Kartic Subr

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EDUCATION

Ph.D. in Computer Science, June 2008, University of California, Irvine. USA.
Advisor: Prof. James Arvo.
Thesis title: *Sampling Strategies for Efficient Monte Carlo Image Synthesis.*
Committee Members:
James Arvo (Univ. of California, Irvine)
Frédo Durand (MIT)
Sharad Mehrotra (Univ. of California, Irvine)
Gopi Meenakshisundaram (Univ. of California, Irvine)

Master of Science in Visual Computing, March 2005, University of California, Irvine.

B.E. (Bachelor of Engineering) in Computer Science and Engineering, September 2001, PES Institute of Technology, Bangalore University, India.

EXPERIENCE

Research experience

Post-doctoral researcher
INRIA Grenoble, France Oct 2008 - present
Fourier domain light transport, image manipulation, computational photography.
Co-supervising a PhD student on adaptive sampling strategies.

Marie Curie visiting researcher
INRIA Grenoble, France Mar 2006 - Oct 2007
Sampling strategies for simulating defocus in finite-aperture cameras.

Research assistant
University of California, Irvine, USA Sep 2003 - Jun 2008
Sampling methods, assessment of Monte Carlo estimators, contrast enhancement of images.

Research assistant
Indian Institute of Astrophysics, Bangalore, India. Jun 2001 - Aug 2001
Developed driver for CCD camera and image manipulation tools, for use in telescopes.

Teaching

Instructor
Columbia University HSP, New York Jun 2007 - Aug 2007
Taught Computer Graphics through Game Programming to incoming freshmen.

Teaching assistant
University of California, Irvine, California Sep 2002 - Jun 2006
Taught a number of introductory courses: Data structures, discrete math, algorithms and programming languages. Taught three computer graphics courses and a project course in graphics.

Teaching assistant
PES Institute of Technology, Bangalore Sep 2000 - Aug 2001
Taught introductory and advanced courses in C++, data structures and algorithms.

Industrial experience

Software Intern
NVIDIA Corporation, Santa Clara, USA. Jun - Sep 2006
Developed drivers for NVIDIA GeForce 8M series.

Software Intern
Rhythm & Hues Studios, Los Angeles, USA. Jun - Sep 2005
Improved internal rendering software.

Software Engineer
Hewlett Packard, Bangalore, India Sep 2001 - Aug 2002
Transferred technology for a large-scale Telecommunication project, from HP Singapore.

PUBLICATIONS

JOURNALS

Yajun Wang, Jiaping Wang, Nicolas Holzschuch, **Kartic Subr**, Jun-Hai Yong, Baining Guo. Real-time Rendering of Heterogeneous Translucent Objects with Arbitrary Shapes. *Computer Graphics Forum Volume 29 - Issue 2 (EG 2010 Proceedings). Acceptance Rate 23% (243 Submitted, 56 Accepted)* (Eurographics 2009 statistics)

Kartic Subr, Cyril Soler, Frédo Durand. Edge-preserving Multiscale Image Decomposition based on Local Extrema. *ACM Transactions on Graphics.* Dec 2009. (ACM SIGGRAPH Asia 2009 proceedings) *Acceptance Rate 25% (275 Submitted, 70 Accepted)*

Cyril Soler **Kartic Subr**, Frédo Durand, Nicolas Holzschuch, François Sillion. Fourier Depth of Field. *ACM Transactions on Graphics.* August 2009. Presented at ACM SIGGRAPH 2009.

REFEREED INTERNATIONAL CONFERENCE PUBLICATIONS

Kartic Subr, James Arvo. Steerable Importance Sampling. *IEEE/EG conference of interactive raytracing.* September 2007. *Acceptance Rate 53% (43 Submitted, 23 Accepted)*

Kartic Subr, James Arvo. Statistical Hypothesis Testing for Assessing Monte Carlo Estimators. *ACM Pacific Conference on Computer Graphics and Applications.* November 2007. *Acceptance Rate 22% (179 Submitted, 39 Accepted)*

Kartic Subr, Aditi Majumder, Sandy Irani. Greedy Algorithm for Local Contrast Enhancement of Images. *International Conference on Image Analysis and Processing.* September 2005.

TECHNICAL REPORTS

Kartic Subr, Pablo Diaz-Gutierrez, Renato Pajarola, Gopi Meenakshisundaram. Order Independent, Attenuation-Leakage Free Splatting using FreeVoxels. *Technical report.* University of Zurich, 2007.

Kartic Subr, Gopi Meenakshisundaram, Renato Pajarola, Miguel Sainz. Point Light Fields. *Technical report.* University of California, Irvine. 2003.

TALKS

Edge-preserving multiscale image decompositions based on local extrema. ACM SIGGRAPH Asia 2009, Yokohama, Japan. December 2009.

Fourier Depth of Field. ACM SIGGRAPH 2009, New Orleans,USA. August 2009.

Fourier Depth of Field. Cornell University, Ithaca, USA. July 2009.

Statistical Hypothesis Testing for Assessing Monte Carlo Estimators. ACM Pacific Conference on Computer Graphics 2007, Maui ,USA. October 2007.

REFERENCES

The following persons may be contacted for letters of recommendation.

1. James Arvo
   Associate Professor, Donald Bren School of Information and Computer Science
   University of California, Irvine
   Irvine, CA 92697-3425
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   Phone: +1 949 824 9236

2. Prof. Frédo Durand
   Associate Professor
   Computer Graphics Group, CSAIL EECS
   Massachusetts Institute of Technology
   The Stata Center, office 32-D426, 32 Vassar Street
   Email: fredo@mit.edu
   Cambridge, MA 02139, USA
   Phone : +1 617 253 7223
   Fax : +1 617 253 4640

3. Nicolas Holzschuch
   ARTIS
   INRIA Rhône-Alpes
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   38334 Saint Ismier Cedex
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4. François Sillion
   Director of research, INRIA Grenoble - Rhône-Alpes
   655, avenue de l'Europe
   38334 Saint Ismier Cedex
   FRANCE
   Email: Francois.Sillion@inria.fr
   Phone: (+33) 4 76 61 53 14 Assistant: (+33) 4 76 61 53 13

AWARDS

Marie-Curie Fellowship for visiting researchers May 2006 - May 2007

Most outstanding student (Dept. of Computer Science & Engineering) batch of 2001, PES Institute of Technology, Bangalore University, India.

LANGUAGES

Written and Spoken: English, Kannada, Hindi, Tamil
Spoken only: Malayalam
In progress: French

Detailed information

PhD thesis abstract

A key step in synthesizing realistic images from digital models is the simulation of the flow of light and its interactions with the models of the scene. Solving this problem, of light transport while respecting the laws of physics, is crucial for realistic portrayal of visuals in a wide variety of fields including medicine, entertainment, engineering, defense and education.

The gargantuan computational problem of light transport in physically based image synthesis is popularly made tractable by reduction to a series of sampling problems. This reduction is a consequence of using Monte Carlo integration at various stages of the transport process. In this document we describe analytic and computational tools for efficient sampling, and apply them at three stages of the light transport process: Sampling the image, sampling the camera aperture and sampling direct illumination due to distant light sources. We also adapt a standard statistical technique of inductive inference to assess different Monte Carlo sampling strategies that solve the light transport problem.

First, we derive a closed-form parameterization that allows the generation of stratified samples according to a linear density function with triangular support. We use this for stratified sampling of importance functions that are piecewise linear.

Next, we describe a new importance sampling strategy with the novel ability to draw samples from a dynamic steerable importance function. Contrary to existing techniques, the steerability of the importance function ensures that no wasted samples are generated in regions where the steering function is zero. We demonstrate its effectiveness in the context of direct illumination from distant light sources. the incident all-frequency illumination is steered by a dynamically orientable positive cosine lobe that is a function of the local normal.

We extend existing theory for studying the radiance function in the frequency domain: We define operators for frequency domain light transport and use them to present a novel analysis of finite aperture cameras in the Fourier domain. Using this analysis, we derive a new sampling algorithm that performs an order of magnitude better than current techniques for simulating depth of field correctly.

Finally, we discuss a novel adaptation of standard statistical hypothesis tests for assessing and comparing Monte Carlo estimators. We demonstrate that this framework can be used to make assertions about the means and/or variances of Monte Carlo estimators in image synthesis, upto a chosen level of significance. Besides comparing estimators, we verify that the framework can be used to detect errors in estimators and sampling algorithms.

Details of courses taught

Jun 2007 – Aug 2007 Instructor High School Summer Program, Columbia University, New York.

Course Title:	Computer Graphics through Game Programming
Course Level:	Undergraduate introduction
Course Description:	Computer graphics topics included introduction to linear algebra, coordinate systems, rasterizing, antialiasing, transformations, texture mapping, ray tracing, and animation. Students created individual visual animation and interactive games to demonstrate their comprehension of the above topics. Teaching consisted of a mixture of lectures and practical sessions.
Lecture Date:	June 2007 - Aug 2007
Teaching hours:	160
Number of Students:	15

September 2002 – April 2006 Teaching Assistant, Department of Computer Science, University of California Irvine, USA. Taught a wide variety of subjects over a period of 4 years. The structure and duties for each of the following courses were the same: Apart from 2 hours a week of in-class instruction, designing and solving assignments, I had office hours for 2h per week to clarify questions. I was also responsible for evaluating assignments, in some cases (as indicated).

Course Title:	Introduction to Computer Graphics
Course Level:	Undergraduate
Course Description:	The course included topics such as rasterization, coordinate systems, linear algebra, introduction to the OpenGL library, transformations, ray tracing. I was a teaching assistant for this course multiple (three) times.
Number of Students:	30
Other Duties:	Assignment instruction, evaluation and office hours.
Teaching Hours:	120
Total Hours:	600

Course Title:	Introduction to Programming Languages
Course Level:	Undergraduate
Course Description:	This course presented multiple programming philosophies: Generic, functional, object-oriented and structural. I taught this course twice
Number of Students:	150
Other Duties:	Assignment instruction, office hours.
Teaching Hours:	120
Total Hours:	600

Course Title:	Discrete Mathematics
Course Level:	Undergraduate
Course Description:	The course included topics such as permutations and combinations, probability theory, logic and introduction to graph theory.
Number of Students:	75
Other Duties:	Assignment instruction, office hours.
Teaching Hours:	40
Total Hours:	200

Course Title:	Introduction to Data Structures
Course Level:	Undergraduate
Course Description:	The course consisted of understanding and analysing important fundamental datastructures such as vectors, lists, trees, queues and maps.
Number of Students:	50
Other Duties:	Assignment instruction and evaluation, office hours.
Teaching Hours:	40
Total Hours:	200

Course Title:	Introduction to Algorithms
Course Level:	Undergraduate
Course Description:	The course consisted of understanding fundamental algorithms like sorting along with the tools for asymptotic algorithm analysis. Also included, were introductions to concepts in complexity theory.
Number of Students:	30
Other Duties:	Assignment instruction and evaluation, office hours.
Teaching Hours:	40
Total Hours:	200