Won-Ki Jeong, Ph.D (H-index: 18, Total time cited: 986)

CONTACT INFORMATION

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RESEARCH INTERESTS

Large-scale biomedical image analysis and visualization, high-performance computing using graphics hardware (GPGPU), computational photography, geometric modeling, surface reconstruction

EDUCATION

University of Utah, Salt Lake City, Utah USA
Ph.D. in Computer Science, 2008
- Advisor : Prof. Ross Whitaker
- Dissertation Title : Interactive three-dimensional image analysis and visualization using graphics hardware

Korea University, Seoul, Korea
M.S. in Computer Science, 2001
- Advisor : Prof. Chang-Hun Kim
- Thesis Title : Piecewise-regular mesh reconstruction from range data for multiresolution modeling

Korea University, Seoul, Korea
B.S. in Mathematics, 1999

WORK EXPERIENCE

Ulsan National Institute of Science and Technology (Ulsan, Korea) **Aug 2011 - Present**
Associate Professor, School of Electrical and Computer Engineering
- Leading High-performance Visual Computing Laboratory (HVCL)

Harvard University (Cambridge, MA) **Nov 2008 - July 2011**
Research Scientist, Center for Brain Science (Advisor : Profs. Hanspeter Pfister and Jeff Lichtman)
- Worked on the connectome project to develop computational methods to interactively reconstruct and visualize neuronal connections in the mammalian brain from tera-scale high-resolution serial section electron microscope images. Developed a segmentation method for multi-channel confocal microscope images (Brainbow).
- Developed GPU-based multiphase level set segmentation and image registration methods.
- Developed a large-scale biomedical image manipulation and visualization framework for interactive digital histopathology.

University of Utah (Salt Lake City, UT) **Aug 2003 - Nov 2008**
Research Assistant, School of Computing and SCI institute (Advisor : Prof. Ross Whitaker)
- Worked on image analysis and scientific computing on the GPU for the Ph.D dissertation research, in collaboration with ExxonMobil Upstream Research Company.
- Developed GPU conjugate gradient and multigrid solvers for anisotropic filtering of height field meshes and images.
- Developed an interactive seismic fault detection and visualization system on the GPU.
- Developed a method to compute and visualize volumetric white matter connectivity in diffusion tensor magnetic resonance imaging (DT-MRI) using a Hamilton-Jacobi solver on the GPU.
- Developed an user-assisted segmentation method for elongated structures in biomedical images using GPU-accelerated image registration and shortest path algorithms.

NVIDIA Corporation (Santa Clara, CA) **Apr 2007 - Jul 2007**
Summer Intern, GPU Computing Group (Mentor : Dr. Massimiliano Fatica)

- Developed GPU random number generators for parallel Monte Carlo simulation using NVIDIA CUDA.
- Implemented several ITK (Insight Segmentation and Registration Toolkit) image filters (Gaussian, Median, Anisotropic filters) on the GPU using NVIDIA CUDA.

ExxonMobil Upstream Research Company (Houston, TX) **May 2006 - Aug 2006**
Summer Intern, Visualization and Integration Group (Mentor : Mark Dobin)
- Developed a 3D directional anisotropic diffusion method for ExxonMobil's in-house volume interpretation system (VIS)
- Developed a 3D attribute-based thinning algorithm (skeletonization) for the geobody connectivity problem.

Max-Planck-Institut für Informatik (Saarbrücken, Germany) **Apr 2001 - Mar 2003**
Research Assistant, Computer Graphics Group (AG4) (Advisor : Prof. Hans-Peter Seidel)
- Worked on subdivision surfaces, mesh simplification, facial modeling and animation, and statistical mesh reconstruction, and published several research papers in refereed Journals and conference proceedings.

Honors and Awards

1. NAVER Young Faculty Fellowship 2016
2. NVIDIA CUDA Research Center 2014
3. Best paper award at Korea Computer Graphics Society Conference 2014
4. Poster honorable mention at IEEE Visualization (SciVis) 2013
5. Paper honorable mention at IEEE Visualization (SciVis) 2012
6. NVIDIA Graduate Fellowship 2007
7. Finalist in the BGCE student paper competition 2007

Publications

Refereed Journals

1. Sumin Hong and **Won-Ki Jeong***, *A Group-Ordered Fast Iterative Method for Eikonal Equations*, IEEE Transactions on Parallel and Distributed Systems, accepted, 2016.
2. Tran Minh Quan and **Won-Ki Jeong***, *A fast discrete wavelet transform using hybrid parallelism on GPUs*, IEEE Transactions on Parallel and Distributed Systems, accepted, 2016.
3. Jinwoong Kim, **Won-Ki Jeong**, Beomseok Nam*, *Exploiting Massive Parallelism for Indexing Multi-dimensional Datasets on the GPU*, IEEE Transactions on Parallel and Distributed Systems, no. 26, pp. 8, pp. 2258-2271, 2015 (IF: 2.173, JCR: 10/102).
4. Hyungsuk Choi, Woohyuk Choi, Tran Minh Quan, David Hildebrand, Hanspeter Pfister, **Won-Ki Jeong***, *Vivaldi: A Domain-Specific Language for Volume Processing and Visualization on Distributed Heterogeneous Systems*, IEEE Transactions on Visualization and Computer Graphics (IEEE Visualization), 20(12), pp. 2407-2416, 2014 (IF: 1.919, JCR: 13/105, #1 in visualization conferences).
5. **Won-Ki Jeong***, Jens Schneider, Axel Hansen, Manhee Lee, Steve Turney, Beverly E. Faulkner-Jones, Jonathan Hecht, Robert Najarian, Eric Yee, Jeff Lichtman, Hanspeter Pfister, *A Collaborative Digital Pathology System for Multi-Touch Mobile and Desktop Computing Platforms*, Computer Graphics Forum, 32(6), pp. 227-242, 2013 (IF: 1.595, JCR: 21/105).
6. Johanna Beyer*, Markus Hadwiger, Ali Al-Awami, **Won-Ki Jeong**, Narayanan Kasthuri, Jeff W. Lichtman, Hanspeter Pfister, *Exploring the Connectome: Petascale Volume Visualization of Microscopy Data Streams*, IEEE Computer Graphics and Applications 33(4), pp. 50-61, 2013 (IF: 1.116, JCR: 45/105).

Dictionary learning for biomedical image analysis

In this talk, I will introduce convolutional sparse coding, which is one of the growing machine learning techiques, and its application in biomedical image analysis. Dictionary learning is a data-driven approach that decomposes the input image into basic components, i.e., atoms, and a sparse code, which is used to combine atoms to approximates the input image. The conventional dictionary learning samples fixed-size patches from the input image to generate the dictionary, which results in growing number of atoms to represent similar features that are slightly offset from each other. Convolutional sparse coding, on the other hand, is using a convolution operation so that the atoms (i.e., filters) can represent shift-invariant features , which allows to construct more compact dictionary compared to patch-based learning methods. In addition, since convolution can be efficiently implement in the frequency domain as a per-pixel multiplication, it maps well to the operations in K-space MRI data. In this talk, we will briefly review the dictionary learning and convolutional sparse coding theory, and explore some recent research results in biomedical image analysis, such as compressed sensing MRI reconstruction and cellular image segmentation.