A Message From the Department Head

Rich Maclin

I hope this holiday season finds all of you well. This is my third year as department head and while I cannot say I am comfortable with the job, at least it is not so intimidating anymore. Things were fairly quiet for the Computer Science department in the past year. Undergraduate enrollment in the Computer Science and Computer Informations Systems major continues to be very low, reflecting a national trend. But we continue to get excellent students and are enjoying the somewhat smaller class sizes.

We are making some attempts to attract students as the job market appears to be solid. We have had alumni and recruiters speak to our freshman classes to discuss the employment market. We also held a very informative panel last February, given by alumni and members of the Computer Science industrial advisory board to answer questions from students preparing to graduate. This panel went very well and we are planning to repeat it, tentatively on February 15. Please contact us at cs@d.umn.edu if you would be interested in participating.

In other department news, Ted Pedersen completed his sabbatical, a productive year that led to a number of publications and presentations. (See the Faculty Spotlight article.) Overall, the department remains very actively engaged in research, producing numerous prestigious publications as well as attracting funding support from organizations such as the National Science Foundation, the National Institutes of Health, the Defense Advanced Research Projects Agency, the Minnesota Department of Transportation, and other University of Minnesota sources.

The renovated Life Science building was finally reopened (and the resulting noise finally stopped). The Pharmacy school has moved into that space, beginning a sequence of moves that will eventually lead to the Computer Science department relocating from Heller Hall to the MWAH building. There have been some further developments, so it is not clear how soon that move will happen. Check back next year.

Finally, I again ask that you please stay in touch with us, and if you find yourself in Duluth please stop by and visit.

Faculty Spotlight

Ted Pedersen

In the fall of 1999, the UMD Computer Science Department welcomed Dr. Ted Pedersen to the faculty. Ted had finished his Ph.D. at Southern Methodist University in 1998 and spent a year on the faculty at California Polytechnic State University in San Luis Obispo. Since joining UMD Ted has become an international authority in natural language processing and computational linguistics, with his long term goal "to develop methods and systems that automatically discover the meaning of written text and understand its content."

Since the advent of digital electronic computers, it has been the wish of computer users and computer researchers alike to make machines understand human language rather than the other way around. Anyone who has studied artificial intelligence knows that this is an elusive goal due to the vagueness, ambiguity, and context dependence of human conversational language. Ted has been chipping away at this formidable problem since his graduate student days and produced a very substantial body of research results, publications, and publicly available software in the relatively short time he has devoted himself to it.

Ted's research program at UMD got off to a flying start when he was awarded a National Science Foundation Early Faculty CAREER Development Award, which helped fund his research through February 2007. During that time, Ted and his research group created SenseClusters, a package of programs that allows a user to cluster similar contexts together using unsupervised knowledge-lean methods; WordNet-Similarity, a module that implements a variety of semantic similarity and relatedness measures based on information found in the lexical database WordNet; the NGram Statistics Package, which allows identification of word n-grams appearing in large corpora using standard tests of association; and SenseRelate, which seeks to use measures of semantic similarity and relatedness to perform word sense disambiguation. The conference papers, presentations, and software resulting from these projects are very impressive.

For the 2006-2007 academic year Ted was granted a Sabbatical Leave that he describes as "a highly productive and invigorating time," an understatement when you consider what he accomplished.

He made presentations at four conferences, including three paper presentations, a tutorial, and an invited talk. At one of the conferences, in India, he gave a keynote address that tied together his work on SenseClusters and WordNet-Similarity. At another, in Mexico City, his presentation on differentiating people with the same name in web searches was voted the best presentation of the conference by the attendees. In addition, he wrote an article for the South Asian Language Review that provides an overview of the large class of problems in language processing that can be solved by identifying pieces of text that are similar to each other.

While Ted is an eloquent speaker and writer, he is also, in that grand tradition of computer science, a "hacker" (in the non-pejorative sense all programmers understand) who likes to build things. Artificial intelligence researchers often participate in shared tasks, or "competitions" that bring together researchers who have developed methods and implemented software systems that can be applied

to some practical task. During his sabbatical, Ted participated in four such shared tasks, ranging from predicting whether a hospital patient was a smoker of tobacco based on the contents of their medical records, to assigning dictionary meanings to words in text based on their surrounding context.

In that grand tradition of science in general, Ted is a believer in making his methods and software available for anyone to use and replicate his experimental results. So he supports the open source model of software development, to the point even of making his software available to the non-technically inclined through the distribution of bootable CDs.

Ted and his UMTC collaborators Serguei Pakhomov and Brian Isetts are currently seeking funding from the National Institute of Health for a project entitled "Semantic Relatedness for Active Medication Safety and Outcomes Surveillance". Hopefully there will be good news to report on that in this newsletter next year.

Alumni Spotlight

Amit Singhal

Many of us who choose the academic life do so because we love to teach and because we acquire new knowledge while teaching. Once in a while, we find our efforts repaid in ways we don't always expect, as when one of our former students contributes in a direct way to work that permanently alters the technological, economic, and social landscape. Such is the contribution of **Amit Singhal**, who received his M.S. degree in computer science from UMD in 1991 and is now a Google Fellow. If you have ever marveled at how Google takes your search phrase and almost instantly returns relevant web pages from among hundreds of thousands, or millions, of matches, you can thank Amit and others in Google's search quality group.

Google Fellow Amit Singhal

Born in India, Amit spent most of his boyhood "in the foothills of the Himalayas" before receiving an undergraduate degree in computer science from the University of Roorkee. From there, he went to Duluth ("somehow, back then, I always found myself in cold places") where he started a master's program in computer science. "UMD was the turning point in my life. Studying Informa-

tion Retrieval with Don Crouch and then Don recommending that I move to Cornell to study with Gerard Salton, is the main reason behind my success today. Don gave me the love for search, I have just followed my passion ever since."

Amit received his Ph.D. in 1996 under Salton, who is considered "the father of digital search." Shortly thereafter, he joined AT&T Labs, where he worked on projects like SCAN, a system that combines speech recognition, information retrieval and user interface techniques to provide a multimodal interface to speech archives. In 2000, Amit moved to Google at the urging of his friend Krishna Bharat. Google is well known for giving its researchers freedom to work in areas of personal interest, and Amit has earned some notoriety in the area of document ranking, which is what search engines do, when given a user query, to rank a large collection of documents so that what you are looking for is ranked ahead of other less useful documents.

The Google "ranking algorithm" is both famous for its efficacy and somewhat mysterious, since Google guards its details as a trade secret. Last summer Amit was the subject of a *New York Times* article that followed him in his daily quest to improve the quality of search. The quest is a difficult one, both due to the massive amount of (sometimes questionable) information that must be sifted, and also to the fact that users are beginning to take high quality search performance for granted. "Search over the last few years has moved from `Give me what I typed' to `Give me what I want'," remarks Amit.

In his quest to satisfy every user query, Amit and his team have built several new technologies that now benefit Google users. One of these systems is the widely acclaimed Google's "universal search." Universal search offers users a more integrated and comprehensive way to search for and view information online. Google's vision for universal search is to ultimately search across all its content sources, compare and rank all the information in real time, and deliver a single, integrated set of search results that offers users precisely what they are looking for. You can imagine how hard

this is, but Amit and his team have made tremendous technological advances in this direction.

Anyone who talks to Amit even for a few minutes can see his passion for search. "Information is power, the more we know, we can make better choices and decisions, and we can all improve the quality of our lives." Amit's desire to improve search for all Internet users comes through strongly. "I always wanted to build something even my Mom can use, and I am happy to say that I did. However, now I hear complaints from my Mom when she can't find the recipe she just searched for on Google. I suppose I will just have to work harder on improving search..."

Amit has come a long way from the foothills of the Himalayas. He is now regarded by the publication *India Abroad* as one of the 50 most influential Indian Americans. But he is characteristically humble about it. "It is the work of a lot of people that gets credited to me."

We in the UMD Computer Science department will take just a small bit of that credit, thank you.

Faculty News

Jim Allert's work took a strange turn in the fall of 2006 when he switched from teaching Computer Science I using C++ console applications to GUI ones instead. It quickly became apparent that the move was enthusiastically welcomed by the students. However, few C++ textbooks take the GUI approach, so Jim wrote a "project manual" for the class. The project writeups, consisting of examples, resource material, and project descriptions, quickly ballooned to over 500 pages. At that point Jim was contacted by a major textbook publisher and asked to rework the material into book form. Look for "Programming with Visual C++ 2008: Concepts and Projects" in your local computer science bookstore, scheduled to come out around the consumer release date for Visual Studio 2008.

Jim has been experimenting with learning resources. This past summer he created a website called 'cshelper' that contains flash animations of how to create programs, debug them, and deal with all of the key issues raised by programs in CS1 and Visual Basic. Students made extensive use of this site when it was first announced and have come to rely on it as a way of meeting their need for assistance 24/7.

Jim continues his research into the learning styles of computer science undergraduates and now has perhaps the largest ongoing study of that topic (n > 2,000) in the world. His publication agenda for the next year, other than the book, focuses on this topic.

Tim Colburn served on the program comittee for the Philosophy of Computer Science track of the European Conference for Computing and Philosophy (ECAP-07) in June at the University of Twente in the Netherlands.

He also presented a paper there on the topic "Metaphor in Computer Science", prepared jointly with **Gary Shute**. Tim and Gary's paper "Abstraction in Computer Science", which grew out of their participation in ECAP-06 in Norway, was published in a special issue on philosophy of computer science in the journal Minds and Machines. Their work on metaphor in computer science has been invited for a special issue on philosophy of computer science in the Journal of Applied Logic.

Tim is delighted to be teaching Honors Computer Science I again for the first time in 10 years. Also, in a stubborn refusal to act his age, he continues to wear his hair in a ponytail.

Carolyn Crouch's research group in information retrieval continues its exploration of web-based retrieval and issues related to the retrieval of elements from structured and semi-structured text. In particular, they have presented a solution to the problem of dynamic element retrieval for structured text. They are now well on their way to dealing with the particular difficulties that arise when text falls short of normal structure (the test collection in this case being Wikipedia). They extend their thanks to all the graduate students, both past and present, who have been instrumental in the success of this work.

Doug Dunham continues to present papers on hyperbolic patterns. The first was "A General Algorithm to Generate Repeating Hyperbolic Patterns" in the sixth ISAMA (International Society for Art, Mathematics, and Architecture) conference at Texas A & M University, May 18-21, 2007. He also conducted a workshop on hyperbolic patterns at that conference. The second, related paper was "An Algorithm for Generating Repeating Hyperbolic Patterns" at the fifth Mathematics & Design conference in Blumenau, Brazil, July 1-4, 2007. The third paper was "A `Circle Limit III' Calculation" at the tenth annual "Bridges" conference in San Sebastian, Spain, July 24-28, 2007.

Doug has been teaching many of the same courses as in the past User Interfaces, Graphics, and Advanced Data Structures and Algorithms. Spring semester, 2007, he taught Computability and Complexity for the first time in several years, dealing with finite automata, Turing machines, and the classes P and NP.

Among his many non-academic pursuits, Doug now includes wake surfing. While we don't have a photo of him actually in action, we do have one of him waiting his turn at Island Lake.
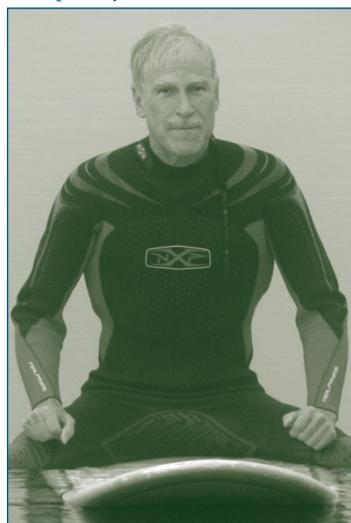
Faculty Publications 2007

Allert, J. (2007). Visual C++ Programming: Concepts and Projects. Thomson Custom Solutions.

Colburn & Shute (2007). Abstraction in Computer Science. Minds and Machines: Journal for Artificial Intelligence, Philosophy, and Cognitive Science 17(2), 169-184.

Crouch, C. & Crouch, D. (2007). Dynamic Element Retrieval in a Semi-structured Collection. Comparative Evaluation of XML Information Retrieval Systems (INEX 2006), Fuhr, et. al., eds. Springer LNCS 4518, 82-88. (with Ganapathibhotla & Bakshi)

Maclin (2007). Refining Rules Incorporated into Knowledge-Based Support Vector Learners Via Successive Linear Programming. Proceedings of the Twenty-Second Conference on Artificial Intelligence (AAAI'07), Vancouver, British Columbia. (with Wild, Shavlik, Torrey & Walker)

Maclin (2007). Relational Macros for Transfer in Reinforcement Learning. Proceedings of the Seventeenth Conference on Inductive Logic Programming, Corvallis, Oregon. (with Torrey, Shavlik, & Walker)

Maclin (2007). Building Relational World Models for Reinforcement Learning. Proceedings of the Seventeenth Conference on Inductive Logic Programming, Corvallis, Oregon. (with Walker, Torrey, & Shavlik)

Pedersen (2007). Using UMLS Concept Unique Identifiers (CUIs) for Word Sense Disambiguation in the Biomedical Domain. Proceedings of the Annual Symposium of the American Medical Informatics Association, Nov 10-14, Chicago, IL. (with McInnes & Carlis)

Pedersen (2007). Measures of Semantic Similarity and Relatedness in the Biomedical Domain. Journal of Biomedical Informatics, 40(3), 288-299. (with Pakhomov, Patwardhan, & Chute)

Pedersen (2007). Determining the Syntactic Structure of Medical Terms in Clinical Notes. Proceedings of BioNLP 2007, June 29, Prague, Czech Republic, 9-16. (with McInnes & Pakhomov)

Pedersen (2007). UMND1: Unsupervised Word Sense Disambiguation Using Contextual Semantic Relatedness. Proceedings of SemEval-2007: 4th International Workshop on Semantic Evaluations, June 23-24, Prague, Czech Republic, 390-393. (with Patwardhan & Banerjee)

Pedersen (2007). UMND2: SenseClusters Applied to the Sense Induction Task of Senseval-4. Proceedings of SemEval-2007: 4th International Workshop on Semantic Evaluations, June 23-24, Prague, Czech Republic, 394-397.

Pedersen (2007). Unsupervised Discrimination of Person Names in Web Contexts. Proceedings of the Eighth International Conference on Intelligent Text Processing and Computational Linguistics, February 18-24, Mexico City, 299-310. (with Kulkarni)

Pedersen (2007). Discovering Identities in Web Contexts with Unsupervised Clustering. Proceedings of the IJCAI-2007 Workshop on Analytics for Noisy Unstructured Text Data, January 8, Hyderabad, India, 23-30. (with Kulkarni)

Turner (2007). Nonmonotonic Causal Logic, a chapter in The Handbook of Knowledge Representation, Elsevier.

Graduate Program News

Professor Carolyn Crouch, Director of Graduate Studies, is pleased to report that our Graduate Program is in excellent condition by all verifiable measures. Our incoming classes are well prepared and compare favorably in terms of background and GRE scores with those of our sister department in the Twin Cities.

As many are aware, academic computer science enrollment across the country has suffered for some years as a result of the burst of the "tech bubble" and the publicity surrounding the revision of immigration policy following 9/11. A perceived tightening of immigration policy, which unfortunately received considerable publicity both here and abroad, had a large impact on international applications for admission, and of course the impact on the profession from the bursting of the tech bubble is only now disappearing.

Still, we continue to attract talented applicants who complete their M.S. degrees in a timely fashion. All of our master's students from the class of 2005-2007 graduated last summer and found the job market most receptive. They are finding employment with major companies across the nation and being accepted for study at the Ph.D. level by some of the best graduate programs in the country. One returned home where he is employed in India's strong and highly competitive computing industry.

M. S. students are all smiles at commencement

2007 Graduates

Nachiket Kamat   Umesh Maitipe
Vikram Malik   Ajit Marathe
Aditya Mone   Vinayak Patil
Neeraj Vohra

Outstanding Teaching Assistant Award

Vikram Malik   Aditya Mone

Our program provides an environment that is almost nonexistent at most universities today--a research-oriented Master's program where each student is given the opportunity to work closely with his/her advisor and a small group of researchers who focus over a two-year period on a particular area of interest. The number of papers produced is indicative of the quality of the research. And the experience itself, the hands-on learning that takes place in this environment, is highly valued both by potential employers and by universities who will make use of those skills in their Ph.D. programs.

We invite all of our M.S. graduates to contact us, when time permits, and let us know where you are and what you are doing. We are particularly interested in the type of work you are engaged in at this stage of your career. We remember you all fondly and hope that the coming year is a good one for you and yours.
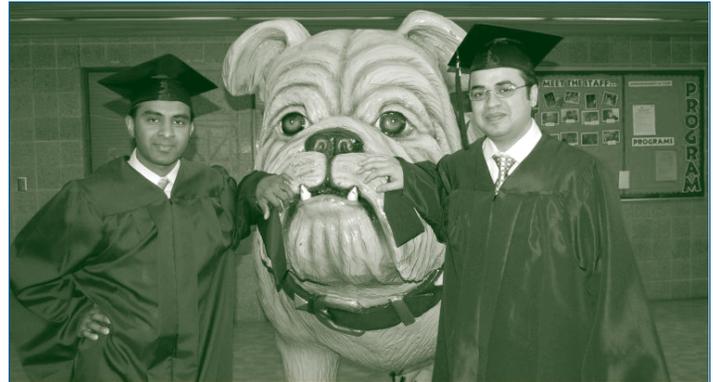
Umesh and Vikram with friend

Undergraduate Program News

The summer of 2007 was a busy time for two of the department's undergraduate majors.

U. of M. Supercomputing Institute Summer Internship
Mike Neilsen, a computer science and mathematics double major, interned at the University of Minnesota Supercomputing Institute, where he participated in the VLab (Virtual Laboratory for Earth and Planetary Materials) project. Mike's tasks included adding functionality to the web portal used by VLab administrators to monitor electronic structure calculations.

When asked how his UMD computer science education prepared him for his internship experience, Mike says, "My work with VLab was composed of working within enterprise Java frameworks, so I was grateful for the exposure to Java that many of my computer science classes provided me." His software engineering course was particularly relevant. "I was fortunate to have exposure to the Java-Server Faces web application framework and the Apache Tomcat web container immediately prior to my internship. This gave me an additional set of functional skills to take along."

Mike values other aspects of his education apart from programming language and software tool experience. "Much more importantly, the courses I've had so far have placed a large emphasis on software design--and specifically, object oriented design. Understanding how to effectively model complex problems using object orientation made the VLab architecture much more comprehensible."

Despite his academic preparation, Mike notes that the frameworks and application architectures that he worked with at MSI were more vast than anything he had been exposed to. Also, none of the project teams he has been part of in course work has been as large as the VLab team. As a result, Mike says he has "formed new values and opinions regarding working with teams composed of members with diverse experiences, managing and organizing resources for a large-scale project, and interacting with a variety of customers. These values have changed how I work in cooperative settings, and I feel that I am a stronger asset in teams because of it."

Upon completion of his internship, Mike returned to UMD in the fall with a full load of 16 math and computer science credits. In his copious spare time, he decided to enter IBM's "Master the Mainframe" contest, an event that spans three months. Mike has successfully completed two phases and is diligently working on the third and final phase. Stay tuned.

Google Summer of Code

The Google Summer of Code program, started in 2005, provides students with software development experience by bringing them together with mentors representing open source development projects from around the world. It has become a prestigious program, and for summer 2007 UMD computer science major **Mike Baynton** proposed a project to be mentored by the Wikimedia Foundation, operator of the collaboratively edited reference project Wikipedia. Mike's proposal, entitled "Comprehensive Automated Multimedia Recoding for Wikimedia," promised to provide scripts that would aid in the conversion of uploaded audio/video media contributions to open formats suitable for in-browser players. Mike reports that he had to skip class to get the proposal finished, but his proposal was accepted, and in June he joined over 900 other students in a "summer of code".

Mike is self-taught in web application programming, and he has maintained or built web apps for several clients. He has low regard for poorly made websites. "There's a lot of ugly code out there powering most any smaller proprietary site you visit. If you ask me it's its own minor software crisis." The opportunity to work on a high quality site was "refreshing".

Mike documented his project in a technical blog that details the problems he ran into and the design issues he faced. At times he had to teach himself things in order to get past a roadblock. "Since my first courses in Computer Science 5 years ago, I've been taught almost exclusively in languages that work like Java and PHP. I've gotta say, there's definitely something cool about doing your own memory management, finding bits with pointer arithmetic, and producing fast machine code at the end. I feel quite accomplished to have figured everything out."

Mike entered UMD as a freshman with credit for CS I and CS II given through his high school's Advanced Placement program, which taught in Java. He took CS II anyway, but the demands of his project required that he relearn memory management.

By the end of the summer, Mike's project was accepted by his WikiMedia mentor, although he points out that some additional elements are needed before his code can "go live" on wikipedia.org. He has some regrets about not finishing these elements but feels he learned a lot. One lesson was not to get bogged down in what computer scientists call analysis paralysis: "The biggest thing I think I learned this summer is not to spend too long getting caught up on a single aspect or feature of your project if you can't figure it out."

Mike believes the Google Summer of Code experience helped him broaden his programing skills, but it also instilled a desire to be part of the open source phenomenon. "I hope that sometime in the future, I will wake up, scan the day's tech headlines, see `Wikipedia adds support for videos,' and know that I had something to do with it."

2007 Graduates

The department conferred 18 undergraduate degrees during the 2006-2007 academic year. The following students received Computer Science degrees:

Samuel Bradley	John Gleason
Evan Harris	Jeremy Hartley
Scott Johnson	Erik Ledeboer
Mark Nelson	Jason Novek
David O'Keefe	Michael Rabas
Gregory Stephens	Chee Vang

The following students received Computer Information Systems degrees:

Timothy Fellman	Michael Johnson
Jacob Lubitz	Andrew Meyer
Benjamin Olson	Aaron Slotness

Undergraduate Awards

In May, 2007, our annual departmental awards were presented:

Outstanding Academic Achievement: Erik Ledeboer

Outstanding Service: Scott Johnson

Scott and Erik with awards

Campus News

College of Science and Engineering Renamed

This fall Dean Riehl and Chancellor Martin announced that in recognition of alumnus Jim Swenson's contributions to our college, it was to be renamed the Swenson College of Science and Engineering. Swenson's total contributions, including money for the Swenson Science Building, science scholarships, undergraduate research programs, and toward the construction of a new civil engineering building, have reached $21 million. If complete funding for the civil engineering building is obtained through the Minnesota Legislature, groundbreaking would take place in the summer 2008, with building completion set for September 2010.

Life Science Building Renovation Complete

After a $15 million renovation, the Life Science Building re-opened for the Fall 2007 semester. No more daily detours through the Medical School to reach lecture halls in MWAH! The fully-renovat-

ed building houses the College of Pharmacy and the Department of Biology. The pharmacy space, named the Paddock Laboratories Pharmacy Education Center, occupies the first and second floors of the refurbished building. The Center has five classrooms, two large laboratories, study space, computer laboratories, and a student lounge.

The ground and third floors of the renovated building house instructional laboratories and offices for biology, complementing the instructional and research laboratories in the new Swenson Science Building, which opened in 2005. The renovated Life Science Building also provides space for state-of-the-art chemical preparation and storage areas, wet and dry animal collections, a laboratory preparation room, biology student clubs, greenhouse preparation areas, two research laboratories, and offices for faculty members, staff, and graduate teaching assistants.

Labovitz School of Business and Economics Building Construction Continues

Construction continues on the $23 million Labovitz SBE Building, begun in July 2006. A "topping off" ceremony--a long-standing tradition in the building trades--took place over the summer, during which Chancellor Martin and benefactors Sharon and Joel Labovitz placed an American flag on the highest part of the building under construction.

Scheduled to open in spring 2008, the Labovitz School of Business and Economics will be the first new public higher education building in the state of Minnesota to be a LEED (Leadership in Energy and Environmental Design) certified "green building". The Labovitz School will be totally designed to meet LEED certification--a rigorous process that evaluates the environmental sustainability of building design, construction and operation.

The new 65,000 square foot building will be approximately 1.5 times the size of the current business school and will emphasize a knowledge-based global economy. Plans call for the building to contain modern computer labs and facilities for distance learning and conferencing. The three-story structure will link to the existing library annex on the lower level, thus allowing students to continue to attend all their classes in shorts and sandals in the middle of February.

Steve Holtz is teaching a new course entitled "Introduction to 3D Game Development," a 4-credit liberal education course designed for non-programmers. Students start off creating storyboards that they animate using a program called Alice. Alice has an interesting drag-and-drop programming language in which syntax errors are not possible. Imagine writing your first program, an interactive 3D animation, without the possibility of generating a syntax error!

Students then move to a full featured 3D modeling/animation game engine using Blender, an environment that has been used to create several open animated films, including "Elephants Dream" and "Peach." Students create simple 3D models that are used to build simple interactive animations and finally a game. The game engine allows students to build and plug in custom functionality written in Python.

Chris Prince won the Soaring Society of America's On-line Contest for Region 7 (IL, IA, MN, Eastern MO, ND, SD, WI). This is a contest in which glider pilots submit GPS flight traces on-line while soaring. Also, on July 28, 2007, with a flight of 358.37 km (222.68 miles), Chris set three Wisconsin state soaring records in the "Free 3-Turnpoint Distance" category. We have no idea what that means, but here's a photo of Chris' glider where it wound up in a farmer's field in Illinois.

Pete Willemsen's current work continues to focus on creating more dynamic and realistic virtual environments. He and his group are working with fluids engineers to more efficiently simulate large-scale particle dispersion in urban environments. Interestingly, their computations to move particles in response to a simulated wind field are processed entirely on the Graphics Processing Unit (GPU) located on the graphics card in a lab PC. Their team discovered that code running on the GPU executes over 180x faster than the same code running on a general purpose CPU, allowing the simulated movement of millions of particles in real-time. The lab's head-mounted display allows visualizing and interacting with a million particles moving around a set of buildings, as in the image below.
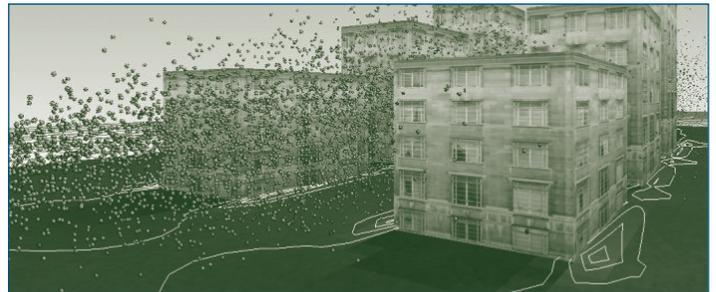
A related project is using this particle simulation code as a base on which to more effectively render snow in real-time. Pete is interested in creating situations in which driving behind a virtual snowplow in snowing or foggy conditions can be simulated to better understand the myriad safety issues related to following snowplows in inclement weather. His team is also using the GPU to simulate the actions of autonomous drivers in a driving simulation. The goal is to fill virtual roadways with tens of thousands of simulated vehicles intelligently driving over the roads and making decisions to turn at intersections. All of these projects will hopefully contribute to more dynamic and realistic virtual environments used in scientific, educational, and training applications.

Support the Computer Science Scholarship Fund

Did you know that you can show your support for your Alma Mater and the Computer Science Department when you make your annual gifts to the University? When you receive a phone call from a student caller or when you receive one of the University's mail pieces asking for your support, please consider helping the current and future Computer Science Students; simply ask that your gift be designated to the Computer Science Scholarship Fund. Through the generous gifts of alumni and friends we hope to provide scholarships to deserving students. So next time you open a UMD letter asking for your support, please consider helping a Computer Science student.

If you would like more information about making a gift to support the Department of Computer Science, please contact Tricia Bunten, Director of Development for the College of Science and Engineering (218-726-6995 or via tbunten@d.umn.edu). You can also visit the Development website at: www.d.umn.edu/development/.