

Alark Joshi

Dept. of Diagnostic Radiology, Yale University
300 Cedar Street, TAC N138
New Haven, CT 06511

Voice: (203) 737-5995
E-mail: alark.joshi@yale.edu
Website: www.cs.umbc.edu/~alark1/

July 23, 2009

RESEARCH INTERESTS

Computer Graphics and Visualization. Primary interests and areas of expertise include volume visualization, non-photorealistic rendering and time-varying data visualization.

EDUCATION

- February 2008 - Present Postdoctoral Associate. Department of Diagnostic Radiology, Yale University.
“Novel visualization techniques for neurosurgical planning and stereotactic navigation”
Advisor: Dr. Xenophon Papademetris.
- November 2007 Ph.D. Computer Science. University of Maryland Baltimore County.
“Art-inspired techniques for visualizing time-varying data”
Advisor: Dr. Penny Rheingans.
- December 2003 M. S. Computer Science. State University of New York at Stony Brook.
“Innovative painterly rendering techniques using graphics hardware”
Advisor: Dr. Klaus Mueller.
- July 2001 M.S. Computer Science. University of Minnesota Duluth.
“Interactive Visualization of Models of Hyperbolic Geometry”
Advisor: Dr. Douglas Dunham.
- June 1999 B.E. Engineering/Computer Science, University of Pune, India.

EMPLOYMENT HISTORY

- 02/08 - Present **Postdoctoral Associate**
Department of Diagnostic Radiology, Yale University
- Working on identifying visualization techniques for visualizing vascular data.
- Developing novel interaction techniques for neurosurgical planning and navigation.
- Developing visualization and software tools for BioImage Suite, an open source image analysis software.
- 01/04-12/07 **Graduate Research Assistant**
Dept. of Computer Science and Electrical Engineering, University of Maryland, Baltimore County
- Worked on identifying and implementing non-photorealistic techniques for visualizing time-varying datasets.
- Developed illustration-inspired techniques for visualizing computational fluid dynamics time-varying data.
- Worked in collaboration with Dr. Lynn Sparling in the Physics department at UMBC to develop visualization tools for conducting research in the field of hurricane visualization.
- Developed art-inspired techniques to visualize global temperature trends in time-varying data

- 01/09- 05/09 **Instructor (via Video Conferencing)**
Dept. of Computer Science and Electrical Engineering, University of Pune, India
 - Taught the *Introduction to Computer Graphics* course to 160 students in the Spring '09 semester.
 - Was responsible for teaching, developing and grading the assignments and making exams for the class.
- 01/05- 05/05 **Instructor**
Dept. of Computer Science and Electrical Engineering, University of Maryland, Baltimore County
 - Taught the *CMSC 435: Introduction to Computer Graphics* course in the Spring '05 semester.
 - Was responsible for teaching, developing the assignments and making exams for the class.
- 06/04- 09/04 **Summer Intern**
Architecture and Technology Group, Vital Images, Plymouth, MN
 - Developed a reporting prototype using .NET, Direct3D and HLSL. The prototype facilitated view-
 ing screenshots, movies, individual slices and the stacked volume of the slices.
 - The volume was rendered using 3D textures and the shaders were written in HLSL.
 - The software was developed on a ATI FireGL X800 graphics card.
 - In the second project, I developed a single-pass raycaster on the GPU using Rendermonkey. The
 shaders were written in GLSL and the volume was procedurally generated using Rendermonkey's
 features.
- 05/03 - 09/03 **Summer Intern**
Imaging and Visualization Department, Siemens Corporate Research, Princeton, NJ
 Implemented a method to perform fast convolution on images and volumes on the GeForce
 FX 5600 card. Developed a Hardware-accelerated Volume Renderer using 3D texture mapping
 on the GeForce FX 5600 card and the use of Non-Photorealistic Rendering techniques to
 enhance volumes was investigated.
- 05/00 - 09/00 **Software Development Intern**
America Online Inc. , Mountain View, CA
 Worked at AOL on the Web version of AOL 6.0 Address Book. Created the User Interface
 using AOLServer Dynamic Pages (HTML Pages with embedded TCL scripts). Fixed bugs
 for the Netscape Netcenter Address book on the Web. Ported an application from the GNU Compiler
 to the Sun C++ Compiler .

TEACHING EXPERIENCE

- Spr 02, Fall 02, Spr 03 Teaching Assistant, CSE/ISE333, "User Interface Development," State University of New York at
 Stony Brook
- Fall 2000 Teaching Assistant, CS5551, "User Interface Design," University of Minnesota Duluth
- Spring 2000 Teaching Assistant, CS5721, "Computer Graphics," University of Minnesota Duluth
- Spring 2001 Teaching Assistant, CS2521, "Computer Organization," University of Minnesota Duluth
- Fall 99/2000 Teaching Assistant, CS2511, "Software Development using C++," University of Minnesota Duluth

PUBLISHED BOOK

Alark Joshi, "Art-inspired Techniques for Visualizing Time-varying Data", VDM Verlag, 228 pages, 2008.

PUBLICATIONS

Alark Joshi, Jesus Caban, Penny Rheingans, Lynn Sparling, "Case Study on Visualizing Hurricanes Using Illustration-
 Inspired Techniques," IEEE Transactions on Visualization and Computer Graphics, vol. 15, no. 5, pp. 709-718,
 Sep./Oct. 2009.

Alark Joshi, Dustin Scheinost, Hirohito Okuda, Isabella Murphy, Lawrence H. Staib, Xenophon Papademetris, "Unified framework for development, deployment and testing of image analysis algorithms", 2009 MICCAI Workshop on Systems and Architectures for Computer Assisted Interventions, September 2009.

Alark Joshi, Dustin Scheinost, Marisa Spann, Xenophon Papademetris, "Evaluation of Multi-viewport based visualization for Electrode Navigation during Stereotactic Image Guided Neurosurgery", (Oral presentation), International Brain Mapping and Interoperative Surgical Planning Society's 6th World Congress for Brain Mapping and Image Guided Therapy, August 2009.

Alark Joshi, Dustin Scheinost, Kenneth P. Vives, Dennis D. Spencer, Lawrence H. Staib and Xenophon Papademetris, "Novel interaction techniques for neurosurgical planning and stereotactic navigation," IEEE Transactions on Visualization and Computer Graphics, vol.14, no.6, pp.1587-1594, Nov.-Dec. 2008.

Alark Joshi, Xiaoning Qian, Donald P. Dione, Ketan R. Bulsara, Christopher K. Breuer, Albert J. Sinusas and Xenophon Papademetris, "Effective visualization of complex vascular structures using a non-parametric vessel detection method," IEEE Transactions on Visualization and Computer Graphics, vol.14, no.6, pp.1603-1610, Nov.-Dec. 2008.

Alark Joshi and Penny Rheingans, "Evaluation of illustration-inspired techniques for time-varying data visualization," In Proceedings of the Eurographics/IEEE TCVG Symposium on Visualization (Eindhoven, Netherlands, May 26-28, 2008), EuroVis 2008.

Jesus Caban, Alark Joshi and Penny Rheingans, "Texture-Based feature tracking for effective time-varying data visualization," IEEE Transactions on Visualization and Computer Graphics, (Vol. 13, No. 6), pp. 1472-1479, 2007.

Jesus Caban, Alark Joshi and Paul Nagy, "Rapid Development of Medical Imaging Tools with Open Source Libraries," Journal of Digital Imaging 20(1), pp. 83-93, 2007.

Alark Joshi and Penny Rheingans, "Illustration-inspired techniques for visualizing time-varying data," Proceedings of the IEEE Visualization 2005, pp. 679-686.

Alark Joshi and Penny Rheingans, "Pointillism-inspired visualization of attribute change in time-varying data," Transactions of Visualization and Computer Graphics 2009 (In preparation).

Alark Joshi and Douglas Dunham, "Interactive Visualization of Models of Hyperbolic Geometry," Masters Thesis, Computer Science Department, University of Minnesota Duluth, June 2001.

PROJECTS

Texture-mapping based Volume Renderer

Implemented a program to perform volume rendering on a ATI Fire GL X800 using Direct3D and HLSL. The renderer allowed interactive exploration of volumes and a transfer function widget to allow fine-tuning of the transfer functions to generate required images. The renderer was developed using managed C++ and .NET technologies.

Advanced Illumination on the GPU

Implemented a program to have multiple objects with different shaders in a scene. The Ashikhmin lighting model, the Banks lighting model and Gooch's NPR lighting model was implemented for objects in the same scene using different shaders for each. The shaders were developed using Cg on a GeForce 6800 Ultra graphics card.

Skin shading using two-pass pseudo-subsurface scattering on the GPU

Created shaders for the two-pass pseudo-subsurface scattering skin. The first pass uses a vertex shader to unwrap the object into texture space and a pixel/fragment shader to compute the per-pixel lighting. The results of this pass are stored in a texture for use in the second pass. The final pass uses several accesses to the lighting texture to create the simulated skin. The shaders were written in Cg and the program ran on a

GeForce 6800 Ultra.

Shading Techniques using Renderman

Implemented a program to render a scene using the Renderman renderer. Displacement, surface and light shaders were used to explore different shading techniques. For the light shader, the Ashikhmin model was implemented. Two-pass shading was used to give the objects in the scene an interesting look.

Volume Preserving Free Form Deformation

Implemented a program to simulate Volume-preserving Free form Deformation of objects using OpenGL. The volume could be deformed using mouse movements and then the program would iteratively minimize the volume and eventually preserve it using the Augmented Lagrangian method.

Volume Illustration: Non-Photorealistic Volume Renderer in OpenGL

Implemented a Volume Renderer which incorporated Non-photorealistic techniques to accentuate and enhance the visualized volumes. It was implemented in OpenGL using FLTK (Fast Light Toolkit). Techniques like silhouette enhancement, boundary enhancement, oriented fading, distance color blending, feature halos and tone shading were incorporated into the volume renderer to obtain perceptually better views of the volumes being rendered.

Physical Simulation of Mass-Spring Models

Implemented a software which allows graphics modelers to directly manipulate and interactively sculpt physical surfaces using “force” tools in 3D using the mouse. Features included displaying the wireframe model, the smoothly shaded model and the texture-mapped model. It was implemented in OpenGL with GLUT as its interface.

Modeling and Rendering of NURBS Objects

Implemented software, which rendered surfaces like Torus, Sphere, Vase, Cylinder, Cone and any other surface of revolution given the profile. The profile curves as well as the surfaces were created using NURBS. Features included displaying the Wireframe of the object, Specular lighting, rotation, panning in all directions as well as zooming. It was implemented in OpenGL with GLUT as its interface.

Virtual Walkthrough using Virtual Reality Modeling Language (VRML)

Implemented a Virtual Reality walkthrough of an exhibition to enable visitors to get more information about the various exhibits.

AWARDS

- Recipient of the National Biomedical Computation Resource (NBCR) Summer Institute 2008 Scholarship. Presented a poster on 'Novel interaction techniques for neurosurgical planning and stereotactic navigation' at the Annual NBCR conference.
- Third Prize in the Poster category for the “Exaggerated shading for volumetric data” at the Annual CSEE Research Conference 2007, held at the University of Maryland Baltimore County.
- First place at UMBC’s Annual Business Plan Competition for 2007.
- Third Prize in the Annual Greater Baltimore Technology Council’s “Mosh Pit 2006” business plan competition. Our team consisted of Sandor Dornbush, Zach Radtka, Jeremy Shopf, Robairta Romiti and myself.
- “Best Senator of the Year” for the Graduate Student Association for the 2005-06 academic year.
- Third Prize in the Poster category for the “Illustration-inspired Visualization of Hurricane Structures” at the Annual CSEE Research Conference 2006, held at the University of Maryland Baltimore County.
- Third Prize for the presentation entitled “Illustration-inspired techniques for time-varying data visualization”, Graduate Research Conference 2005 held at the University of Maryland Baltimore.
- Best Graduate Teaching Assistant, Computer Science department, State University of New York at Stony Brook, 2001-2002, 2002-2003.

- Outstanding Graduate Teaching Assistant of the year in the Computer Science Department at the University of Minnesota Duluth, 2000-2001.

INVITED TALKS

- “Visualization techniques for Neurosurgical planning and ROI connectivity” September 2008, Yale fMRI Seminar Series, New Haven, CT.
- “Teaching a Users’ training course” June 2008 at the First Annual NITRC Enhancement Grantee Meeting, National Institutes of Health, Washington DC.
- “Illustration-inspired techniques for time-varying data visualization” at the IBM Graphics and Visualization Student Symposium 2006 at IBM T. J. Watson Research Center in Hawthorne, NY.
- “Illustration-inspired Volume Rendering,” April 2006 at the Johns Hopkins University Whiting School of Engineering
- “Conducting Research at the Undergraduate level,” January 2007 at the Vishwakarma Institute of Technology (VIT), Pune, India
- “Conducting Research” January 2007 at the Pune Institute of Computer Technology (PICT), Pune, India
- “Illustration-inspired Visualization,” April 2007 at the Johns Hopkins University Whiting School of Engineering
- “Illustration-inspired techniques for time-varying data visualization,” December 2005 at the UMBC CSEE Department Student Speaker Colloquium.

SERVICE

- Posters and Interactive Demos Chair for IEEE Visualization conference 2009.
- International Program Committee for the International Symposium on Visual Computing 2009.
- Reviewer for International Journal of Computer Assisted Radiology and Surgery.
- Reviewer for Elsevier’s Image and Vision Computing Journal.
- Reviewer for IEEE Visualization conference 2005, 2006, 2007, 2009.
- Reviewer for the IEEE Transactions on Visualization and Computer Graphics.
- Reviewer for the Symposium on Interactive 3D Graphics and Games conference 2006.
- Reviewer for the Computer Supported Cooperative Work 2008 (CSCW) conference.
- Reviewer for the Eurographics workshop on Visual Computing for Biomedicine 2008.
- Reviewer for the EuroVis 2007, 2008, 2009 conference.
- Student Volunteer at the IEEE Visualization 2004, 2005, 2007 conference.
- Student Volunteer at the ACM SIGGRAPH 2006 conference
- Student Volunteer at the I3D 2005 - Symposium on Interactive 3D Graphics and Games at Washington DC
- Vice President for the Graduate Student Association for the 2006-07 academic year.
- Senator for the 2005-2006 academic year, Computer Science and Electrical Engineering Department at UMBC
- External Customer for the CMSC 345: Introduction to Software Engineering for Spring 06, Fall 06 and Spring 07.

AFFILIATIONS

- Association for Computing Machinery (ACM).
- Institute of Electrical and Electronics Engineers (IEEE).
- UMBC Graduate Students Association.
- UMBC Visualization, Animation, Non-Photorealistic Graphics, Object-Modeling and Graphics Hardware (VANGOGH) Lab.