





Notes from the Chair by Prof. Larry Davis

he Spring 2007 semester is over, and nearly 100 students received their B.S. degrees at the College graduation ceremony. Dr. Ravi Sethi, the CEO of Avaya Labs, was the College commencement speaker; after the ceremony Ravi spent time meeting with faculty and graduate students in the Department.

While undergraduate enrollments in computer science are down nationwide, we have started to see an increase in new students, thanks, in large part, to the vigorous recruiting activities of our undergraduate office led by Prof. Purtilo. We believe that our success in recruiting new undergrads is also due to the Passport program that Nelson Padua-Perez has developed and grown especially during the past year. This spring semester we had over 200 middle and high school students come to the campus every Saturday for instruction in computer science at four different levels. Our department's undergraduate enrollment is still more than twice the median for top twenty computer science departments, according to recent statistics released by the Computing Research Association.

While undergraduate enrollments are down, applications to our graduate program remain at high levels. We had over 1200 applicants this year for only 35-40 new graduate student positions. There is a significant amount of work involved in evaluating so many applications, and then actively recruiting students we are especially interested in having attend our program. Prof. Khuller spends an enormous number of hours each spring semester on graduate student recruitment. It culminates in our annual visit day for perspective students, and this year we had a record 30 students visit the campus to meet faculty and students and learn first hand about our program.

Faculty recruiting this year focused on the recently established Minker Professorship and in the area of computational biology. We were successful in hiring a new junior faculty member in computational biology (Carl Kingsford, a graduate of Princeton whose research will be described in our fall newsletter), and are continuing our search for the Minker Professorship.

A large anonymous gift, donated about a year ago to the Gannon fund, allowed us to significantly expand our undergraduate student scholarship offerings. The income from that fund is now used both to recruit excellent new students to our program, and to reward our very best students for their outstanding academic performance. We are also using some of the fund's income to support first year graduate students during the summer while they work on research projects with faculty members. Students were asked to submit proposals and a committee selected three of the strongest for this first summer. These students will give presentations this fall on their work. It is not too late to contribute to the fund – it really makes a difference in recruiting and retaining highly rated undergraduate students and providing an early research component in our graduate program.

I delivered the first "State of the Department" address in April. It gave me a chance to thank many of the people who have contributed to the department's programs, and to bring everyone up to date on department initiatives in research and education. The slides from that presentation are available on the department's web page. I also want to congratulate Profs. Ramani Duraiswami and Atif Memon who were promoted this spring to the rank of Associate Professor and Adam Porter who was promoted to full Professor. With the departure of Heather Murray from our Graduate Office, we were fortunate to hire Jennifer Story as our Graduate Coordinator. Jenny has been employed in various positions at the University since 1988. During the last eleven years, she was an Assistant Director for the University's Honors Program. I also want to acknowledge all of those faculty, staff, and students who participated in the Department's Awards Ceremony. Pictures from the event and a copy of the program can be found on the department's web page. Finally, we want to acknowledge Professor Emeritus Jack Minker who will be celebrating his 80th birthday and 40 years with the Computer Science Department.

Student Transportation Design Competition



Clockwise: Martin Stolen, Anna Nhan, Tiffany Gray and John Dobrosielski

With the demand on energy resources increasing as the supply decreases, energy costs in the United States have been at an all-time high. Despite these costs, congestion is still steadily increasing. Carpooling has for a long time been an option to help reduce congestion, but commuters currently under use it. The Carpool.UMD website prototype started as a term project for CMSC 434 Human Factors in Computer and Information Systems (http://www. cs.umd.edu/class/fall2006/cmsc434/), under the supervision of Professor Ben Shneiderman.

It is a social-networking website designed to make carpooling to and from the University of Maryland, College Park easier. The website allows users to search for carpools, learn more about other riders and manage their carpools. Carpool.UMD aims to create a safe and friendly community as well as making it convenient to carpool to and from the University.

A project paper was entered in the Student Design Competition of the Computer-Human Interaction (CHI) 2007 Conference held in San Jose, California (www.chi2007.org). Carpool.UMD was one of 12 teams, out of 54 teams from around the world (19 different schools in 11 countries), that were selected to present a design in the final stage of the competition. The conference took place from April 28 to May 3, 2007. The team consisted of three Computer Science Seniors; John Dobrosielski, Anna Nhan and Tiffany Gray, as well as one Aerospace Engineering graduate student, Martin Stolen.

Team members presented their project to an audience on Monday, April 16 in the CSIC Lecture Hall. A reception was held prior to their presentation.

The Departments of Computer Science, Transportation, and Aerospace Engineering provided financial support so that team members could attend the competition in California. We are all very proud of the students and wish them success at the Conference and in their professional careers upon graduation.

Professor Samir Khuller Wins Prestigious Distinguished Scholar-Teacher Award



faculty members receive this honor each year. The award honors senior faculty who possess a record of outstanding scholarly accomplishment, combined with excellence in teaching.

Samir is internationally recognized for his research in designing efficient graph theoretic algorithms that can be used to solve optimization problems from different areas. Many problems in this area are NP Hard, so it is important to develop provably gooy approximate algorithms for these problems. One of Samir's most well known results concerns research on a fundamental network design problem call Light Approximate Shortest Path Trees. This work shows how to obtain a smooth tradeoff between spanning tree weight and distance. In addition, the research he conducted on Connected Dominating sets has been widely used in the wireless networking community and formed the basis of ad hoc network routing methods in wireless systems.

Samir is also passionate about teaching. He has worked closely with some of our brightest campus and area high school students. Undergraduate students have said that Prof. Khuller "got them excited" about theoretical computer science. He taught them about "patience and hard work". He is seen as a "very enthusiastic researcher" who gives "clear presentations, full of exciting problems". He is a "wonderful human being and scholar, an embodiment of hope, energy and great ideas" and "he has helped us grow into something better and beyond ourselves without any sense of effort."

One of Samir's students, An Zhu, won the Dorfman Award for Undergraduate Research then attended Stanford where she earned a Ph.D degree. An is now with Google. Jessica Chang was selected as a Phillip Merrill Presidential Scholar and identified Samir as one of the teachers that most influenced her. Samir continues to work with high school students from Montgomery Blair. In 2004, Michael Forbes was a finalist for the Intel Science Talent Program. This year, Matt McCutchen has conducted some impressive research which he plans to publish next year.

Samir graduated from The Indian Institute of Technology in Kanpur, India in 1986. He received his B. Tech. degree from the Computer Science and Engineering Department and later earned his Ph.D. at Cornell University in 1990. In 1992, he was appointed an Assistant Professor in the department after spending two years in UMIACS as a postdoctoral scientist. He received an NSF CAREER Award in 1995, a Lilly-CTE Teaching Fellowship in 1997, and the 2003 ACM PODS Best Newcomer Paper Award. He was promoted to full Professor in 2004. Samir's publishing and department service records are outstanding. Along with his many other contributions, Samir is currently our Associate Chair for Graduate Education.

The Department is very proud of Prof. Khuller's accomplishments and appreciates his hard work, dedication, and commitment to high academic and intellectual standards. No doubt his professorial visibility and career will continue to grow.

The campus has selected Prof. Samir Khuller to receive a Distinguished Scholar-Teacher Award for 2006-2007. Only a few

The Scientific Computing Group



Ramani Duraiswami, G.W. Stewart, Howard Elman and Diane O'Leary

Numerical analysis and scientific computing have a long history in our department, dating from the work of Werner Rheinboldt and colleagues in the 1970's on the numerical solution of nonlinear equations. The group has always had close ties with numerical analysts in the Mathematics Department, and our students are drawn from the Applied Mathematics and Scientific Computing Program as well as the Computer Science Department. Alumni include Xiaobai Sun (Duke), Robert van de Geijn (Texas), Yuan-Jye Jason Wu (Boeing), and Tamara Kolda (Sandia). Four faculty members currently work in the area of numerical analysis and scientific computing:

- G. W. Stewart
- Howard Elman
- Dianne O'Leary
- · Ramani Duraiswami

Our research ranges from answering basic questions about numerical algorithms, to applying numerical techniques to a diverse set of applications. We give brief summaries of some of our work below.

Matrix Eigenvalue Problems

Eigenvalue analysis is used, for example, to determine resonant frequencies of musical instruments, stability of control systems for automobile braking, and flight characteristics of airplanes. Our work has produced fundamental understanding of the effects of perturbations on the eigenvalues and eigenvectors of matrices. Most recently, our focus has been on development of Eigentest, a test matrix generator for large-scale eigenproblems, and a residual Arnoldi method for solving these problems.

Solution of Large Linear Systems of Equations

In one study of numerical software, it was determined that 90% of the subroutine calls accessed solvers for linear systems of equations. This is an important problem in its own right, but also a component of algorithms for more complex problems such as solving nonlinear equations and partial differential equations, so efficiency is key. We study iterative methods such as GMRES and the conjugate gradient algorithm for solving large linear systems. In particular, we develop preconditioning techniques to speed the solution of certain problems arising in the solution of differential

equations.

The Fast Multipole Algorithm and Applications

The motivation for fast multipole algorithms is to develop an efficient algorithm for computing the potential function for a set of charged particles. Dense matrices derived from point distributions of data arise commonly in applications. The fast multipole method can be used to speed up matrix vector products and iterative solvers involving matrices with such structure. We are exploring the application of fast multipole algorithms to diverse problems including the biharmonic equation, Laplace equation, the Helmholtz equation, radial basis function fitting, Maxwell's equations, and to various kernels that arise in computational machine learning (Gaussian, logistic function, the logit kernel). Research is also focused on developing different data structures, other than the standard ones used in the FMM, and on the development of preconditioners that can be easily implemented in the context of the FMM.

Optimization

Numerical optimization methods are used to find the fastest, or least expensive, or most lowest energy solutions to problems in areas ranging from finance to protein folding. Some of our research focuses on the efficient use of linear algebra in optimization; some exploits structure in the optimization problem in order to devise more efficient algorithms. Recent work concerns the solution of conic convex optimization problems.

The Solution of the Convection-Diffusion Equation

Models of convection and diffusion are among the most widespread in science and engineering, with applications such as semiconductor modeling and transport of pollutants or heated fluids. Discretization and numerical solution of such problems is complicated by the presence of steep gradients (boundary layers) in parts of the solution. We have developed efficient solution strategies based on multigrid and have analyzed the effects of stabilizing discretization strategies on accuracy an on performance of numerical solution algorithms.

Solution of Ill-Posed Problems & Image Deblurring

In ill-posed problems, small changes in the data can cause arbitrarily large changes in the results. Although it would be nice to avoid such problems, they have important applications in medicine (computerized tomography), remote sensing (determining whether a nuclear reactor has a crack), and astronomy (image processing). Our work has focused on studying the characteristics of solutions produced by various regularization methods, especially iterative methods for large problems. We have proposed efficient numerical algorithms for image deblurring.

Solution Algorithms for Models of Incompressible Flows

The Navier-Stokes equations are of fundamental importance for modeling of incompressible flows. Discretization leads to a coupled system of nonlinear algebraic equations for velocities and pressures. By taking advantage of the special structure of the discrete problem and building on algorithmic advances achieved for individual scalar subproblems, we have developed new solution algorithms that are generally applicable to steady-state and evolutionary problems and display convergence rates largely insensitive to fundamental problem parameters such as discretization mesh size and Reynolds number. Ongoing research in this direction includes the extension of these ideas to solve the eigenvalue problems that arise from stability analysis of steady-state solutions.

Computing with Uncertainty

Traditional methods of mathematical modeling depend on the assumption that components of models such as diffusion coefficients or boundary conditions are known. In practice, however, such quantities may not be known with certainty and instead they may be represented as random functions, that is, a random variable for each point in the physical domain. An approach for performing computational studies of models of this type is the stochastic finite element method, which is a generalization of finite element discretization for deterministic problems designed to handle problems posed with uncertainty. We have explored this methodology to model elliptic partial differential equations when some terms in the problem are not known with certainty, and we have developed efficient algorithms for solving the associated discrete problems.

Information Retrieval

In spite of the fact that more than 600,000 medical papers are published annually, physicians are expected to be familiar with current literature ranging from the common cold to cancer. Researchers in a variety of fields face similar challenges. The aim of our research in information retrieval is to develop tools, based on linear algebra and optimization, that retrieve documents that are relevant to a user's query and provide contextual summaries of these documents.

Medical and Biological Applications

The structure of a protein provides critical information in determining its function. Our recent work includes development of a new algorithm for determining the shape of a protein and a fast screening algorithm for finding proteins whose structure is expected to be similar to one presented for classification.

Quantum Computing

Quantum computers may offer a way to solve certain problems that are larger and more complex than any that can be solved on conventional computers. One way to view a quantum computer is as a machine that multiplies a vector by a unitary matrix. Our work in this area focuses on several questions relevant to the decomposition of the unitary matrix into quantum ``gates" that can actually be made to work.

Scientific Computing on Graphics/Game Architectures

Architectures such as Graphical Processing Units (GPUs) or Cell Processors are application specific and have seen a tremendous improvement in their capabilities over the past decade, while at the same time being relatively inexpensive. While their primary use is for graphics and gaming, our research attempts to use them in an heterogeneous environment including these processors and

CPUs to speed up algorithms in linear algebra, interior point methods, image processing, audio processing, and the fast multipole method.

JAMES A. HENDLER ACCEPTS POSITION AT RENSSELAER POLYTECHNIC INSTITUTE



Dr. James Hendler, a Professor in the department for the past twenty years, accepted a position as Senior Constellation Professor at Rensselaer Polytechnic Institute effective January 1, 2007. RPI Constellations focus on a specific research area and comprise a multidisciplinary mix of senior and junior faculty and postdoctoral and graduate students. Jim holds appointments in both the Computer Science and the Cognitive Science Departments at RPI. He also serves as the Associate Director of the Web Science Research Initiative headquartered at MIT.

As Chair of the Tetherless World Research Constellation, a Center to direct the "Future of Information" Project, Prof. Hendler is conducting research on increasing access to information at any time and place without the need for a "tether" to a specific computer or device. He and other researchers envision an increasingly Web-accessible world in which personal digital assistants (PDAs), cameras, music-listening devices, cell phones, laptops, and other technologies converge to offer the user interactive information and communication. Jim also plans to continue his work in Web Science, guide interdisciplinary research, and enhance information technology, computer science, and cognitive science programs.

Rensselaer's President Shirley Ann Jackson said in a press release, "Dr. Hendler's intellect and scientific leadership are evident in his pioneering work to extend the reach of the World Wide Web. He is actively engaged in both scientific discovery and public discourse on Web-related technologies. As leader of the Tetherless World Research Constellation, he will guide interdisciplinary research and enhance information technology, computer science, and cognitive science programs at Rensselaer."

Prof. Hendler received a Bachelor's Degree in Computer Science and Artificial Intelligence from Yale University, a Master's Degree in Cognitive Psychology and Human Factors Engineering from Southern Methodist University and a second Master's Degree and Doctorate in Computer Science and Artificial Intelligence from Brown University. Upon receiving his Ph.D., he began his academic career at the University of Maryland as an Assistant Professor. Prof. Hendler, a renowned computer scientist and World Wide Web researcher, has amassed a long list of accomplishments during his career. Jim has authored one book and more than 200 technical papers in the areas of artificial intelligence, Semantic Web, agent-based computing and high performance processing. He is a Fellow of the American Association of Artificial Intelligence, a member of the World Wide Web Consortium's Semantic Web Coordination Group, Editor-in-Chief of the journal IEEE Intelligent Systems, and a reviewing editor for the journal Science, the first computer scientist ever to serve on its board. Jim was a past recipient of the Fulbright Foundation Fellowship in 1995, a former Chief Scientist of the Information Systems Office at the U.S. Defense Advanced Research Projects Agency (DARPA), and a former member of the U.S. Air Force Science Advisory Board. He was awarded a U.S. Air Force Exceptional Civilian Service Medal in 2002.

Widely recognized as one of the inventors of the 'Semantic Web', Jim says, "this extension of the World Wide Web will bring new information resources which will enable computers to interpret the meaning and context of words and numbers. This technology could be used to bring informative databases – from Internet business to basic biology research – to the Web in more searchable and usable ways. While modern science has grown in complexity and scope, there is an increasing need for more collaboration between scientists at different institutions, in different sub-areas, and across scientific disciplines. The current World Wide Web supports scientific research to a great extent, but is insufficient for the needs of collaboration across scientific disciplines.

The Semantic Web also provides a common framework that allows data to be shared and reused across application, enterprise, and community boundaries for the non-scientist. There are lots of data used every day, which are not part of the web. One can view bank statements, photographs, and calendar appointments but can not see photos in a calendar so that one knows what we were doing when we took the photo or see a bank statement in a calendar because we don't have a web of data. Data is controlled by applications, and each application keeps to itself. The Semantic Web allows a person, or a machine, to start off in one database, and then move through an unending set of databases which are connected not by wires but by being about the same thing."

The Department is very proud of Prof. Hendler and his accomplishments. A reception was held on May 2 to officially thank Jim for his many years of work at UMD and to wish him much success in his career at RPI. Jim and his family will be moving to New York in July 2007.

AI RESEARCH DAY

I he Department's first ever AI Day was held on April 27. The day was designed to give graduate students, especially our new graduate students, an overview of our AI research program. The day started off with short presentations by many of our AI faculty. Students, researchers, and faculty heard about research in machine translation, automatic reasoning, cognitive neuroscience, computer vision, machine learning and other topics. There was an entertaining intermission in the midst of the talks during which the audience took an AI trivia quiz (portions reproduced below in case you'd like to try it). Lunch time was poster time, with over 25 students presenting posters describing work they've presented at

major AI conferences. Many thanks to Lise Getoor and Don Perlis, graduate students Galileo Namata, Gerardo Simari, Amy Sliva, Vanina Martinez and Shomir Wilson, and support staff Brenda Chick and George Pelham, who put the day together. The event was a great success with over 100 faculty and students participating in the event.

TRIVIA QUIZ

1. Which two CS professors at UMCP also got their Ph.D.s here?

2. Who discovered games such that the more you know, the worse you play?

3. Who was the first chairman of our department?

4. What AI professor has received an award for his work on human rights?

5. What AI professor headed an eponymous company?

6. What professor has both a Ph.D. and an M.D.?

7. What AI professor has two Ph.D.s?

8. What AI professor has a Ph.D. graduate who is an NSF PCASE awardee?

9. Which CS professor went to ground school for a pilot's license?

10. Which CS professor's thesis advisor was instrumental in the development of the internet?

11. Which CS professor was Chair of the ACM Computer Science Education Committee which wrote the famous report on Computer Science Education at the college/university level?

12. Which CS professor's MS advisor was the postdoc advisor of her Ph.D advisor?

⁽Answers: 1.Larry Davis, 1976; Jim Reggia,1981 2. Dana Nau, pathological games 3. Jack Minker 4.Jack Minker, AAAS Fellow 5.Laveen Kanal, LINK Corp. 6.Jim Reggia, MD in neurology 7.Don Perlis, CS and Math 8.Dana Nau (awardee, S.K. Gupta) 9. Bonnie Dorr 10.Hanan Samet 11.William F. Atchison, Director of UMD's Computer Science Center 12. Getoor; she did her MS w/ Stuart Russell, who was the postdoc advisor of her Ph.D. advisor, Daphne Koller.)

IN THE NEWS...

Congratulations to Necip Fazil Ayan, who was a major contributor and second author on the "Best Paper" at the North American ACL-2007 this year. Fazil provided a novel phrase-level system combination approach for machine translation and also demonstrated that a combination of three approaches (word-level, phrase-level, and sentence-level) achieves the best result.

Jessica Chang was selected for Honorable Mention in the Computing Research Association's Outstanding Undergraduate Award for 2007. This year's nominees were a very impressive group. A number of them were commended for making significant contributions to more than one research project, several were authors or coauthors on multiple papers, others had made presentations at major conferences, and some had produced software artifacts that were in widespread use. It is quite an honor to be selected for Honorable Mention from this group. Congratulations, Jessica!

Over spring break, Dana Nau gave invited talks at two Chinese universities: Hong Kong University of Science & Technology and Sun Yat-Sen University (in Cantonese) or Zhongshan University (in Mandarin). During the visit, he discovered that a professor at the latter university is translating his book, *Automated Planning: Theory and Practice*, into Chinese.

Bill Arbaugh was quoted in "Computer Weekly" in an article about the rootkit problem. Malware writers are using the exact techniques that the security writers have been using for years in order to keep their software from being detected.

Allison Druin and the Human-Computer International Children's Library were featured on "ABC News" on January 2 in a piece that focused on the design and testing of the Library's interface for children's books across digital media.

Professor Emeritus Jack Minker gave an invited keynote address, ``Reflections on Logic Programming and Nonmonotonic Reasoning,'' at the International Conference on Logic Programming and Nonmonotonic Reasoning held in Tempe, Arizona, May 14 - May 17, 2007.

CS 6

Dianne O'Leary was chosen as the winner of the College's annual Board of Visitor's award for 2007