Youngmin Kim

CONTACT INFORMATION

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RESEARCH INTERESTS

Scientific Visualization and Graphics, High-performance and Parallel Computing, Graphics Hardware
Numerical Analysis and Scientific Computing, Pattern Discovery and Analysis, Visual Perception

EDUCATIONAL BACKGROUND

University of Maryland, College Park, MD

Ph.D. in Computer Science, "Saliency-guided Graphics and Visualization", Aug 2008 (expected).
Advisor: Dr. Amitabh Varshney

M.S. in Computer Science, May 2005, Advisor: Dr. Amitabh Varshney
Courses: Intro to Financial Math, Scientific Computing, Numerical Analysis, AI, Computer Vision

Seoul National University, Seoul, Korea

B.S. in Computer Engineering, Feb 1999
Courses: Statistics, Calculus I & II, Engineering Mathematics, Intro to Economics

HONORS AND AWARDS

Finalist for Invention of the Year 2006 in the University of Maryland	**April 2007**
Graduate School Fellowship in University of Maryland, College Park	**2002 – 2004**
Merit-based Scholarship in Seoul National University, Korea	**1995 – 1999**

PATENTS

Geometric Visual Enhancement (IS-2007-044), patent pending. A. Varshney and Y. Kim

Saliency-Guided Visual Enhancement (IS-2006-099), patent pending. A. Varshney and Y. Kim

PUBLICATIONS

[1] Y. Kim, C. Y. Ip, A. Anishkin, A. Varshney, D. P. O'Leary and S. Sukharev, "Salient Frame Detection for Time-Series Datasets by Sliding Window SVD", *IEEE Trans. on Visualization and Computer Graphics*, (under preparation), 2008.

[2] C. H. Lee, Y. Kim, and A. Varshney, "Saliency-guided Lighting", *IEICE Trans. on Information and Systems*, (submitted), Apr 2008.

[3] Y. Kim, C. Y. Ip, and A. Varshney, "Multichannel Mesh Saliency", *IEEE Visualization*, (submitted), Mar 2008.

[4] S. Kumar, J. Chhugani, C. Kim, D. Kim, A. Nguyen, C. Bienia, Y. Kim, and P. Dubey, "Characterization and Analysis of Second Life Virtual World", *IEEE Computer Graphics & Applications*, (submitted), Mar 2008.

[5] Y. Kim, A. Varshney, D. W. Jacobs, and F. Guimbretière, "Mesh Saliency and Human Eye Movements", *ACM Trans. on Applied Perception*, (submitted), May 2007.

[6] Y. Kim and A. Varshney, "Persuading Visual Attention through Geometry", *IEEE Trans. on Visualization and Computer Graphics*, Vol. 14, No. 4, pages 772–782, 2008.

[7] Y. Kim and A. Varshney, "Saliency-guided Enhancement for Volume Visualization", *IEEE Trans. on Visualization and Computer Graphics (IEEE Visualization 2006)*, Vol. 12, No. 5, pages 925–932, 2006.

[8] Y. Kim, C. H. Lee, and A. Varshney, "Vertex-Transformation Streams", *Graphical Models*, Vol. 68, No. 4, pages 371–383, 2006.

[9] T. Baby, Y. Kim and A. Varshney, "Unsupervised Learning Applied to Progressive Compression of Time-Dependent Geometry", *Computers and Graphics*, Vol. 29, No. 3, pages 451–461, 2005.

SELECTED RESEARCH PROJECTS

Salient Frame Detection for Time-Series Datasets by Sliding Window SVD: Time-series datasets can be acquired from scientific simulation, financial data, and videos. Each value is sequentially recorded and saved in a data file. Fast-previewing of time-series datasets is important for the purpose of summarization and abstraction in various fields. We formulate the time-series sequences by a matrix, and apply a sliding-window singular value decomposition (SVD). We automatically detect salient time frames by identifying the changes of the singular value distribution. Our approach is especially effective in detecting non-repetitive salient frames.

Progressively Updating Time-Series Subspaces: Recent advances in acquisition and simulation techniques have generated a huge amount of time-series datasets. We introduce a technique based on motion subspaces for fast analysis of large time-series datasets. We formulate the time-series sequences as a matrix and a set of time-series subspaces which can be shared by consecutive frames. We automatically update these subspaces only if a new salient frame emerges. Our method significantly improves the communication bandwidth requirement and the cache-coherence in processing and rendering time-series data.

Performance Analysis and Optimization for Intel Multi-Core Processors: Several graphics and visualization applications are typically implemented using the Client-Server model. The key components on both the client and the server can be parallelized to take advantage of a large number of cores. We analyze the performance of the CPU running a virtual world client program using Intel VTune software. We also profile the rendering performance of the client program in a variety of scenarios. Our measurements show that this application places significant demands on servers, clients, and the network. One of the reasons for these requirements is that it uses user-created content that is constantly created and modified. We introduce several optimization techniques for processing and rendering user-created content and achieve 200% to 300% improvements in time.

CPU-GPU Cluster: The Maryland CPU-GPU Cluster is a computational infrastructure that leverages the synergistic cluster coupling of CPUs, GPUs, displays, and storage. The GPU programming model is an approximation of the streaming-model of data computation. We use the CPU-GPU cluster and LCD display wall for projects related to Graphics and Scientific Computing. These include large scale data visualization, rendering from compressed data, parallel rendering, and highly parallel matrix computations.

Vertex Transformation Streams: Recent trends in parallel computer architecture strongly suggest the need to improve the arithmetic intensity, the compute-to-bandwidth ratio, for greater performance in time-critical applications. We have designed and built a view-dependent point rendering system which can improve arithmetic intensity for point datasets through interleaving vertex and transformation streams. Large point datasets are efficiently factored into a set of source vertices and transformation streams using Fourier transform. The system shows 200% to 500% improvements in input geometry bandwidth to the GPU.

Saliency-Guided Visual Enhancement: Artists, illustrators, photographers, and cinematographers have long used the principles of contrast and composition to guide visual attention. We introduce geometry modification as a tool to persuasively direct visual attention. We also introduce a general class of saliency-guided enhancement operators that generate an emphasis field from a user-specified saliency field for Volume Visualization. These operators are based on the center-surround mechanisms at multiple scales and invert the process of the saliency computation at each scale. We have carried out several statistical data analyses to show the effectiveness of our enhancement techniques over the previous methods. These include two-way ANOVA and pairwise t-tests to validate the statistically significant increase of human eye-fixations on the regions of interest enhanced by our technique.

SELECTED COURSE PROJECTS

Fitting Lines using Least Squares, Total Least Squares, and E-M: Recognizing objects from images is one of the most challenging problems in computer vision. Many man-made objects such as buildings and industrial products have straight lines, but it is not simple to find all the boundaries due to the noise and occlusions in an image. In this project, we have implemented three systematic ways to fit lines to scattered data points. We compare the conventional least squares and total least squares methods with the expectation-maximization (E-M) algorithm using the total least squares on sets of 2D points with Gaussian noise.

High Performance Computing for Bioinformatics: Expressed sequence tags (ESTs) are short transcribed nucleotide sequences that can be used to discover new genes. Since individual ESTs are error-prone, they should be clustered. We first compare the precision of two clustering methods: ESTmapper and Spidey. We have also improved the MPI-based implementation of the EST mapper.

PROFESSIONAL EMPLOYMENT EXPERIENCE

Intel Corp., Santa Clara, CA

Graduate Technical Intern in Microprocessor Technology Lab. (CTG/MTL/ARL) **Jun 2007 – Aug 2007**

- Supervisors: Pradeep Dubey, Sanjeev Kumar.
- Analyzed the Virtual World workload using Intel VTune Performance Analyzer.
- Proposed enhancements to Intel platforms in rendering user-created content.

Samsung Electronics Co., Ltd, Suwon, Korea

Summer Internship in Mobile Communication Division **Jun 2003 – Aug 2003**

- Implemented the function of remote control and data transfer using IrDA (Infrared Data Association) protocols on the new generation cell phone model, SCH-v410.

HandySoft Corporation, Seoul, Korea

Senior Research Engineer **Feb 1999 – Mar 2002**

- Software task leader for a development team following the Capability Maturity Model (CMM), a set of guidelines to improve the software process proposed by SEI at CMU.
- Designed and developed a digital Form Flow based on Java2 Technologies.
- Designed and developed workflow system based on Microsoft platform (Windows NT).

HandySoft Global, Falls Church, VA, USA

Senior Research Engineer **Sep 2000 – Dec 2000**

- Developed a workflow product called "Bizflow 2000", which was a business operating system for the National Institute of Standards and Technology (NIST).
- Developed the enterprise software that helps businesses get greater value out of existing "Bizflow 2000" infrastructure with NEON Systems Inc.

ACADEMIC EMPLOYMENT EXPERIENCE

University of Maryland, College Park, MD

Graduate Research Assistant **Aug 2004 – present**

Graduate Teaching Assistant **Aug 2002 – Aug 2004**

Seoul National University, Seoul, Korea

Undergraduate Research Assistant in Computer Systems Lab. **Jul 1998 – Dec 1998**

- Research project *"Design and Implementation of a Copying Garbage Collector in Java Virtual Machine (JVM)"*
- Studied Java specification (JVM internal) and garbage collection algorithms.

Undergraduate Research Assistant in Codesign and Parallel Processing Lab. **Sep 1997 – Jun 1998**

- Research project *"Implementation of the Prototyping Board for the 3D Graphics Accelerator"*
- Improved the efficiency of C programs in VLIW architecture environment – became familiar with Assembly Language for TMS320C6x, VLIW (RISC) CPU made by Texas Instruments.

COMPUTER SKILLS

- Programming Languages:
  MATLAB, C/C++, Java, OpenGL, GPU Programming(Cg, HLSL Vertex/Fragment Programs)
- Operating Systems and Tools:
  Linux, Windows, XML, HTML, Rational Rose (a modeler of Rational Corp.)

PROFESSIONAL ACTIVITIES

Technical Reviewer

ACM SIGGRAPH 2005, 2006, 2007, 2008
IEEE Visualization 2007, 2008
IEEE Transactions on Visualization and Computer Graphics 2007, 2008
ACM Transactions on Applied Perception 2007, 2008
Eurographics 2005, 2006, 2007, 2008
Eurographics Symposium on Geometry Processing 2007
Eurographics Symposium on Point-Based Graphics 2006
Pacific Graphics 2005, 2006

REFERENCES

Available upon request