CHAIR’S MESSAGE

As I write my first Chair’s letter, I join the department in expressing my deepest gratitude to Alan Biermann, who stepped down as Chair in August 2004, for his leadership, dedication, and hard work. In the post dot.com-bust era, as computing permeates in almost every discipline, computer science faces many challenges but there are also numerous opportunities. I look forward to working with everyone in meeting these challenges, capitalizing on the opportunities, and taking this very strong department, one of the top-20 computer science departments in the nation, to the next level of excellence.

We are pleased to announce the arrival of many new members to the department. Kamesh Munagala, whose research interests are in the area of algorithms, joined the department as an Assistant Professor. Chris Dwyer, Terrence Furey, and Uwe Ohler joined us as secondary faculty members, and Wolfgang Gentzsch joined as an Adjunct Professor. Letta Barnhill is our new Grants Accounting Specialist. Nineteen new students joined the Ph.D. program in fall, one of our largest Ph.D. classes. We welcome all of them to our community.

The biggest strength of the department is its eminent faculty, and it’s always a pleasure to share their achievements with you. We congratulate Carlo Tomasi for being promoted to the rank of Full Professor, Owen Astrachan and Jeffrey Chase for receiving IBM Faculty Awards, and Carla Ellis for being elected to the CRA Board. We also congratulate the students who graduated recently and wish them all the best as they embark on their new careers.

TechConnect, co-organized by Computer Science, Pratt School of Engineering, and the Career Center, was held on September 21, 2004. An annual Duke event that brings students and potential employers together was a major success. The department held its annual department meeting in September and recognized many students for their outstanding achievements. The department once again had the honor of hosting the ACM Mid-Atlantic Programming Contest. The Duke team magabe, comprised of undergraduates Ben Mickle, Garrett Casto, and Matt Edwards, tied for first place. We wish them all the best for their success in the world championship to be held in Shanghai in April.

Be sure to check out our Web site to learn the latest news about the department and to be part of our community. If you are in the RTP area, we hope you will stop by for a visit. We look forward to hearing from you.

Best wishes,
Pankaj K. Agarwal
PANKAJ K. AGARWAL: NEW CHAIR OF COMPUTER SCIENCE DEPARTMENT

PANKAJ K. AGARWAL has accepted the position of Chair of the Department of Computer Science. Agarwal is a distinguished professor of computer science and mathematics, becoming an ACM Fellow in 2002 and earning the National Young Investigator award in 1993. He received his doctorate degree from Courant Institute of Mathematical Sciences in 1989. Agarwal has concentrated on interdisciplinary projects with the biology, biochemistry and mathematics departments, as well as Pratt School of Engineering and the Nicholas School of the Environment.

Agarwal’s research focuses on developing efficient algorithms and data structures for large-scale geometric problems. Challenging algorithmic problems arise in molecular biology, environmental sciences, databases, and mobile computing. He uses geometry to gain insight into these problems to minimize computational requirements and make the problems tractable on modern computer architectures. “I’m interested in anything that’s geometric, from the molecular level to the global level,” says Professor Agarwal. His mathematical models employ approximation and randomization techniques to find simple, fast solutions.

TOOLS DESIGN DNA-NANOTUBE LOGIC

RESEARCHERS FROM DUKE UNIVERSITY are aiming to make the process of assembling molecular-scale components easier with a suite of computer-aided design (CAD) tools for designing computer circuits made from carbon nanotubes assembled by DNA.

The tools are designed to build computer circuits at a density of 2,500 transistors per square micron, which is about 30 times more closely packed than devices made using current chipmaking technologies, according to Chris Dwyer, assistant professor of electrical and computer engineering and computer science at Duke University. A micron is one thousandth of a millimeter.

Transistors are arranged into logic gates, which in turn are combined by the millions into the complicated circuits that process and store data. Being able to assemble individual nanotube transistors is the prerequisite for developing a nanotube-based chipmaking technology. The key is finding ways to combine them into logic circuits.

The tools use a DNA scaffold recently created by another Duke University research team as the foundation for nanotube circuits. The scaffold is a self-assembled, grid-like fabric of DNA molecules. The grid’s cavities measure 20 nanometers across.

The architecture also calls for attaching metallic nanowires along the DNA segments that make up the scaffold on both the top and bottom sides. To fill the gaps between the nanotubes at the intersections of the grid and the points where the transistor nanotubes connect to the grid, the architecture includes DNA sequences that attract metallic nanoparticles. Later in the process, the nanoparticles attract metal atoms to form a chemically-assembled solder.

Like traditional computer-aided design tools, the researchers’ tools allow users to design individual devices like logic gates, connect the devices to form whole systems, generate a circuit layout, and produce a sequence of assembly steps. The assembly plan includes specific DNA sequences as well as the nanotube or nanoparticle component for each step.

Nanoelectronics, and particularly the self-assembly process, require different ways of thinking about circuitry and how computations occur to make the best of the technology, said Dwyer. “Our tools provide a foundation for those future designs,” he said. “Further down the road, we hope these tools will mature to the level that present-day very large-scale integration computer-aided design tools have—this will make wider access to the new technology possible.”

One challenge is that the larger the DNA scaffold, the greater the number of unique DNA sequences required to create circuits. The researchers are working on minimizing the overall number of required sequences, according to Dwyer.

The researchers’ nanotech fabrication computer-aided design tools could be used to carry out nanotube construction in five to ten years, said Dwyer. Dwyer’s research colleagues are Vijeta Jafri, Moky Cheung, Jaidev Patwardhan, Alvin Lebeck and Daniel Sorin.

OWEN ASTRACHAN AND JEFFREY CHASE RECEIVE IBM FACULTY AWARD

OWEN ASTRACHAN AND JEFFREY CHASE have received a 2004 IBM Faculty Award. IBM Faculty Awards provide funding to outstanding faculty for exploratory research in areas important to IBM. The Faculty Award program is highly competitive: IBM grants a limited number of awards across the mathematics and computer science disciplines.

Astrachan’s award supports projects to identify key issues and practices in developing and deploying software architectures and ontologies for large-scale software componentization. Large-scale componentization may require developing conventions, formalisms, and practices for requirements and specifications related to performance, reliability, security, Quality of Service, maintainability, and related functional and non-functional characteristics.

Chase’s award supports continuing research in on-demand computing and storage, including an investigation of new techniques for automated resource management in the Cluster-on-Demand project, in cooperation with our colleagues at IBM’s Autonomic Computing initiative.
Chris Dwyer, Terrence Furey and Uwe Ohler, Secondary Faculty

WE HAVE THREE recent additions to our secondary faculty: Chris Dwyer, Terrence Furey and Uwe Ohler. These faculty bring with them a wealth of experience and will be a great asset to the department.

Chris Dwyer’s primary appointment is in the Department of Electrical and Computer Engineering. Dwyer is currently working on the design and fabrication of nanoscale self-assembling computer systems and architectures. He is also interested in DNA self-assembly, nanoscale circuit design, and design tool and simulator support for emerging device technologies. Dwyer worked in the Department of Physics & Astronomy at UNC as a postdoctoral fellow and at the Department of Computer Science at Duke as a visiting assistant professor from 2003-2004. Terrence Furey’s primary appointment is in the Department of Biostatistics and Bioinformatics. Furey’s research focuses on genome sequence analysis with the aim of uncovering mechanisms of biological phenomena. Current projects include the investigation of regions of early replicating DNA as part of a collaboration with scientists at UNC Chapel Hill, the Los Alamos National Lab, and Wayne St University. The DNA replication phase during the cell cycle is an exquisitely timed and coordinated process that is poorly understood. The precise mapping of origins of replication and a corresponding analysis of genomic sequence in these regions should provide clues as to the mechanism regulating this process. Along with researchers at UC Santa Cruz, Furey is working to computationally predict and later experimentally verify novel instances of this process in the human genome.

Uwe Ohler’s primary appointment is in the Department of Biostatistics and Bioinformatics. Ohler’s research focus is on computational biology/bioinformatics. Coming from a background in computer science, he is mostly interested in understanding the regulation of gene expression, i.e. how the full repertoire of genes in an organism is active only in the right place at the right time. To this aim, he uses approaches from pattern recognition and machine learning, in particular probabilistic models, to make sense of the vast amount of data coming from molecular biology today. Projects so far have led to computational models that identified regulatory genes and control regions in genomic DNA of several organisms (worm, fly, human), but it is planned to extend this to other types of data such as images or measurements of gene expression levels.

Kamesh Munagala, Adjunct Faculty

Kamesh Munagala is the managing director of MCNC Grid Computing & Networking Services, a non-profit organization in the Research Triangle Park in North Carolina. After leading grid technology development at Sun Microsystems, he joined MCNC in April 2004 with more than 25 years of experience in distributed computing (parallel, supercomputing, grid), software development, computational engineering, computer architecture, and teaching. At MCNC, Gentzsch directs the organization’s grid strategy and technology development, including the development of one of the nation’s first statewide research and education grids.
ASTRACHAN WORKS WITH DUKE’S PROGRAM TO HAND OUT iPODS TO FRESHMEN

UPPERCLASSMEN OFTEN CLAIM that freshmen are as obvious on campus as off-key notes in pop songs, but this fall it was the earphones dangling from the newbies’ necks that gave them away.

The University paid $500,000 dollars to provide every incoming freshman with a 20-gigabyte iPod and develop support programs to make the gadgets educationally applicable.

The iPod giveaway is a one-year pilot program. Administrators said there are not yet plans to pay for the program to continue if it is successful, but part of the pilot plan does include hiring one or two full-time staff members for technical support.

Duke approached Apple about the possibility of using iPods educationally. Duke purchased the iPods at a discount under a special agreement with Apple.

CARLO TOMASI PROMOTED TO FULL PROFESSOR

DUKE UNIVERSITY has recognized the contributions of Carlo Tomasi with a promotion to Full Professor.

“I am proud to be playing an even more active role in a thriving department and in one of the best universities in the country,” says Tomasi.

Tomasi’s research focuses on the analysis of image motion, stereo vision, image retrieval, and medical imaging. He made a widely recognized contribution to structure from motion with his Ph.D. thesis, whose ramifications have generated a steady flow of publications from his research group and others. Ten years later, his theory of factorization still generates Ph.D. theses across the world, has spawned two companies (Geometric in Sunnyvale and Point Cloud in Minneapolis), is one of the most cited pieces of work in computer vision, and is constantly used as a starting point for new ideas by researchers in the field. In image retrieval, Tomasi has contributed pioneering concepts and techniques for the flexible description of image similarity, an obviously fundamental notion in this field.

Tomasi’s recent work in computer-assisted medical diagnosis has led to systems for the automatic detection of colon cancer in its early stages, pointing the way to the automated and unobtrusive screening of large numbers of people at a relatively low cost. “It feels really satisfying when your ideas click from a theoretical standpoint,” says Tomasi. “But when they help save people’s lives, the thrill is incomparably more intense!”

SLAM

This January, SAIC gave a generous gift of $80,000 to Assistant Professor Ronald Parr. These funds will be used by Parr to support research with graduate student Austin Eliazar on the problem of 3D Simultaneous Localization and Mapping (SLAM). SLAM, is the problem of constructing a map of an unknown environment using a robot and sensors like laser range finders or cameras. This is an important task for applications such as search & rescue, military or police reconnaissance, and underwater exploration. In previous work on 2D slam, Eliazar and Parr developed novel data structures and algorithms which allowed the creation of maps of extremely high precision using a laser range finder and the department’s robot named Markov (another gift from SAIC). Eliazar presented this work at the IJCAI and ICRA conferences in 2003 and 2004. More details are available at http://www.cs.duke.edu/~parr/dpslam/.

In their new project, they plan to collaborate with Carlo Tomasi and experts at SAIC to develop a 3D mapping approach based upon stereo vision. While vision is a natural sensing method for people, it is far less accurate than a laser range finder. Nevertheless, it has advantages in speed, cost, weight, size, ruggedness and stealth that make it very appealing for many robotic applications. The Duke researchers aim to develop and apply novel statistical techniques to help overcome the limitations of a vision based approach while retaining the advantages.

SAIC gifts have previously supported research in spoken dialogue systems, stereo vision, and two dimensional robotic mapping in the Department of Computer Science.
TECHCONNECT 2004

TechConnect 2004 was held on Tuesday, September 21, 2004. The event was hosted by The Career Center, Pratt School of Engineering, and the Department of Computer Science.

TechConnect is an annual event that brings students and employers together. Each year, a panel of employers is selected to provide advice to students seeking internships and full-time jobs. Through this panel presentation, students get a good understanding of the characteristics employers seek as well as a realistic view of the job market for students interested in engineering and technical careers.

The panel discussion is followed by a vibrant networking event. Students from all classes are welcome to visit with employer representatives, many of whom are Duke alumni. This venue provides a less formal environment than the traditional Career Fair, which takes place the next day in the Bryan Center.

Sponsors included ExxonMobil, GE, Language Computer Corporation, Eli Lilly, Medtronic, and Microsoft.

STUDENT PRESENTATIONS

ALLISTER BERNARD presented a paper at PSB 2005, the Pacific Symposium on Biocomputing, January 4–8 in Hawaii. He presented the paper "Informative Structure Priors: Joint Learning of Dynamic Regulatory Networks From Multiple Types of Data".

DEJAN KOSTIC presented a paper at the USENIX/OSDI 2004 conference titled "FUSE: Lightweight Guaranteed Distributed Failure Notification", held Dec 6–8 in San Francisco.


PENG YIN presented a paper titled "Complexity of Graph Self-Assembly in Accretive Systems and Self-Destructible Systems" at the Caltech DNA World Workshop on January 6–8 in Pasadena at the CIT Center for Biological Circuit Design.

OUTSTANDING ACHIEVEMENTS

Outstanding Ph.D. Dissertation
Yusu Wang

Outstanding Preliminary Ph.D. Proposal
Hai Yu and Ke Yi

Outstanding Master’s Thesis
Emma Buneci

Outstanding 2nd Year Research Project
Badrish Chandramouli

Outstanding Teaching Assistant
Dmitriy Morozov

Outstanding Departmental Service
Laura Grit

TECHCONNECT 2004

Outstanding Ph.D. Dissertation
Yusu Wang

Outstanding Preliminary Ph.D. Proposal
Hai Yu and Ke Yi

Outstanding Master’s Thesis
Emma Buneci

Outstanding 2nd Year Research Project
Badrish Chandramouli

Outstanding Teaching Assistant
Dmitriy Morozov

Outstanding Departmental Service
Laura Grit

TALKS

THE DEPARTMENT WELCOMES talks given by renowned researchers in industry and academia. Colloquium is hosted by the department and Triangle Computer Science Distinguished Lecture Series (TCSDLS) is jointly run by the computer science departments at Duke University, North Carolina State University, and University of North Carolina.

We welcome our alumni, partners and friends to attend our talks. An updated schedule can be found at the department Web site.

Some of our speakers in Spring 2005 are:

Chandu Thekkath
Boxwood: An Experiment in Using Abstractions as Storage Infrastructure

G. W. Pete Stewart
MATRAN: A Fortran 95 Wrapper for Matrix Operations

Emre Kiciman
Using Statistical Monitoring to Detect Failures in Internet Services

Thomas Poggio
Learning: Theory and Applications

Christos Faloutsos
Data Mining Using Fractals and Power Laws

Magdalena Balazinska
Load Management and Fault-Tolerance in a Distributed Stream Processing System

Jack Dongarra
An Overview of High Performance Computing and Self-Adapting Numerical Software

Leonidas J. Guibas
Lightweight Distributed Reasoning in Sensor Networks

VISIT HERE FOR MORE CS HAPPENINGS:
http://www.cs.duke.edu/dept_info/events/
BUILDING A ROBOT has always been a dream of Jy-erick Stevons, an 8th-grader at Chewning Middle School. Although he’s built several robots out of Legos, he’s never had the computer equipment necessary to give his contraptions life — until now.

Stevons, and about 30 of his classmates, are participating in a mentoring program with Duke University, where students in Jeffrey Forbes’ robotics class are teaching Chewning students the basics of making a robot. On Saturday about a half-dozen Chewning students were hunched around laptop computers at Duke’s main campus learning how to program Lego robots — built by Chewning students — to navigate a maze. Since the program began in September, Chewning students have been meeting four days a week after school to learn about science and robotics. Students from Duke visit the school twice a week to give the students hands-on instruction. Chewning students occasionally visit Duke’s campus as well.

Forbes, an assistant professor of the practice of computer science, said the program had been beneficial not only to Chewning students, but to his as well. Forbes said having to teach the material to others had accelerated the learning of his students. "One of the best ways to learn is to teach," Forbes said. “[The Duke students] really have to understand what they are doing.”

As the program progresses through the year, the Chewning students will work on more advanced projects along with their Duke mentors.

DUKE TIES FOR FIRST PLACE
IN ACM MID-ATLANTIC REGIONAL PROGRAMMING CONTEST

ON SATURDAY, November 13, 2004, the Department of Computer Science at Duke University hosted the ACM Mid-Atlantic Programming Contest. The Duke team "magabe" solved 5 of the 8 programming problems and tied for first place. Scores are based on number of minutes to solve a problem with penalties for extra submissions. “magabe” will head to Shanghai in April to compete in the international programming contest finals. The team consists of undergraduates Ben Mickle, Garrett Casto, and Matt Edwards.

The contest drew students from colleges and universities throughout New Jersey, eastern Pennsylvania, Delaware, Maryland, the District of Columbia, Virginia, West Virginia, and North Carolina. Winners selected from regional contests on six continents will advance to the ACM Programming Contest World Finals to compete for bragging rights and scholarships. The contest fosters creativity, teamwork, and innovation in building new software programs, and enables students to test their ability to perform under pressure. Quite simply, it is the oldest, largest, and most prestigious programming contest in the world. The contest pits teams of three university students against eight or more complex, real-world problems, with a grueling five-hour deadline. Huddled around a single computer, competitors race against the clock in a battle of logic, strategy and mental endurance. For a well-versed computer science student, some of the problems require precision only. Others require a knowledge and understanding of advanced algorithms. Still others are simply too hard to solve — except, of course, for the world’s brightest problem-solvers.

Congratulations to the other Duke teams! "majasa" - Jadrian Miles, Matt Territo, and Sam Louis; "oakasa" - Aaran Wise, Kshipra Bhawalkar, and Oaz Nir; "plansa" - Andrew Dreher, Plamen Nikolov, and Sam Heald.

DUKE ROBOTICS STUDENTS
TEACH MIDDLE SCHOOLERS
SHAUN LOCKHART, The Herald-Sun, 11/15/04

Jeffrey Forbes

Duke robot students work to build robots with middle schoolers.
CONGRATULATIONS!
It is with great pleasure to announce our newest graduates. We are proud of their accomplishments and celebrate with them in having reached this important goal that they set out on several years ago. Best of luck in the future!

Ph. D. DEGREES:

Yujuan Bao  
Co-advisors: Xiaobai Sun/Kishor Trivedi  
Adaptive Software Rejuvenation

Yun Fu  
Advisor: Amin Vahdat  
Resource Allocation for Global-Scale Network Services

Sathish Govindarajan  
Advisor: Pankaj K. Agarwal  
Spatial Data Structures and Algorithms for Large-Scale Applications

Lipyeow Lim  
Advisor: Jeffrey S. Vitter  
On-line Methods for Database Optimization

Nabil Mustafa  
Advisor: Pankaj K. Agarwal  
Shapes: Simplification, Estimation and Classification of Geometric Objects

Vijay Natarajan  
Advisor: Herbert Edelsbrunner  
Topological Analysis of Scalar Functions for Scientific Data Visualization

Yusu Wang  
Co-advisors: Pankaj K. Agarwal/Herbert Edelsbrunner  
Geometric Methods in Molecular Shape Analysis

Rajiv Wickremasinghe  
Advisor: Jeffrey S. Chase  
Methods and Models for Reconfigurable Data Intensive Computing

M. S. DEGREES:

Badrish Chandramouli  
Co-advisors: Amin Vahdat/Jun Yang  
Distributed Network Querying with Bounded Approximate Caching

Jeff Hoerle  
Co-advisors: Rachael Brady/Allen Song  
Using AVID for 3D ROI Creation

Wenbin Pan  
Advisor: Jun Yang  
An Unsupervised Learning Approach to Author Name Disambiguation

Associate Chair, Richard Lucic presents Emma Buneci her degree.
PICNIC!
The department got together on September 3, 2004 for a picnic to thank Alan Biermann for his hard work as Chair and to meet and greet all the new people in our department. Families and friends joined in on the fun!