

Computer Science

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News

Best Poster Award

Etienne Grossmann, Amit Kale, Christopher Jaynes and Samson Cheung got the best poster award at the British Machine Vision Conference, for the poster of the article "Offline generation of high-quality background subtraction data." "Background subtraction" consists in labeling foreground and background in video sequences. This problem is ill-posed in the sense that the definitions of "fore-" and "background" depend on the user's preference. Their approach consists of learning to approximate the user's preferences by an additive combination of off-the-shelf image operators. The jury rewarded the simplicity of the poster, which is about a hundred words long, plus a few images.

ACM Student Programming Contest Held at UK

On Saturday, November 5, the Department of Computer Science hosted a satellite site of the 30th ACM Programming Contest - MidCentral Region. This region consists of Arkansas, Illinois, Kentucky, Missouri, and Tennessee. This is an annual contest with about 6,500 hundred teams competing worldwide and culminating with the World Finals in April.

There were 122 teams this year in our region and the top three teams were:

Washington University in St. Louis: WUSTL
DePaul University: DePaul Monks
University of Kentucky: U Kentucky

With the third place there is a possibility that we will be invited to the finals.

Our team, consisting of Stephen duBarry, Isaiah Damron and Kyle Vogel, was at the top of the region for most of the contest and finally placed third out of 122 teams. Our second team placed 10th in the region. At the Lexington satellite site we placed first, second and fourth out of 21 teams. The University of Louisville was third. We congratulate our students for their outstanding performance. It is a great success to place so highly in this extremely competitive contest. Thanks also go to Professor Jaromczyk, who was the site director.

Young Researcher Fellowship Award

Wensheng Shen, a Ph.D. student under the supervision of Professor Zhang, won a competitive Young Researcher Fellowship Award, which carried a personalized fellowship certificate and covered all expenses for him to attend and present a paper at the Third MIT Conference on Computational Fluid and Solid Mechanics, in Boston, MA, in June 2005.

Sudoku Craze Hits UK CS Department

Professors Marek, Truszczynski, and Finkel publish a daily Sudoku puzzle at <http://www.cs.uky.edu/~raphael/sud.html>. It is based on an algorithm they developed and comes with hints and a solution.

My Research

Graphics and Geometric Modeling

- Dr. Fuhua (Frank) Cheng

My research interests center around the design of graphics and geometric algorithms, with special emphasis on the computation techniques for rendering and geometric problems, and modeling of geometric shapes. The areas covered include geometric/solid modeling, reverse engineering, finite-element mesh generation, biomedical imaging, and collaborative CAD.

I have made important contributions in several areas of computer graphics and geometric modeling. I was the first person to develop a hardware device for the

generation/rendering of parametric curves and surfaces.

This work won me the Dr. Sun Yat-Sen Technology Invention Award in 1985. My joint work with Arthur A. Goshtasby, "A Parallel B-Spline Surface Fitting Algorithm," initiated a new research area, parallel spline algorithms. The area is still active today. The first conceptual model for a collaborative CAD system was presented by my research group. We are also the first group in addressing the implementation of collaborative CAD on World-Wide Web.



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Presentations

Professor Cheng presented two posters, “Constrained Design, Streamline modeling, Automatic Fairing and Automatic Joining Techniques for NURBS Surfaces” and “Tessellation, Fairing, Shape Design and Trimming Techniques for Subdivision Surface-based Modeling,” at the 2005 NSF Grantees’ Conference in Scottsdale, Arizona, from 1/3/05 to 1/6/05. He gave a talk titled “Adaptive Subdivision of Catmull-Clark Subdivision Surfaces” at CAD ’05 in Bangkok, Thailand, June 2005 and gave a talk titled “Texture Mapping on Surfaces of Arbitrary Topology using Norm Preserving based Optimization” at 2005 Pacific Graphics Conference in Macau, China, October 2005.

Graduate student **Bryan S. Crawley** and **Professor Finkel** presented the paper “Micky: Methods With Implicit Calls” at the 2005 International Conference on Programming Languages and Compilers, PLC ’05, June 27-30, 2005, Las Vegas.

Professor Fei and his student **Mengkun Yang** presented the paper “Cooperative failure detection in overlay multicast” at IFIP Networking 2005 in Waterloo, ON, Canada, in May 2005.

Professor Dekhtyar presented the papers “Text Mining for Software Engineering: How Analyst Feedback Impacts Final Results,” co-authored by **Professor Hayes** and graduate student **Senthil Sundaram**, at the Second International Workshop on Mining Software Repositories (MSR 2005); “Towards a Query Language for Multihierarchical XML: Revisiting XPath,” co-authored by graduate student **Emil Iacob**, at the Eighth International Workshop on the Web and Databases (WebDB 2005); “Searching Multihierarchical XML Documents: the Case of Fragmentation,” co-authored by graduate students **Emil Iacob** and **Srikanth Methuku**, at the International Conference on Database and Expert Systems Applications (DEXA 2005); “Revisiting the Semantics of Interval Probabilistic Logic Programs,” co-authored by **Michael I. Dekhtyar**, at the Eighth International Conference on Logic Programming and Non-Monotonic Reasoning (LPNMR 2005); “On Improving Local Website Search Using Web Server Traffic Logs: A Preliminary Report,” co-authored by graduate student **Qing Cui**, at the International Workshop on Web and Database Management (WIDM 2005).

Professor Dekhtyar and his Ph.D. student **Emil Iacob** presented the demonstrations “Processing XML documents with Overlapping Hierarchies” and “Building Image-based Electronic Editions using the Edition Production Technology” (the latter also co-authored by **Professor Jaromczyk**, graduate student **Neil Moore**, **Kevin Kiernan** and **Dorothy C. Porter**) at the Joint Conference on Digital Libraries (JCDL 2005); “Edition Production Technology: an Eclipse-based platform for

building Image-Based Electronic Editions,” also co-authored by **Professor Jaromczyk**, graduate students **Neil Moore**, **Kevin Kiernan** and **Dorothy C. Porter**, at the International Conference of the Association for Computing in Humanities (ACH/ALLC 2005); “A Framework for Processing Complex Document-centric XML with Overlapping Structures,” at the ACM SIGMOD 2005 conference.

Professor Douglas presented the papers “Minimus - is a Grid Lite the right approach?” at HP-CAST4, Krakow, Poland, April (invited); “Multiscale Interpolation, Backward in Time Error Analysis for Data-Driven Contaminant Simulation” (jointly authored with post-doc **Deng Li** and graduate students **Adam Zornes**, **Ryan McKenzie**, and **Wei Li**) at the International Conference on Computational Science 2005, Emory University, Atlanta, May (invited), at the Symposium on Scientific Computing and Mathematical Software in Emerging Sciences and Technology, Hong Kong, June (invited plenary talk), at the 2005 Japan Society of Industrial and Applied Mathematics Conference, Sendai, Japan, September (invited), and at the 2005 European Multigrid Conference, Scheveningen The Hague, Netherlands, September (invited).

Professor Goldsmith presented the paper, “Interactive Preferences and Decision-Theoretic Planning,” co-authored by students **Derek Williams**, **Kyle Bailey**, and **Professors Dekhtyar**, **Finkel**, **Goldstein**, and **Mazur**, at the IJCAI Workshop on Preference Handling in Edinburgh, Scotland, in July. Her paper “Complexity of DNF and Isomorphism of Monotone Formulas,” co-authored by Matthias Hagen, and Martin Mundhenk, appeared in Mathematical Foundations of Computer Science (MFCS ’05) 2005, Gdansk, Poland.

Professors Hayes and **Dekhtyar** and their student **Senthil Sundaram** presented their paper “Baselines in Requirements Tracing” at the Predictive Models on Software Engineering (PROMISE) workshop associated with the IEEE/ACM International Conference on Software Engineering (ICSE) 2005 in St. Louis, Missouri in May. They presented the results of their NASA grant “Improving Requirements Tracing and Independent Verification and Validation via Information Retrieval and Text Mining” as part of the NASA Software Assurance Symposium in Morgantown, West Virginia in August 2005.

Professor Hayes presented her paper “Maintainability Prediction: A Regression Analysis of Measures of Evolving Systems” at the IEEE Int’l Conference on Software Maintenance (ISCM) in Budapest, September 2005.

Graduate student **Emil Iacob** presented the papers

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My Research - *continued from front page*

Most recently, my effort is on finding error control and parametrization techniques for Catmull-Clark subdivision surfaces. Catmull-Clark Subdivision surfaces are popular because they can model any shape and any topology with only one surface, and they are of multi-resolution by nature and they cover both polygon form and surface form. However, even though Catmull-Clark subdivision surfaces have been declared as the next generation representation scheme for the past decade, and they are used as a primary representation scheme in many commercial renders and modelers such as Alias Wavefront's Maya, Pixar's Renderman, Michiman's Mirai, and NewTek's Lightwave 3D, they are not included in any CAD/CAM system at all. Why? Because we don't have a parametric representation and we cannot control error for Catmull-Clark subdivision surfaces. Without a parametric representation and an error control technique, it is impossible for a CAD/CAM system to include Catmull-Clark subdivision surfaces as a free-form surface modeling tool because of problems with standard operations such as picking, rendering, mesh generation and texture mapping.

Several attempts have been made in the past at parametrization of Catmull-Clark subdivision surfaces, but none of them have completely solved the problem, because nobody is able to find the eigenvalues of the subdivision matrix explicitly. By converting the control points of a Catmull-Clark subdivision surface into same frequency groups through discrete Fourier Transforms, I and my student Shuhua Lai are able to reduce a large system into blocks of fixed (7x7) size and, consequently, solve the problem completely. Our work not only finds the complete parametrization of a Catmull-Clark subdivision surface, but also provide solution to problems such as surface rendering, texture mapping, Boolean operations, surface trimming, adaptive tessellation and animation for Catmull-Clark subdivision surfaces.

The long sought error control technique for Catmull-Clark subdivision surfaces has also been solved by me and my students Gang Chen and Junhai Yong recently. Using a metric call 'second order forward difference' on the control points of a Catmull-Clark subdivision surface, we are able to compute a subdivision depth, n , for a given error tolerance that guarantees that, after n levels of recursive subdivision, the distance between the limit surface and the resulting control mesh is smaller than the given error tolerance. This work not only provides an error control technique for Catmull-Clark subdivision surfaces, but also provides a mechanism to integrate the current representation techniques into one scheme. Note that Catmull-Clark subdivision surfaces include B-spline and NURBS surfaces as special cases. If one can control the precision of a Catmull-Clark subdivision surface, then a universal representation for all CAD/CAM applications can be developed and a universal language for all CAD/CAM applications can be adopted.

Recent and upcoming colloquia

Distinguished Lecture Series:

September 15, 2005 - 5:30 p.m.
Vision-Guided Autonomous Robots: Past and Future
Professor Takeo Kanade (Carnegie Mellon University)
Host: Professor David Nister
Location: William T. Young Library Auditorium

October 13, 2005 - 5:30 p.m.
Behavioral Computation Theory: From Foundations to Industrial Tools
Dr. Yuri Gurevich (Microsoft Research)
Host: Professor Victor W. Marek
Location: William T. Young Library Auditorium

October 26, 2005 - 4:30 p.m.
Progress on the PORTIA Project
Professor Joan Feigenbaum (Yale University)
Host: Professor Judy Goldsmith
Location: William T. Young Library Auditorium

February 2, 2006 - 5:30 p.m.
Lessons Learned from the Internet
Professor Douglas Comer (Purdue University)
Host: Professor Jim Griffioen
Location: William T. Young Library Auditorium

March 20, 2006 - 5:30 p.m.
The Role of Empirical Study in Software Engineering
Professor Victor R. Basili (University of Maryland)
Host: Professor Jane Hayes
Location: William T. Young Library Auditorium

Department Colloquia

August 11, 2005 - at 11 a.m. in RMB (CRMS) 323
Evidence Centered Design using Bayesian Networks
Russell Almond (Educational Testing Services)
Host: Prof. Judy Goldsmith

September 8, 2005 - at 3:30 p.m. in 800 Kentucky Utilities Building
Scaling Up Sensing for Virtual Environments
Greg Welch (The University of North Carolina at Chapel Hill)

September 19, 2005 - at 4 p.m. in ASTeCC 149
Designing a Publish-Subscribe Substrate for Privacy/Security in Pervasive Environments
Lukasz Opyrchal (Miami University, Ohio)
Host: Prof. Jerzy W. Jaromczyk

September 28, 2005 - at 4 p.m. in RGAN 202
The Java Eclipse Project
Beth Tibbits (IBM Watson)
Host: Prof. Alex Dekhtyar

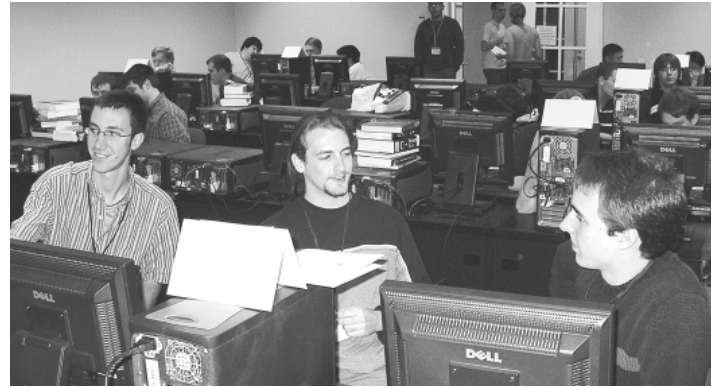
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“Building Tools for Image-Based Electronic Editions” and “Concurrent Markup Hierarchies: a Computer Science Approach” at the International Conference of Association for Computing in Humanities (ACH/ALLC 2005) and “xTagger: a New Approach to Authoring Document-centric XML,” at the Joint Conference on Digital Libraries (JCDL 2005). These papers were joint work with **Professor Dekhtyar**.

Professor Jaynes gave invited talks at the Dalhousie University Research Horizons Series titled “New approaches to modeling shape and space in computer vision” and at UIUC titled “Visual Interfaces.”

Professor Kale presented the paper “Shape-space sampling distributions and their impact on visual tracking” at the IEEE Conference on Image Processing, 2005. This paper was co-authored by **Professor Jaynes**.

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The UK team of (left to right) Kyle Vogel, Isaiah Damron, and Stephen duBarry finished third out of 122 teams in the MidCentral Region of the 30th ACM Programming Contest.



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Recent colloquia - *continued from page 3*

October 31, 2005 - at 4 p.m. in RGAN 202
Software Engineering Standards: Confusion, confusion, confusion.
Jeffrey M Voas (SAIC)
Host: Prof. Jane Hayes

November 4, 2005 - at 4 p.m. in RMB (CRMS) 323
Pose Invariant 3D Face Recognition
Andreas Koschan (The University of Tennessee)
Host: Prof. David Nister

November 9, 2005 - at 4 p.m. in RGAN 202
Numerical Integration in Thousands of Dimensions
Frances Kuo (University of New South Wales)
Host: Prof. Grzegorz Wasilkowski

November 17, 2005 - at 2:00 p.m. in ASTeCC 149
Exploiting Graph Locality in External-Memory Graph Search
Eric Hansen (Mississippi State University)
Host: Prof. Judy Goldsmith

November 28, 2005 - at 4 p.m. ASTeCC 149
Crossing Number versus Odd Crossing Number
Mark Schaefer (DePaul University)
Host: Prof. Judy Goldsmith

November 30, 2005 - at 4 p.m. Alltel Solutions Center
(Hardymon, Room 100)
Finite-State Methods in Natural Language Processing
Lauri Karttunen (Palo Alto Research Center)
Host: Prof. Raphael Finkel

December 5, 2005 - at 4 p.m. in RGAN 202
Sensitivity of best recovery in Sobolev spaces
Marek A. Kowalski (Cardinal Stefan Wyszyński University in Warsaw)
Host: Prof. Grzegorz Wasilkowski

Presentations *continued from back page*

Professor Klapper presented a paper titled “Linear Complexity of Sequences under Different Interpretations” at the International Workshop on Sequences and their Applications, in Shimonoseki, Japan, in October 2005.

Graduate student **Eun-Joo Lee** presented a paper “Diagonal Reordering Strategy for Preconditioning Indefinite Matrices,” and graduate student **Shuting Xu** presented a paper “Solvability Prediction of Sparse Matrices with Matrix Structure-Based Preconditioners,” both co-authored with **Professor Zhang**, at the 2005 International Conference on Preconditioning Techniques for Large Sparse Matrix Problems in Scientific and Industrial Problems, in Atlanta in May 2005.

Professor Manivannan gave a talk on “A Communication-Induced Checkpointing and Asynchronous Recovery Protocol for Mobile Computing Systems” at the Sixth International Conference on Parallel and Distributed Computing, Applications and Technologies held at Dalian University, China, in December 2005. This was joint work with Ph.D student **Tongchit Tantikul**. He also gave a talk on “An Asynchronous Recovery Algorithm based on a Staggered Quasi-Synchronous Checkpointing Algorithm” at the International Workshop on Distributed Computing (IWDC-2005), Dec. 27-30, 2005, IIT Karagpur, India. This is joint work with **Professor Mukesh Singhal** and several Ph.D. students.

Professor Nister was the invited keynote speaker at the Computer Vision Winter Workshop (CVWW 2005), Austria, February 2-4, 2005, with the talk “The Soft Reset Problem: A Challenge to the Community.” Professor Nister also gave invited talks at Australian National University, Canberra, Australia, May 2005, Microsoft Research, Redmond, April 27, 2005, the Pattern Recognition and Computer Vision Colloquium, ICPR TC 14, IAPR, Center for Machine Perception (CMP), Prague, April 7, 2005, the GRASP Laboratory, University of Pennsylvania, April 1, 2005 and the Robotics Institute, Carnegie Mellon University, March 18, 2005. **Chris Engels** and Professor Nister gave an invited talk at the International Symposium on 3D Data Processing, Visualization & Transmission (3DPVT04), Thessaloniki, Greece, September 2004.

Professor Nister and **Professor Andrew Davison** of Imperial College London, gave a tutorial “Real-Time Motion and Structure Estimation from Moving Cameras,” at the IEEE Conference on Computer Vision and Pattern Recognition, San Diego, 2005.

Graduate student **Wensheng Shen** presented the paper “Performance of ILUT Preconditioners in Modeling Bioheat and Mass Transfer in Skin Thermal Injury,” co-authored by **Professor Zhang**, and Chemical and Material Engineering **Professor Fuqian Yang**, at the Third MIT Conference on Computational Fluid and Solid Mechanics, in Boston, MA, in June 2005.

Graduate student **Wensheng Shen** and **Professor Zhang** presented the paper “Simulation of Burn Injury: Heat Transfer, Water Evaporation, Strain Energy, and Protein Denaturation,” co-authored by Chemical and Material Engineering **Professor Fuqian Yang** at the

Third Annual Kentucky Innovation and Enterprise Conference, Louisville, Ky., in March 2005.

Graduate student **Matt Steele** presented the paper “Feature Location Uncertainty in the Presence of Covariant Image Noise,” IEEE Computer Vision and Pattern Recognition, 2005. This paper was co-authored by **Professor Jaynes**.

On July 12, 2005, **Professor Truszczynski** presented the paper “Properties of Programs with Monotone and Convex Constraints,” co-authored by graduate student **Lengning Liu**, at the 24th National Conference on Artificial Intelligence, AAAI-05, in Pittsburgh. On August 5, 2005, **Professor Truszczynski** presented the paper “The Computational Complexity of Dominance and Consistency in CP-Nets,” at the International Joint Conference on Artificial Intelligence, IJCAI-05, in Edinburgh, Scotland. It was co-authored by **Professor Goldsmith, Jerome Lang** and **Nic Wilson**.

Graduate student **Jie Wang** presented the paper “Support Vector Machine Approach for Partner Selection of Virtual Enterprises,” graduate student **Dianwei Han** presented the paper “Mobile Agent System,” and graduate student **Ning Cao** presented the paper “Diffusion Tensor Magnetic Resonance Imaging and White-Matter Fiber Tracking,” at the 19th Annual Symposium in Mathematical, Statistical and Computer Sciences, in Richmond, Ky., in April 2005.

Professor Wasilkowski presented the papers “Adaption makes it easy to integrate functions with unknown singularities” at the Institute for Applied Mathematics, Bonn University, Bonn, Germany, May 2005; “Polynomial-time algorithms for multivariate linear problems of finite order” at the Institute of Applied Mathematics, University of Warsaw, Warsaw, Poland, May 2005; and “Optimal adaptive quadratures for integrating functions with singularities” at the School of Physical Sciences, University of Cardinal S. Wyszyński, Warsaw, Poland, May 2005. He gave the invited talk “Polynomial-time algorithms for multivariate linear problems with small effective dimension: average case setting” at the International Conference on Statistics in Honor of Professor Kai-Tai Fang’s 65th Birthday, Hong Kong, June 2005.

Graduate student **Shuting Xu** presented the papers “A Data Mining Approach to Matrix Preconditioning Problem,” at the Eighth Workshop on Mining Scientific and Engineering Datasets, and “Matrix Condition Number Prediction with SVM Regression and Feature Selection,” at the Fifth SIAM International Conference on Data Mining, in Newport Beach, Ca., in April 2005. Both were co-authored by **Professor Zhang**.

Professor Yang presented the papers “Geometric and Photometric Restoration of Distorted Documents,” co-authored with **Mingxuan Sun, LinYun, George Landon, Professor Brent Seales, Michael S. Brown**, and “BRDF Invariant Stereo using Light Transport Constancy,” co-authored with **James Davis** and **Liang Wang**, at the Tenth International Conference on Computer Vision (ICCV 2005) October 15-21, 2005 in Beijing, China. He also presented the papers “View-dependent Textured Splatting,” co-authored by **David Guinip** and **Liang Wang**, at the Thirteenth Pacific Conference on Computer Graphics and Applications, October 12-14, 2005, in Macao, China; “Efficient Rendering of Integral Images,” co-authored by

Xinyu Huang and **Shunnan Chen**, at the SIGGRAPH 2005 Poster Program, Los Angeles; and “Image-Gradient-Guided Real-Time Stereo on Graphics Hardware,” co-authored by **Mingjun Gong**, at the Fifth International Conference on 3-D Digital Imaging and Modeling (3DIM '05), June 13-16, 2005, Ottawa, Ontario, Canada.

Professor Zhang gave a keynote speech on “Fiber Tractography with Diffusion Tensor Magnetic Resonance Imaging: A Survey and Beyond” at the International Symposium on Medical Imaging and Computing, June 20, 2005, in Beijing, China.

Professor Zhang presented the papers “Approximating Anatomical Brain Connectivity with Diffusion Tensor MRI using Kernel-Based Diffusion Simulation,” co-authored by graduate student **Ning Kang**, and collaborator **Stephen Rose**, at the 2005 International Conference on Information Processing in Medical Imaging, in Glenwood Springs, Colo., in July 2005; “Data Distortion for Privacy Protection in a Terrorist Analysis System,” co-authored by graduate students **Shuting Xu**, **Dianwei Han**, and **Jie Wang**, at the 2005 IEEE International Conference on Intelligence and Security Informatics, in Atlanta, Ga., in May 2005; “Two-level Preconditioning Techniques for Electromagnetic Scattering Problems,” co-authored by former Ph.D. student **Jeonghwa Lee**, and Electrical and Computer Engineering Professor **Cai-Cheng Lu**, at the 2005 IEEE/ACES International Conference on Wireless Communications and Applied Computational Electromagnetics, in Honolulu, Hawaii in April 2005; and the poster presentation “Diffusion Simulation for Exploring Fiber Connectivity and Alzheimer’s Disease,” co-authored by graduate student **Ning Kang** and collaborator **Eric S. Carlson**, at the 2005 Annual Conference of the Organization of Human Brain Mapping, in Toronto, Canada, in June 2005.

Grants and Awards

Professor Douglas is the lead PI of an NSF DDDAS-TMRP grant titled “Collaborative Research: Adaptive Data-Driven Sensor Configuration, Modeling, and Deployment for Oil, Chemical, and Biological Contamination near Coastal Facilities,” 10/05 - 9/06. This is a joint grant with Texas A&M, and the Universities of Utah and Miami. UK’s share is \$114K.

Professor Fei received the grant “Multimedia Streaming Using Overlay Networks” for \$68,062 from Kentucky Science and Engineering Foundation in May 2005.

Professors Hayes and **Dekhtyar** received “The Award for Best Research Initiative 2005” for their NASA grant “Improving Requirements Tracing and Independent Verification and Validation via Information Retrieval and Text Mining” as part of the NASA Software Assurance Symposium in Morgantown, W. Va. in August 2005.

Professor Jaynes received the grant “Immersive Interactive Spaces: Research at the Center for Visualization and Virtual Environments” from NSF. The total award is \$2,496,477. He also received the grant “Rapidly Deployable Immersive Displays for Emergency Response,” from the U.S. Dept. of Homeland Security, \$350,000. **Professor Yang** is a coPI.

Professor Klapper received a three-year, \$202,000 grant from NSF titled “Theory and Application of Algebraic Feedback Shift Registers.”

Professor Nister, PI, and **Professor Yang**, co-PI, won a DARPA award for the project “Urbanscape.” The project started in March 2005 and is expected to run for two to three years. The UK budget is approximately \$1,000,000. The prime contractor on the project is GSTI, and GSTI, UK, UNC, UrbanScan and Quantapoint are on the project team. The project is being conducted at the Center for Visualization and Virtual Environments.

Professor Nister, together with the company AVID and Professor Sanjiv Singh at Carnegie Mellon University (CMU), was one of the three teams to win the first phase of a DARPA STTR, 3D Reconstruction from a MicroAir Vehicle (MAV). The target vehicle is a micro helicopter of a ducted fan type and the goal is to support autonomous obstacle detection and navigation in a cluttered urban environment using computer vision techniques. The other two teams consist of spin-off companies from CMU and Jet Propulsion Laboratory. The first phase is expected to run for 6-8 months with a budget of \$100,000 with a UK portion of \$30,000.

Professor Wasilkowski received the grant “Information-Based Complexity and Efficient Algorithms for Multivariate Problems” from NSF. It runs from 9/05 to 8/06.

Professor Yang received the grants “3D Light-Field Display for Simulation and Training \$285,085, 2005-2006 (Chris Jaynes is a CoPI) and “Wide-area Rapid Iris Image Capture with Pan-tilt-zoom Cameras,” \$731,287, 2006-2007. Both grants are from the Department of Homeland Security.

Professor Zhang received a \$193,915 grant from NSF for the project “MSPA-MCS: Mathematical and Computational Algorithms for Visualization of Human Brain Neural Pathways.” He also received \$12,000 from NSF to enhance research experience for undergraduate students in computer science. In addition, he received \$64,612 from KSEF to study “Support Vector Machine Approach to Matrix Condition Number Prediction.”