamal Dey receives the Lumley plaque from Umit Ozkan, Associate Dean for Research.*

## Collaborative Efforts win Large Funding

As part of his Ohio Third Frontier Project, Governor Bob Taft announced that $11 million will be given to Wright State University. The money will be used to establish the Wright Center of Innovation for Advanced Data Management and Analysis. The proposal for the Center was a collaboration including: The Ohio State University, Kent State University, Ohio Supercomputer Center, University of Cincinnati, University of Dayton, Wright Brothers Institute, CDO Technologies, Cincinnati Bell, Cincom Systems, CincyTechUSA, EDS, Intelliseek, James Gregory Associates, Lexis-Nexis, NCR, Online Computer Library Center, Procter & Gamble, Science Applications International Corporation, Solve Interactive, Standard Register, and Uniform Code Council.

According to the Governor's office, "The Center will further the research and commercialization of new technologies advancing the application of data management solutions. Effective solutions for data management will

be important to advances in research, clinical medicine, retail, manufacturing, military operations and homeland security."

**Dr. Stuart Zweben** is listed as the PI for the CSE portion of funding which is expected to be $1 million. However, other members of the faculty shall be involved; particularly, members of the Systems and Graphics groups.

## HP Gives Equipment

**Drs. Mario Lauria** (CSE), **D. K. Panda** (CIS), **Tahsin Kurc** (Biomedical Informatics) and **Daniel Janies** (Biomedical Informatics) have received $388,598.00 (list price) in equipment from Hewlett-Packard as part of the Hewlett-Packard Company's 2003 Advanced Technology Platforms - Itanium 2 Academic Grants Program.

HP has awarded 19 universities across the United States $2.9 million in state-of-the-art Itanium® 2-based workstations and servers. The grants are a component of the company's Advanced Technology Platforms – Itanium 2 grant initiative, which is designed to bring the power of high-performance computing to the classroom.

## Distinguished Professor Position Filled

**Dr. David Lee** will fill the CSE long sought position of Ohio Board of Regents Distinguished Professor. This position is part of a special enhancement of computer science being funded by the Board of Regents and was subject to an extensive search.

*Dr. David Lee*

An international expert in network protocols and testing, Dr. Lee joins OSU-CSE after a distinguished career in industry. He was Vice President for Bell Labs Research where he founded and led Bell Labs Research China and Asia Pacific. He originally joined Bell Laboratories Research in 1985 and became director of the Networking Research Department in 1998.

## Best Paper Awards

A collaboration of faculty and graduate students achieved a Best Paper award from the International Parallel and Distributed Processing Symposium (IPDPS'2004). **Sandhya Krishnan** (grad student), **Sriram Krishnamoorthy** (grad student), **Gerald Baumgartner** (assistant professor), **Chi-Chung Lam** (grad student), J. Ramanujam (Department of Electrical and Computer Engineering Louisiana State University), **P. Sadayappan** (professor) wrote "Efficient Synthesis of Out-of-core Algorithms Using a Nonlinear Optimization Solver." This award was given in the Applications Track and will be presented at the conference in April. IPDPS is an international forum for engineers and scientists from around the world to present their latest research findings in all aspects of parallel computation. In addition to technical sessions of submitted paper presentations, the meeting offers workshops, tutorials, an industrial track, and commercial exhibits.

This is the second paper from Sandhya Krishnan's Masters thesis to win a best paper award. The first paper won a Best Paper award at the HiPC conference last year.

**Dr. Paul A. G. Sivilotti** and **Scott Pike**, Ph.D. candidate, won the Best Paper award at the 24th International Conference On Distributed Computing Systems (IEEE ICDCS-2004). The paper entitled, "Dining Philosophers with Crash Locality 1," won it's first place standing against a field of 475 papers.

**Professors Ten-Hiang (Steve) Lai** and **Neelam Soundarajan** received the "Best Paper Award in the area of Distributed Systems" at the 15th IASTED ( International Association of Science and Technology for Development International Conference on Parallel And Distributed Computing And Systems. Their paper, "Distributed Mutual Exclusion," was chosen from a pool of approximately 160 accepted papers; 37 were nominated for awards, and five awards, one in each of five different areas, received the award.

## Faculty Promotions

The Department of Computer Science and Engineering is pleased to announced the promotions of **Tamal Dey** to Full Professor and **Paul Sivilotti** to Associate Professor.

Dr. Dey is an active member of our Graphics group. His research interests are Computational Geometry; Geometric

Modeling; and Shape Modeling. Tamal received his B.E. degree in Electronics from Jadavpur University in India in 1985. He then moved on to Indian Institute of Science-Bangalore for a M.Tech. degree in Computer Science which he received in 1987. Purdue University awarded Tamal a Ph.D. in Computer Science in 1991. For more details about his work, please link to his web page at http://www.cse.ohio-state.edu/~tamaldey/.

The Software Engineering group is the research home of Dr. Sivilotti. Specifically, his work is in Distributed Systems; Software Engineering; and Tool-based Support for Testing Component Implementations. Paul's educational background began in Canada when he received his B.Sc.H. in Computing Science, Mathematics & Biochemistry from Queen's University in Ontario in 1991. He then moved on to the California Institute of Technology where he received his M.S. (1993) and his Ph.D. (1998) both in computer science. The web site for Dr. Sivilotti is http://www.cse.ohio-state.edu/~paolo/.

## New Courtesy Faculty Appointments

The Department of Computer Science and Engineering is very pleased to announce the acceptance of two courtesy faculty appointments: **Dr. Chris Brew** of the Linguistics Department and **Dr. Furrukh Khan** of the Electrical and Computer Engineering Department.

Dr. Brew is currently an Assistant Professor in the Linguistics Department and a member of the Center for Cognitive Science. Currently his main research interests are statistical NLP and speech synthesis. His work with CSE will include: research and teaching in computational linguistics, natural language processing and language technology; informal mentoring of junior faculty; and advising students.

An Associate Professor since 1991, Dr. Furrukh Khan originally joined the ECE Department in 1985. His research areas of interest are quantum molecular dynamics, parallel computation, semiconductor dynamics and surfaces, and semiconductor electronic structures. He is also a member of the Collaborative for Applied Software Technology, an initiative of CSE.

## Lecturer's Efforts Recognized

**Bettina Bair** received the 2004-2005 Mary Ann Williams Woman's Leadership Award from the Association of Faculty and Professional Women. The honor is bestowed upon a University woman who exhibits special leadership, instills in others a sense of confidence to succeed, and promotes a greater understanding of others.

Bettina wears several hats within the Department. As well as being a full-time lecturer teaching CSE 102, 200, 360 and 616 classes, she is the Director, TWICE-c.a.s.t. and the Co-Director of our Undergraduate Diversity program. Though possibly her most fun activity is serving as the Faculty Advisor to the ACM-W Student Chapter, a group of very active students. This latter effort has been gaining a lot of notice. The international ACM web site recently highlighted her "Computer Anatomy:101" workshop which was part of the OSU Take Your Daughter to Work Day.

## Advisor Wins National Award

**Peg Steele,** CSE Coordinator of Academic Advisement, received an Outstanding Advising Award from the National Academic Advising Association. She received the award in the category of Academic Advising - Primary Role. Peg is one of eight academic advisors from across the nation who attained recognition in this category.

*Peg Steele (left) with Betsy McCalla-Wriggins, NACADA President.*

The goal of these awards: "is to encourage wider support and recognition of the importance of academic advising by colleges and universities by providing an opportunity for recognition of outstanding advising. An ultimate outcome of this program is to improve advising services for students."

## Grants Administrator Receives Masters

**J. Quincy Howard**, CSE Grants Administrator, received his Masters of Arts in Higher Education Administration and Student Affairs.

*Quincy with his wife, Melinda, and daughter Sydney.*

## Student Highlights

### Graduate Student One Of Elite

**Scott Pike** has been the recipient of many awards and honors. One of the most prestigious was the Ohio State University Graduate Associate Teaching Award. This very prestigious award is the University's highest recognition of the exceptional teaching provided by graduate students at Ohio State. A $1500 award is given to the ten GTA recipients along with a plaque, which is presented to the awardees during a visit to their classes. Since the University employs approximately 3,000 graduate teaching students a year, these ten are a very select group.

*Dean Susan Huntington (Dean and Vice Provost of the Graduate School) and Yolanda Zepeda, the Director of Enrichment Programs for the Graduate School, surprised Scott while he taught a CSE 221 class and presented him with the Graduate Associate Teaching*

Also recently, he was given an OSU Outstanding Graduate Student Leadership Award. With Dr. Paul A. G. Sivilotti, Scott won the Best Paper award at the 24th International Conference On Distributed Computing Systems (IEEE ICDCS-2004). The paper entitled, Dining Philosophers with Crash Locality 1, won it's first place standing against a field of 475 papers. He is this year's CSE Eleanor Quinlan Memorial Award for Outstanding Teaching. Previously he had received the Department's Outstanding Service Award in 2001.

Scott will be graduating with his Ph.D. in August 2004. Very recently, he accepted an assistant professor position with Texas A&M. He will be missed within the CSE community.

### CSE Students Named University Leaders

*Michael Campesino, front left, receiving his recognition at the Leadership Awards Ceremony.*

The University has recognized undergraduate **Michael Campesino** and grad student **Scott Pike** with Leadership Awards. These awards honor students who serve the OSU community with distinction and who demonstrate leadership in activities such as service on university committees, department committees, or student organizations.

Michael Campesino won the Outstanding Senior Award. Michael was the most recent President of the Society of Hispanic Professional Engineers. He has coordinated the SHPE Professional Symposium. He also recently received the SHPE Member of the Year and was recognized for Academic Excellence by the Minority Engineering Program.

Michael will graduate in Spring of 2004 and plans to work in computer software design.

### Students Win Presidential Fellowships

CSE Graduate students **Ms. Jinzhu Gao** and **Mr. Ruoming Jin** have been awarded OSU Presidential Fellowships. This prestigious award is a very competitive program and recognizes students who maintain the highest standards of scholarship.

The purpose of the program is "1) to recognize outstanding scholarly accomplishment and potential in graduate students entering the final phase of their dissertation research and 2) to provide financial support to the recipients so that they can devote one year of full time study toward the completion of their dissertations unimpeded by other duties."

## Women Leading the Way

The women of CSE strive and achieve great recognition. Many of them received awards at the Twenty-Fourth Annual Women in Engineering Banquet. **Hilary Pike** efforts with the W.H.I.L.E. lunches were acknowledged with a Leadership Award. Outstanding Academic Awards were presented to (the endower of the award is indicated in parentheses): **.Caroline** (CSE); **Ming Fan** (Lockheed Martin); **See-Ming Fung** (CSE); **Jia Li Lau** (Raytheon); **Hannah Rufener** (WiE); **Chetna Sharma** (Convergys); and **Marcella Tanzil** (Microsoft). **Binaebi Akah** and **Emily Cortright** achieved First Quarter Certificates.

*A very lucky Stu Zweben sits in the center of the CSE women.*

## Minority Engineering Program Celebrates Anniversary

2004 brought a very special awards nights – the 25th Minority Engineering Program Awards Banquet. It was a very special evening with many CSE students among the honorees. **Chamie Lubin-Townsend** (shown below with her parents) was recognized with the Upperclassman Award for her "unusual effort and enthusiasm for helping other students and the community." For maintaining a 3.0 or higher gpa during at least 75% of his OSU enrollment, **Michael Campesino** was given an Academic Excellence Award. The Academic Status award, given in recognition of maintaining a 3.0 or higher gpa, was received by: **Binaebi Akah; Ilsa Bolano; Kenneth Goolsby; Justin Swan; Jason Ware**; and **Edward Worbis**.

Additionally, CSE alumnae, **Cheryl Lezenley**, announced an initiative to raise $1 million as an alumni endowment for the MEP.

*The Townsend Family.*

# Alumni Highlights

## Fullbright To Bulgaria For CSE Alum

The Fullbright Scholar Program has awarded **Dr. Douglas Harms** a Fellowship to spend a year teaching and researching computer science at the University of Rousse in Rousse, Bulgaria. Dr. Harms is currently serving as an Associate Professor at DePauw University. Doug, an advisee of Dr. Bruce Weide's, graduate with his Masters in 1983 and followed that with his Ph.D. in 1990. He says of his Fullbright award, "I anticipate this award will be beneficial to me professionally by giving me the opportunity to meet and interact with Bulgarian colleagues, research the history of computing from a non-US centric point of view, and experience teaching in a large university environment where students' primary language is not English. I also plan to investigate locations and activities for possible future Winter Term or Winter Term in Service trips to Bulgaria. My wife, Mary Beth, and our three youngest children (Abigail, age 8, Isaac, age 9, and Alisha, age 15) will move with me to Rousse, and though we know there will be many challenges ahead, we are confident this experience will be meaningful and rewarding for all of us and will help us be more culturally sensitive and aware."

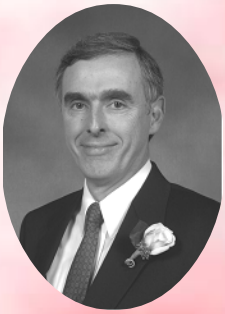
## Alums Win NSF CAREER Awards

Drs. **Christopher Bailey-Kellogg** (M.S., ’94; Ph.D., ’98) and **Sonia Fahmy** (M.S., ’96; PhD, ’99) have individually a received the NSF CAREER Award. This is the National Science Foundation’s most prestigious award available to outstanding young researchers.

Drs. Bailey-Kellogg and Fahmy are both currently assistant professors at Purdue University. Christopher is pursuing research in new theory, representations and algorithms to address data interpretation and experiment design problems. Sonia’s work deals with getting messages around bottlenecks that cause such congestion on the Internet.

## College Designates Alum As Distinguished

The College of Engineering recognized the achievements of **Dr. Bruce Flinchbaugh** (Ph.D. 1980) with its Distinguished Alumnus Award. These awards are given “to recognize distinguished achievement on the part of alumni in the field of engineering or architecture by reason of significant inventions, important research or design, administrative leadership, or genius in production. Nominations are judged by the College Committee on Honorary Degrees and Honors on behalf of the College faculty.”



Bruce Flinchbaugh earned a MS in 1976 and a PhD in 1980 in Computer and Information Science from OSU. He is a TI Fellow, and manages the Video and Image Processing Branch of the DSP R&D Center at Texas Instruments in Dallas. He is responsible for video and image processing projects for TI businesses with programmable digital signal processor (DSP) products for digital cameras, cellular phones and other digital imaging and video systems. His current R&D projects target high-performance optimizations and architectures for the adoption of JPEG2000 image coding, MPEG-4 AVC/H.264 video coding and OpenGL ES graphics in low-power embedded systems.

Since joining TI in 1982, Bruce and his research teams have enabled TI products for diverse digital signal processing applications. His early contributions were methods for the automatic interpretation of three-dimensional seismic data for oil exploration, which directly led to development of a TI geophysical workstation and a method that halved the concrete complexity of geophysical data processing in production. Another early project devised a method for automatic diagnosis of semiconductor manufacturing processes in situ, which is used in TI semiconductor production. After the Berlin Wall fell in 1989, Bruce began directing his research branch from automatic target recognition technology projects for defense applications toward problems in autonomous video surveillance for security applications. In the early 1990's his team pioneered the development of a real-time autonomous video monitoring prototype that tracked people and dynamically mapped their positions. By the mid-1990's, the unique event recognition capabilities of this system had grown to earn TI a sole-source award for autonomous video surveillance research. In 1998, Bruce's branch developed a standalone network camera prototype of the system, with software implemented entirely on a single DSP, which contributed to the formation of the TI business unit for digital camera processors in production today.

Bruce holds seventeen patents for TI systems and methods and has published, or presented, in over 50 technical forums including journals, industry trade magazines and conferences. He was Principal Investigator for the DARPA Image Understanding Research Program at TI from 1993-99. He has served as program chair and on program committees for numerous technical conferences. He currently represents TI on an external advisory board at OSU, and on the Industrial Liaison Committee of the International Association for Pattern Recognition. Bruce has recruited and mentored dozens of TI employees, including the supervision of MIT and University of Illinois master's thesis projects at TI, and over twenty-five other graduate students working as TI R&D summer interns over the past twenty years.

## Alumni Mini-Reunion

During the Summer of 2003, various alumni contacted Marty Marlatt and as the emails pinged, a mini-reunion was born. The group gathered for the Washington at OSU game and met at Marty's for a pregame feast catered by Hoggy's. All went well fed and quite content after the win!

*Chairman Stu Zweben greets the alums as they gather for a pre-game party in Marty Marlatt's back yard.*

*Seated Julie Barnes and Linda Condron. Standing: Marty Marlatt, Arlene Parent, Kevin and Kathy Culp.*

*Left to Right: Amit Sheth, Charles Nicholas; Michael Kaebling; Conleth O'Connell; and Prabha Gopinath.*

*LeightShubra with Doyt Perry and Charlie Shubra.*

*Manas Mandal, Rajiv Ramnath and Prabha and Gopinath.*

*Left to right: Anne Lenzotti, Con O'Connell, Kevin and Kathy Culp and Bill Lenzotti*

*Stu Zweben talks with Dave and Malia Ogle.*

# Annual CSE Awards Banquet

## Scholarships

**ACM**
Vlad Toader, CSE

**DaimlerChrysler**
Mohit Belanie,CSE
Dustin Hoffman, CIS

**Leggett Family Fund**
Sucheta Soundarajan, CIS

**Lockheed Martin**
Jonathan Ou-Yang, CSE

**O'Connell Family Fund**
Nicole Spreng, incoming freshman - CSE

**Proctor & Gamble**
Todd Porter, CSE
Rajiv Jain, CSE
Aaron Lint, CIS

**Raytheon**
Filip Paun, CIS
Nathan Andrysco, CSE

**Radoslava Excellence Award**
Chetna Sharma, CSE

**CSE Department Awards**
Brian Thomsen, CSE
Ryan Yoder, CSE
Matthew Schwaberow, CSE

*Sue Torrell of Lockheed Martin and Dr. Zweben congratulate Jonathan Ou-Yang for his scholarship the company funded*

*Raytheon Corporation funded two scholarships. Their representative for the presentation was Dennis Frailey (2nd from left). Filip Paun and Nathan Andrysco earned the scholarships.*

*Aaron Lint and Todd Porter receive their Proctor & Gamble scholarship certificates.*

*Radoslava Excellence Award was given to Chetna Sharma. The funding for this award was arranged by an undergraduate student, Mashuir Rahman (center), as a tribute to a friend and former mentor who he feels was instrumental in his life.*

## CSE Departmental Outstanding Award Winners:

**Annual Report Cover Design Contest**
E. J. Sexton

**Research Award**
Samrat Goswami
Jiuxing Liu
Jieshing Wu

**Service Award**
Catrena Collins
Rick Wagner

**Teaching Awards**
David Mathias

**Eleanor Quinlan Memorial Award**
Scott Pike

**Chair's Award**
Don Stredney, Ohio Supercomputer Center

*Service Award Winner Catrena Collins (standing in front of husband, Joseph) with a very proud family. Seated left, daughter, Kayla, mother, Carolyn Page, son, Joseph, and father, Thomas Page.*

*Don Stredney receives the Chair Award from Stu Zweben.*

*Those Software Engineers! Bruce Weide, with alum Neil Kirby, and Bob Mathis, part-time lecturer, stand behind Scott & Hilary Pike. Scott was this recepient of the 2004 Elearnor Quinlan Memorial Award.*

*Department Service Award recipient, Rick Wagner (center) with his wife, Nathasha, (left) and his grandmother, Delorice Yank.*

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In June, 1974, a young woman from Newcomerstown, Ohio, joined a relatively new department in Ohio State. Martha "Marty" Marlatt became the Department Secretary in the Computer & Information Science (now Computer Science & Engineering). Her duties included all the typing for the Department and assisting Ernie Stavely with his HR duties. Over the years Marty has done most of the administrative jobs. For the past 18 years she has served as the assistant to the Chair working first for Merv Muller and then for Stu Zweben.

Marty has become the heart of CSE as well as it's history archive. Over the years she has made dear friends of faculty, staff and students. No one can imagine CSE without her and it is an unanimous hope that it will be a long time till we find out what that version of the Department is like.


At the banquet, Stu presented her with two gifts: a clock bearing the face of a yellow lab and a garden stone with OSU engraved. The significance of these items is in that they honored two of Marty's greatest passions: raising puppies for Canine Companions for Indepdendence and gardening.

## Explanations of Awards

### The Leggett Family Award

The Leggett Family established this endowment in memory of Ernest William Leggett, Jr., who received his Ph.D. from the Department in 1977. Dr. Leggett passed away in 1994.

### Outstanding Service Awards

All faculty, staff and students who contribute to the Department's success by working beyond the expected are eligible.

### Outstanding Teaching Awards

This award is given to a member of the faculty, a lecturer or teaching assistant who demonstrates exemplary ability in the class-room and in her/his interaction with students.

### Eleanor Quinlan Memorial Award

This fund is an endowment established to honor the memory of Eleanor "Elley" Quinlan, who was both a staff and graduate of the Department. From 1990 until her passing in January 2001, she was the Academic Program Assistant. The proceeds from this fund are used for the development and recognition of graduate teaching associates in the CSE Department.

### Chair's Award

The recipient of this award is someone other than a current CSE faculty, staff, or student who has made sustained and/or single outstanding contributions to the Department.

# CSE in the News

## Systems Group Making Impact

The research of Dr. D. K. Panda is impacting many of our benchmark departments and thereby garnering substanstial press the likes of ACM TechNews; HPC NewsWire; Innovations-Report, Germany; Supercomputing Online. among others. The software, called MVAPICH, works by connecting traditional supercomputing software with innovative networking technology that speeds data flow. Most notably, Ohio State's MVAPICH supports Virginia Tech's innovative Macintosh-based supercomputer.

Another collaboration with computer chip maker Intel and leading InfiniBand developer Mellanox Technologies, Inc, of Santa Clara, California, is opening the Ohio State software to further applications in research and business. These companies have used MVAPICH to enable calculations on an off-the-shelf supercomputer that is capable of performing teraflop-level computing, or trillions of calculations per second. Intel calls-the system TOTS, for "TeraFlop-Off-the-Shelf," and it will debut in the exhibition hall of the supercomputing conference.

The name MVAPICH is short for "MPI for InfiniBand on VAPI Layer." VAPI refers to the VAPI software interface developed by Mellanox. MVAPICH is pronounced like "em-vah-peach."

Since 2002, more than 65 organizations world-wide have downloaded the open source MVAPICH code to develop applications. One of the first was Sandia National Laboratory, which recently used MVAPICH to power a large-scale (128-node) supercomputer. A similar project at Los Alamos National Laboratory involves a 256-node supercomputer.

This is not the first time work from Ohio State and the Ohio Supercomputer Center (OSC) garnered a ranking on the top 500 list. On the current top 500 list, OSC's cluster ranks 180.

The primary funding for Ohio State to develop MVAPICH came from Sandia National Laboratory, the Department of Energy, and the National Science Foundation. Intel provided partial funding, and Mellanox donated InfiniBand network adapters and switches to the project.

## Line In The Sand Dust Demo

The press covered the September 8th demonstration of Dr. Anish Arora and his research group's new technology that could help the U.S. military on future battlefields. Tiny wireless sensors, scattered across the lawn of CSE corporate friends Chemical Abstracts, detected the movement of vehicles and people on foot -- and determined if a person may be carrying a weapon.

The sensors are integrated with "smart dust" devices designed at the University of California, Berkeley, and Ohio State leads a consortium of universities that is working to develop large scale applications for the technology. The project, dubbed "A Line in the Sand," is funded by the Defense Advanced Research Projects Agency (DARPA).

While these sensors are being tested in labs across the country, Ohio State has made special contributions to the project by designing network services that let a large number of sensors collaborate efficiently and reliably, and by incorporating a tiny radar device. Ultimately, Arora wants the research to carry over to other aspects of his specialty: computer networking.

## AI Surveillance Research In The News

Because of its topicality in our post 9/11 world, the research of Dr. James W. Davis has received a great deal of attention. The *Columbus Business First* is the most recent medium to pay attention to Davis's thermal camera technology.

## Collaborative for Applied Software Technology

This is a one year old initiative in the Computer Science & Engineering Department. Our mission is to create an integrated, industry-supported and industry-relevant program and center of applied research, practice and education.

Our internal and primary mission is to benefit our department and the University - i.e. its students and faculty. We believe that our technology-transfer activities will help our faculty by bringing in industry problems to work on that will help them identify areas of applied research, or by validating the results of their existing work in industrial scenarios. Our students benefit with the industry relevance we are bringing to the classroom - we will give them a sense of what the "real-world" is about and a collection of practical skills to complement the theory that they have learned in the classroom. Our external mission is to work with local (and national) business and industry, and to make a contribution (however small) to the economic development of Ohio. We hope to be of direct benefit to industry by providing high-value local expertise and by being a channel of vendor-independent knowledge and knowledge-sharing and networking.

Here is a report on some of our initiatives and projects for this year:

Practice and Technology Transfer:

- We sucessfully completed the Migration Technologies project - where we assisted them in the model-based migration of a legacy enterprise system development environment. They were able to successfully deliver the first version of their system to Navistar.

- We delivered to the City of Columbus its Information Technology Strategic Plan. CAST presented this plan to the entire Department of Technology in Summer 2004, with a potential presentation to the Mayor and City Council to follow.

- We also delivered a Services Architecture Review to the Central Ohio Transportation Authority (COTA). COTA intends to use this review to assist them in their I.T restructuring efforts.

- Finally, CAST is providing project and program management services as well as software engineering services to Prof. Anish Arora's Extreme Scaling Sensor project. This project has been funded by DARPA and has very high visibility. We are privileged to be part of it.

Education:

- CAST has begun to offer workshops in applied technology, technology management, software quality and advanced practices. The first set of workshops was offered through the Ohio Aerospace Institute from October through December The second set of workshops were offered locally through the Fisher College of Business and Platform Labs. All workshops were very well received by the participants, who recognized the unique value these workshops were bringing.
- We have continued our curriculum improvement efforts, with industry participation. Our restructuring of the Senior Software Engineering Capstone continues - in Spring of 2004 we had 4 industry sponsors for our course.

Applied research:

- We have begun a research program around enterprise systems architectures for complex systems. Most of our activities in the research arena have been around consortium building and scenario development.
- All our research has been around interdisciplinary problems. To that end we have built (mainly faculty-to-faculty) relationships with other departments and Centers at OSU - most notably, the Dept. of Industrial Design in the College of Arts, the Center for Information Technology in Management in the College of Business, the Moritz School of Law, the School of Public Policy, the College of Human Ecology and the Dept. of History. With these partners, we submitted 4 major proposals this year - three to NSF and one to OSU's Office of Research's interdisciplinary research program.

Our work began last year, and is beginning to build momentum over this year. We hope to showcase additional activities and our first set of success stories over this coming year!

## DOCTORATES AWARDED

**Name** Advisor Home
Dissertation Title
Where They Are Going
Previously earned degrees

### SUMMER 2003

**Darius Buntinas** Dr. D. K. Panda Chicago, IL
"Improving Cluster Performance Through the use of Programmable Network Interfaces"
Argonne National Labs, Chicago, Illinois, USA
B.S., Loyola University, Chicago // M.S., Loyola University, Chicago

**Wulue Zhao** Dr. Tamal Dey Yuncheng, P.R.C.
"Shape and Medial Axis Approximation from Samples"
Electronic Data Systems, Ann Arbor, Michigan, USA
B.Engineering, Tsinghua University // M.S., University of Science & Technology of China / Academia Sinica

### AUTUMN 2003

**David Quan Liu** Dr. Ming Tsan Liu Boston, MA
"Differentiated Services Support in Optical Burst Switching WDM Networks"
Purdue University, Lafayette, Indiana, USA - Assistant Professor
B.S., Nanjing University // M.S., Shanghai Jiao Tong University M.S., The Ohio State University

**Mingyang Wu** Dr. DeLiang Wang Chang Zhou, P.R.C.
"Pitch Tracking and Speech Enhancement in Noisy and Reverberant Environments"

B.S., Tsinghua University // M.S., The Ohio State University

### WINTER 2004

**Nigamanth Sridhar** Dr. Paul Sivilotti // Dr. Bruce Weide
Chennai, India
"Dynamically Reconfigurable Parameterized Components"
Cleveland State University, Cleveland, Ohio, USA - Assistant Professor
M.Sc. (Tech.) in Information Systems, Birla Institute of Technology and Science, India // M.S. in Computer and Information Science, The Ohio State University, Columbus, OH, Jun 2000.

*Dr. Paul Sivilotti hoods Nigamanth Sridhar.*

### SPRING 2004

**Arjav Jagannath Chakravarti** Dr. Gerald Baumgartner
Mumbai, India
"Scientific Computation on a Peer-to-Peer Network Using Mobile Agents"
"The Math Works", Natick, MA, USA
B.Engineering, Univeristy of Mumbai // M.S. The Ohio State University

**Jinzhu Gao** Dr. Han-Wei Shen Columbus, Ohio
"Visibility Acceleration for Large-Scale Volume Visualization"
Oakridge National Labs, Oakridge, TN, USA
B.S.C.I.S., Hauzhong University of Science & Technology // M.S. Mech. Eng., Hauzhong Universiyt of Science & Technology

## Masters Degrees Awarded

Graduate's Name Home
Other Degrees Previously Obtained

### Summer 2003

**Robert Blodgett** Sandy, Utah, USA
B.S., University of Utah

**Matthew Coatney** Centerville, Ohio, USA
B.S., The Ohio State University

**Ted Skidmore Donley** Hiram, Ohio, USA
B.A., Oberlin College

**Amol Ganesh Kandalgaonkar** Mumbai, India
B.Engineering, University of Mumbai

**Susmitha Prabhakar Kini** Coimbatore, India
B.Engineering, Bharathiar University

**Feng Li** Columbus, Ohio, USA
B.Engineering, Beijing Institure of Technology // M.E., Beijing Institure of Technology

**Xiaoyan Liu** Columbus, Ohio, USA
B. Engineering, Shanghai Jiao Tong University // M.S., The Ohio State University // M.S., Shanghai Jiao Tong University

**Benjamin Rutt** Goshen, IN
B. A., Indiana University, Bloomington

**Weiwei Shi** Beijing, P.R.C.
B.S., Fudan University // M.S., Unviersity of Science & Technology of China // M.S., The Ohio State University

**Sudha Srinivasan** Chennai, India
B.Engineering Bharathidasan Unviersity

**Peter Stuart** Park City, Utah, USA
B.A., University of Montana

**Radhakrishnan Sundaresan** Chennai, India
B.Engineering, Birla Institute of Technology & Science // M.S., Birla Institute of Technology & Science

**Jonathan L. Woodring** Delta, Ohio, USA
B.S., The Ohio State University

Autumn 2003

**Guadalupe Canahuate** Santo Domingo, Dominican Republic
Engineer, Catholic University of Santo Domingo

**Balasubramanian Chandrasekaran** Chennai, India
B. Engineering, Anna University

**Matthew Hornbrook** Canton, Ohio, USA
B.S., The Ohio State University // B.S.C.S.E., The Ohio State University

**Garima Kochhar** Bangalore, India
B.Engineering, Birla Institute of Technology & Science // M.S., Birla Institute of Technology & Science

**Sandhya Krishnan** Navi Mumbai, India
B.Engineering, University of Mumbai

**Rohan Kurian** Indore, India
B.Engineering, Devi Ahilya Vishwa Vidyalaya

**Vineet Mittal** Chandigarm, India
B.Engineering, University of Roorkee

**Hsin-Ji Wang** Taipei, Taiwan, R.O.C.
B.S., National Taiwan University

## Winter 2004

**Alina Bibireata** Columbus, Ohio, USA
B.S., Universitatea din Bucuresti

Maj. Christopher Bohn Ballwin, Missouri, USA
B.S.E.E., Purdue University // M.S., Air Force Institute of Technology // M.S., Unviersity of North Dakota

**Arjav Jagannath Chakravarti** Mumbai, India
B.Engineering, University of Mumbai

**Ananth Devulapalli** Panna, India
B.Tech., Indian Institute of Technology, Bombay

**Martin Jansche** Karlsruhe, Germany
Zwischenprufun, University of Heidelberg // M.A., The Ohio State University // Ph.D., The Ohio State University

**Zhiguo Zhang** JiLin, P.R.C.
B.Engineering, Beijing University of Chemical Technology

## Spring 2004

**Michael Gibas** Bellbrook, Ohio, USA
B.S.E.E., The Ohio State University

**Eric LaMonte Glover** Columbus, Ohio, USA
B.S., DeVry Institute of Technology

**Jason Hallstrom** Orland Park, IL
B.S., Miami University, Oxford, OH // M.A., Miami University, Oxford, OH

**Mary Jacob** Bangalore, India
B.Engineering, Nagpur University

**Aravind Ramachandran** Trichy, India
B.Tech., Indian Institute of Technology, Madras

**Miriam Reddoch** Little Rock, Arkansas, USA
B.S., The Ohio State University

**Meesun Song** Sachon, South Korea
B.S., Ewha Woman's University

**Shivraraj Tenginakai** Bangalore, India
B.Tech., Indian Institute of Technology Madras

**Brent Mark Watkins** Cincinnati, Ohio, USA
B.S.C.S.E., The Ohio State University

# BACHELOR DEGREES AWARDED

## Summer 2003

### College of Arts & Sciences

Danielle Nicole Cummings
Cheryl Lynn Eddy
Kent Takehito Fukul
Seth Daniel Kraner
Luke Andrew Kucalaba, *Magna Cum Laude*
Luke Lynn Molnar, *Magna Cum Laude*
Joseph Bentley Morwick
Peter Norman Shumaker

### College of Business

Lian Huan Bong
Aran Lee Cross, *Cum Laude*
Amanda Kay Hodges, *Magna Cum Laude*
Sandriani Jufri, *Cum Laude*
Sally Kao
Timothy S Kim
Candace Rene Lifer
Chi-Yu Lin
Aditya Vikram Mittal
Todd Philip Odenweller
Maria Christina Pilato
Zarrar Said
Nupoor K Shah
Jason Lee Streitenberger
Ronald James Strittmatter
Susanne Peters Thacker

### College of Engineering

Sang Hoon Cha
Savita Choudhary
Aaron Matthew Croyle
Fredrick André Felter
Hyunju Seo
Joel Davin Stephens
David Walter Timmerman, *Summa Cum Laude*

## Autumn 2003

### College of Arts & Sciences

Brian Adams
Woojin Cho
Neil Coplin, *with Honors in the Liberal Arts*
Stephen Deck, *Cum Laude*
Karl Erisman
Danny Gao
Jeffrey Hawk, *Cum Laude*
Christopher Heine
Emily Howe, *Cum Laude*
Jeremy Jones
Scott Ranft
Brian Riedinger
Cinthia Simmons
Clifton Snyder, *Cum Laude*
Ryan Stocker
Ameer Tashfeen
Kairsten Thies
Matthew Thornton, *Magna Cum Laude with Honors in the Liberal Arts*
Joseph Walton
Kelli Webb
Ingrid Wijaya
Marie Wong
Liping Xu

### College of Business

Samy Affo
Perry G. Bacogiannis
Seth Alexander Burris
Wei-Jen Chang
Erica Lynn Cheyney Cum Laude
Heather Denise Christmas
Wei-Chih Jim Chuang
Anna Marie Conrad, *Magna Cum Laude*
Alfred William Farmwald
Yun-Young Maeng
Yuki Mizukoshi
David Charles Murchie
Thomas N Nguyen
Purnomo Nugroho
Pranay Patel
Randy Michael Richardson
Somya Saxena
Jarod Vincent Valigore
Ming-Chiang Wang
Shy Yie Wang Cum Laude
Woan-Rou Yong, *Magna Cum Laude*

### College of Engineering

Indonesia Bogor
Dipal Rajendra Bhatt
Purnama Chandra, *Cum Laude*
Wai-Ping Anita Chiu
Daniel Curtis Cole, *Cum Laude*
Kwan Chung Hung
Kristopher Benjamin Kastens, *Cum Laude*
Stepan N. Kazakov
Pu-Fan Mo
Susan Alexandra Negrelli
Van Trinh N. Nguyen
Peter John Power, Jr.
William E. Snead, III , *Summa Cum Laude*

## Winter 2004

### College of Arts & Sciences

Michael David Arps
Eric Paul Bishop, *Cum Laude*
Alexander Craig Elek, *Cum Laude*
John Travis Glass
Jeffrey Michael Horak, *Cum Laude with Honors in the Arts & Sciences*
Albert Japardi, *Magna Cum Laude*
Tae Jin Kim
Brent James Kimmel
Michael Benjamin Mayhew, *Cum Laude with Honors in the Arts & Sciences*
Mehul B. Patel
Daniel Christopher Rodgers
Wandy
Paul Louis Yearger, III

### College of Business

Rashmi Angrish
Suhasini Aswath
Eang Chen Hoong
Hendy Chong
Brian Joseph Ebersole
Brandon Lyn Eley
Kathleen Elizabeth Gaydos, *Magna Cum Laude*
Quiess M. Johnson
Dion N. Katuari
David Patrick Langton
Jay Hee Lee, *Cum Laude*
Ryan Joseph Michalski, *Cum Laude*
Nozomi Shimokawa
Edward Charles Tomayko, *Magna Cum Laude*
George Allen Tuvell, II, *Cum Laude*
Pei-Yuen Yam
Mustafa Yazar

### College of Engineering

Abdullah Saif Al-Araimi
David J. Brannigan
Christopher L. Corelli
Nicholas J. Finnegan
Jeffrey M. Forrest
Carew Benham Goshorn
Demetrius D. Jackson
Mohammad Faisal Karim
Brian Morgan Lees, *Cum Laude*
Sean Philip Parmelee
Hannah Marie Rufener, *Cum Laude*
Steven Scott Speicher, *Cum Laude*
Rudy Tjahjana
Tod Jason Trevillian
Michael Joseph Welsh
Yuan Wen
Matthew Michael Wolf

## Spring 2004

### College of Arts & Sciences

Matthew Joseph Ackerman, *Cum Laude*
Guillermo Arellano , Jr.
Adam Charles Baker, *Magna Cum Laude, with Honors in the Arts & Sciences*
Connor Emery Bliss
David Joseph Flynn
Hussein Issack Haji
Mark Haines Herriott, *Cum Laude*
Jacob Whaley Howlett, *Summa Cum Laude*
Nicholas Wayne Hurley, *Summa Cum Laude*
Irnov, *Magna Cum Laude*
Ellis Lee Itson III
Thomas Francis Kerwin, *Cum Laude, with Honors in the Arts & Sciences*
Jason Philip Kirschenbaum, *with Honors in the Arts & Sciences*
Sameh Maher Labib
Aaron Stephen Lasseigne
David W. Lawrence
Kyu-Jin Lee
Timothy Manhardt
Ross Nicholas Meloro

### College of Business

Farhan Abid
Benjamin Christopher Belloni
Erin Marie Boldi, *Magna Cum Laude*
Brandon Jason Boyd, *Cum Laude*
Scott David Browning
Uzair Iqbal Butt, *Magna Cum Laude*
Keith Alan Byrne
Brian Edward Campbell
Sujeet Chatterjee
Anup Rajendra Dadhania, *Cum Laude*
Yin-Ling Fang
Gina Nan Fong
Michael S. Frank
Ronald Ray Gedrich, *Magna Cum Laude*
Ryan J Graham
Wesley Douglas Hahn
Valerie Llamita Harris
James M Hoover
Eric Michael James
Keerti Karra
Gofaone Pinah Kereeletsine
Jae Sun Kim
Joo-Wan Kim

### College of Engineering

James Harold Anderson, *Magna Cum Laude*
Nicholas D. Ang
Kin Keung Au
James Marcus Bales
Michael R. Baron
Christopher Benjamin Belloni
Benjamin Wayne Bettin
Michael Adam Birchmeier
Michael Campesino
Anson Chan
Jemin Chang, *Magna Cum Laude*
Kai Hsian Chang, *Magna Cum Laude*
Clement K. Cheng
Li-Fong Cheng
Chi-Wai Cheung
Benjamin P. Coleman
Sarya Maan Danawi
Jerry Rodger Diday
Jeffrey Allen Eganhouse
Cemil Alkim Eyikocak
Ming Fan
Rebecca Anne Fiebrink, *Summa Cum Laude*
Sean Keenan Flynn

*Spring 2004 Bachelor's degrees continued on the next page.*

## College of Arts & Sciences

Lisa Ann Michna, *with Honors in the Arts & Sciences*
Bradley Thomas Moore, *Cum Laude, with Honors in the Arts & Sciences*
Heather Lynn Paulsen
Kimberly Lynn Pinney
Darin Leigh Reynolds
John Mark Rodgers II, *Cum Laude*
Vishal Kumar Singh
Clayton Emory Smith
Debra Lynn Steinkirchner
Zsolt Torok
Mary Marge Valli
Vijay R. Varanasi, *Magna Cum Laude*

## College of Business

Jeffrey Edward Klusmeier, *Cum Laude with honors in Business Administration*
Neil Daniel Larocca
Michael Scott Leib
Zhibo Li
Jerry L. Lowery, Jr., *Magna Cum Laude*
Lauren Melissa Lyles, *Cum Laude*
Brenda Sue Marino, *Magna Cum Laude*
Thanh T. Nguyen, *Cum Laude*
Jason Todd Pequignot
Seth Michael Phillips, *Cum Laude*
Kevin Joseph Radecki
Sharad Ramnath
Anthony John Roth
Rahul Pravin Shah
Manish Shaida
Michael Joel Shall
Kavita Shankar, *Cum Laude with honors in Business Administration*
Eugene Shats
Steven Robert Sherman, *Cum Laude*
Xu Shi
Sucipto, *Cum Laude*
Hoa G. Ta, *Magna Cum Laude*
Nicholas Tieu
Karrie Elizabeth Woodward

## College of Engineering

Mauktik Harshad Gandhi, *Summa Cum Laude*
Jason M. Holler
Surbhil Jain
Ryan Studebaker Johnson, *Cum Laude*
Amit Surendra Joshi
Theologos George Kafantaris
Kwang K. Kim, *Magna Cum Laude*
Kyong-Hwan Kim
Ryan Andrew Leidal
Dawlin Li
Julie Theresa Light
Adam James Matuszak
Jordan Scott Meyer
Laurence Patrick Mis
Justin Kit Ng
Nathan Charles Parry, *Summa Cum Laude*
Hetu B. Patel, *Magna Cum Laude*
Keith Alan Platfoot, *Magna Cum Laude*
Ferdinand Poppyco, *Cum Laude*
Mashiur Rahman, *Cum Laude*
Gregory Michael Ramsey
Kunal Rohatgi
Ryan Alexander Schuerger
Aaron Nayef Shbeeb, *Magna Cum Laude, w/ distincition in Computer Science & Engineering, w/ honors in Engineering*
Christine Marie Task
Chamie Ruth Lubin Townsend
Brian Douglas Underwood
Raj Vardhan
Ian B. Walker
David J. Wannemacher, *Magna Cum Laude, w/ distincition in Computer Science & Engineering, w/ honors in Engineering*
Matthew Clark Whitcher

# STUDENT ORGANIZATIONS

The Student Organizations were especially active this year. ACM-W, Opensource and NTsig among others kicked off the year participating in the Student Activities Fair. Opensource hosted John "Maddog" Hall, Executive Director of Linux for a talk on the state of Opensource in today's environment. Diane Drozd Curtis, alumnae and Microsoft designer, met with the women of CSE at a W.H.I.L.E. (Women's Hour: Information, Lunch, Enthusiasm) session. ACM-W held a very special "Take Your Daughter to Work Day" session.


*Students stop by the Open Source table at the Student Activities Fair.*

*At W.H.I.L.E., Diane Drozd Curtis shares her "real world" experiences with current students.*

*The women of CSE conversing on the state of computing and women at W.H.I.L.E.*

*Left: Bettina Bair works with a young woman identifying what differs in her particular PC from what she has at home.*

*Right: Undergraduate Advisor, Nikki Strader, works with a workshop participant.*

*One young participant shows no fear attacking a hard drive with a screwdriver.*

The CSE chapter of ACM-W, let by lecturer Bettina Bair, participated in this year's campus-wide "Take Your Daughter to Work Day" activities. They held a "Computer Anatomy 101" workshop. Each girl was given a computer (donated by various faculty, staff, students and family members) which they could then dissect. Using Mindquest type trading cards they had to find and identify 11 parts. Various prizes were awarded for the successful teams.

*Jill O'Donnell identifies pieces with one girl while her teammate dismantles another section.*

*ACM-W President, Mary Valli answers questions for a participant.*

# ARTIFICIAL INTELLIGENCE

## KNOWLEDGE SYSTEMS GROUP

B. Chandrasekaran, John R. Josephson
http://www.cis.ohio-state.edu/lair/index.html

The Knowledge Systems group at the LAIR is concerned with making computers smart by giving them knowledge about the world and methods of using the knowledge to solve problems. Thus knowledge representation and problem solving are two key themes in the group's work. The strategy adopted by the Knowledge Systems group is to focus on complex real-world tasks, such as engineering or medical problem solving, or visual or speech perception. Of course the programs built are capable of solving complex problems in these domains, but the goal transcends artifact building. It includes understanding cognitive architectures, and abstract principles of knowledge-based reasoning and problem solving. A detailed sampling of works in progress follows.

### CAUSAL AND FUNCTIONAL UNDERSTANDING

For more than a decade, the group has investigated how engineers and scientists understand functions of devices, i.e., how they relate functions to the structures and behaviors of devices and scientific knowledge of the relevant domain. Explicitly representing such causal understanding is useful in building systems that can help design artifacts and perform diagnostic reasoning on them. The group has developed a language called Functional Representation that has been used to support reasoning about biological systems, engineering devices and software. Recently, the team formalized the notion of function in such a way that it can be used to build device libraries that can be accessed by designers looking for components that might help them achieve certain functionalities. KSG currently has grants from the Defense Advanced Research Projects Agency and from Army Research Office to conduct research on technologies for device libraries and functional reasoning.

### ABDUCTIVE REASONING

The Knowledge Systems group at LAIR is a major center of research in abduction. This is a type of inference that is being increasingly recognized as of fundamental importance in intelligence. In this form of inference, a conclusion is made which best explains the evidence available. This is different from what is normally called deduction in which the conclusion made from the data is definitive, or what is called "demonstrative." John Josephson's group has long argued that in addition to its importance in helping model problem solving activities such as diagnosis, abduction is also a useful model of speech and visual perception, and natural language understanding. With collaborators, diagnostic reasoning systems in medicine and engineering have built, systems that use abductive problem solving as a component of their activity. There is also a close connection between FR research on causal understanding and abduction. John and Susan Josephson are editors of the book "Abductive Inference: Computation, Philosophy, Technology," (Cambridge University Press), which describes LAIR work on abduction.

### ARCHITECTURE FOR EXPLORING MULTICRITERIAL DECISION SPACES

Decision-making is inherently multicriterial, with the weighting of different criteria being very nonlinear over the value space, making it difficult for even professionals to express their preferences by means of linear weights that are required by various mathematical techniques to make the problem tractable. We have developed and are experimenting with an architecture that enables a decision maker to understand the decision space, i.e., see the relationships between decision parameters and performance criteria, as well as to select the best candidates. The search architecture consists of three modules, a Seeker, a Filter and a Viewer. The Seeker generates a large number of candidates systematically, and evaluates each of them using a number of different criteria. The Filter retains only those candidates that satisfy the Pareto Optimality criterion, i.e., none of the survivors is clearly superior to another along all the dimensions of evaluation. On realistic problems, this somewhat filtering — locally called dominance filtering — can remove more than 99% of the candidates. The Viewer displays the survivors as a set of linked trade-off plots. The designer can identify interesting candidates in one of the plots, and see how the selected candidates fare in the other trade-off plots, and make a series of selections on different plots to narrow the choices. The

technology has been applied in various design and planning domains. The Viewer can also be used to view the candidates in plots that show performance criteria against design parameters, and this can be useful in understanding how sensitive different performance dimensions are to different design parameters over different regions of the parameter space. The technology has been applied as a technique of visual data mining to understand decision spaces corresponding to Courses of Actions for the Army. The suite of technologies includes CFML, which supports specifying the behavior of components and components in various generic interactions. The technology can be used to automatically compose decision candidates from the components in the library and simulate them to obtain various performance measures.

A recent technology developed in our Laboratory enables designers to search very large design spaces. The search architecture consists of three modules, a Seeker, a Filter and a Viewer. The Seeker generates a large number of candidates systematically, and evaluates each of them using a number of different criteria. The Filter retains only those candidates that satisfy the so-called Pareto Optimality criterion. The candidates that survive the Pareto criterion have the property that none of them is clearly superior to another along all the dimensions of evaluation. On realistic problems, this somewhat filtering — locally called dominance filtering — can remove more than 99% of the candidates. The Viewer displays the survivors as several trade-off plots. The designer can identify interesting candidates in one of the plots, and see how the selected candidates fare in the other trade-off plots. The technology is applicable to a wide variety of multi-criterial decision-making problems.

## Speech and Language Technologies (SLaTe) Laboratory

Donna Byron, Eric Fosler-Lussier
http://www.cse.ohio-state.edu/slate

The SLaTe Lab's goal is to build software agents that interact with users in natural, conversational language. We are interested in both the interface issues in building these agents, as well as developing the underlying speech recognition and and natural language processing technologies to improve human-computer interactions. The SLaTe lab has several ongoing projects:

### Contextually-aware language understanding

Current spoken dialogue systems are "disembodied": they are minimally aware of the circumstances in which a conversation takes place, such as where the person they are interacting with is located, what objects that person can see, and how those objects should be discussed based on the task they are working on together. If language-aware agents are to become truly personal assistants, they must have a sense of the spatial location and preferences of the user. For example, when driving down a road, one might make a turn "ahead on the left", whereas in reading a map, the same action might be described as "turning north" or "turning left", depending on the speaker's preference. This project explores conversational assistants that operate in two spatially-oriented domains (planning routes with maps and search-and-rescue in virtual reality). The goal is to understand how to computationally represent the beliefs about the world that the user and system share, and to interpret and produce language appropriately based on those beliefs.

### Reference resolution

Reference resolution, the process of assigning meanings to names, pronouns, and descriptions, is a core task that any language understanding software must perform. The SLaTe lab's reference resolution research encompasses basic linguistic analysis to make theoretical advances, creating algorithms for reference processing, and also designing interface protocols for reference resolution software. A particularly challenging aspect of this task for future AI systems is to design agents that can interact using multiple communication modalities, such as graphics and language. To address this need, my research group is focused on applications that present specific challenges for reference understanding. These applications move the locus of conversation away from the desktop and out into the world, and include:

- conversational characters within graphical simulations
- conversational mobile agents as personal assistance or remote exporation
- wearable intelligent personal assistants.

### Error Prediction within Automatic Speech Recognition

Automatic speech recognition (ASR) systems, which take audio input and provide a textual representation of an utterance, are notoriously far from perfect: current state-of-the-art systems incorrectly transcribe 30-50% of words in human-human conversations. However, because there are many sources of information in the system, such as the way people pronounce words, the way the acoustic signal will correspond to pronunciations, or the way that sentences are composed of words, it is often difficult to track down different sources of error. In this project, we are working towards providing diagnostic tools to the ASR system builder that indicate which parts of the model may be causing errors to be made by the system. By making the diagnostic tools general enough to be used with any recognizer, we are providing the field with a valuable resource which will help advance the state of the art.

## Computer Vision Laboratory

James W. Davis
http://www.cis.ohio-state.edu/~jwdavis

The research interest of the computer vision group is the development of an advanced video surveillance system that uses computers equipped with video cameras to detect the presence of people and identify their activities. The research has broad implications for Homeland Security as well as search and rescue, border patrol, law enforcement and many other types of military applications. The current system combines a thermal camera with machine learning methods, enabling the computer to perform the kind of visual recognition that seems effortless for humans. Davis' work in investigating computer vision methods was recently recognized by the National Science Foundation with the prestigious NSF Faculty Early Career Development (CAREER) Program award.

## Perception and Neurodynamics

Dr. DeLiang (Leon) Wang
http://www.cis.ohio-state.edu/pnl

Leon Wang's general area of interest is machine perception. More specifically, he is interested in biologically plausible neural computation for auditory and visual information processing. To achieve this, his research program seeks to uncover computational principles for auditory and visual analysis, including segmentation, recognition and generation. This research is on the basis of psychological/neurobiological data from human and animal perception and computational considerations.

A fundamental aspect of perception is its ability to group elements of a perceived scene or sensory field into coherent clusters (objects), generally known as scene analysis and segmentation. The general problem of scene analysis remains unsolved in auditory processing and computer vision. For a number of years, Wang's group focuses on understanding the dynamics of large networks of coupled neural oscillators and their applications to scene analysis. The results of this study have yielded a novel and effective approach for solving the general problem of auditory and visual scene segmentation.

His recent work focuses on models and algorithms for auditory scene analysis. In order to achieve the ultimate goal of constructing a computational system that possesses the human ability of cocktail-party processing, one must understand individual analyses, such as pitch, location, amplitude and frequency modulation, onset/offset, rhythm, and so on. One must also incorporate top-down aspects, including attention and recognition. His lab works on a variety of topics under the general theme of computational audition. Although the approach is primarily computational, his group also conducts psychophysical experiments in order to guide model development.

# COMPUTER GRAPHICS

Computer Graphics is an active area of research in Computer Science as well as a very popular area among both the graduate and undergraduate students. Six faculty are involved in a variety of research projects related to computer graphics including: image based rendering, computer animation, geometric modeling, and scientific visualization.

The faculty and students are consistently very active participants in the most important conferences and the premier publications in the field of computer graphics. As a result, graphics is one of the most internationally recognized research areas in the department. In addition to activity within the department itself, there are several units in and around campus that provide unique opportunities for collaboration, including: the Advanced Computing Center for Art and Design (ACCAD), Biomedical Informatics, the Ohio Supercomputer Center (OSC), the Center for Mapping, and the Institute for Ergonomics.

There are currently six CIS faculty in Computer Graphics: Roger Crawfis, Tamal K. Dey, Raghu Machiraju, Richard Parent, Han-Wei Shen and Rephael Wenger. A brief account of research interest and current projects of each faculty member is listed below.

## Dr. Roger Crawfis

Roger Crawfis's primary research interests lie in the areas of computer graphics, scientific visualization, medical imaging, and volume rendering. His group has been investigating new techniques for representing and rendering three-dimensional scalar and vector data. They currently have an NSF grant for investigating the effectiveness of various vector field or fluid flow visualization techniques. Garnering a better understanding of the perceptual and cognitive schemes that work will aid in investigation of new techniques or a closer coupling of two or more different techniques to represent the flow. For time-varying or multi-dimensional data, Dr. Crawfis is also examining new techniques for encoding and representing four-dimensional isosurfaces with Drs. Wenger, Shen and Dey. Applications of this research include volume deformation, compression of time-varying data, morphological properties of time-evolving structures and interval volumes or contour threshold sensitivity.

## Dr. Tamal Dey

Tamal Dey's research focuses on designing efficient algorithms for geometric problems that arise in geometric modeling. In particular, he is interested in shape modeling that is encountered in the areas of CAD/CAM, computer graphics and visualizations. Currently, he is focusing on shape modeling questions such as how to reconstruct curves and surfaces from their samples, how to simplify these reconstructed models and how to extract features out of these models. This set of questions are generic in that they appear in various forms over a wide range of applications such as medical imaging, solid modeling, CAD/CAM, meshing, scientific visualization and so on. Current advances in laser technology have made it easier to obtain a large number of samples from the boundary of an object. Approximating the boundary with a piecewise linear model, simplifying and smoothing it effectively form a different paradigm for modeling which he calls Sample Based Modeling (SBM). He believes that SBM provides a platform where a synergy between mathematical disciplines such as differential geometry, differential topology, discrete geometry and computational disciplines such as computational geometry, numerical methods would achieve significant advances. His research pivots around this idea.

## Dr. Raghu Machiraju

Raghu Machiraju's research interests include graphics, visualization and computational methods. He is interested in applying computational techniques and analysis methods to problems in graphics and visualization. His current efforts include feature-preserving multiscale representation and compression of very large datasets. Given the proliferation of datasets of extremely large sizes it is imperative that more efforts be expended on their analysis and representation and not just their display. The mainstay of his techniques include the wavelet transforms and robust region-based feature mining techniques for complex, large and unsteady data. The feature mining techniques

developed by him and his group exploit the underlying physics of the problem-at-hand. He is collaborating with faculty in Material Sceinces, Computational Fluid Dynamics and BioInformatics on several related problems. Recently, he has been also exploring the synthesis of fluid flowl phenomena and light transport using computational methods. His work has been funded by the National Science Foundation , Department of Defense, National Institutes of Health and Mitsubishi Electric Research Laboratories.

### Dr. Richard Parent

Rick Parent is interested in computer animation, especially as it relates to the human figure. He has recently written a book on the subject, "Computer Animation: Algorithms and Techniques," published by Morgan-Kaufman. His students are working on various projects related to human figure design and motion control. Recent graduates have worked on the following: lip-sync animation (Scott King), a genetic algorithm for graphic design (Matt Lewis), and automatically generating an interior skeleton for an arbitrary polyhedron (Lawson Wade). Current projects include using ACCAD's motion capture lab to analyze human motion and techniques to extract human motion from video. Many of Parent's former students are prominent in the entertainment industry including Doug Roble at Digital Domain, who just won a Technical Achievement Award from the Academy of Motion Picture Artists, Dave Haumann at Pixar who was the lead Technical Director (TD) on the Academy Award winning Geri's Game, and Beth Hofer at PDI who was the lead character TD on Shrek. Rick is Co-Program Chair of the next Symposium on Computer Animation and was the last Chair of the Technical Sketches at SIGGRAPH.

### Dr. Han-Wei Shen

Han-Wei Shen is interested in computer graphics and scientific visualization. Currently his research focuses include large-scale time-varying data analysis and visualization, adaptive volume visualization framework, fast vector field visualization techniques, and parallel view-dependent isosurface extraction. For the time-varying data visualization project, he and his students are designing system architectures to enable fast data access, pipelining parallel processing, and approximate algorithms for efficient rendering and processing of time-series data. Novel techniques such as high-dimensional rendering and dynamic feature tracking are also being developed. For the adaptive volume rendering project, he and his students are designing novel control frameworks for rendering hierarchical volumes so that an interactive frame rate can be guaranteed. For the vector field visualization research, he and his students are working on interactive rendering techniques for large-scale vector fields using programmable graphics hardware. For the parallel view-dependent isosurface extraction project, the focus is on reducing the size of surface patches so that they can be interactively rendered using low-end PC graphics hardware.

### Dr. Rephael Wenger

Rephael Wenger works on the design and analysis of geometric algorithms. He attempts to exploit the mathematical and combinatorial structure of geometric objects to design faster, more reliable algorithms, and to design algorithms in non-intuitive spaces such as four dimensions. Together with Drs. Crawfis, Dey and Shen, he is working on visualization of four or more dimensional data. Such data sets are typical in dynamic 3-dimensional systems such as atmospheric or fluid flow models. They also are produced by parametric studies of three dimensional models and simulations where each parameter adds a dimension. This work focuses on reconstructing surfaces, called isosurfaces, from this data.

Researchers from the Department of Medical Microbiology and Immunology are developing a process to detect and diagnose cancer by analyzing changes in DNA. The DNA is spliced into subsequences which is then represented as hundreds or thousands of spots on a two dimensional gel. By comparing images from normal and potentially cancerous tissue, they can identify markers of various types and stages of cancer. Dr. Wenger is supervising the development of software to automate this image analysis.

# NETWORKING

## Dependable Distributed and Networked Systems Group

Anish Arora

### NEST Project: Self-Stabilization in NEST

The goal of the DARPA NEST program is to enable "fine-grain" fusion of physical and information processes. The quantitative target is to build dependable, real-time, distributed, embedded applications comprising 100-100,000 computing nodes. The nodes are networked, their operation is coordinated and dynamically reconfigured as a response to changing physical conditions and modes of operation. The nodes include physical and information system components coupled by sensors and actuators. Closed loop interaction between physical and information system components is an essential feature of relevant NEST applications and it differentiates the NEST program from general, ubiquitous computing directions. Potential examples for target applications include MEMS based control and health management of weapon platforms, coordinated operation and control of large groups of physical objects (weapons, munitions, vehicles), and smart structures.

In our part of the project we will demonstrate the value of stabilization at all levels of the NEST system stack: from the application program level, to the middleware services level, to the computing/sensing node level. Compilers that preserve stabilization are part of our research deliverables. Issues of data corruption and the physical status of the environment (including for instance location and energy) will be addressed. To the best of our knowledge this is the first time the role of stabilization is being studied at all system levels.

### A Line in the Sand: A DARPA-NEST Field Experiment

We recently performed a field experiment at MacDill Air Force base, as part of the technology evaluation and transition efforts in the DARPA NEST program. Broadly speaking, our experiment demonstrated the potential of sensor networks for unattended ground sensing over a large, distributed region. More specifically, we showcased how to detect, classify, and track various types of objects (such as persons and cars) using many, resource-poor smart dust sensor nodes. Smart dust is the popular name for a wireless sensor network technology developed at the University of California at Berkeley as part of DARPA-funded research.

Some details of our experiment follow; interspersed, you will find pointers to more detailed technical reports and poster presentations on (1) the overall approach and design architecture, (2) our choice of sensors, and (3) particular sensors and middleware services.

Our field experiment supported the objective of "putting tripwires anywhere", including deserts and other areas where physical terrain does not constrain dismount or vehicle movement. A smart dust sensor network, empowered with distributed middleware services developed as part of the NEST program, was used. We hand-placed 90 pre-configured nodes at known locations, 78 containing magnetometer sensors & 12 containing micro-power impulse radar (MIR) sensors, as a basis for locally detecting metallic and nonmetallic objects moving through the smart dust network (our selection of sensors took into account several factors). The nodes self-formed into a network. As objects moved through the network, the nodes that detected them then cooperated to classify and track them. Classification of objects with significant metallic content (such as soldiers and cars) and objects without significant metallic content (such as civilians) was demonstrated at various speeds of motions (ranging from 3mph to 25mph).

The key enabler in our experiment is NEST "middleware" network software. Examples include software services for routing and time synchronization. The main technical challenge in developing these services was to ensure end-to-end reliable delivery of messages, despite the interference effects in wireless radio communication and failure, movement, or battery exhaustion of the sensor nodes. Each of our services overcame these difficulties by virtue of being self-repairing and self-stabilizing. Their reliability however came at a premium; we observed interesting tradeoffs in reliability versus accuracy and latency.

In terms of performance, our experiment was remarkably successful. Correct classification was obtained; there were no false positive or false negative observations. The quality of "soldier" localization during tracking was in the 1-2m range, whereas for cars it was in the 1-5m range. Tracking was predictably more smooth and steady for soldiers than it was for cars.

Efforts to further develop our technology are already underway. Our personal focus will be on scaling the "line", say to a 10 km range: we expect to achieve node density that is far less & a cost/energy budget that scales much better than that of our experiment. We will achieve this by: (a) using better, alternative, and additional sensors, (b) incorporating other classification features, and (c) systematically thinning the line, all while controlling the accuracy.

## Microsoft Research (MSR) Project: Continuous Self-Maintenance of .NET Services Project description.

.NET services are distributed, large-scale, and long running. As such, continuous maintenance is necessary in .NET platforms. And it is desirable that the maintenance be as autonomous as is possible, thus involving human operators only when it is unavoidable. In an ongoing joint project with MSR's Marvin Theimer, we are building a framework for continuous self-monitoring and evolution of .NET service components. We propose to complement that project by building frameworks for (i) dynamic composition of fault-tolerance components and (ii) continuous self-testing of .NET services. Further, we propose to integrate and demonstrate these three frameworks in the Herald .NET service being currently developed in MSR.

## NSF Project: Gray Box Stabilization

Research in system stabilization has traditionally relied on the availability of a complete system implementation. As such, it would appear that the scalability and reusability of stabilization is limited in practice. To redress this perception, in this paper, we show for the first time that system stabilization may be designed knowing only the system specification but not the system implementation. We refer to stabilization designed thus as being "graybox" and identify "local everywhere specifications" as being amenable to design of graybox stabilization. We illustrate a method for designing graybox stabilization using timestamp-based distributed mutual exclusion as our example.

## SIEFAST Simulator Project

Siefast is a tool to help you write and test programs for distributed and networked systems. Program testing lets you verify that closure properties, leads-to properties, invariant properties, and variant functions are satisfied by the simulated computations that you obtain via the tool.

Note that the since the tool only tests simulated computations one-at-a-time, it does not let you verify that the program at hand satisfies some closure properties, leads-to properties, etc. Siefast will not check your proofs of correctness for you; rather, it should help you gain a better understanding of your programs and their properties.

*The Smart Dust Research Assistants.*

# SOFTWARE ENGINEERING

Software engineering is the study of designing and building architecturally sound software systems. Highlighted here are advances in component-based software, program analysis, testing and maintenance, and (a common theme among all the work at OSU in this area) sound and modular reasoning about the behavior of software systems. For more information about this and other work in the software engineering area at Ohio State, visit http://www.cis.ohio-state.edu/~weide/se.

## Dr. Eitan M. Gurari

The work of Dr. Eitan Gurari is focused on the translation of structural TeX-based sources to XML, processing of documentation in XML format, and transcribing scientific and technical content into braille.

## Dr. Atanas Rountev

The research of Dr. Atanas (Nasko) Rountev and his students is focused on methods and tools for building of software systems. This work involves theoretical problems, such as the design of new algorithms for software analysis; system building, in particular building of tools for understanding and testing of complex software; and experimental evaluation, by applying the tools to real-world systems.

The major focus of our work is static and dynamic program analysis for object-oriented software. Static analysis determines software properties that hold over all possible run-time executions, while dynamic analysis examines software behavior during some particular execution. Both techniques are of fundamental importance for software understanding, transformation, testing, verification, and optimization. We are working on several important problems in this area, such as analysis of partial programs, analysis of object references and calling relationships in Java software, and analysis of component-based systems. The most recent work in our research group considers new algorithms for static analysis of distributed applications, as well as techniques for performing security analysis of software.

One application area for our analyses is reverse engineering of UML sequence diagrams. Sequence diagrams play an important role in modern software development; thus, it is essential to have high-quality reverse engineering tools that extract such diagrams from existing code. We are currently working on several novel research problems generated by this project; our ultimate goal is to incorporate these results in a state-of-the-art tool. Another significant dimension of our research is testing of object-oriented software. Recently we defined several techniques for thorough testing of polymorphism and object interactions. The static and dynamic analyses from this work are currently being integrated in a test coverage tool for Java software.

## Dr. Paul Sivilotti

The Distributed Components Research Group, led by Dr. Paul Sivilotti, investigates tools, techniques, and methodologies for the deployment of high-confidence distributed systems. A theme of our work is sensitivity to the trade-off between (i) the confidence in the correctness of a system and (ii) the effort required to achieve this confidence. Thus, the group focuses on both the theoretical underpinnings for sound specification and reasoning, as well as practical tools for application to real systems.

On the theoretical front, we are developing novel reasoning techniques and algorithms for distributed systems. These reasoning techniques are based on carefully restricting temporal properties. Our work in algorithms has included new approaches to gathering global state through snapshots, as well as algorithms for containing the effect of component failures to optimally small neighborhoods of a distributed system.

On the applied technology front, we are integrating our specification and reasoning methodology with state-of-the-practice technologies for distributed system deployment, including Web Services, XML, and CORBA. We investigate how industry-standard interface description languages can be extended to support the semantic description of component behavior. We are developing a tool suite for component providers to test and debug their components, as well as for component clients to validate these remote implementations.

This work has been funded by the National Science Foundation, Lucent Technologies, SBC Ameritech, the Ohio Department of Transportation.

### Dr. Neelam Soundarajan

The research of Dr. Neelam Soundarajan and his students is focused on developing approaches to specifying and reasoning about the behavior of component-based systems. Much of the work is based on the key observation that many systems are built incrementally by extending or enriching the functionality of previously built components, or components purchased from software vendors. The key question then is how to reason incrementally, rather than from scratch, about the behavior of the resulting system. Incremental reasoning is important not only to make the task of understanding the resulting system more manageable; it becomes indispensable in those cases where the underlying system is purchased from a software vendor and the source code of that system, as is typically the case, is not available.

Our recent research has made considerable progress in developing such incremental reasoning approaches. A related approach to monitoring the system has been developed that can be used to ensure that a given component-based system behaves according to its specification, by monitoring its execution without needing access to the source code of the system. Current work aims to extend the reasoning approach and monitoring techniques to handle design patterns underlying these systems.

## ACUITY

Dr. Sandy Mamrak's ACUITY project is devoted to innovative information-system technology to support cancer research. In particular we have developed a new technology for automatically generating complex, multi-screen forms for web-based update of relational databases, new metric sets to support decision-making about expanding an application framework, and an object-oriented version of JavaScript, Object JavaScript.

### Reusable Software Research Group

The Reusable Software Research Group is composed of faculty members Drs. Timothy Long, William F. Ogden, Bruce W. Weide, and Stuart H. Zweben, post-doctoral researcher Dr. Paolo Bucci, senior lecturer Dr. Wayne Heym, and several graduate and undergraduate research students. A key issue in the design of software is reusability, i.e., developing software from existing software components. At the heart of component-based software engineering is the need to design and develop components whose properties (correctness, efficiency, etc.) can be certified locally, or modularly, out of the context of the larger systems into which they might be incorporated. Suppose one has a specification for what a component is supposed to do, i.e., how it is supposed to behave as an abstraction. Suppose one also has an implementation of the component that has been proved correct or that has passed other certification standards such as rigorous testing. Then of course one would like to be able to assume that the component works correctly when it is embedded in a larger system. This is the only hope for certifying important properties such as correctness for large software systems. Unfortunately, with current programming practices there are many subtle ways in which dependencies between components can arise, and that can thwart this kind of modular reasoning about software. RSRG research aims to sort out these problems and to codify engineering design principles that will permit local certification of important component properties.

RSRG members are also engaged in a long-term effort to integrate, into an undergraduate computer science curriculum, component-based software engineering principles including those developed through RSRG research activities. The goal is to create the core of an instructional system capable of producing software professionals with greater awareness and understanding of the technical issues faced by the software industry, and with measurably better software design and development skills. The entire first-year course sequence for CS majors is integrated in this fashion.

RSRG research has been supported by the National Science Foundation, DARPA, Lucent Technologies, and Microsoft Research. Instructional development has enjoyed funding by the National Science Foundation and the Fund for the Improvement of Post-Secondary Education.

# SYSTEMS RESEARCH GROUP

The Information Technology era has seen an explosive growth of applications with heavy demands on systems performance. Experimental computing systems is an active, growing and exciting research area within Computer Science, driven by new technologies, novel implementation techniques and the requirements imposed by such end-applications.

The goal of the systems research group at Ohio State University is to take advantage of current trends in computing, networking, and I/O technologies to deliver high performance cost-effective systems infrastructure that can support such techniques and applications. Current research interests in the group span: high performance communication, I/O, networking, and file systems; middleware including programming models and APIs for data and resource management and scheduling; data-intensive computing technologies such as data mining and data servers; and application-specific (e.g. scientific computing, medical informatics, computational biology) systems support. Faculty members associated with this research area are: Gagan Agrawal, Hakan Ferhatosmanoglu, Mario Lauria, Dhabaleswar K. Panda, Srinivasan Parthasarathy, P. Sadayappan, and Joel Saltz. Research interests of these faculty members and the on-going research activities are mentioned later in this section.

State-of-the-art experimental systems and facilities are key to the research and development in the Computing Systems area. The group has excellent networking and computing facilities as follows: 1) a cluster of 16-node Quad Pentium 733 MHz systems (64 processors) and 16-node Dual Pentium 1GHz systems (32 processors) connected with Myrinet and GigaNet; 2) a cluster of 16-node Dual Pentium 300 MHz systems (32 processors) connected with Myrinet, Gigabit Ethernet, and GigaNet interconnections; 3) a cluster of 9 dual 1 GHz Pentium systems (18 processors) connected with Myrinet and with multiple disks per node for a total of 1 Terabyte of high access bandwidth storage; 4) a cluster of 8-node Dual Xeon 2.4 GhZ system (16 processors) connected with InfiniBand and Quadrics.

The first cluster is being connected with a video wall to carry out integrated network-based computing systems and applications research. The second cluster supports multiple communication layers (GM and VIA) and multiple programming environment layers (Message Passing Interface (MPI) for distributed memory programming and TreadMarks for distributed shared memory programming). The third cluster is being used for data mining, data intensive computing and remote data access research. A dedicated 1 Gbps link to the OSC over optical fiber will provide direct connectivity both to OSC clusters and to the Internet II OSU terminal for data transfer experiments over wide area networks.

## GAGAN AGRAWAL

### COMPILING SCIENTIFIC DATA INTENSIVE AND DATA MINING ALGORITHMS

We have been working in the area of compiling and optimizing data intensive applications for several years now. Our on-going work in this area focuses on the use of XML and XQuery. XML has emerged as a standard for exchanging data between organizations. Therefore, it is to be expected that simulation, sensor, and image datasets available for analysis will be in XML format. XQuery has emerged as the standard language for querying and processing XML datasets. We have started building a compiler that will optimize data intensive computations expressed in XQuery. A number of research challenges are being addressed in this context. They are: optimization of complex data intensive reductions expressed using the functional style of XQuery, parallelization of such reductions, and optimization of processing when the actual data is in a low-level format.

In our recently completed work, we have developed a data parallel compiler for data mining algorithms. Our compiler is able to perform both distributed memory and shared memory parallelization. This work is built upon our work on middleware for data mining (FREERIDE).

Another significant piece of work in this area was developing a compiler for scientific data intensive applications written in a data parallel dialect of Java we have developed. We particularly focus on applications which process and analyze large volumes of disk-resident data. We have chosen a dialect of Java with data-parallel extensions for specifying collections of objects, a parallel for loop, and reduction variables as our source high-level language. Our compiler analyzes parallel loops and optimizes the processing of datasets through the use of an existing run-time system, called Active Data Repository (ADR). We have shown how loop fission followed by interprocedural static

program slicing can be used by the compiler to extract required information for the run-time system. We have developed a design of a compiler/run-time interface which allows the compiler to effectively utilize the existing run-time system.

## System Support for Scalable Data Mining

As the amount of information available for analysis is increasing, scalability of data mining applications is becoming a critical factor. To this end, parallel versions of most of the commonly used data mining algorithms have been developed in recent years. However, developing, maintaining, and optimizing a parallel data mining application on today's parallel systems is an extremely time-consuming task.

We have developed a middleware system to enable rapid implementation of parallel data mining algorithms. Our middleware is called FREERIDE (FRamework for Rapid Implementations of Datamining Engines). Our middleware can help exploit parallelism on both shared memory and distributed memory configurations, while allowing efficient processing of disk resident data. Our work is based on the observation that parallel versions of a large number of common data mining algorithms including, apriori association mining, bayesian networks, k-means clustering, artificial neural networks, and k-nearest neighbors, share a similar structure. The middleware interface needs a high-level specification of a parallel data mining algorithm and does not require the application developer to specify or optimize file I/O, communication (for distributed memory parallelism), or threads (for shared memory parallelism).

The middleware has been successfully used for a variety of popular mining algorithms, including apriori association mining, k-means clustering, and RainForest based decision tree construction. We are now beginning to use the middleware for new data mining algorithms for scientific data mining and bioinformatics.

A related direction has been to develop performance models to choose between a set of parallelization techniques. We have developed and empirically validated performance models that capture the impact of memory hierarchy (including a two-level cache and TLB), contention between threads, coherence cache misses, and memory bus contention.

## Data Mining and OLAP Algorithms

Recently, we have been interested in developing novel algorithms for Online Analytical Processing (OLAP) and data mining.

Our on-going work in data mining is in two areas: 1) developing practical algorithms for parallel decision tree construction, so that decision tree construction can be parallelized using the same structure as the one used for association mining and clustering algorithms, and 2) developing algorithms to handle streaming data.

In the area of OLAP, we have focused on parallelization, as well as the use of tiling for data cube construction. We have developed an aggregation tree for sequential (and parallel) data cube construction, which has minimally bounded memory requirements. An aggregation tree is parameterized by the ordering of dimensions. We have developed a parallel algorithm based upon the aggregation tree. We have constructed a closed form expression for the total communication volume involved in the algorithm. We have proved that the same ordering of the dimensions minimizes both the computational and communication requirements. We have also developed a method for partitioning the initial array and prove that it minimizes the communication volume.

## Compiling for a Grid Environment

Grid computing has been receiving a lot of attention in recent years. A grid environment typically comprises heterogeneous resources over a wide-area network. Though a lot of effort has been put into resource management, resource discovery, security and system and user-level middlewares for grid computing, no support is available for high-level languages for grid application development.

We are developing a compilation system for grid application development that particularly targets data intensive applications that contain generalized reductions. The output of the compiler is a filter-stream program. This program is then executed on DataCutter, a user-level middleware that can flexibly schedule filter-stream programs.

### Distributed Processing of Data Streams

We are increasingly seeing data collected as continuous streams and from distributed sources. We are initiating work on efficient distributed processing of data streams, combining and expanding our on-going efforts in mining algorithms for data streams, performance models, and compiling for a grid environment.

## Hakan Ferhatosmanoglu

Dr. Ferhatosmanoglu's research interests are broadly in the field of database systems. His research focuses on effective storage, retrieval and indexing, and efficient data analysis, mining, and query processing in modern database applications.

### Retrieval and Indexing of Multi-dimensional and Multimedia Data

As databases increasingly integrate different types of information such as multimedia, spatial, time-series, scientific, and biosequence data, it becomes necessary to support efficient retrieval of multi-dimensional data. Both the dimensionality and the amount of data that needs to be processed are increasing rapidly. For example, multimedia data is inherently large and is usually represented by a multi-dimensional feature vector which describes the original data. Similarly, many large data sets in scientific domains consist of a large number of attributes that may be queried and analyzed. Traditionally, DBMSs supported simple query types such as selection queries, range queries, and join queries. With the new DBMS applications, supporting various types of queries, such as similarity, nearest neighbor, spatial and similarity join queries is emerging.

Effective indexing and retrieval of high dimensional data is crucial for database support for many modern applications. The general approach has been to extend the traditional techniques to higher dimensions. However, neither the well-known techniques nor their extensions can be successfully scaled for high dimensional data because of the effects of the infamous dimensionality problems. Radical approaches that are specifically optimized for high dimensions are needed. We develop a class of scalable index structures based on scalar and vector quantizations that are specifically optimized for efficient search and retrieval of such data sets. We also investigate dimensionality reduction techniques that directly target minimizing the errors made in the approximations and that can be used as an effective preprocessing step. Both quantization and reduction techniques are developed to support dynamic data with respect to both the data objects and the dimensionalities such as the case in data streams. We investigate effective methods to integrate our dimensionality reduction and quantization techniques with a search-optimized clustering scheme that jointly accounts for both database distribution and query statistics.

### Storage and Parallel I/O

The amount of data in many applications is increasing rapidly. It is important to develop an intelligent way of storing/declustering the data to multiple disks/servers to reduce query response times using parallel I/O. The current declustering techniques are not scalable for high dimensions, and mostly assume uniformity of the data, uniformity of the queries, and constant cost for I/O operations. We develop effective declustering techniques considering the realistic settings for modern database applications. We exploit storage redundancy to further improve the query time. In particular, we employ the idea of replication in the context of declustering and investigate effective techniques that can achieve strictly optimal parallel I/O, which was shown to be impossible using any single copy declustering technique. Since typical applications is used by multiple clients in a collaborative environment, we investigate declustering and associated retrieval techniques that optimize parallel I/O in multi-client environments. Finally, we plan to extend our work in replicated declustering to optimize parallel I/O to encompass grid-based data servers.

### Bioinformatics

We investigate effective ways of developing storage, retrieval, data analysis and query processing techniques for biological and biomedical data. An increasing number of databases containing biomedical data, such as biosequences, protein structures, and medical data warehouses, are available online and have been used by many researchers to generate new knowledge. For example, queries asking similarity on sequences or on protein structures are widely used to capture interesting and useful information from these large databases. Most of the

current techniques are getting infeasible for emerging biomedical data because of the exponentially increasing sizes of the databases. We propose a multi-dimensional approach to develop database systems and query processing techniques for common queries that are potentially useful for biomedical research. For example, we develop efficient three-dimensional query processing and indexing techniques for protein-protein interaction discovery, homology-based recognition, threading, and docking. Existing systems consist mainly of non-indexed geometric and chemical attributes, lacking the underlying support that would facilitate spatial query and similarity searching of the entire database which is crucial in many fields of biomedical research. Our projects in bioinformatics are performed in collaboration with several faculty and researchers from College of Medicine.

Besides the projects mentioned above, Dr. Ferhatosmanoglu works on related research problems in other emerging applications including information security, privacy preserving data mining, and data management in sensor networks.

### Mario Lauria

Mario Lauria's research interests cover different aspects of PC cluster technology - architecture, system software, applications, and the intersections of Cluster Architecture and Grid Computing.

One important focus of his investigation is how to integrate Terabyte-sized disk storage built using off-the-shelf components into a parallel machine with supercomputer performance and enhanced I/O capabilities. The node parallelism of cluster architectures present a unique opportunity to increase the performance of file access if augmented with a well designed striped file system that can leverage the parallelism of disk access.

Another focus of Dr. Lauria's research is the investigation of mechanisms to increase the efficiency of data transport between remote clusters over wide area networks. The purpose of this project is to overcome current performance limitations seen by data intensive Grid applications in accessing remote data repositories.

On the application side he is studying computationally intensive Computational Biology problems involving large amounts of data such as genome assemblies, whole genome comparisons, and tools for high sensitivity queries to biological databases. More details on dr. Lauria's research projects can be found at http://www.cis.ohio-state.edu/~lauria.

#### High Performance I/O

Today one Terabyte of disk storage can be easily added to a cluster for less than $5,000 by installing several IDE disks on each node. Besides the low cost, such a configuration has other benefits such as a large aggregate disk access bandwidth and the availability of resources for distributed preprocessing and caching of data. Currently however there are no robust system tools capable of reaping all the potential benefits of this type of distributed storage. We are interested in developing tools and system software to enable parallel applications to efficiently and transparently access storage on multiple cluster nodes. We are looking at existing parallel file systems (PVFS) and parallel I/O libraries (MPI-IO) and studying how they can be adapted and optimized for our purposes. Some of this work is done in collaboration with the Ohio Supercomputer Center in the context of the OSC Mass Storage project.

#### Data Transport over the Grid

The increasing need to access distant large data sets is the motivation behind the study of novel techniques to increase the throughput of data transfer between remote sites. One of the tools we are developing is an enhanced version of a remote storage access tool called Storage Resource Broker (SRB); SRB is a production quality tool developed at the San Diego Supercomputer Center. The performance enhanced version of SRB employs several strategies to increase the amount of data moved per unit of time between two remote machines. One such strategy is to introduce a notion of pipelining in handling the data and try to overlap different stages of the transfer. Another strategy is to stripe data across several parallel connections between the two remote sites. In a collaboration with researchers at the San Diego Supercomputer Center Dr. Lauria is developing an MPI-IO interface to SRB that would enable parallel applications to take full advantage of the aggregate bandwidth of the network striping.

### Data intensive Computational Biology

Dr. Lauria keeps experimenting with his own cluster to learn new ways of building and programming clusters specifically to solve demanding computational biology problems. In a recent project on the assembly and annotation of a complete mammalian genome directed by Dr. Bo Yuan at the OSU Medical College, the development of a parallel version of a popular bioinformatic tool (BLAST) and an enhanced 1 TB storage system resulted in an order of magnitude improvement in the speed of the large scale computation required for the assembly.

In a separate project in collaboration with Dr. Ralf Bundschuh in the Physics Department, Dr. Lauria is studying how to enhance the sensitivity of PSI-BLAST using a novel statistical theory of sequence alignments. PSI-BLAST is the program of choice for the search of large protein databases. This new theory should enable the creation of a version of PSI-BLAST in which the use of position-specific gap costs should enable the detection of very weak and thus previously undetectable alignments.

### Biologically Inspired Computing

Dr. Lauria has recently started exploring new concepts at the intersection of computation and biology. In a collaboration with Gerald Baumgartner, a new approach to desktop Grid computing based on self-organizing mobile agents is being explored. In this system the computation is carried out over a large number of machines by independent agents that migrate and interact with neighbors according to simple rules and using only local information about the system. This represents a radical departure from current approaches to metacomputing in which a centralized entity (the scheduler) tries to come up with an optimal computation schedule based on detailed information about the whole system. The objective of this project is to eventually be able to perform computations using very large numbers (millions) of idle PCs.

### Cellular Computation

Cellular computation is a new field of research that seeks to perform computation using genetically modified living cells in view of possible applications such as cell-based sensor networks, environmental remediation, cell-mediated delivery of drugs. The mechanism of conditional gene expression is one of the main components of the genetic machinery of the cell: at any point in time only some of the the genes contained in the cell's DNA are expressed, and not some others, depending on the environmental conditions and the current status of the cell. By manipulating this mechanism, elementary gate functionality (such as AND, OR, XOR) can be built using protein concentrations as input and output signals. Starting with the definition of a finite state machine, dr. Lauria is investigating how to define a configuration of genes and expression factors that implements the given machine. This project involves both a theoretical approach using quantitative models of transcription logic, and lab experiments using recombinant DNA technology.

## Dr. Dhabaleswar K. Panda

Prof. Dhabaleswar K. Panda's research interests are in the area of network-based computing, interprocessor communication, parallel computer architecture, clustered and heterogeneous systems, and high-performance computing. His research group is currently taking an integrated approach in designing high performance network-based computing systems by using modern networking technologies (Gigabit Ethernet, GigaNet, Myrinet, and Quadrics), communication standards (Virtual Interface Architecture (VIA) and InfiniBand Architecture (IBA)) and commodity PCs/workstations. Brief descriptions of some of the on-going projects are as follows. More details on these projects can be obtained from http://nowlab.cis.ohio-state.edu and http://www.cis.ohio-state.edu/~panda/pac.html. Some of these research projects have been carried out jointly with Prof. P. Sadayappan. Some of these projects are being done in collaboration with IBM T.J. Watson Research Center, Sandia National Laboratory, Pacific Northwest National Laboratory, Los Alamos National Laboratory, Mellanox, and Intel.

### Low-latency Point-to-Point Communication with User-level Networking Protocols

User-Level Networking Protocols (ULNPs) are being proposed for high performance computing systems to provide low-latency and high-bandwidth communication. Efficient implementation of these protocols requires research along several directions: balanced work distribution between the host processor and the Network Interface Card

(NIC) processor, minimization of copying at sender and receiver side with OS bypassing, flow control, and reliability. The latest industry standard for ULNP are the Virtual Interface Architecture (VIA) and InfiniBand Architecture (IBA). Along this direction, the group has extensively evaluated the impact of different design choices on the performance of VIA. By taking a suitable combination of design choices, we have developed an efficient VIA implementation on the IBM Netfinity cluster. We have also developed a comprehensive benchmark suite to compare different VIA implementations. A new zero copy protocol, called EMP (Ethernet Message Passing), for Gigabit Ethernet systems with Alteon NICs has also been developed. This protocol has also been parallelized with dual CPUs on Alteon NICs and it enables to deliver close to Gigabits/sec bandwidth to the applications. High performance point-to-point communication protocols are also being developed with InfiniBand and Quadrics networks.

### NIC-level Support for Collective Communication and Synchronization

Frequently used collective communication operations in high performance computing systems include broadcast, multicast, barrier synchronization, reduction, scatter, gather, all-to-all broadcast, and complete exchange. Traditional implementation of collective communication using a set of point-to-point operations lead to very high latency. Modern computing systems are being built with NICs having programmable processors and a reasonable amount of memory. This helps to implement collective communication operations at the NIC efficiently. Using this framework, we have developed NIC-level support for broadcast and barrier synchronization operations. For a 16-node system, the barrier synchronization implementation reduces the barrier synchronization time by a factor of 1.8, compared to the host-level implementations. We have also developed efficient implementations for atomic read-modify-write and compare-and-swap operations with active network interface support on Myrinet networks. These implementations lead to high performance and scalable implementation of distributed locks in clusters. In addition to NIC-level support, we are also exploring the usage of remote-memory-based (RDMA-based) schemes available on VIA and InfiniBand architecture to provide efficient and scalable support for collective communication and synchronization.

### NIC-level Support for Quality of Services (QoS)

In addition to high performance, modern network-based computing applications require support for QoS. Along this direction, we have developed a NIC-level support for proportional bandwidth allocation in clusters with Myrinet interconnection and MPI/GM messaging layer. This scheme implements a novel packet-scheduling at the NIC and allows applications to reserve and allocate bandwidth for multiple outgoing/incoming flows from/to a node in a given proportion. Using this scheme, we have developed a QoS-aware middleware framework with integrated CPU/network scheduling and admission control schemes such that interactive applications (such as visualization) can be admitted to a shared cluster with QoS guarantees. This framework also exploits resource-adaptive properties of the applications to admit maximum jobs to a system. We are extending this framework to provide QoS support on next generation clusters with InfiniBand architecture.

### High-Performance Programming Environments/Middleware for Clusters

With the development of high performance communication subsystems for clusters, a bigger research challenge is how to pass on this performance to the programming environment layer. Along this direction, we are focusing on four commonly used programming environments: distributed memory, software distributed shared memory, get/put shared memory without coherency, and sockets. We have developed a thin communication substrate over VIA which allows the popular TreadMarks (a software distributed shared memory environment) to deliver far better performance compared to its UDP implementation. We have also developed a high performance implementation of Global Arrays (a popular model supporting get/put shared memory) on top of Myrinet/GM. We have developed a high performance implementation of the Message Passing Interface (MPI) standard (for distributed memory programming) over InfiniBand architectures. Finally, we have developed high performance implementation of user-level sockets over Gigabit Ethernet and VIA. These implementations deliver significant performance benefits compared to TCP/IP. We are extending our research along these directions to modern networking technologies like Quadrics and InfiniBand.

### High Performance I/O and File Systems for Clusters

In addition to high performance communication, many applications (scientific and commercial) need support for high performance I/O and file systems. Modern networking architectures like VIA and InfiniBand are providing novel mechanisms like RDMA, third party data transfer, etc. for handling efficient I/O. Our objective along this direction is to take advantage of these new mechanisms to provide high performance I/O and file systems. We have developed a high performance support for MPI-IO on DAFS (Direct Access File Systems) over VIA. With high performance implementations of sockets and support for efficient collective communication (as discussed in the above paragraphs) over modern interconnects, we are exploring new ways to design I/O and file subsystems for clusters so that communication performance at the networking layer can be delivered to the I/O and file subsystems with very little performance degradation.

## Dr. Srinivasan Parthasarathy

Spurred by technological advances in data collection techniques, data mining is an interdisciplinary field merging ideas from statistics, machine learning, databases, and high performance computing systems. Dr. Parthasarathy's research in this area has focussed on actively mining dynamic datasets, parallel and distributed data mining, architectural and operating systems support for data mining applications, and applying these techniques on a varied set of domains (biological, web, network security, e-commerce/business and scientific).

### Active Data Mining

Most current work in data mining assumes that the data is static and a database update requires re-mining both the old and new data. We have proposed and evaluated several algorithms that maintain valid mined information (mining summary structures) across i) database updates, and ii) user interactions(modifying/constraining the search space) in a client-server setting. The primary challenge is the design of a mining summary structure that satisfies the following two properties: i) the information stored in the structure should be able to address a wide range of user interactions; ii) it should allow for incremental maintenance. In other words, the summary structure from the old data along with the database update should ideally be sufficient to produce the summary structure for the updated data, without having to access the old data. We have successfully implemented and evaluated active mining solutions for association mining, sequence mining, similarity discovery, and discretization. This project is being extended on several fronts. We are evaluating similar strategies for clustering and classification. We are seeking to improve the performance of existing active mining techniques through the use of memory placement and data compression strategies to enhance locality. Simultaneously we are also evaluating the quality vs. efficiency tradeoff in using various data stratification algorithms (such as sampling, discretization and dimensionality reduction) in order to reduce the I/O demands of existing algorithms. Recent efforts have focused on identifying methods and systems support to mine and manage streaming datasets (this is an area of ongoing collaboration with Dr. Ferhatosmanoglu).

### Parallel and Distributed Data Mining

We have developed several scalable parallel and distributed algorithms for dataset clustering and association mining. The algorithms proposed are efficient, work out of core, and scale to very large databases. The new algorithms utilize graph-theoretic techniques to decompose the original problem into smaller sub-problems that can be solved independently in main memory while facilitating parallelization. We are extending this work in the following ways: Developing parallel incremental algorithms for mining dynamic datasets; Studying the impact of combining data-shipping and function shipping on parallel data mining applications; Evaluating various reduction operations such as data associations, fast fourier transforms and wavelet transforms to efficiently mine distributed data sets.

### Resource-Aware Systems Support for Data Intensive Applications

Modern-day enterprises usually contain a cluster of shared memory workstations connected by some (intra-enterprise) network. Such a cluster of shared-memory symmetric multi-processors (SMPs) can be a cost effective powerful computational resource. The goal of this project is to effectively use such a cluster for data mining applications. Leveraging this enterprise- wide cluster can pose several problems in terms of programmability, the interactive requirements imposed by such applications, the large data sets involved, and the unpredictability

involved with sharing cluster resources with other applications. We have developed a prototype object-based system called InterAct which has addressed some of these issues: programmability, interactivity and resource-aware scheduling. Our current focus is on scalable I/O (active filesystems) and communication support (with Prof. Lauria and Prof. Saltz), compression and memory placement of InterAct objects to reduce the communication requirements, as well as extending InterAct's current support to address resource aware computing in a shared environment.

### Application-Oriented Mining

KDD is ultimately motivated by the need to analyze data from a variety of practical applications. Of particular interest to us is the application of data mining to the domains of electronic commerce, network performance data, the World Wide Web, scientific simulations and biomedical informatics. Within the E-commerce and WWW domain we have been investigating the issue of analyzing web logs and E-commerce data to cluster similar users, transacted items and web pages. In the network security domain we have been working with the enterprise services group at the office of information technology and Dr. Machiraju (Graphics group) to mine and visualize network performance data for intrusion detection and accounting purposes. More recently our research has evaluated the viability of using a NIC-based approach to network intrusion detection and prevention (joint work with Dr. Panda). In the scientific simulation domain, along with Dr. Machiraju and Dr. John Wilkins (Physics), we have been evaluating methods by which one can steer the analysis of a molecular dynamics simulation through the incremental mining of simulation data. In conjunction with Dr. Andrej Rotter (Pharmacology) we have been evaluating how one can use various mining techniques to examine and analyze gene expression data for drug discovery.

## Dr. P. Sadayappan

Dr. Sadayappan's research interests pertain broadly to the facilitation of effective use of high-performance computing systems for computationally intensive applications. Collaborators on the projects include Prof. Baumgartner, Prof. Panda and several researchers at Oak Ridge and Pacific Northwest Laboratories.

Currently, his research focus is on the following projects:

### Scheduling and Resource Management for Parallel/Distributed Systems

This project is investigating a number of issues pertaining to the effective scheduling of parallel jobs on parallel/distributed systems.

### Moldable Job Scheduling:

Although most parallel applications are not hardwired for execution on a specific number of processors, in order to simplify the scheduling task, supercomputer centers currently require users to choose some specific processor count for their jobs. We are exploring moldable scheduling approaches where users specify a range for the processor count. Fairness and robustness under varying load and scalability conditions are challenges being addressed.

### Scheduling in Heterogeneous Environments:

Coordinated scheduling across multiple geographically distributed supercomputer sites offers potential for improved utilization and response times. Both centralized approaches (suitable for a small number of sites) as well as distributed approaches (required when the number of sites is large) are being explored.

### Quality-of-Service (QoS) for Job Scheduling:

Currently job schedulers at supercomputer centers do not offer users QoS in the form of deadline guarantees or trade-off between resource charge and response time. We are developing a job scheduling approach that incorporated deadlines and are also exploring resource charging models that take responsivity into consideration.

### Scheduling Data Intensive Applications:

Most of the research on job scheduling has considered computationally intensive jobs but not data intensive jobs. We are developing job scheduling strategies for data intensive applications, such as those exemplified by a filter stream programming model.

### High Level Programming for High Performance Computing

The development of high-performance parallel programs is usually done using the message passing programming model and is often very tedious and time consuming. Often, the time to develop an efficient parallel program for a computational model is a primary limiting factor in the rate of progress of the science. Therefore systems support for the development of high-performance parallel programs is very important. Prof. Sadayappan has been working with Prof. Baumgartner and colleagues in the sciences and engineering, to address various research issues in performance optimization.

Over the last few years, the application domain of computational chemistry has been an area of special focus for development of a high-level programming framework and performance optimization techniques. A prototype program synthesis tool has been developed, that can be used by computational chemists to generate high-performance parallel programs for computational structures specified in a high-level form. A number of optimization issues are being addressed in this context:

### Algebraic Transformations:

Many of the core computations in electronic structure modeling can be expressed as sets of tensor contractions, which essentially translate to sum-of-products array expressions. However there are a large number of algebraically equivalent forms for the same computation (assuming that reordering of floating point operations using associative and distributive laws is permissible). These equivalent forms can differ in the number of arithmetic operations by orders of magnitude. Although the problem of finding the operationally minimal form is NP-hard, practically effective search procedures are being developed.

### Memory Minimization:

The application of algebraic transformations to minimize operations often requires the use of temporary arrays to hold intermediate results that are reused multiple times. Sometimes the sizes of these temporary arrays are so large that they make practical implementation impossible. However, there are significant opportunities for reducing the memory requirements through loop fusion and array contraction. But the optimal choice of loop fusions is not trivially identified. A systematic framework has been developed to address this problem for operator trees, and extensions of the methods to more general operator DAGs (Directed Acyclic Graphs) are being addressed.

### Space-Time Trade-Off:

Sometimes the reduction in memory through application of loop fusion and array contractions is inadequate and the total memory required exceeds the available disk capacity on the system, making the computation infeasible. In such a situation, it is often possible to seek a trade-off that reduces memory requirements by redundantly recomputing some intermediate results instead of storing and reusing them. We are trying to develop a systematic framework for the modeling of space-time trade-offs and the derivation of program transformations that attempt to reduce memory requirements to within specified limits.

Data Locality Optimization:

If the space requirement exceeds physical memory capacity, portions of the arrays must be judiciously moved between disk and main memory as needed, in a way that maximizes reuse of elements in memory. The same considerations are involved in effectively minimizing cache misses - blocks of data must be moved between physical memory and the limited space available in the cache. We are developing techniques for automatic generation of efficient out-of-core algorithms for this context, and seek to extend the approach to other domains such as signal processing.

### Data Distribution and Partitioning:

We are studying the problem of how best to partition the data among the processors of a parallel system, so as to minimize communication overheads. An important issue in interfacing synthesized code with existing software packages is that of efficiently redistributing data from an existing distribution to a desired distribution. We are working with researchers at Pacific Northwest National Laboratory to incorporate the data redistribution algorithms into the Global Arrays (GA) and Disk Resident Arrays (DRA) library.

## Dr. Joel Saltz

The research interests of Dr. Saltz and his group span techniques, runtime optimizations, and systems software and middleware tools to provide support for storage, data management and manipulation of very large scientific datasets on parallel machines and in distributed environments. The group works on parallel algorithms and domain decomposition methods for scientific computations and application of parallel computing in scientific visualization.

The research group, in conjunction with Dr. Gagan Agrawal, also focuses on development of tools and techniques that aid development of efficient computing and data intensive applications. A particular focus of this research has been applications from medical and biological domains. Dr. Saltz, Dr. Agrawal and their PH.D. student, Renato Ferreira, developed a language and compiler framework that allows data intensive applications to be specified at a very high-level.

Other members of the group also look at query generation, multiple query workloads in data analysis applications and decision tree construction for data mining.

Dr. Saltz and his collaborators, Dr. Kurc and Dr. Catalyurek, developed the Active Data Repository (ADR) and DataCutter software projects to provide the software support needed to manage large scientific datasets.

### Active Data Repository

ADR optimizes storage, retrieval and processing of very large multi-dimensional datasets. In ADR, datasets can be described by a multidimensional coordinate system. In some cases datasets may be viewed as structured or unstructured grids, in other cases (e.g. multiscale or multiresolution problems), datasets are hierarchical with varying levels of coarse or fine meshes describing the same spatial region. Processing takes place in one or several steps during which new datasets are created, preexisting datasets are transformed or particular data are output. Each step of processing can be formulated by specifying mappings between dataset coordinate systems. Results are computed by aggregating (with a user defined procedure), all the items mapped to particular sets of coordinates. ADR is designed to make it possible to carry out data aggregation on processors that are tightly coupled to disks. Since the output of a data aggregation is typically much smaller than the input, use of ADR can significantly reduce the overhead associated with obtaining postprocessed results from large datasets.

The Active Data Repository can be categorized as a type of database; correspondingly retrieval and processing operations may be thought of as queries. ADR provides support for common operations including index generation, data retrieval, memory management, scheduling of processing across a parallel machine and user interaction. ADR assumes a distributed memory (or in database terminology, shared-nothing) architecture consisting of one or more I/O devices attached to each of one or more processors. Datasets are partitioned and stored on the disks. An application implemented using ADR consists of one or more clients, front-end processes, and a parallel backend. A client program, implemented for a specific domain, generates requests that are translated into ADR queries by ADR front-end processes. The front-end translates the requests into ADR queries and performs flow control, prioritization and scheduling of ADR queries that resulted from client requests.

### DataCutter

DataCutter is a middleware infrastructure that enables processing of scientific datasets stored in archival storage systems across a wide-area network. DataCutter provides support for subsetting of datasets through multi-dimensional range queries, and application specific aggregation on scientific datasets stored in an archival storage system.

DataCutter provides a core set of services, on top of which application developers can implement more application-specific services or combine with existing Grid services such as metadata management, resource management, and authentication services. The main design objective in DataCutter is to extend and apply features of the Active Data Repository (ADR), namely support for accessing subsets of datasets via range queries and user-defined filtering operations, for very large datasets in a shared distributed computing environment. In ADR, data processing is performed where the data is stored (i.e. at the data server). In a Grid environment, however, it may not always be feasible to perform data processing at the server, for several reasons. First, resources at a server (e.g., memory, disk space, processors) may be shared by many other competing users, thus it may not be efficient and cost-effective to perform all processing at the server. Second, datasets may be stored on distributed collections of storage systems, so that accessing data from a centralized server may be very expensive. Moreover, distributed

collections of shared computational and storage systems can provide a more powerful and cost-effective environment than a centralized server, if they can be used effectively. Therefore, to make efficient use of distributed shared resources within the DataCutter framework, the application processing structure is decomposed into a set of processes, called filters. DataCutter uses these distributed processes to carry out a rich set of queries and application specific data transformations. Filters can execute anywhere (e.g., on computational farms), but are intended to run on a machine close (in terms of network connectivity) to the archival storage server or within a proxy server. Another goal of DataCutter is to provide common support for subsetting very large datasets through multi-dimensional range queries. Very large datasets may result in a large set of large data files, and thus a large space to index. A single index for such a dataset could be very large and expensive to query and manipulate. To ensure scalability, DataCutter uses a multi-level hierarchical indexing scheme.

DataCutter is also being integrated with the Storage Resource Broker (SRB), under development at the San Diego Supercomputing Center through the NPACI consortium. The SRB provides transparent access to distributed storage resources in a Grid environment, and DataCutter will enhance the SRB services to allow for subsetting and filtering of large archival datasets stored through the SRB.

The Active Data Repository and DataCutter research is supported by NSF, the National Partnership for Advanced Computing Infrastructure (NPACI), DARPA, and DOE ASCI. This systems software is also being used to implement data analysis applications in several projects that are funded by NPACI, NSF, and DARPA. Active projects involve development and optimization of data analysis applications that query and manipulate large multi-dimensional datasets. The applications include visualization of digitized microscopy slides, exploration and analysis of data gathered from sensors attached to Landsat satellites, databases for coupled simulation systems, and visualization of biomedical volumetric datasets and output from scientific and engineering simulations. The group is currently working on runtime optimizations and systems software for execution of these classes of applications on disk-based storage clusters and in the Grid environment, and runtime systems for optimizing execution of multiple query workloads on distributed-memory machines and SMP clusters.

Most recently, Dr. Saltz and his group, in collaboration with the Texas Institute for Computational and Applied Mathematics (TICAM) have been funded for an NSF ITR entitled A Data Intense Challenge: The Instrumented Oilfield of the Future. The objective of this project is to advance key enabling technologies and to to create a new generation of data-driven, interactive and dynamic adaptive strategies for subsurface characterization and reservoir management. The proposed approach will combine multiresolution reservoir models derivable from diverse data types and executing on very large distributed heterogeneous computational environments, with embedded sensors in instrumented reservoir-fields (e.g. permanent downhole sensors and seismic sensors anchored at the seafloor) that dynamically monitor changing fluid and rock properties. Completing this symbiotic feedback loop between measured data and the computational models will enable an “instrumented oilfield”, providing more efficient, cost-effective and environmentally safer production of oil reservoirs, and result in enormous strategic and economic benefits.

# Research Grants & Awards

Legend:
Sponsor
*Title*
**PI** w/ Co-I (non-CSE collaborator source)
Project Period
Total Award

## AETION Technologies LLC

*Separation of Speech from Background.*
**Wang, DeLiang (Leon)**
9/1/2003 - 8/31/2004
$40,000

## Air Force Material Command

*Collaborative Center for Control Science*
**Weide, Bruce;** Passino, Kevin M.
Ended 09/28/2004
$89,504

## Air Force Office of Scientific Res

*Robust Speaker Recognition in Co-Channel.*
**Wang, DeLiang (Leon)**
4/20/2004 - 4/19/2005
$70,000

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*Monaural Speech Segregation by Integrating Primitive and Schema-based Analysis.*
**Wang, DeLiang (Leon)**
2/15/2004 - 12/31/2004
$170,995

## Ames Research Center

*Visualizing Time-Varying Data Distributions in EOS Applications.*
**Shen, Han-Wei**
3/1/2001 - 2/28/2004
$18,807

## Army Robert Morris Acquisition Center

*Handling Large, Noisy, and Under-Sampled Data in Sample Based Shape Modeling.*
**Dey, Tamal**
8/1/2002 - 10/31/2004
$71,005

## Battelle-Pacific Northwest Lab

*Enhancements to Disk Resident Arrays Library.*
**Sadayappan, P.**
2/3/2004 - 9/30/2004
$65,217

## Cable Television Laboratories Inc.

*Network Dimensioning Tool — Capstone Project.*
**Ramnath, Rajiv;** Zweben, Stuart H
3/29/2004 - 6/7/2004
$1,000

## Central Ohio Transit Authority (COTA)

*Services Architecture Validation.*
**Zweben, Stuart H.**; Ramnath, Rajiv
1/15/2004 - 2/29/2004
$10,952

## City of Columbus

*City of Columbus IT Strategic Plan*
**Zweben, Stuart H**.; Ramnath, Rajiv
9/15/2003 - 5/15/2004
$19,600

## Coop State Res. Educ. & Extension Service

*Contribution of Seed Polymorphism to Diverse Adaptation of the Native Invasive Annual, Ambrosia Trifida*
**Fujimura, Kikuo; Zweben, Stuart**
Ends 06/05/2005
$22,526.00

## Defense Advanced Res Projects Agency

*Self-stabilization in NEST.*
**Arora, Anish K.**
5/30/2001 - 5/30/2005
$582,480

## Delta & Pineland Co.

*Seed Vigor Assessment Project*
**McDonald Jr., Miller B.;** Bennett, Mark A; Fujimura K.
Ends 12/31/2004
$63, 552.00

## Dept. of Energy

*Scalable Storage and Efficient Retrieval of Large-Scale, High Dimensional Scientific and Biomedical Data.*
**Ferhatosmanoglu, Hakan**
9/1/2003 - 8/31/2004
$97,920

*Center for Programming Models for Scalable Parallel Computing.*
**Panda, Dhabaleswar K.**
9/15/2001 - 9/14/2003
$150,000

*An End-to-End Processing Pipeline for Large Scale Time-Varying Data Visualization.*
**Shen, Han-Wei**
9/1/2003 - 8/31/2004
$100,859

## Honda Research Institute, USA

*Advanced Research Trend of Computer and Information Science*
**Zweben, Stuart H.**
Ends 9/30/2004
$155,000

## Intel Corp

*Analysis and Enhancements to MVAPICH wrt IBAL, SMP, Connection Management, and MPICH2*
**Panda, Dhabaleswar K.**
7/1/2003 - 11/30/2003
$25,000

## Los Alamos National Lab

*Efficient Implementation of Point-to-Point and Collective Communication Services.*
**Panda, Dhabaleswar K.**
10/1/2003 - 9/30/2004
$99,996

*Design of Scalable and High Performance Collective Communication Schemes for Infiniband-based Clusters.*
**Panda, Dhabaleswar K.**; Wycoff, Pete (Ohio Supercomputer Center)
7/28/2003 - 9/30/2003
$99,989

*Efficient Implementation of Point-to-Point and Collective Communication Services.*
**Panda, Dhabaleswar K.**
8/1/2003
9/30/2003
$49,995

## Mayo Foundation

*Molecular Markers of Glioma Initiation and Progression.*
**Mamrack, Sandra A.**; Saqr, Hany E. ; Pearl, Dennis K.
6/1/2003 - 5/31/2004
$481,659

## Mellanox Technologies, Inc

*Research on High Performance and Scalable MPI over InfiniBand.*
**Panda, Dhabaleswar K.**
4/1/2004 - 4/1/2005
$92,500

## Micro Analysis & Design

*Artificial Intelligence Techniques and Advanced Decision Architectures*
**Chandrasekaran, B.**; Woods, D.
Ends 09/30/2005
$1,323,000

## Migration Technologies

*Legacy to Three Tier Migration.*
**Zweben, Stuart H.**; Ramnath, Rajiv
7/15/2003 - 7/1/2004
$8,500

## National Geospatial-Intelligence Agency

*Mathematical Principles for Spatial Data Management*
**Dey, Tamal;** Saalfeld, Alan J.
$446,301

## National Institute of Health

*Center for Grid-Enabled Medical Image Analysis*
Panda, D. K.; Machiraju, Raghu; Clymer, Bradley; Lee, Robert; Eng, Charis; Wyckoff, Pete; Friedman, Avner; Saltz, Joel, H.; Kurc, Tahsin M.; Stutz, Alvin E.; Knopp, Michael; Catalyurek, Umit V.; Kuppusamy, Periannan; Zweier, Jay L.; Stredney, Donald L.; Kamal, Jyoti; Au, Jessie L.
Ends. 07/31/2005
$1.375,000

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*Genomic Scanning in Oral Cancer*
**Wenger, Rafe;** Plass, Christopher
Ends: 03/31/2004
$257,250

## National Science Foundation

*SOFTWARE: High-level Programming Methodologies for Data Intensive Computations.*
**Agrawal, Gagan**; Saltz, Joel H.
2/1/2004 - 1/31/2005
$118,800

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*ITR/AP: Synthesis of High Performance Algorithms for Electronic Structure Calculations*
**Baumgartner, Gerald;** Sadayappan, P.; Pitzer, Russell M.
Ends 08/31/2006
$1.950,900

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*CAREER: Computer Recognition of Human Activity.*
**Davis, James W.**
3/1/2003 - 2/28/2005
$100,000

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*ITR: Automatic translation of scientific literature to Braille.*
**Gurari, Eitan M.**
7/15/2003 - 6/30/2005
$119,775

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*A Scalable Framework for Mining Scientific and Biomedical Data.*
**Parthasarathy, Srinivasan**
1/15/2004 - 12/31/2004
$95,515

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*CAREER: Toward Effective Visualization of Large Scale Time-Varying Data.*
**Shen, Han-Wei**
2/15/2004 - 1/31/2005
$60,486

*ITR/AP & IM A Data Intense Challenge: The Instrumented Oilfield of the Future*
**Saltz, Joel H.**
Ends 09/30/2004
$225,000

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*Dynamics-Based Speech Segregation*
**Wang, DeLiang (Leon)**
Ends 08/31/2004
$438,180

## NSF Biological Instr & Resources

*Iterative Hybrid Alignment; Improving the Sensitivity of Biological Database Searches*
**Lauria, Mario;** Bunschuh, Ralf A.
Ends 08/31/2005
$231,152

## NSF Biological Sciences

*A Web-Based Relational Database for Thermodynamic and Structure Data on Lipids*
**Parthasarathy, Srinivasan;** Caffrey, Martin D.
Ended 12/31/2003
$457,638

## NSF Computer & Computation Research

*HDCCSR: Scalable Dependability in Componentized Software via Self-Stabilization.*
Arora, Anish K.
10/1/2003 - 9/30/2007
$390,127

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*Software: Framework for Mining Large and Complex Scientific Datasets.*
**Machiraju, Raghu, K.**; Agrawal, Gagan ; Parthasarathy, Srinivasan
9/15/2003 - 8/31/2005
$124,037

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*Network Interface Support for High-Performance and Scalable Communication Services in Clusters.*
**Panda, Dhabaleswar, K.**
7/1/2002 - 6/30/2005
$53,702

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*Designing High Performance and Scalable Communication Subsystem for Next Generation Clusters with Infiniband Architecture.*
**Panda, Dhabaleswar, K.**
8/15/2003 - 7/31/2005
$150,000

NSF Computer & Information Science & Engineering

*Visualization: Effective Visualizations for Complex 3- and 4-Dimensional Flow Fields.*
**Crawfis, Roger A.**; Machiraju, Raghu K.; Shen, Han-Wei
10/1/2002 - 9/30/2005
$77,878

*Traffic Management in IP Networks.*
**Durresi, Arjan**
10/1/2002 - 3/31/2004
$27,737

NSF Advanced Scientific Computing

*NSF/NTR: A Framework for Discovery, Exploration and Analysis of Evolutionary Simulation Data (DEAS)*
**Machiraju, Raghu, K.**; Parthasarathy, Srinivasan; Wilkins, John W.
9/15/2003 - 8/31/2004
$6,000

*ITR/NGS: A Framework for Discovery, Exploration and Analysis of Evolutionary Simulation Data (DEAS)*
**Machiraju, Raghu, K.**; Parthasarathy, Srinivasan; Wilkins, John W.
9/15/2003 - 8/31/2004
$343,000

*Visualization: Overlay Network Support for Remote Visualization of Time-Varying Data.*
**Xuan, Dong**; Shen, Han-Wei
9/1/2003 - 8/31/2004
$89,677

*Visualization: Overlay Network Support for Remote Visualization of Time-Varying Data.*
**Xuan, Dong**; Shen, Han-Wei
9/1/2004 - 8/31/2005
$93,286

NSF Info Robotics & Intelligent Systems

*Workshop: Student Research in Computational Linguistics, at the HLT/NAACL 2004 Conference.*
**Fosler-Lussier, J Eric**
5/1/2004 - 4/30/2005
$20,164

Ohio Aerospace Inst

*Data Compression, Formatting, and Management of Real-Time Meteorological Data.*
**Ferhatosmanoglu, Hakan;** Ramnath, Rajiv
2/27/2004 - 8/26/2005
$10,000

*Data Compression, Formatting, and Management of Real-Time Meteorological Data.*
**Ferhatosmanoglu, Hakan;** Ramnath, Rajiv
2/27/2004 - 8/26/2005
$39,686

Pfizer, Inc.

*Pathodynamics of Drug Induced Hepatoxicity.*
**Friedman, Avner**; Ferhatosmanoglu, Hakan; Parthasarathy, Srinivasan
Ends 09/30/2005
$276,669

Polytechnic University

*Visualization: Integrated Compression and Cut-of-Core Techniques for Large Time-Varying Data Visualization.*
**Shen, Han-Wei**
9/15/2001 - 8/31/2004
$60,612

Sandia Corp

*Supporting MPI Collective Communication Operations with Application Bypass.*
**Panda, Dhabaleswar K.**; Sadayappan, P., Wyckoff, Pete (Ohio Supercomputer Center)
5/6/2003 - 12/31/2003
$84,995

Scientific Applications Intl. Corp

*Distributed Collaborative Decision Support Technologies: Evaluation of Courses of Action.*
**Chandrasekaran, B.**
6/4/2004 - 9/30/2004
$25,000

SEAFIRE MICROS, INC.

*High Performance Networks: Smart High-Speed Network Interface Card.*
**Panda, Dhabaleswar K.**
8/1/2003 - 4/30/2004
$33,000

STANFORD UNIVERSITY

*Shape Analysis from Point Cloud Data.*
**Dey, Tamal**
4/1/2002 - 3/31/2004
$64,875

*Shape Analysis from Point Cloud Data.*
**Dey, Tamal**
4/1/2002 - 3/31/2005
$93,370

UNIVERSITY OF ALABAMA AT BIRMINGHAM

*ITR-ASP.*
Machiraju, Raghu K.
9/1/2002 - 8/31/2004
$55,000

UNIVERSITY OF CALIFORNIA

*MVAPICH MPI on Infiniband.*
**Panda, Dhabaleswar K.**; Wycoff, Pete (Ohio Supercomputer Center)
6/17/2003 - 9/30/2003
$40,000

UNIVERSITY OF CALIFORNIA -DAVIS

*ITR for Gleaning Insight in Large Time-Varying Scientific & Engineering Data.*
Shen, Han-Wei
9/15/2003 - 8/31/2004
$60,000

UNIVERSITY OF MARYLAND

*NSA Unbalanced Tree Benchmark.*
**Sadayappan, P.**
5/5/2004 - 5/4/2005
$73,547

VERIDIAN-SRL

*Psychoacoustic Evaluation of Computational Multitalker Analysis Systems.*
**Wang, DeLiang (Leon)**
1/1/2003 - 3/31/2004
$21,820

WRIGHT STATE UNIV

*Secure Knowledge Management IIENGA.*
**Chandrasekaran, B.**
4/1/2004 - 5/31/2005
$68,980

*Analysis and Knowledge Extraction from Video & Audio - Task No. 1.7.*
**Davis, James W.**; Parent, Richard E.; Machiraju, R. K.; Wang, DeLiang (Leon)
7/2/2003 - 3/15/2004
$192,551

## FACULTY

### GAGAN AGRAWAL

*Associate Professor*

*B.S., Computer Science & Engineering, Indian Institute of Technology, Kanpur, India, 1991; M.S., Computer Science, University of Maryland, College Park, Maryland, 1994; Ph.D., Computer Science, University of Maryland, College Park, Maryland, 1996*

Department Research Area:
SYSTEMS
Interests: System Software for Parallel and Distributed Environments; Compiler and Runtime Support for Data Intensive Applications; Scalable Data Mining; Performance Modeling and Prediction; and Grid Middleware for Processing Streamlining Data.

### ANISH ARORA

*Full Professor*

*B. Tech., Computer Science and Engineering, Indian Institute of Technology, New Delhi, 1986; M.S., Computer Science, University of Texas, Austin, 1988; Ph.D., Computer Science University of Texas, Austin, 1992.*

Department Research Area:
NETWORKING
Interests: Dependable Distributed and Network Systems; Fault-Tolerance, Security, Timeliness Properties, Scalable Dependability.

### GERALD BAUMGARTNER

*Assistant Professor*

*Dipl.- Ing (equi., to M.S.) Computer Science, Johannes Kepler University, Linz, Austria, 1988; M.S., Computer Science, Purdue University, 1992; Ph.D., Computer Science, Purdue University, 1996.*

Department Research Area:
SOFTWARE ENGINEERING
Interests: design and implementation of domain-specific languages, desktop grids, object-oriented languages, software engineering tools, and embedded systems programming tools.

### DONNA BYRON

*Assistant Professor*

*B.A., French, University of Texas, Arlington, 1986; M.B.A., Information Systems, University of Texas, Arlington, 1987; M.S.C.S., Computer Science and Engineering, University of Texas, Dallas, 1996; Ph.D., Computer Science, University of Rochester, 2002.*

Department Research Area:
ARTIFICIAL INTELLIGENCE
Interests: Language Understanding Software Components and Linguistic Resources for Ubiquitous Computing and Language Enabled VR Environments; Spoken Dialog Interfaces; Pronoun Resolution.

### ROGER CRAWFIS

*Associate Professor*

*B.S., Computer Science and Applied Mathematics, Purdue University, 1984; M.S., Computer Science, University of California, Davis, 1989; Ph.D., Computer Science, University of California, Davis, 1995.*

Department Research Area:
GRAPHICS
Interests: Computer Graphics; Scientific Visualizations; Medical Imaging; and Volume Rendering.

**James W. Davis**

*Assistant Professor*

*B.S., Computer Science, University of Central Florida, 1994; M.S., Media Laboratory, Massachusetts Institute of Technology, 1996; Ph.D., Media Laboratory, Massachusetts Institute of Technology, 2000.*

Department Research Area:
ARTIFICIAL INTELLIGENCE
Interests: Computer Vision; Automatic Visual Surveillance and Monitoring; Human Activity Recognition; Video Understanding; and Human-Computer Interaction.

**Tamal K. Dey**

*Associate Professor*

*B.E., Electronics, Jadavpur University, 1985; M.Tech., Computer Science, Indian Institute of Science-Bangalore, 1987; Ph.D., Computer Science, Purdue University, 1991.*

Department Research Area:
GRAPHICS
Interests: Computational Geometry; Geometric Modeling; Shape Modeling.

**Hakan Ferhatosmanoglu**

*Assistant Professor*

*B.S., Computer and Information Science, Bilkent University, Turkey, 1997; Ph.D., Computer Science, University of California, Santa Barbara, 2001.*

Department Research Area:
SYSTEMS
Interests: Bioinformatics; Data Streams; High Performance Databases for Multi-dimensional and Scientific Applications, and Multimedia and Spatial Data.

**Eric Fosler-Lussier**

*Assistant Professor*

*B.A., Linguistics, University of Pennsylvania, 1993; B.A.S., Cognitive Science, University of Pennsylvania; 1993; Ph.D., Computer Science, University of California, Berkeley, 1999*

Department Research Area:
ARTIFICIAL INTELLIGENCE
Interests: Automatic Speech Recognition, Corpus-based Computational Linguistics, Spoken Dialogue Systems, Semantics of Path Planning

**Eitan M. Gurari**

*Associate Professor*

*B.S., Physics, Technion-Israel Institute of Technology, Israel, 1971; M.S., Computer Science, Technion-Israel Institute of Technology, Israel, 1974; Ph.D., Computer Science, University of Minnesota, 1978.*

Department Research Area:
SOFTWARE ENGINEERING
Interests: Hypertext Production and Manipulation; Theoretical Computer Science; Literate Programs; and Programmed Figures.

**Ten-Hwang Lai**

*Full Professor*

*B.S., Mathematics, Fu-Jen University, Taiwan, 1972; M.S., Mathematics, Fordham University, 1976; Ph.D., Computer Science, University of Minnesota, 1982.*

Department Research Area:
NETWORKING
Interests: Wireless Networks; Mobile Computing; and Parallel and Distributed Computing.

**Mario Lauria**

*Assistant Professor*

*Laurea degree, Electrical Engineering, University of Naples, 1992; M.S., University of Illinois, Urbana-Champaign, 1996; Ph.D., Electrical Engineering and Computer Science, University of Naples, 1997.*

Department Research Area:
SYSTEMS
Interests: Cluster Architecture; Parallel I/O and Cluster File Systems; Bioinformatics; Biologically inspired Grid computing; Biological Computation.

**David Lee**

*Ohio Board of Regents Distinguished Professor*

*M. A., Mathematics, Hunter College, City University of New York, 1982; M. S. and Ph. D., Computer Sciences, Columbia University, 1985*

Department Research Area:
NETWORKING

Interests: Data communications and networking: foundation, reliability and applications.

**Ming-Tsan (Mike) Liu**

*Full Professor*

*B.S.E.E., Electrical Engineering, National Cheng Kung University, Taiwan, 1957; M.S.E.E., Electrical Engineering, University of Pennsylvania, 1961; Ph.D., Electrical Engineering, University of Pennsylvania, 1964.*

Department Research Area:
NETWORKING

Interests: Computer Architecture and Networking; Parallel and Distributred Computing; Wireless and Mobile Computing; and Protocol Engineering and Design.

**Timothy J. Long**

*Associate Professor*

*B.S., Education, University of Cincinnati, 1972; B.A., Mathematics, Unviersity of Cincinnati, 1972; M.S., Computer & Information Science, The Ohio State University, 1974; Ph.D., Computer Science, Purdue University, 1978.*

Department Research Area: SOFTWARE ENGINEERING
Interests: Design, Implementation, Verification, Testing and Application of Reusable Software Components.

**Raghu Machiraju**

*Assistant Professor*

*B.Sc., Electrical Engineering, Delhi University, 1982; M.S., Automation, Indian Institute of Science, Bangalore, 1984; Ph.D., Computer Science, The Ohio State University, 1996.*

Department Research Area:
GRAPHICS

Interests: Graphics; Visualization; Scientific Computing; and Signal Processing.

**Sandra A. Mamrak**

*Full Professor*

*B.S., Mathematics, Notre Dame College of Ohio, 1967; M.S., Computer Science, University of Illinois, Urbana-Champaign, 1973; Ph.D., Computer Science, University of Illinois, Urbana-Champaign, 1975.*

Department Research Area:
SOFTWARE ENGINEERING

Interests: Web-based Information Systems Architecture; Object-Oriented Frameworks Architecture.

**Dhabaleswar K. Panda**

*Full Professor*

*B.S., Electrical Engineering, Indian Institute of Technology, Kampur, India, 1984; M.S., Electrical and Computing Engineering, Indian Institute of Science, Bangalore, India, 1986; Ph.D., Computer Engineering, University of Southern California, Los Angeles, 1991.*

Department Research Area:
SYSTEMS

Interests: Network-based Computing; Interprocessor Communication; Parallel Computer Architecture; High Performance Networking; Clustered and Heterogeneous Systems; and High-performance Computing.

**Richard E. Parent**

*Associate Professor*

*B.S., Computer Science and Mathematics, University of Dayton, 1972; M.S., Computer Science, The Ohio State University, 1973; Ph.D., Computer Science, The Ohio State University, 1977.*

Department Research Area:
GRAPHICS

Interests: Computer Graphics; Computer Animation; Modeling and Animating Human Figure, Tracking Human Figures in Video

**Srinivasan Parthasarathy**

*Assistant Professor*

*B.E., Electrical Engineering, University of Roorkee, India, 1992; M.S., Electrical Engineering, University of Cincinnati, 1994; M.S., Computer Science, University of Rochester, 1996; Ph.D., Computer Science, University of Rochester, 2000.*

Department Research Area:
SYSTEMS

Interests: Data Mining; Parallel & Distributed Computing and Systems; Bioinformatics.

**Atanas (Nasko) Rountev**

*Assistant Professor*

*B.S., Computer Science & Engineering, Technical University, Sofia, Bulgaria, 1995; M.S., Computer Science, Rutgers University, 1999; Ph.D., Computer Science, Rutgers University, 2002.*

Department Research Area:
SOFTWARE ENGINEERING

Interests: Static and Dynamic Program Analysis; Software Testing; Programming Languages and Compilers; Object-Oriented Software

**Ponnuswamy Sadayappan**

*Full Professor*

*B.S., Electrical Engineering, Indian Institute of Technology, Madras, India, 1977; M.S., Electrical Engineering, State of University of New York, Stony Brook, 1978; Ph.D., Electrical Engineering, State of University of New York, Stony Brook, 1983.*

Department Research Area:
SYSTEMS

Interests: Scheduling and Resource Management; and Performance Optimizations for High-Performance Scientific Computing.

**Joel H. Saltz, M.D.**

*Chair of the*
*Department of Biomedical Informatics*
*Joint Appointment - Full Professor*

*B.S., Mathematics and Physics, University of Michigan, 1977; M.S., Mathematics, University of Michigan, 1978; M.D., Ph.D., Computer Science, Duke University, 1985.*

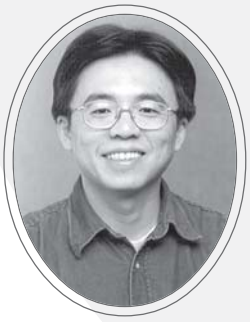
Department Research Area:
BIOMEDICAL INFORMATION

Interests: Bioinformatics; Data Cacheing; Processing and Parallel I/O

**Han-Wei Shen**

*Assistant Professor*

*B.S., Computer Science, National Taiwan University, 1988; M.S., Computer Science, State University of New York, Stony Brook, 1992; Ph.D., Computer Science, University of Utah, 1998.*



Department Research Area:
GRAPHICS

Interests: Computer Graphics; Scientific Visualization; Large Scale Time-Varying Data, Remote Data Exploration; Volume Rendering.

**Prasun Sinha**

*Assistant Professor*

*B. Tech., Computer Science and Engineering, Indian Institute of Technology, Delhi, India, 1995; MS, Computer Science, Michigan State University, 1997; PhD, Computer Science, University of Illinois, Urbana-Champaign, 2001.*

Department Research Area:
WIRELESS NETWORKING

Interests: Sensor Networking; Ad-hoc Networking; Mobile Computing; Wireless Networking

**PAUL A.G. SIVILOTTI**

*Assistant Professor*

*B.Sc.H., Computing Science, Mathematics & Biochemistry, Queen's University, Ontario, Canada, 1991; M.S., Computer Science, California Institute of Technology, 1993; Ph.D., Computer Science, California Institute of Technology, 1998.*

Department Research Area:
SOFTWARE ENGINEERING

Interests: Distributed Systems; Software Engineering; and Tool-based Support for Testing Component Implementations.

**NEELAM SOUNDARAJAN**

*Associate Professor*

*B.S., Physics, Bombay Unviersity, India, 1970; M.S., Physics, Bombay University, India, 1972; Ph.D., Computer Science, Bombay University, India, 1978*

Department Research Area:
SOFTWARE ENGINEERING

Interests: Software Engineering; Reasoning about Program Behavior; Specification, Verification, Testing.

**KENNETH J. SUPOWIT**

*Associate Professor*

*A.B., Linguistics, Cornell University, 1978; Ph.D., Computer Science, University of Illinois, 1981.*

Department Research Area:
SOFTWARE ENGINEERING

Interests: Combinational Algorithms

**DELIANG (LEON) WANG**

*Full Professor*

*B.S., Computer Science, Beijing University, 1983; M.S., Computer Science, Beijing University, 1986; Ph.D., Computer Science, Unviersity of Southern California, Los Angeles, 1991.*

Department Research Area:
ARTIFICIAL INTELLIGENCE

Interests: Machine Perception and Neurodynamics

**BRUCE W. WEIDE**

*Full Professor*

*B.S.E.E., Electrical Engineering, University of Toledo, 1974; Ph.D., Carnegie Mellon University, 1978.*

Department Research Area:
SOFTWARE ENGINEERING

Interests: Component-Based Software

**Rephael Wenger**

*Associate Professor*

*B.S.E., Computer Science, Princeton University, 1984; Ph.D., Computer Science, McGill University, 1988.*

Department Research Area:
COMPUTER GRAPHICS

Interests: Computational Geometry; Computer Visualization; Isosurface Reconstruction; and Image Processing.

**Dong Xuan**

*Assistant Professor*

*B.S., Electronic Engineering, Shanghai Jiao Tong University, China, 1990; M.S., Electronic Engineering, Shanghai Jiao Tong University, 1993; Ph.D., Computer Engineering, Texas A&M University, 2001.*

Department Research Area:
NETWORKING

Interests: Scalable QoS Guarantees; Network Security; and Application Layer Networking

**Stuart H. Zweben**

*Chairperson of Computer Science & Engineering*
*Full Professor*

*B.S., Mathematics, City College of New York, 1968; M.S., Statistics and Computer Science, Purdue University, 1971; PhD., Computer Science, Purdue University, 1974.*

Department Research Area:
SOFTWARE ENGINEERING

Interests: Reusable Software; Quality Evaluation; and Engineering Education.

# VISTING ASSISTANT PROFESSORS

**RAJIV RAMNATH**

*B.Tech., Indian Institute of Technology, New Delhi, India, 1981; M.S., Computer & Information Science, The Ohio State University, 1983; Ph.D., Computer & Information Science, The Ohio State University, 1988*

Research Interests: Workflow and Work-management Systems; Complex Enterprise Systems; Distributed Dystems; Systems Integration; Software Engineering; Enterprise Architecture; Enterprise Strategic Planning

**MICHAEL P. STOVSKY**

B. S., Computer & Information Science, The Ohio State University, 1981; M.S., Computer & Information Science, The Ohio State University, 1985; Ph.D., Computer & Information Science, The Ohio State University, Columbus, Ohio, 1990.

Research Interests: Software Engineering, Software Quality, Software Process Development Models, Software Development Drocess Evaluation and Improvement, Quality Systems, Risk Management, Licensing and Certification of Software Practitioners.

# EMERITUS APPOINTMENTS

## PROFESSOR EMERITUS

Balakrishnan Chandrasekaran
Charles A. Csuri
Mervin E. Muller

## ASSOCIATE PROFESSOR EMERITUS

Clinton R. Foulk
Douglas S. Kerr
William F. Ogden
Anthony E. Petrarca

# ADJUNCT FACULTY

Kikuo Fujimura
Raj Jain

# JOINT APPOINTMENTS

## PROFESSOR

Kenneth J. Breeding; Dept. of Electrical & Computer Engineering
Chris Brew, Dept. of Linguistics
Wayne Carlson; Dept. of Industrial Design, Chair
Harvey Friedman; Dept. of Mathematics.
Farukh Kahn, Dept. of Electrical & Computer Engineering

# RESEARCHERS

**BALAKRISHNAN CHANDRASEKARAN**

*Senior Research Scientist*

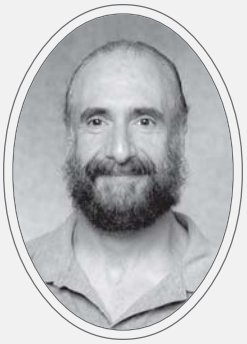
*B.E., Electrical Engineering, A. C. College of Engineering and Technology, Madras University, India, 1963; Ph.D., Electrical Engineering, Moore School of Electrical Engineering, University of Pennsylvania, 1967*

Research Interests:
ARTIFICIAL INTELLIGENCE

**JOHN JOSEPHSON**

*Research Scientist*

*B.S. Mathematics The Ohio State University 1968; M.S. Mathematics The Ohio State University 1970; Ph.D. Philosophy The Ohio State University 1982*



Research Interests:
ARTIFICIAL INTELLIGENCE
Computational Epistemology, Abductive Inference, Causal Reasoning, Multiple Criteria Decision Making, Perception, Diagnosis, Theory Formation, Logic of Investigation and Foundations of Science.

**PAOLO BUCCI**

*Senior Research Associate*

*Laurea in Science Dell' Informazione, Universita' Degli Studi di Milano, Italy, 1986; M.S., Computer & Information Science, The Ohio State University, 1989; Ph.D., Computer & Information Science, The Ohio State University, 1997.*

Research Interests:
SOFTWARE ENGINEERING, COMPUTER SCIENCE EDUCATION

# LECTURERS

**GOJKO BABIC**

*Senior Lecturer*

*B.S., Electric Engineering, University of Sarajevo, 1972; M.S., Computer Science, Florida Institute of Technology, 1975; Ph.D., Computer Science, The Ohio State University, 1978.*

Research Interests:
Computer Networking and Security

**BETTINA BAIR**

*Lecturer*

*B.S., Business Administration, University of Phoenix, 1987; M.B.A., University of Denver, 1992.*

Research Interests:
Women in Computing; Effects of Technology on Business and Culture; and Computer Education.

**DEBBY GROSS**

*Lecturer*

*B.S., Chemical Engineering, Massachusetts Institute of Technology, 1977; M.B.A., University of Chicago, 1987.*

Research Interests:
Business Technology and Applications.

**WAYNE HEYM**

*Senior Lecturer*

*B.Phil., Miami University, 1978; M.S., Cornell University, 1980; M.S., Computer & Information Science, The Ohio State University, 1989; Ph.D., Computer & Information Science, The Ohio State University, 1995.*

Research Interests:
Software Engineering and Computing Education

**MARY BETH LOHSE**

*Senior Lecturer*

*B.A., Mathematics, The Ohio State University, 1973; M.S., Computer & Communication Sciences, The University of Michigan, 1975.*

Research Interests:
Software Engineering; Database Systems; and Introductory Architecture.

**H. DAVID MATHIAS**

*Senior Lecturer*

*B.S., Computer Science, University of Delaware, 1991; M.S., Computer Science, Washington University, 1993; D.Sc., Computer Science, Washington University, 1996.*

Research Interests:
Computational Learning Theory.

## PART-TIME LECTURERS

Moez Chaabouni
Mike Compton
Matt Curtin
Sandy Farrar
Steve Gomori
Charles Giles
John Heimaster
Robert Joseph
Perumal Krishnasamy
Igor Malkiman
Michelle Mallon
Robert Mathis
Prasad Mikkilineni
Doyt Perry
Al Stutz
Ron Salyers
Dong Zhou

## LOHSE RETIREMENT

March, 2004, marked the end of era. In 1981, Dr. Stu Zweben hired Mary Beth Lohse as a full-time lecturer on a three year contract with option for renewal. Twenty-three years later, she decided to retire. And she will be missed. With her cheerful attitude, it has been a pleasure working with Mary Beth. The Department wishes her and her husband, John, (former CSE Ph.D. candidate, 1979) good fortune with their future endeavors in winemaking.

*Reminding her of the inconsistent temperatures frequently found within Dreese Labs, Stu Zweben gives Mary Beth a case of the giggles when he presents her with her weather station.*

*Mary Beth shares her future plans for the farm she and John bought. Her rapt audience is (seated, left) Rick Wagner and his wife, Natasha, (seated, right) Mike Compton, Marty Marlatt (hidden, right) and (standing, left) Betty and Tony Petrarca.*

*Enjoying the festivies are (left row, front to back) Bill Ogden, Ruth Smilan, John Lohse, Rochelle Zweben, (right, front to back) Doug Kerr, Wayne Heym and Larry Stefanich.*

# Advising & Administration

## Undergraduate Office for Academic Advising

The Undergraduate Office for Academic Advising is responsible for assisting computer science students in the College of Engineering and the Colleges of the Arts and Sciences. Typical advising sessions can be as simple as university resource referring or academic course schedule planning to more complex work with job search strategies or career mapping.

The Undergraduate advisors also assign students to a faculty advisor upon admission to the major. The faculty advisors are then responsible for assisting students in choosing appropriate technical electives in the field and answering questions regarding graduate school and the field of computer science. They will also approve the advisee's curriculum for graduation.

### Peg Steele, Coordinator of Academic Advisement

Ms. Steele joined the department during winter quarter, 1998. She holds a BA in French from Westminster College in Pennsylvania and an MA in College Student Personnel from Bowling Green State University in Ohio. Peg sits on the executive committee for the Academic Advising Association of Ohio State. She will serve as the Co Chair Pre Conference Workshops, NACADA 10/04.

She has presented at regional and national conferences:
P. Steele, J. Grube Vestal, P. Gardner, "Keeping the Wind in Our Sails: Navigating the Cross Winds of Advising," NACADA Regional Conference, Chicago, IL 4/04.
P. Steele, J. DeGraaf, A. Merrill, L. Martensen, "Students and Academic Advisors: Partners in Academic Success," OSU Advising Conference, 4/04.
P. Steele, J. Grube Vestal, "Strategies of Academic Advisor Success: Time, Education Excitement, Assessment, Stamina," NACADA National Conference, Dallas, TX, 10/03; Ohio College Personnel Association (OCPA)/Ohio Association for Student Personnel Administrators (OASPA), Columbus, OH 1/04.
P. Steele, G. Steele, M. Miller, "How has Technology Shaped the Delivery of Academic Advising on Your Campus? Views from Advisors, Admissions, and Registrar's Staffs," NACADA National Conference, Dallas, TX, 10/03.

### Nikki Strader, Academic Advisor & Staff Assistant

Nikki joined the department in November 2003. She holds a B.Mus. in music history and applied double bass from West Virginia University, an M.Mus. in musicology from Indiana University, and a Ph.D. in music history/literature from The Ohio State University. Prior to joining CSE, she worked for a Columbus-based music software company. She has also served as an academic counselor for pre-majors in nursing and allied medical professions and occasionally teaches as a lecturer for the School of Music at Ohio State.

### Ming Liu, Graduate Administrative Assistant

Ming Liu received the B.E. in computer science and technology from Tsinghua University, Beijing, China in 1996 and the M.S. in computer and information science from The Ohio State University, Columbus, OH, in Autumn 1997. He is a Ph.D. candidate in the Department of Computer and Information Science.

While doing his research in wireless communication and multimedia systems, he has also been working in the undergraduate advising office since Winter 2000.

### Robert M. Weekley, Graduate Administrative Assistant

Robert M. Weekley received his B.S.C.S.E. from Ohio State in Spring 2003. He is now working toward a Masters of Science degree in Computer Science (expected Spring 2005). His major focus is on Computer Animation & Graphics with an interest on how Artists utilize and benefit from related applications. This year he has taught freshman survey and he has also been working in the undergraduate advising office since Autumn 2003.

KATHRYN "KITTY" REEVES, INSTRUCTIONAL DEVELOPMENT SPECIALIST

One of the most challenging positions within CSE is that of Instructional Development Specialist. Through the stress of being both staff member and lecturer, Kathryn "Kitty" Reeves works with competence and grace. She introduces new graduate students to the policies and procedures of the University and Department, assigns course teaching assistants and graders, assists the course coordinators and GTA's training and monitors the progress of GTAs in the department. Each quarter she handles the department scheduling of classes. Kitty serves on both the curriculum and graduate studies committees as well as teaching sections of CSE 200 and 314.

Ms. Reeves graduated from Auburn University, in Auburn, Alabama in December 1986 with a Bachelor of Computer Engineering and in August 1991 with a Master of Science in Computer Science.

## ADMINISTRATIVE STAFF

The Administrative Staff has once again shown its professionalism and strength. Lori Graci maintained a positive flow in the Fiscal Office, an increasingly difficult task in the current economic times. Elizabeth O'Neill managed the incoming graduate student applications and exiting graduation applicants. Qunicy Howard was kept on his toes by the ever expanding multiplicity of research grants. Catrena Collins made sure that everyone was paid and that the faculty had its necessary class texts. Marty Marlatt has kept the Chair's office as well as the entire building running efficiently. Ewana Witten has kept everyone's travel itineraries moving and, with Tom Fletcher, dealt with everyone's keys, mail and copy needs. Tamera Cramer has posted web pages, photographed events and coordinated faculty search applications.

*Lorie Graci explains to Hunter, then a Canine Companion for Independence puppy-in-training, that he's a real dog and the one in her hand isn't. Hunter was successfully raised by Marty Marlatt and after advanced training has gone on to become a skilled companion to a little girl in Pennsylvania.*


*CCI Puppy in Training, Preston P. Puppy, meets, greets and wins the heart of Brutus Buckeye.*

# COMPUTING SERVICES

The CSE Computing Services staff provides computing support to the Department of Computer Science and Engineering. This support is provided to the Department's faculty, graduate students, undergraduate majors, non-majors, and staff. The staff provides hardware and software support for over 3000 users each quarter. They also design, configure, and maintain various software tools and hardware to support a unified computing environment. Their mission at Ohio State is to bridge the gap between the educator and the computer user by providing a user-friendly, stable computing environment.

The CSE computing environment consists of two main operating systems. Sun Solaris is provided to CSE users via Sun quad processor login servers and is primarily used in support of our introductory programming, majors, and graduate courses. The Windows platform is provided for our service level courses through Dell quad processor servers that allow multiple users to simultaneously use the same server. Each user's desktop, primarily personal computers, is connected via a high-speed Ethernet network. Connected through this network are approximately six hundred desktop devices, including a variety of specialty labs and departmental labs. Wireless connectivity to the Department's network is available for the faculty and students majoring in Computer Science and Engineering.

The departmental labs are in Caldwell Laboratory, Bolz Hall, and Baker Systems. These labs support both majors and service level courses. Caldwell, the Department's largest computing lab, consists of a 20 seat instructional room which was upgraded to PCs last summer. Caldwell also has a 100 seat open area, and a 40 seat instructional room. Caldwell and Baker Labs will be upgraded to PCs this summer (2004).

The UPS (uninterruptible power supply) has been upgraded. This gives the Department's computer room and research computer room added protection against an unplanned power outage.

## Dr. Arora goes to Washington

*In March, 2004, Dr. Anish Arora and two of his research asssitants travelled to Washington, D.C., to participate with Intel in a technology demonostration on Capitol Hill. Members of both houses as well as representatives from the Armed Services, various committees and government organizations stopped by.*

*Sandip Bapat (left) and Prabal Dutta (right) pose next to the Capitol Hill display of their research.*

*At the Capitol Hill demonostration, Anish Arora (right) talks with Richard Stoddard (left), OSU's Assistant Vice President for Government Relations and Dean Freeman (center) of Math and Physical Sciences.*

# EXTERNAL ADVISORY BOARD

The external Advisory Board was established in 1987. The members are Department Chair appointees and while some of the members are alumni, it is not a requirement. The only prerequisite is a spirit of achievement, a history of accomplishment and a desire to assist the CSE Department to fulfill its mission. The Board's primary purpose is providing the Department with valuable input concerning computing trends and proposing new directions which can enhance the department's growth.

This year's members are:

### Dr. David Cohen, Board President

Dr. David Cohen, alumnus ('77), has over 30 years of experience in software development and systems engineering. He is the co-founder and President of sente.com, Inc. Recently, sente conducted over 100 software program assessments around the world and was able to recover over 90% of the original investments. During the last 17 years sente deployed a requirements validation platform to improve return on software investments (ROI) and to extend the life cycle of legacy systems. He has authored many publications in the area of database security, distributed database management for new network services, software reliability, systems engineering, software development and operations center productivity. During the last 5 years David explored over sixty countries for hiking and fun, documenting the trips with over 200K pictures.

### Dr. Richard Baum

Dr. Baum is Vice President, Server Technology for the IBM Server Group where he leads strategy, architecture and design efforts for future server systems. He was named an IBM Fellow in 1991 and received his Ph.D. from Ohio State in 1975.

### Mr. James Cates

James E. Cates has been a member of the CSE Advisory Board for over ten years. He is a Masters graduate of the OSU/CSE department and has received the OSU distinguished Alumni Award. Mr. Cates has worked for technology leaders such as IBM, where he spent most of his early career, Silicon Graphics Corporation, Synopsys Corporation and Information Technology Solutions Corporation. His current position is Chief Information Officer, Vice President of Information Systems and Corporate Process Officer for Brocade Communications Systems, Inc.

### Dr. Bruce Flinchbaugh

As TI Fellow and manager of video and image processing in the DSP R&D Center at Texas Instruments, Dr. Flinchbaugh is responsible for the development of video, imaging and graphics algorithms, software and architectures for several TI semiconductor products. His team is developing H.264 advanced video coding, next-generation video standards, and OpenGL ES 3-D graphics technology for digital cameras, cellular phones and PDAs. Dr. Flinchbaugh received his OSU-CSE Ph.D. in 1980.

### Mr. Bryan K. Pflug

Located in Seattle, Mr. Pflug is Director of Embedded Software at Boeing's company offices. He is responsible for coordinating embedded software activities, business strategies, and improvement investments across the company's five business units (Air Traffic Management, Aircraft and Missiles, Connexion, Commercial Airplanes, and Space and Communications). Within Boeing, embedded software consists of the mission software that is integral to the operation of company products – aircraft, weapons, spacecraft, and related systems. He is a 1977 Masters graduate.

### Dr. Arthur Pyster

Dr. Pyster is the Deputy Chief Information Officer for the Federal Aviation Administration. He ensures that FAA's information systems and resources best support the agency's business, paying special attention to information management, information security, and e-government. He received his Ph.D. from OSU in 1975.

Mr. Alexander Trevor

Mr. Trevor is founder and president of Nuvocom, a technology consulting company specializing in prior-art research for Internet-related patents. He is a Director of Applied Innovation and CMHC Systems, both in Dublin, OH. He was CTO and EVP of CompuServe until 1996, and has been a member of the CSE Advisory Board since 1990.

Mr. Dennis Yun

A Masters Graduate of the Department, Mr. Yun is Information Systems Engineering Vice President with Battelle, directing the system integration and consulting activities of over 280 computer, management, and functional specialists performing integration, planning, analysis, design, programming, and implementation of computer-based information management systems. Dennis is also a member of Battelle's Technical Council responsible for investment deCSEions to maintain Battelle's long-term technology and competitive edge in the Information Technology field.

## The Annual Autumn Kick-Off Party!

*Kaykay, the clown, takes a break from face painting and ballon sculpting to pose with soem of the CSE children.*

*SoFia Sivilotti, above, and Elliott Fosler-Lussier make their debut appearances at a CSE social event. Sophia is held by her mother, Linda, with proud papa, Paul standing by. Dad, Eric, holds Elliott while mom, Danielle shows off the balloon the clown make him.*

*Department grad students indulge in their favorite activities: eating free food and talking!*

The Department of Computer Science and Engineering is 36 years old. The faculty and staff members of CSE are proud of our many achievements and continually stride to improve the quality of our teaching and level of service for the students, especially during times of economic change. During the past ten years, we have taught nearly 141,000 young men and women. The chart below reflects how we have changed over those years.

| | AU 1993 | AU 1994 | AU 1995 | AU 1996 | AU 1997 | AU 1998 | AU 1999 | AU 2000 | AU 2001 | AU 2002 | AU 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Faculty* | | | | | | | | | | | |
| *Full Time* | 34.5 | 32.5 | 32.5 | 31.5 | 31.5 | 30 | 28.5 | 29 | 30 | 29 | 31 |
| *Part Time* | 4.25 | 7.25 | 6.25 | 7.25 | 12.75 | 10.25 | 10.25 | 9 | 10.35 | 8.8 | 8.8 |
| *Course Enrollment/ Autumn Quarter* | 2,963 | 3,121 | 3,240 | 3,507 | 3,630 | 4,124 | 3,693 | 3,977 | 4,103 | 4,076 | 3,650 |
| | 93-94 | 94-95 | 95-96 | 96-97 | 97-98 | 98-99 | 99-00 | 00-01 | 01-02 | 02-03 | 03-04 |
| *Students Taught* | 10,261 | 11,383 | 11,138 | 12,140 | 13,098 | 14,230 | 14,278 | 14,278 | 14,006 | 13,878 | 12,208 |

CSE offers respected programs of courses for both undergraduate and graduate students. We are proud of the students we teach and the two programs offer a young computer scientist the opportunity to experience many areas of the discipline.

## UNDERGRADUATE PROGRAM

The Department offers undergraduate degrees through three colleges: Engineering, Arts and Sciences and Business. Each of these degree programs is carefully tailored to provide the perspective on computing appropriate to the college in which it is offered. Students from any college may also earn a minor in Computer Science and Engineering (CSE).

Undergraduate students with exceptional ability and potential are encouraged to enroll in the Undergraduate Honors Program courses, with the expectation that they will find additional challenges and stimulation to enhance their technical skills and broaden their knowledge of computer science. CSE participates in the Honors Program by offering a two-course sequence: CIS H221 Software Development using Components and CIS H222 Development of Software Components.

| | AU 1993 | AU 1994 | AU 1995 | AU 1996 | AU 1997 | AU 1998 | AU 1999 | AU 2000 | AU 2001 | AU 2002 | AU 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Undergrad Students Enrolled* | 930 | 886 | 881 | 965 | 1,124 | 1,358 | 1,519 | 1,556 | 1,741 | 1,562 | 1,209 |
| | 93-94 | 94-95 | 95-96 | 96-97 | 97-98 | 98-99 | 99-00 | 00-01 | 01-02 | 02-03 | 03-04 |
| *B.A., B.S. Degrees Awarded* | 246 | 229 | 217 | 214 | 227 | 259 | 296 | 297 | 277 | 335 | 274 |

## Graduate Program

The mission of The Ohio State University Department of Computer Science and Engineering Graduate Program is to develop researchers, educators and practicing professionals with advanced skills in computer science and engineering. Students can pursue either a Master's degree or Doctorate or both. Students intending to pursue a Ph.D. without first obtaining a Master's degree may apply to the Direct Ph.D. Track. The graduate program has approximately thirty-nine faculty and lecturers, seventy-five Master's students and sixty Ph.D. students. The program admits about fifty new students each year. Master and Doctorate degrees are offered with an emphasis on specialized research areas. Additionally, students may pursue a dual masters degree in CIS and Biomedical Communications.

During the 2002-2003 academic year, we received 1,518 applications for graduate admissions to the Autumn 2003 quarter. The Department accepted 83 for admission and 48 of those joined the Department; 35 being supported. Graduate student enrollment, new and in process, was 174. Research grants and departmental funds supported 149 of these students. Entering graduate students scores on the general graduate record examination averaged as: verbal = 622; quantitative = 763; analytical = 750, or 4.81 according to the new standards. Their mean grade point average was 3.8.

| | AU 1993 | AU 1994 | AU 1995 | AU 1996 | AU 1997 | AU 1998 | AU 1999 | AU 2000 | AU 2001 | AU 2002 | AU 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Graduate Students Enrolled* | 176 | 174 | 165 | 175 | 155 | 169 | 160 | 157 | 159 | 164 | 174 |

| | 93-94 | 94-95 | 95-96 | 96-97 | 97-98 | 98-99 | 99-00 | 00-01 | 01-02 | 02-03 | 03-04 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Graduate Student Applications* | 427 | 439 | 298 | 304 | 362 | 536 | 703 | 857 | 940 | 1,542 | 1,508 |
| *Graduate Students Supported* | 90 | 80 | 75 | 101 | 128 | 119 | 111 | 130 | 175 | 156 | 149 |
| *M.S. Degrees Awarded* | 55 | 31 | 40 | 57 | 56 | 64 | 58 | 36 | 19 | 30 | 31 |
| *Ph.D. Degrees Awarded* | 13 | 21 | 9 | 11 | 12 | 10 | 10 | 8 | 4 | 7 | 7 |
| *Ph.D. Degrees (cumulative)* | 234 | 255 | 264 | 275 | 287 | 297 | 307 | 314 | 318 | 325 | 332 |

# COURSE LISTING

| Course No. & Title | Credits |
|---|---|
| 100 -------- Introduction to Computing Technology | 3 |
| 101 -------- Computer Assisted Problem Solving | 4 |
| 102 -------- Introduction to the Internet and World-Wide Web | 3 |
| 200 -------- Computer Assisted Problem Solving for Business | 5 |
| 201 -------- Elementary Computer Programming | 4 |
| 202 -------- Introduction to Programming and Algorithms for Engineers and Scientists | 4 |
| 214 -------- Data Structures for Information Systems | 4 |
| 221 -------- Software Development Using Components (honors section offered once a year) | 4 |
| 222 -------- Development of Software Components (honors section offered once a year) | 4 |
| 230 -------- Introduction to C++ Programming | 4 |
| 314 -------- Business Programming with File Processing | 4 |
| 321 -------- Case Studies in Component-Based Software | 4 |
| 360 -------- Introduction to Computer Systems | 4 |
| 459.12 ---- The UNIX Programming Environment | 1 |
| 459.21 ---- Programming in C | 1 |
| 459.22 ---- Programming in C++ | 1 |
| 459.23 ---- Programming in Java | 1 |
| 459.31 ---- Programming in LISP | 1 |
| 459.41 ---- Programming in COBOL | 1 |
| 459.51 ---- Programming in PERL | 1 |
| 489 -------- Professional Practice in Industry | 2 |
| 494I ------- Introduction to Information Security | 3 |
| 502 -------- Object-Oriented Systems Analysis | 4 |
| 541 -------- Elementary Numerical Methods | 3 |
| 560 -------- Systems Software Design, Development and Documentation | 5 |
| 581 -------- Interactive Computer Graphics | 4 |
| 601 -------- Social and Ethical Issues in Computing | 1 |
| 612 -------- Introduction to Cognitive Science | 3 |
| 616 -------- Object-Oriented Systems Analysis | 4 |
| 621 -------- Introduction to High-Performance Computing | 3 |
| 625 -------- Introduction to Automata and Formal Languages | 3 |
| 630 -------- Survey of Artificial Intelligence I: Basic Techniques | 3 |
| 655 -------- Introduction to the Principles of Programming Languages | 4 |
| 660 -------- Introduction to Operating Systems | 3 |
| 662 -------- Operating Systems Laboratory | 3 |
| 670 -------- Introduction to Database Systems I | 3 |
| 671 -------- Introduction to Database Systems II | 3 |
| 675.01 ---- Introduction to Computer Architecture | 4 |
| 675.02 ---- Introduction to Computer Architecture | 4 |
| 676 -------- Microcomputer Systems | 3 |
| 677 -------- Introduction to Computer Networking | 3 |
| 678 -------- Internetworking | 3 |
| 679 -------- Introduction to Multimedia Networking | 3 |
| 680 -------- Introduction to Analysis of Algorithms & Data Structures | 3 |
| 681 -------- Introduction to Computer Graphics | 4 |
| 682 -------- Computer Animation | 4 |

| Course No. & Title | Credits |
|---|---|
| 693 -------- Individual Studies | 1-5 |
| 694I ------- Computer Vision for Human-Computer Interaction | 3 |
| 721 -------- Introduction to Parallel Computing | 4 |
| 725 -------- Computability and Unsolvability | 3 |
| 727 -------- Computational Complexity | 3 |
| 730 -------- Survey of Artificial Intelligence II: Advanced Topics | 3 |
| 731 -------- Knowledge-Based Systems | 4 |
| 732 -------- Computational Linguistics | 3 |
| 737 -------- Proseminar in Cognitive Science | 2 |
| 739 -------- Knowledge-Based Systems in Engineering | 3 |
| 741 -------- Comparative Operating Systems | 3 |
| 752 -------- Techniques for Simulation of Information Systems | 3 |
| 755 -------- Programming Languages | 3 |
| 756 -------- Compiler Design and Implementation | 4 |
| 757 -------- Software Engineering | 3 |
| 758 -------- Software Engineering Project | 4 |
| 760 -------- Operating Systems | 3 |
| 762 -------- Advanced Operating Systems Laboratory | 3 |
| 763 -------- Introduction to Distributed Computing | 3 |
| 768 -------- Applied Component-Based Programming for Engineers and Scientists | 3 |
| 770 -------- Database Systems Implementation | 3 |
| 772 -------- Information System Project | 4 |
| 775 -------- Computer Architecture | 3 |
| 776 -------- Hardware/Software Interface Design Project | 4 |
| 777 -------- Telecommunication Networks | 3 |
| 778 -------- Computer Aided Design and Analysis of VLSI Circuits | 4 |
| 779 -------- Introduction to Artificial Neural Network Methods | 3 |
| 780 -------- Analysis of Algorithms | 3 |
| 781 -------- Introduction to 3D Image Generation | 4 |
| 782 -------- Advanced 3D Image Generation | 3 |
| H783 ------ Honors Research | 1 |
| 784 -------- Geometric Modeling | 3 |
| 788 -------- Intermediate Studies in Computer Science and Engineering | 1-5 |
| 793 -------- Individual Studies | 1-5 |
| 794 -------- Group Studies | 1-5 |
| 794R ------ Applied Enterprise Distributed Computing for Engineers & Scientists | 3 |
| 875 -------- Advanced Computer Architecture | 3 |
| 885 -------- Seminar on Research Topics in Computer Science and Engineering | 1 |
| 888 -------- Advanced Studies in Computer Science and Engineering | 1-5 |
| 894U ------ Applied Use Case Driven Object-Oriented Analysis & Design for Engineers & Scientists | 3 |
| 889 -------- Advanced Seminar in Computer Science and Engineering | 2 |
| 999 -------- Research | 1-18 |

# HOSTED TALKS & PRESENTATIONS

**Guest Name**
Home
*Title of Talk*

## Distinguished Guest Lecturers

**Bir Bhanu**
Center for Research in Intelligent Systems; University of California at Riverside
*Biometrics for Human Identification*

**Peter Chen**
Lousiana State University
*Entity-Relationship Modeling: Past, Present, and Future*

**David S. Ebert**
School of Electrical and Computer Engineering; Purdue University
*The Next Leap in Computer Graphics and Visualization Research*

**Agha Gul**
University of Illinois at Urbana-Champaign
*Methods for Specification, Monitoring & Reasoning About Scalable Distributed and Embedded Systems*

**James Hendler**
University of Maryland
*TeraFlops, PetaBytes and Exalinks: Science on the Semantic Web*
*This talk is co-sponsored by the departments of Comuter & Information Science and Biomedical Informatics*

**Nikos Papanikolopoulos**
University of Minnesota
*Distributed Robotic Teams*

**Mary Lou Soffa**
University of Pittsburgh
*Profit Driven Optimizations*

**Bhavani Thuraisingham**
The MITRE Corporation
*Secure, Selective and Authentic Third Party Distribution of XML Documents*

**Dr. Wei Zhao**
Texas A&M
*Effectiveness of Traffic Camouflaging over Internet*

## Guest Speakers

**Ana Belen Benitez**
Columbia University
*Multimedia Knowledge: Discovery, Classification and Navigation*

**Chris Brew**
The Ohio State University
*Terascale Semantics: Why And How To Handle Piles Of Words That You Don't Know*

**J. McGrath Cohoon**
University of Virginia
*Must There Be So Few Women in Computer Science?*

**Bruce Flinchbaugh**
Texas Instruments
*Introduction to Digital Video Systems*

**Ted Herman**
University of Iowa
*Time-Division Multiple Access in Sensornets*

**Christine Julien**
Washington University
*A Software Engineering Perspective on Context-Awareness in Ad Hoc Mobile Networks*

**Tamer Kahveci**
University of California, Santa Barbara
*Indexing Biological Sequences*

**Furrukh Khan**
The Ohio State University
*Beyond Core Web Services – Standards for Routing, Security, Policy, and Trust*

**Peter Middleton**
Queen's University, Belfast
*Just-in-Time Software Development*

**Bryan Pardo**
University of Michigan
*Name That Tune: Finding A Song From A Sung Query*

**Jonathan Richard Shewchuk**
University of California at Berkeley
*Anisotropic Triangulations*

**Radu Sion**
Purdue University
*Rights Protection beyond Multimedia*

**Yusu Wang**
Duke University
*Geometric Techniques For Protein Structure Analysis*

## Buckeye Alumni Creating Knowledge

This CSE Department Colloquium series is presented in conjunction with OSU-ACM and OSU-UPE. The featured speakers are undergraduate alums who are pursuing post-graduate degrees

**Patrick Coleman**
University of Toronto
*A Warped Perspective on Computer Imagery: Psychorealism and More*

**Jill O'Donnell**
The Ohio State University
*Where Have All the Good Times Gone?*

## LUNCHBUNCH!
## GRAD STUDENT PRESENTATIONS

Lunchbunch seminars are an opportunity for CSE graduate students to "dry-run" their dissertation defenses and prepare for job interviews. Also, these sessions are sometimes used by faculty members to offer workshops on practical topics of interest to students.

**Chris Bohn**
*Discovering Winning Strategies with Limited Information About the Adversary*

**Udeepta Bordoloi**
*1) Algorithms For Increasing Visualization Efficiency*
*2) Space Efficient Fast Isosurface Extraction For Large Datasets*

**Dr. Donna Byron**
*Job Hunting For Graduate Students*

**Arjav J. Chakravarti**
*Scientific Computation on a Peer-to-Peer Network using Mobile Agents*

**Murat Demirbas**
*Scalable Fault-tolerance for Wireless Sensor Networks*

**Jinzhu Gao**
*Visibility-Assisted Large Data Visualization*

**Amol Ghoting**
*Facilitating Interactive Distributed Data Stream Processing and Mining*

**Jason Hallstrom**
Dynamically Reconfigurable Software Product Lines

**Ramakrishnan Kazhiyur- Mannar**
*Adaptive Resolution Isosurface Extraction*

**Hilary Pike**
*Modular Design of Robust Authentication Protocols*

**Scott Pike**
*Fault-Localization In Distributed Resource Allocation*

**Richard Sharp**
*1) A New Approach to Subsurface Scattering: Investigations in Circuit Analysis and Real World MRI Data*
*2) A Comprehensive Study in Subsurface Scattering for Physically Based Photorealistic Rendering of Organic Material*

**Nigamanth Sridhar**
*Dynamically Reconfigurable Component-Based Software*

## SPECIAL PRESENTATION WITHIN SPECIFIC RESEARCH GROUPS

*Unless noted, the speakers are members of OSU-CSE community.*

### AI GROUP TALKS

**Dr. Donna Byron**
*Using Diagrams And Graphical Displays In Spoken Dialog Systems*

**Hui Gao**
*Gender Recognition from Movement Patterns*

**Unmesh Kurup**
*An Introduction to Soar*

**Eric Fosler-Lussier**
*Integrative Techniques in ASR & Spoken Dialogue Systems*

**Ambrish Tyagi**
*Review of Computer Vision Techniques*

**Dr. DeLiang (Leon) Wang**
*On Computational Objectives of Auditory Scene Analysis*

### GRAPHICS TALKS

**Guangfeng Ji**
*Volume Tracking Using Higher Dimensional Isosurfacing*

**Jonathan Woodring, Chaoli Wang and Han-Wei Shen**
*High Dimensional Direct Rendering of Time-Varying Volumetric Data*

### SYSTEMS PRESENTATIONS

These talks are funded by a grant from the Ohio Board of Regents.

**Arjav Chakravarti**
*The Organic Grid: Self-Organizing Computation on a Peer-to-Peer Network*

**Dr. Suresh Chalasani**
School of Business and Technology; University of Wisconsin-Parkside
*Software Architectures for E-Commerce Computing Systems*

**Guozhu Dong**
*Mining Knowledge about Changes, Differences, and Trends*

**Dr. Rahul Garg**
IBM Research, India
*Adaptive Incremental Checkpoint for Massively Parallel Systems*

**Amol Ghoting**
*Facilitating Interactive Distributed Data Stream Processing and Mining*

**Thom Hickey**
Office of Research; OCLC
*Text Searching on a Beowulf Cluster*

**Chris Jermaine**
University of Florida
*Approximate Query Processing with Sampling and Pre-Aggregation*

**Ruoming Jin**
*A Systematic Approach for Optimizing Complex Mining Tasks on Multiple Databases*

**Sriram Krishnamoorthy**
*Efficient Synthesis of Out-of-Core Algorithms Using a Nonlinear Optimization Solver*

**Matthew Otey**
*Parallel & Distributed Methods for Incremental Frequent Itemset Mining*

**Manoj Pillai**
*Efficient Redundant Storage in Cluster File Systems*

**N. Sivaramakrishnan**
*Support for Data-Driven Scientific Applications in the Grid*

**Weikuan Yu**
*Nic-Based Efficient Collective Communications Over Myrinet/gm-2*

*Photo courtesy of William Barson*

*The Garden of Constants is an especially beautiful place, no matter what the weather!*

# PUBLICATIONS


Attie, P. C.; **Arora, A.**; and Emerson, E.A. "Synthesis of Fault-Tolerant Concurrent Programs," *ACM Transactions on Programming Languages and Systems (TOPLAS).*

Balaji, P.; Narravul, S.; Vaidyanathan, K.; Krishnamoorthy, S.; Wu, J.; and **Panda, D. K.** "Sockets Direct Procotol over InfiniBand in Clusters: Is it Beneficial?," *International Symposium on Performance Analysis of Systems and Software* (ISPASS 04), 2004.

Bernaschi, M.; Iannello, G.; and **Lauria, M**. "Efficient Implementation of Reduce-Scatter in MPI," *Journal of System Architecture*, Vol. 49, No. 3, 2003, pp. 89-108.

Bernholdt, D.E.; Auer, A.; **Baumgartner, G.**; Bibireata, A.; Choppella, V.; Cociorva, D.; Gao, X.; Harrison, R.J.; Hirata, S.; Krishnamoorthy, S.; Krishnan, S.; Lam, C.; Lu, Q.; Nooijen, M.; Pitzer, R.M.; Ramanujam, J.; **Sadayappan, P.**; Sibiryakov, A.; and White, T.; "A High-Level Approach to the Synthesis of High-Performance Codes for Quantum Chemistry." *Los Alamos Computer Science Institute Symposium* (LACSI), poster presentation.

Bernholdt, D.E.; Auer, A.; **Baumgartner, G.**; Bibireata, A.; Choppella, V.; Cociorva, D.; Gao, X.; Harrison, R.J.; Hirata, S.; Krishnamoorthy, S.; Krishnan, S.; Lam, C.; Lu, Q.; Nooijen, M.; Pitzer, R.M.; Ramanujam, J.; **Sadayappan, P.**; and Sibiryakov, A.; "Synthesizing Highly Optimized Code for Correlated Electronic Structure Calculations." *226th ACS National Meeting*, 2003, American Chemical Society.

Bhaniramka, P.; **Wenger, R**.; and **Crawfis, R.** "Isosurface Construction in any Dimension Using Convex Hulls," *IEEE Transactions On Visualization and Computer Graphics*, Vol. 10, 2004, pp. 130-141.

Bohn, C. A.; **Sivilotti, P. A. G.**; and **Weide, B. W.** "Using a Model Checker to Find a Hidden Evader," *Workshop on Agent/Swarm Programming '03*, 2003, pp. 1-7.

Bohn, C. A.; **Sivilotti, P.A.G.**; and **Weide, B. W**. "Designing the Control of a UAV Fleet with Model Checking", in Murphey, R.; Pardalos, P.; and Grundel, D.; eds.; *Theory and Algorithms for Cooperative Systems*, Kluwer Academic Publishers.

Bordoloi, U. and **Shen, H.-W.** "Space Efficient Fast Isosurface Extraction for Large Datasets," *IEEE Visualization 2003*, pp. 201-208.

Bordoloi, U.; David, D.; Kao, L.; and **Shen, H.-W.** "Visualization And Exploration Of Spatial Probability Density Functions: A Clustering Based Approach," *Proceedings of SPIE & IS&T Conference on Visualization and Data Analysis*, 2004.

Brown, G. J. and **Wang, D. L.** "Timing Is Of The Essence: Neural Oscillator Models Of Auditory Grouping," In: Greenberg S. and Ainsworth W. (ed.), *Listening to Speech: An Auditory Perspective*, Lawrence Erlbaum, Mahwah NJ, (2004).

Brown-Schmidt, S.; **Byron D. K**.; and Tanenhaus, M. K. "That's Not It And It Is Not That: Reference Resolution And Conceptual Composites," In *The On-line Study of Sentence Comprehension, Eyetracking, ERP, and Beyond*. ed. Manolo Carreiras, Psychology Press 2004.

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Xue, D. and Crawfis, R. "Fast Dynamic Flow Volume Rendering Using Textured Splats on Modern Graphics Hardware," *Proceedings SPIE EI 2004*, San Jose, CA.

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# INVITED TALKS

**James Davis**

*Computer Recognition of Human Actions*
Boston University; Oct. 30, 2003
University of Illinois at Urbana-Champaign; Oct. 24, 2003
Siemens Corp., Princeton, NJ; Dec. 15, 2003

*Representing and Recognizing Human Actions*
Robotics Institute, Carnegie Mellon University; March 26, 2004.

*Video Surveillance of Tomorrow*
ASIS International Annual Seminars and Exhibits; May 13, 2004

*Detection and Recognition of Human Activity in Thermal Video",*
U.S. Army Night Vision Laboratory, Fort Belvoir, VA; June 28, 2004.

*Gender Recognition from Walking Movements using Adaptive Three-Mode PCA*
IEEE Workshop on Articulated and Nonrigid Motion; June 2004

**D. K. Panda**

*State of InfiniBand in Designing Next Generation Clusters, Cluster-based Servers and Datacenters*
Int'l Conference on Cluster Computing and Grid (CCGrid'04); April 2004

*Designing Next Generation Clusters with InfiniBand: Opportunities and Challenges*
ARL Cluster Symposium, July 22, 2003
Hot Interconnect (HotI 11), Stanford; August 22, 2003
Int'l Conference on Cluster Computing (Cluster '03), Hong Kong; Dec 1, 2003

*InfiniBand Architecture and Its Impact on High Performance Computing*
Int'l Conference on Parallel Processing (ICPP), Kahosiung, Taiwan, Oct 6, 2003

*MPI, File Systems, Storage, and Datacenter Research with InfiniBand: Latest Research Results and Plans*
Second annual DOE InfiniBand Workshop, January 20, 2004

**DeLiang (Leon) Wang**

*On Computational Objectives of Auditory Scene Analysis*
NSF Workshop on Perspectives on Speech Separation, Nov. 2003, Montreal, Canada

*Multipitch Tracking for Noisy Speech*
IRCAM - CNRS, Sept. 2003, Paris, France

*Monaural Speech Segregation and Oscillatory Correlation*
IJCNN Special Session on Dynamical Aspects of Information Encoding in Neural Networks, July 2003, Portland OR

**Bruce Weide**

*Assignment + References = Disaster*
Virginia Tech, April 2003

*Case Studies of Undergraduate Research: Students and Projects*
Keynote address for Midstates Conference for Undergraduate Research in Computer Science and Mathematics, October 2003.

**Stuart Zweben**

*The Changing State of Computing*
Northwest Ohio Computer Science Conference, Bowling Green, OH, October 2003

*ABET and Software Engineering Accreditation*
Frontiers in Education, Westminster, CO, November 2003

*The Changing Face of Computing and its Impact on Higher Education*
University of Minnesota, Minneapolis, MN, January 2004

# TECHNICAL REPORTS

Andrade, H.; Kurc, T.; Sussman, A.; and Saltz, J. "A Framework for Multiple Query Optimization on Multidimensional Data Analysis Applications," 37 pp. OSU-CISRC-7/03-TR44

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Arora, A.; Dutta, P.; Bapat, S.; Kulathumani, V.; Zhang, H.; Naik, V.; Mittal, V.; Cao, H.; Gouda, M.; Choi Y. "A Line in the Sand: A Wireless Sensor Network for Target Detection, Classification, and Tracking," 33 pp. OSU-CISRC-12/03-TR71

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Bohn, C. A.; Sivilotti, P. A.G.; and Weide, B.W. "Using Model Checking to Find a Hidden Evader," 7 pp. OSU-CISRC-9/03-TR51

Chakravarti, A..; Baumgartner, G.; and Lauria, M. "The Organic Grid: Self-Organizing Computation on a Peer-to-Peer Network," 22 pp. OSU- CISRC-10/03-TR55

Chellappan, S.; Wang, X.; and Xuan, D. "A biologically inspired framework for Self-healing Overlay Systems," 16 pp. OSU-CISRC-3/04-TR15

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Dutta, P. K. and Arora, A. K. "Integrating Micropower Radar and Motes," 8 pp. OSU-CISRC-12/03-TR67

Ghoting, A. and Parthasarathy, S. "Interactive Disk-Aware Data Stream Processing and Mining," 25 pp. OSU-CISRC-7/03-TR39

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Jin, R. and Agrawal, G. "An Algorithm for In-Core Frequent Itemset Mining on Streaming Data," 10 pp. OSU-CISRC-2/04-TR14

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Krishnamoorthy, S.; Baumgartner, G.; Cociorva, D.; and Lam, C.-C. "On Efficient Out-of-Core Matrix Transposition," 29 pp. OSU-CISRC-9/03-TR52

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Mascarenhas, A. "Property Transformers for Compositional Reasoning," 73 pp. OSU-CISRC-7/03-TR40

Mehta, S.; Parthasarathy S.; and Yang, H. "Correlation Preserving Discretization," 12 pp. OSU-CISRC-12/03-TR69

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Rountev, A.; Milanova, A.; and Ryder, G. "Fragment Class Analysis for Testing of Polymorphism in Java Software, 41 pp. OSU-CISRC-1/04-TR04

Shao, Y. and Wang, D. L. "Model-Based Sequential Organization in Cochannel Speech," 16 pp. OSU CISRC-5/04-TR30

Sivilotti, P. A. G. and Bruce Weide, "Research, Teaching, and Service: The Miniconference as a Model for CS Graduate Seminar Courses," 6 pp. OSU-CISRC-9/03-TR50

Soundararajan, S. and Wang, D. L. "A Schema-Based Model for Phonemic Restoration," 33 pp. OSU-CISRC-1/04-TR03

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Wu, J.; Wyckoff, P.; Panda, D. K.; and Ross, R. "Unifier: Unifying Cache Management and Communication Buffer Management for PVFS over InfiniBand," 10 pp. OSU-CISRC-1/04-TR02

Wu, M. and Wang, D. L. "A Two-Stage Algorithm For One-Microphone Reverberant Speech Enhancement," 20 pp. OSU-CISRC-11/03-TR62

Yu, W.; Buntinas, D.; and Panda, D.K. "Scalable and High Performance NIC-Based Allgather over Myrinet/GM," 16 pp. OSU-CISRC-4/04-TR22

Yu, W.; Buntinas, D.; Graham, . L.; and Panda, D.K. "Efficient and Scalable NIC-Based Barrier over Quadrics and Myrinet, 11 pp. OSU-CISRC-11/03-TR63

Yu, W.; Sur, S.; Panda, D.K.; Aulwes, R. T.; and Graham, R. L. "High Performance Broadcast Support in LA-MPI over Quadrics," 11 pp. OSU-CISRC-11/03-TR59

Yu, W.; Wu J.; and Panda, D. K. "Scalable Startup of Parallel Programs over InfiniBand," 11 pp. OSU-CISRC-5/04-TR33

## Equipment*

### Servers:

| | |
|---|---|
| 6 | Sunfire V480s |
| 5 | Sun Ultra Enterprise 250 |
| 19 | Sun Ultra Enterprise 450 |
| 2 | Sun Ultra Enterprise 2 |
| 1 | Sun Ultra Enterprise 1 |
| 11 | Dell Poweredge 6300 |
| 1 | Dell Poweredge 6400 |
| 1 | Dell Poweredge 2300 |
| 2 | Dell Poweredge 6450 |
| 1 | Dell Poweredge 6650 |
| 4 | Dell Poweredge 2650 |
| 2 | Sun Blade 1000 |
| 1 | Sun Blade 2000 |

### Workstations:

| | |
|---|---|
| 200 | Dell PCs |
| 340 | NCD Thin Clients |

### Disk Space:

| | |
|---|---|
| 750+ | GB of disk space |

### Peripherals:

| | |
|---|---|
| 1 | Lexmark Color Printer |
| 2 | Xerox Color Printer |
| 3 | HP 8100 Laser Printer |
| 2 | HP Laserjet 4100 |
| 3 | HP Laserjet 4300 |
| 9 | HP 8150 Laser Printer |
| 6 | Eiki LC-SX1U LCD Projectors |
| 2 | Epson Portable Projectors |
| 1 | 250 MB Zip drive |
| 2 | HP Scanjet 4570c scanner |
| 3 | HP Laser Jet 4100 |

**These figures do not include equipment in our graduate or research labs.*

## Faculty Search Report

| | |
|---|---|
| Total Applications Received | 402 |
| Interviews Held | 10 |
| Hires | 1 |

The concentration of applications was received in the following areas:

| | |
|---|---|
| Chairperson Applications | 32 |
| Artificial Intelligence / HCI / Robotics / Vision | 77 |
| Graphics | 18 |
| Networking / Multimedia / Security / Cryptography | 106 |
| Software Engineering / Theory | 35 |
| Systems / Bioinformatics / Databases / Datamining | 106 |

*This publication is a result of the efforts of all CSE faculty, staff and numerous grad students. Thanks are given to all.*

*The Editors*

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