Cory Quammen

Research Interests

Image processing and analysis, parallel computing, high-performance computing on graphics processing units, visualization, interactive computer graphics.

Education

May 2010 *(expected)* **Ph.D., Computer Science**, *University of North Carolina at Chapel Hill*.

May 2006 **M.S., Computer Science**, *University of North Carolina at Chapel Hill*.

June 2002 **B.A., Computer Science with Honors, *summa cum laude***, *Gustavus Adolphus College*.

Research Experience

2005-present **Research Assistant**, *Nanoscale Science Research Group*, University of North Carolina at Chapel Hill.
- Investigated methods for extracting the graph structure of 3D fibrin networks and for tracking networks in videos of stretching experimens.
- Wrote the Clarity deconvolution software library for removing blur from fluorescence microscopy images. The library uses CUDA to accelerate key portions of the deconvolution algorithms. Achieved approximately 2× speedup over 4 dual-core Opteron processors connected by HyperTransport on a single NVIDIA Quadro 5600 FX.
- Employed graphics hardware for fast fluorescence microscope simulation, including use of 32-bit floating-point blending, gather operations in fragment programs, and Fourier domain methods for fast convolution rendering of arbitrary geometric models.
- Implemented fast gray-scale morphology for AFM simulator using z-buffer in graphics hardware.

2004-2005 **Research Assistant**, *Renaissance Computing Institute*, Chapel Hill, NC.
- Created a library for remote monitoring of hardware health using the Network Weather Service.
- Wrote server software that decides when a client scientific application should take checkpoints based on the probability that the hardware on which it is running is going to fail.
- Wrote an event-based simulator for evaluating different algorithms for scheduling parallel workloads on supercomputers.

2001-2002 **Visualization Intern**, *Network Computing Services, Inc.*, Minneapolis, MN.
- Wrote interactive volume renderer of unstructured grids using OpenGL.
- Achieved interactive frame-rates for meshes with several million cells.

Summer 2001 **AHPCRC Summer Institute Participant**, *Army High Performance Computing Research Center*, Minneapolis, MN.
- Developed an OpenMP-based parallel ray-casting volume renderer for tetrahedral meshes that ran on shared-memory multiprocessors.

Professional Experience

Summer 2007 **Compute Architecture Intern**, *NVIDIA Corporation*, Durham, NC.
- Developed testing infrastructure for general-purpose computing capabilities of graphics and compute acceleration cards.

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2002-2004 **Visualization Research Programmer**, *Network Computing Services, Inc.*, Minneapolis, MN.
- Created volume visualization software for Cray X1 to visualize large weather simulation data sets. Demonstrated at Cray booth, Supercomputing 2003, with server rendering on Cray X1 in Minneapolis and client display in Phoenix.
- Added support for structured grids in general-purpose visualization software developed in house. Implemented a variety of parallel visualization techniques in parallel, including volume rendering and degeneracy-free isosurface generation.
- Created miscellaneous visualization software, including a custom OBJ viewer for an Elumens VisionDome and MPI-based animation software for clusters driving multiple displays.

Summer 1999 Summer 2000 **E-commerce Developer**, *Heartland America*, Chaska, MN.
- Created a new e-commerce web site from scratch with Active Server Pages and Microsoft SQL Server, including customer front-end and administrative back-end.

Teaching Experience

Spring 2008 **Visualization in the Sciences**, *University of North Carolina at Chapel Hill*.
- Co-taught graduate course in visualization with Russell M. Taylor II. Course was intended for students from many university departments, including Material Science, Physics, Applied Math, Biology, Biomedical Engineering, and Computer Science.
- Responsible for creating one homework assignment and grading six homework assignments.
- Gave eleven lectures throughout the course, two of which I created.
- Modified homework assignments to use the visualization program VisTrails.
- Mentored three groups of students who designed goal-driven visualizations for client scientists across the university.

Peer-Reviewed Publications

[1] Brandon Lloyd, Naga Govindaraju, **Cory Quammen**, Steven Molnar, and Dinesh Manocha. Logarithmic perspective shadow maps. *ACM Transactions on Graphics*, 27(4), October 2008.

[2] **Cory Quammen**, Alvin C. Richardson, Julian Haase, Benjamin D. Harrison, Russell M. Taylor II, and Kerry S. Bloom. FluoroSim: A visual problem-solving environment for fluorescence microscopy. In Charl Botha, Gordon Kindlmann, Wiro Niessen, and Bernhard Preim, editors, *EuroGraphics Workshop on Visual Computing for Biomedicine*, pages 150–158. EuroGraphics, October 6-7 2008.

[3] Jameson Miller, **Cory Quammen**, and Matthew C. Fleenor. Interactive visualization of intercluster galaxy structures in the Horologium-Reticulum supercluster. *IEEE Transactions on Visualization and Computer Graphics (Proceedings Visualization / Information Visualization 2006)*, 12(5):1149–1156, Sept.-Oct. 2006.

Articles

[4] **Cory Quammen**, David Feng, and Russell M. Taylor II. Performance of 3D deconvolution algorithms on multi-core and many-cory architectures (in preparation). *UNC-Chapel Hill Department of Computer Science Technical Report*, TR-09-001, 2009.

[5] **Cory Quammen**. Introduction to programming shared-memory and distributed-memory parallel computers. *Best of ACM Crossroads*, 12(4):3–9, 2005.

[6] **Cory Quammen**. Interactive visualization of large-scale weather simulations. *AHPCRC Bulletin*, 14(1):5–9, 2004.

[7] Andrew A. Johnson and **Cory Quammen**. Large scale scientific visualization on Cray MPP architectures. In *Proceedings of the Cray User Group Meeting*, 2003.

[8] **Cory Quammen**. Introduction to programming shared-memory and distributed-memory parallel computers. *ACM Crossroads*, 8(3):16–22, 2002.

[9] **Cory Quammen**. Evolutionary learning in mobile robot navigation. *ACM Crossroads*, 8(2):10–14, 2001.

Posters

[10] **Cory Quammen** and Russell M. Taylor II. Using instrument simulation to quantify experimentation. In *Microsoft eScience Workshop at RENCI*, page 107, Chapel Hill, NC, October 21-23 2007.

Systems Built

Clarity Deconvolution Library
http://cismm.cs.unc.edu/resources/software-manuals/clarity-deconvolution-library/
Library implements three types of deconvolution for 3D fluorescence microscope images: deconvolution via Wiener filtering, Jansson-van Cittert deconvolution, and maximum likelihood deconvolution. Software runs between approximately 2 times faster on an NVIDIA Quadro 5600 FX than four dual-core 2.8GHz Opterons connected by HyperTransport.

Microscope Simulator
http://www.cs.unc.edu/~nanowork/cismm/download/microscopesimulator/index.html
Simulator for atomic force microscopes and fluorescence microscopes. Includes visualization mode for comparing experimental fluorescence microscope stacks with simulated stacks. Output from the simulator was featured on the cover of January 22, 2008 edition (Vol. 18, No. 2) of *Current Biology*.

Volumetric Depth Peeling Renderer
http://wwwx.cs.unc.edu/ cquammen/wp/projects/volumetric-depth-peeling/
Graphics hardware-accelerated ray-casting volume renderer in GLSL on NVIDIA GeForce 8800 GTX hardware provides an order-of-magnitude rendering speedup from the fastest available software renderer. This system includes volumetric depth peeling (VDP), a novel volume rendering extension for view-dependent occlusion culling of volumetric data developed at UNC.

GyVe (Galaxy Viewer) http://sourceforge.net/projects/gyve
3D visualization software for viewing observational galaxy data and its relation to known galaxy clusters. Features include curved drop lines for indication of galaxy positions along RA-DEC-cz coordinate axes, interactive grouping of galaxies, and screen-door transparency for seeing galaxies through density isosurfaces.

Event-based Scheduler Simulator
Simulator for analyzing effectiveness of failure prediction schemes for checkpoint scheduling.

Failure Indicator Toolkit (FIT)
Prototype library for monitoring hardware health in large-scale distributed and parallel systems using the Network Weather Service for gathering data. System included a checkpoint scheduler server built on top of FIT with which a running scientific application could register to accept server scheduling of checkpoints based on the health of the system.

IVOL
Interactive volume renderer for tetrahedral meshes based on the splatting approach to volume rendering. Used graphics acceleration hardware to achieve interactive rendering of meshes with several million tetrahedra.

Vorenge
Parallel volume renderer for tetrahedral meshes for shared-memory multiprocessors.

Service

Journal and Conference Article Reviewing

IEEE Visualization 2008, *Graphics Interface 2008*, *Proceedings of the IEEE*, *Supercomputing 2007*

Departmental Service

UNC Faculty Search, High Performance Computing Subcommittee

Honors and Awards

July 2008	STIBET Contact Fellowship, German Academic Exchange Service, University of Würzburg, Germany
2001	Phi Beta Kappa (inducted junior year)
1998-2002	Partners Scholarship, Gustavus Adolphus College
1998-2002	Jussi Björling Music Scholarship, Gustavus Adolphus College
1998-2002	Dean's List, all semesters at Gustavus Adolphus College
1998	National Merit Commended Student

Skills

Languages	C, C++, Java, Python, CUDA, Cg, GLSL
APIs	Standard Template Library, OpenGL, Visualization Toolkit, Message Passing Interface, OpenMP, Java Swing
Applications and Tools	Eclipse, Visual Studio .NET, emacs, vi, gcc, gdb, valgrind, CVS, SVN, Perforce, Cmake, VisTrails, ParaView, VolView, MATLAB

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