Summary: Experienced researcher and teacher, with expertise in real-time computer graphics, including rendering, advanced light and material properties, efficient algorithms & data structures, GPU computing, VR, and applications of deep learning.

Education:

2004   PhD, Computer Science; University of Utah
1999   BS, Computer Science; BS, Mathematics; University of Minnesota

Employment:

July 2021 – Present	*Distinguished Research Scientist, NVIDIA*	*Redmond, WA*
Oct 2016 – June 2021	*Principal Research Scientist, NVIDIA*	*Redmond, WA*
Aug 2013 – Sept 2016	*Senior Research Scientist, NVIDIA*	*Redmond, WA*
May 2012 – Aug 2013	*Visiting Professor, NVIDIA*	*Salt Lake City, UT*
July 2010 – June 2014	*Associate Professor, University of Iowa*	*Iowa City, IA*
May 2011 – Dec 2011	*Contractor, SURVICE Engineering*	*Aberdeen, MD*
July 2004 – June 2010	*Assistant Professor, University of Iowa*	*Iowa City, IA*
Aug 1999 – June 2004	*Research Assistant, University of Utah*	*Salt Lake City, UT*
Sept 1997 – June 1999	*Teaching Assistant, University of Minnesota*	*Minneapolis, MN*
Summer 1998, '99, '01	*Teaching Assistant, Summer Science Program*	*Ojai, CA*

Refereed Journal Papers: (24)

Area ReSTIR: Resampling for Real-Time Defocus and Antialiasing, *ACM Trans. Graph., 43(4), 98:1-13.*
Decorrelating ReSTIR Samplers via MCMC Mutations, *ACM Trans. Graph., 43(1), 10:1-17.*
Amortizing Samples in Physics-Based Inverse Rendering using ReSTIR, *ACM Trans. Graph. 42(6), 214:1-17.*
Generalized Resampled Importance Sampling: Fundamentals of ReSTIR, *ACM Trans. Graph. 41(4), 75:1-23.*
Fast Volume Rendering with Spatiotemporal Reservoir Resampling, *ACM Trans. Graph. 40(6), 279:1-18.*
Glossy Probe Reprojection for Interactive Global Illumination, *ACM Trans. Graph. 39(6), 237:1-16.*
Spatiotemporal Reservoir Resampling for Real-time Ray Tracing with Dynamic Direct Lighting, *ACM Trans Graph 39(4), 148:1-17.*
Improved Alpha Testing Using Hashed Sampling, *IEEE Trans. Vis. Comput. Graph. 25(2), 1309-1320.*
Generating Stratified Random Lines in a Square, *Journal of Computer Graphics Techniques 6(2), 48-54.*
Towards Foveated Rendering for Gaze-Tracked Virtual Reality, *ACM Trans. Graph, 35(6), Article 179.*
Frustum-Traced Irregular Z-Buffers: Fast, Sub-pixel Accurate Hard Shadows, *IEEE Trans. Vis. Comput. Graph, 22(10), 2249-2261.*
CloudLight: A System for Amortizing Indirect Lighting in Real-Time Rendering, *Journal of Computer Graphics Techniques 4(4), 1-27.*
Adaptive Depth Bias for Shadow Maps, *Journal of Computer Graphics Techniques 3(4), 146-162.*
Analytic Fits for the CIE XYZ Color Matching Functions, *Journal of Computer Graphics Techniques 2(2), 1-11.*
Non-Pinhole Approximations for Interactive Rendering, *IEEE Computer Graphics & Applications 31(6), 33-40.*
Interactive, Multiresolution Image-Space Rendering for Dynamic Area Lights, *Computer Graphics Forum 29(4), 1279-1288.*
The General Pinhole Camera: Effective and Efficient Non-Uniform Sampling, *IEEE Trans. Vis Comput. Graph. 16(5), 777-790.*
Interactive Indirect Illumination Using Multiresolution Adaptive Splatting, *IEEE Trans. Vis. Comput. Graph. 16(5), 724-741.*
Hierarchical Image-Space Radiosity for Interactive Global Illumination, *Computer Graphics Forum 28(4), 1141-1149.*
Adaptive Caustic Maps Using Deferred Shading, *Computer Graphics Forum 28(2), 309-318.*
Improving Image-Space Caustics via Variable-Sized Splatting, *Journal of Graphics Tools 13(1), 1-17.*
Interactive Display of Isosurfaces with Global Illumination, *IEEE Trans. Vis. Comput. Graph. 12(2), 186-196.*
The Halfway Vector Disk for BRDF Modeling, *ACM Trans. Graph. 25(1), 1-18.*
An Approximate Image-Space Approach for Interactive Refraction, *ACM Trans. Graph. 24(3), 1050-1053.*

Refereed Conference Papers: (22)

Conditionally Resampled Importance Sampling and ReSTIR, *2023 SIGGRAPH Asia, Article 91.*
Rearchitecting Spatiotemporal Resampling for Production, *2021 Symp. on High Performance Graphics, 23-41.*
Correlation-Aware Semi-Analytic Visibility for Antialiased Rendering, *2018 Symp. on High Performance Graphics, Article 2.*
Spatiotemporal Variance-Guided Filtering: Real-Time Reconstruction for Path Traced Global Illumination, *2017 Symp. on High Performance Graphics, Article 2.*
Hashed Alpha Testing, *2017 Symp. on Interactive 3D Graphics and Games, Article 7.*
Exploring and Expanding the Continuum of OIT Algorithms, *2016 Symp. on High Performance Graphics, 1-11.*
Decoupled Coverage Anti-aliasing, *2015 Symp. on High Performance Graphics, 33-42.*
Frustum-Traced Raster Shadows: Revisiting Irregular Z-Buffers, *2015 Symp. on Interactive 3D Graphics and Games, 15-23.*
Adaptive Depth Bias for Shadow Maps, *2014 Symp. on Interactive 3D Graphics and Games, 97-102.*

Imperfect Voxelized Shadow Volumes, *2013 Symp. on High Performance Graphics, 45-52.*
Efficient Rendering of Anatomical Tree Structures Using Geometry Proxies, *2013 Int'l Symp on Biomedical Imaging, 206-209.*
Voxelized Shadow Volumes, *2011 Symp. on High Performance Graphics, 33-40.*
Interactive Visualization of Hospital Contact Network Data on Multi-Touch Displays, *2010 MexiHC, 15-22.*
Multiresolution Splatting for Indirect Illumination, *2009 Symp. on Interactive 3D Graphics and Games, 83-90.*
Interactive Volumetric Shadows in Single-Scattering Media, *2008 Symp. on Interactive Ray Tracing, 87-92.*
Hierarchical Caustic Maps, *2008 Symp. on Interactive 3D Graphics and Games, 163-171.*
The Soft Shadow Occlusion Camera, *2007 Pacific Graphics, 189-198.*
Interactive Refractions with Total Internal Reflection, *2007 Graphics Interface, 185-190.*
Interactive Image-Space Techniques for Approximating Caustics, *2006 Symp. on Interactive 3D Graphics and Games, 153-160.*
Interactive Image-Space Refraction of Nearby Geometry, *2005 GRAPHITE, 205-211.*
Interactive Caustics Using Local Precomputed Irradiance, *2004 Pacific Graphics, 143-151.*
Penumbra Maps: Approximate Soft Shadows in Real Time, *2003 Eurographics Symposium on Rendering, 202-207.*

Book Chapters: (7)
Weighted Reservoir Sampling: Randomly Sampling Streams, *in <u>Ray Tracing Gems 2</u>, APress*, 345-349.
The Alias Method for Sampling Discrete Distributions, *in <u>Ray Tracing Gems 2</u>, APress*, 339-343.
Rendering of Many Lights with Grid-Based Reservoirs, *in <u>Ray Tracing Gems 2</u>, APress*, 351-365.
Introduction to DirectX Raytracing, *in <u>Ray Tracing Gems</u>, APress*, 21-47.
Fast, Stencil-Based Multiresolution Splatting for Indirect Illumination, *in <u>GPU Pro</u>, AK Peters, 199-214.*
A Hybrid Method for Interactive Shadows in Homogeneous Media, *in <u>Shader X7</u>, Charles River Media, 331-344.*
Interactive Refractions and Caustics Using Image-Space Techniques, *in <u>Shader X5</u>, Charles River Media, 359-371.*

Co-Edited Proceedings, as Papers, Program, or Conference Co-Chair: (4)
Proceedings of the 2017 ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games. ISBN 978-1-4503-4886-7
Proceedings of the 2016 ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games. ISBN 978-1-4503-4043-4
Proceedings of the 2011 ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games. ISBN 978-1-4503-0565-5
Proceedings of the 2010 ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games. ISBN 978-1-60558-939-8

Patents: (17)
Spatiotemporal resampling with decoupled shading and reuse. US Patent #11,948,246
Reflection denoising in ray-tracing applications. US Patent #11,941,745   [Continuation of #11,373,359]
Projective hash maps. US Patent #11,925,860
Asynchronous lighting for image illumination. US Patent #11,922,567   [Continuation of #11,295,515]
Using importance resampling to reduce the memory incoherence of light sampling. US Patent #11,663,773
Reflection denoising in ray-tracing applications. US Patent #11,373,359   [Continuation of #10,776,985]
Reservoir-based spatiotemporal importance resampling utilizing a global illumination data structure. US Patent #11,315,310
Photon-based image illumination rendering. US Patent #11,295,515   [Continuation of #10,713,838]
Reflection denoising in ray-tracing applications. US Patent #10,776,985
Image illumination rendering system and method. US Patent #10,713,838   [Continuation of #10,008,034]
Performing spatiotemporal filtering. US Patent #10,600,167
Perceptually-based foveated rendering using a contrast-enhancing filter. US Patent #10,438,400
System and method for generating temporally stable hashed values. US Patent #10,417,813
Frustum tests for sub-pixel shadows. US Patent #10,055,883
System, method, and computer program product for computing indirect lighting in a cloud network. US Patent #10,008,034
System, method, and computer program product for shading using a dynamic object-space grid. US Patent #9,754,407
System, method, and computer program for performing object-space shading. US Patent #9,747,718

Publicly Available US Patent Applications: (2)
Illumination resampling using temporal gradients in light transport simulation systems and applications. US 20230138718 A1
Grid-based light sampling for ray tracing applications. US 20220058851 A1

Advised Graduate Students (at University of Iowa):
Greg Nichols (PhD 2010), Noah Abrahamson (MS 2008), Zeng Dai (MS 2014), Scott Davis (MS 2007), Hang Dou (MS 2013), Ethan Kerzner (MS 2013), Qi Mo (MS 2007), Rajeev Penmatsa (MS 2012), Yajie Yan.

Direct Mentorship / Supervision of Interns (at NVIDIA):
Yuxiang Wang (2014), Ian Mallett ('15), Christoph Peters ('17), Lifan Wu ('18), Benedikt Bitterli ('19 & '20), Daqi Lin ('20 & '21), Song Zhang ('23), Nathan Morrical ('23), Trevor Hedstrom ('24), Jeffrey Liu ('24).

External Dissertation Committee Member / Faculty Opponent:
Markus Billeter, PhD 2014 (Chalmers University), Daqi Lin, PhD 2022 (University of Utah), Luca Surace, PhD TBD (USI Lugano)

Supervised Undergraduate Researchers (at University of Iowa):
Ethan Kerzner, Maranda Franke, Bruce Davis.

Grants: As faculty at University of Iowa, received $900,000+ contract/grant funding as sole PI and $500,000+ with others.

Research Dissemination: Presented over 17 talks internationally and 55 talks domestically. My research, custom variations, and derivative work has shipped in many games, game engines, DCC plugins, visualization tools, and research frameworks. We distribute code for many of our research projects, and freely distribute more product-ready SDKs (e.g., NVIDIA's RTXDI). Organized and/or presented at 7 SIGGRAPH Courses for more detailed dissemination.

Major Conference Organization:
ACM SIGGRAPH
  2023: Courses Chair; **2013:** General Submissions & Unified Jury Chair; **2012:** Late Breaking Submissions & Jury Chair;
  2011: Unified Jury Research Section & Posters Lead
ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games
  2010 & 2016: Conference Co-Chair; **2011 & 2017:** Papers Co-Chair; **2009 & 2015:** Posters Chair
Eurographics
  2018: Industry Co-Chair

Editorial Boards:
J. Computer Graphics Techniques (2012-'17), *Computer Graphics Forum* (2011-'14), *J. Graphics Tools* (2008-'12)

Grant Reviews: National Science Foundation, US Army Research Office, Nebraska Research Institute, Fonds Wetenschappelijk Onderzoek

Faculty Promotion and Tenure Letters: One in 2016, one in 2018.

Technical Program Committees and Juries: (78)
ACM SIGGRAPH General Submissions Jury 2010-'13,'15-'16,'20-'23; ACM SIGGRAPH Late Breaking Jury 2010-'13,'15; ACM SIGGRAPH Posters Committee 2006, '16, '18, '22; ACM SIGGRAPH Technical Papers Committee 2024; ACM SIGGRAPH Asia Technical Briefs Committee 2016-'19; ACM SIGGRAPH Asia Technical Papers Committee 2022, ACM SIGGRAPH Asia Workshops Committee 2017; ACM Symposium on Interactive 3D Graphics and Games 2006, '08-09, '12-'15, '18, '24; ACM Symposium on Virtual Reality Software and Technology '18; Eurographics 2006, '08-'09, '18-'19, '25; Eurographics Short Papers 2009; Eurographics Symposium on Rendering 2009-'11,'15-'16; Graphics Interface 2009-'10,'17; High Performance Graphics 2012, '17-'24; International Symposium on Visual Computing 2009-'10; Pacific Graphics 2006-'08, '11, '13-'21; Vision, Modeling and Visualization 2004-'06.

Book Reviews: Addison-Wesley, CRC Press, Elsevier, Morgan & Claypool, Prentice Hall

Paper Reviewer:
ACM Transactions on Graphics (ToG), Computer Graphics Forum (CGF), IEEE Transactions on Visualization and Computer Graphics (TVCG), Journal of Computer Graphics Techniques (JCGT), Journal of Graphics Tools (JGT), Journal of Zhejiang University Science, The Visual Computer, Computers & Graphics (C&G), Symposium on High Performance Graphics (HPG), ACM SIGGRAPH, ACM SIGGRAPH Asia, Symposium on Interactive 3D Graphics and Games (I3D), Symposium on Principles and Practice of Parallel Programming (PPoPP), Symposium on Virtual Reality Software and Technology (VRST), Eurographics (EG), Eurographics Symposium on Rendering (EGSR), Graphics Interface (GI), IEEE EIT, IEEE Symposium on Mixed and Augmented Reality (ISMAR), IEEE Visualization, PLOS One, International Symposium on Visual Computing (ISVC), Pacific Graphics (PG), Vision Modeling and Visualization (VMV).

Honors:
Best papers: (1st Place) HPG 2017, I3D 2015; (2nd Place) HPG 2016, IEEE CG&A 2011; (3rd Place) HPG 2015, HPG 2011; (One of top 4) I3D 2009; *Best Presentation*: (1st Place) I3D 2015; *Other Technical Awards:* 2016 Laval Virtual Award (from SIGGRAPH E-Tech); *Member:* 2009 DARPA Computer Science Study Group; *Major Educational Support:* University of Utah Wayne Brown Fellowship, WalMart Competitive Edge Scholarship, National Merit Scholarship

Miscellaneous: *Admissions Committee*, Summer Science Program 2010-'22 (http://www.summerscience.org)