

# Kevin Karsch

[kevinkarsch.com](http://kevinkarsch.com)

## EDUCATION

### PhD in Computer Science

University of Illinois Urbana-Champaign, 2009-2015

- › Thesis: Inverse Rendering Techniques for Physically Grounded Image Editing
- › Advisors: David Forsyth, Derek Hoiem

### BS in Math, Computer Science

University of Missouri-Columbia, 2005-2009

- › Summa Cum Laude with Departmental Honors in Math and Computer Science

## EXPERIENCE

### Co-founder, CTO

Lightform, 2014-Present

- › **Company highlights:**
  - › Shipped multiple AR products to customers, including the first all-in-one AR projector
  - › Patented novel research prototypes, most notably a steerable, smart-home projection device
  - › Acquired >10k customers since the initial hardware launch in 2018
- › As an **executive**, helped define company vision, direction, and culture:
  - › Responsible for company technical decisions and deadlines
  - › Directed the development of Lightform's IP portfolio
  - › Voting member of the board of directors
- › As a **manager**, directed software projects with various team sizes and experience levels:
  - › Engaged daily with customers and stakeholders to define and revise the product roadmap
  - › Shipped new products annually while maintaining legacy product compatibility
  - › Implemented scrum practices and processes for iterative development
- › As a **research engineer**, developed proprietary and patented algorithms:
  - › A structured light technique using low-cost hardware, tolerant to harsh conditions
  - › Automatic alignment and re-alignment techniques for projected AR
  - › Negative space detection and automatic perspective warping
- › As a **software engineer**, contributed multi-platform production code in use by customers:
  - › Developed and maintained the application layer running on Lightform embedded devices
  - › Implemented graphics/UI/network components and infrastructure for Lightform desktop software
  - › Performed regular code reviews, and mentored junior developers

### Co-founder

Subliminl, 2012-2014

- › Developed applications for seamlessly inserting advertisements into images and video
- › Created a method for inserting animations into existing video content

### Computer Vision Engineer

Lumenco, 2012-2014

- › Developed software for displaying glasses-free, 3D media via autostereoscopy
- › Made an algorithm that synthesized extreme viewpoints from stereo images and videos

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**Computer Vision Engineer**Precision Augmented Reality Works, 2013

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- › Created software to detect changes in retail store displays for inventory management
- › Implemented a method to automatically register 3D inventory models with image data

**Intern**Adobe Research, 2012

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- › Published an image editing method for automatically inserting 3D models into pictures
- › Aspects of this work have been integrated into Adobe Dimension

**Intern**Microsoft Research, 2011

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- › Published a single image depth estimation technique
- › Created a new-view synthesis algorithm for generating stereo images and accompanying dataset

**Intern**Naval Research Laboratory, 2009

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- › Researched and implemented graphical representations for occluded objects in AR
- › Conducted user studies to determine which representation should be used in an AR system used by soldiers

**Software Engineer**Reynolds Journalism Institute, 2008-2009

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- › Led a team of four students to implement a unique news-based iPhone application (Newsflash)
- › Newsflash App awarded "People's Choice Award" by RJI's Futures Lab
- › Learned modern development techniques from engineers at Apple Headquarters

**Intern**Department of Defense, 2008

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- › Implemented a mesh segmentation algorithm using a modified form of mean-shift segmentation
- › Presented research at the Maneuver Support and Technology Conference
- › Developed automatic terrain visualization software

**Intern**Washington University, 2007

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- › Researched methods to improve patient care by enhancing treatment software
- › Collaborated with graduate researchers to develop a treatment review system
- › Created an automated patient documentation system used daily by physicians

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**PUBLICATIONS**

- › Zicheng Liao, **Kevin Karsch**, Hongyi Zhang, David A. Forsyth. An Approximate Shading Model with Detail Decomposition for Object Relighting, *IJCV* 2019.
- › Brittany Fatura, Laura LaPerche, Phil Reyneri, Brett Jones, **Kevin Karsch**. Lightform: Procedural Effects for Projected AR, *SIGGRAPH (Emerging Tech)* 2018.
- › Giang Bui, Brittany Morago, Truc Le, **Kevin Karsch**, Zheyu Lu, Ye Duan. Integrating videos with LIDAR scans for virtual reality, *VR* 2016.
- › Brett Jones, Rajinder Sodhi, Pulkit Budhiraja, **Kevin Karsch**, Brian Bailey, David A. Forsyth. Projectibles: Optimizing Surface Color For Projection, *UIST* 2015.
- › Zicheng Liao, **Kevin Karsch**, David A. Forsyth. An Approximate Shading Model for Object Relighting, *CVPR* 2015.

- » **Kevin Karsch**. Inverse Rendering Techniques for Physically Grounded Image Editing, *PhD Thesis (UIUC 2015)*.
- » Pulkit Budhiraja, Rajinder Sodhi, Brett Jones, **Kevin Karsch**, Brian Bailey, David A. Forsyth. Where's My Drink? Enabling Peripheral Real World Interactions While Using HMDs, *Tech Report (2015)*.
- » **Kevin Karsch**, Ce Liu, Sing Bing Kang. DepthTransfer: Depth extraction from video using non-parametric sampling, *TPAMI 2014*.
- » **Kevin Karsch**, Kalyan Sunkavalli, Sunil Hadap, Nathan Carr, Hailin Jin, Raphael Fonte, Michael Sittig, David A. Forsyth. Automatic Scene Inference for 3D Object Compositing, *TOG 2014 (Presented at SIGGRAPH 2014)*.
- » **Kevin Karsch**, Mani Golparvar-Fard, David A. Forsyth. ConstructAide: Analyzing and Visualizing Construction Sites through Photographs and Building Models, *SIGGRAPH Asia 2014*.
- » **Kevin Karsch**, David A. Forsyth. Blind Recovery of Spatially Varying Reflectance from a Single Image, *SIGGRAPH Asia 2014 Workshop on Indoor Scene Understanding (best paper)*.
- » **Kevin Karsch**, Zicheng Liao, Jason Rock, Jonathan T. Barron, Derek Hoiem. Boundary Cues for 3D Object Shape Recovery, *CVPR 2013*.
- » **Kevin Karsch**, Ce Liu, Sing Bing Kang. Depth Extraction from Video Using Non-parametric Sampling, *ECCV 2012 (oral presentation)*.
- » **Kevin Karsch**, Varsha Hedau, David A. Forsyth, Derek Hoiem. Rendering synthetic objects into legacy photographs, *SIGGRAPH Asia 2011*.
- » **Kevin Karsch**, John C. Hart. Snaxels on a plane, *NPAR 2011 (best paper honorable mention)*.
- » Mark A. Livingston, Zhuming Ai, **Kevin Karsch**, Gregory O. Gibson. User interface design for military AR applications, *VR 2011*.
- » Qing He, **Kevin Karsch**, Ye Duan. Semi-automatic 3D segmentation of brain structures from MRI, *Int J Data Min Bioinform*.
- » Qing He, Shawn E. Christ, **Kevin Karsch**, Dawn Peck, Ye Duan. Shape analysis of corpus callosum in phenylketonuria using a new 3D correspondence algorithm, *SPIE Medical Imaging 2010*.
- » Qing He, Ye Duan, **Kevin Karsch**, Judith Miles. Detecting 3D Corpus Callosum abnormalities in autism based on anatomical landmarks, *Psychiatry Res 2010*.
- » Qing He, Ye Duan, Xiaotian Yin, Xianfeng Gu, **Kevin Karsch**, Judith Miles. Shape analysis of corpus callosum in autism subtype using planar conformal mapping, *SPIE Medical Imaging 2009*.
- » Qing He, Shawn E. Christ, **Kevin Karsch**, Amanda J. Moffitt, Dawn Peck, Ye Duan. Detecting 3D Corpus Callosum abnormalities in phenylketonuria, *Int J Comput Biol Drug Des 2009*.
- » Qing He, Ye Duan, Xiaotian Yin, Xianfeng Gu, **Kevin Karsch**, Judith Miles. Detecting corpus callosum abnormalities in autism subtype using planar conformal mapping, *Int J Numer Meth Biomed Engng 2009*.
- » **Kevin Karsch**, Qing He, Ye Duan. A Fast, Semi-automatic Brain Structure Segmentation Algorithm for Magnetic Resonance Imaging, *BIBM 2009*.
- » Qing He, **Kevin Karsch**, Ye Duan. A Novel Algorithm for Automatic Brain Structure Segmentation from MRI, *ISVC 2008*.
- » **Kevin Karsch**, Brian Grinstead, Qing He, Ye Duan. Web based brain volume calculation for magnetic resonance images, *EMBC 2008*.
- » Qing He, **Kevin Karsch**, Ye Duan. Abnormalities in MRI traits of corpus callosum in autism subtype, *EMBC 2008*.
- » Qing He, **Kevin Karsch**, Ye Duan. Detecting thalamic abnormalities in autism using cylinder conformal mapping, *ISVC 2008*.
- » **Kevin Karsch**, Robert Drzymala. Electronic transmission of Gamma Knife records to a radiation oncology record and verify system and e-mail, *Medical Physics 2008*.
- » Robert Drzymala, **Kevin Karsch**, James Alaly, Divya Khullar, Yu Wu, Joseph Deasy. Import of Gamma Knife Model C treatment plans into CERR, *Medical Physics 2008*.

## PATENTS

- › Rajinder Sodhi, Brett Jones, **Kevin Karsch**, Phil Reyneri, Douglas Rieck, Pulkit Budhiraja. System for projecting spatially-referenced content within a space, (*pending*).
- › Rajinder Sodhi, Brett Jones, **Kevin Karsch**, Pulkit Budhiraja, Phil Reyneri, Douglas Rieck. Method for augmenting changes in a space with ambient, responsive visual interfaces, (*pending*).
- › Rajinder Sodhi, Brett Jones, **Kevin Karsch**, Pulkit Budhiraja, Phil Reyneri, Douglas Rieck. Method for augmenting surfaces in a space with visual content, (*pending*).
- › Rajinder Sodhi, Brett Jones, **Kevin Karsch**, Pulkit Budhiraja, Phil Reyneri, Douglas Rieck, Andrew Kilkenny. System and methods for augmenting surfaces within spaces with projected light, *US10805585B2*.
- › **Kevin Karsch**, Rajinder Sodhi, Brett Jones, Pulkit Budhiraja, Phil Reyneri, Douglas Rieck, Andrew Kilkenny, Ehsan Noursalehi, Derek Nedelman, Laura LaPerche, Brittany Factura. Method for augmenting a scene in real space with projected visual content, *US10373325B1*.
- › David A. Forsyth, **Kevin Karsch**, Mani Golparvar-Fard. 4D vizualization of building design and construction modeling with photographs, *US9852238B2*.
- › Mark A. Raymond, Hector Andres Porras Soto, **Kevin Karsch**. Conversion of a digital stereo image into multiple views with parallax for 3D viewing without glasses, *US9786253B2*.
- › **Kevin Karsch**, Zicheng Liao, David A. Forsyth. Relighting fragments for insertion into content, *US9471967B2*.
- › **Kevin Karsch**, Ce Liu, Sing Bing Kang. Automatic 2D-to-stereoscopic video conversion, *US9414048B2*.
- › **Kevin Karsch**, Varsha Hedau, David A. Forsyth, Derek Hoiem. Inserting objects into content, *US9330500B2*.
- › **Kevin Karsch**, Kalyan Sunkavalli, Sunil Hadap, Nathan Carr, Hailin Jin. Automatic geometry and lighting inference for realistic image editing, *US9299188B2*.

## FUNDING

- › NSF SBIR (Phase IIb). *Projected augmented reality systems for large scale enterprise deployment*, 2019-2021.
- › NSF SBIR (Phase II-TECP). *Automatic calibration and realignment of projection mapping systems*, 2017-2019.
- › NSF SBIR (Phase II). *Reliable, scalable projection mapping systems with reusable content*, 2016-2018.
- › NSF SBIR (Phase Ib). *Self-contained projection mapping systems*, 2015-2016.
- › NSF SBIR (Phase I). *A unified system for low-cost, scalable projection mapping*, 2015-2016.

## BOOK CHAPTERS

- › **Kevin Karsch**, Ce Liu, Sing Bing Kang. DepthTransfer: Depth extraction from video using non-parametric sampling. In *Dense Image Correspondences for Computer Vision* (Tal Hassner, Ce Liu eds). Springer International Publishing, 2016, Chapter 9, pages 173-206.

## TEACHING

### TA (Computational Photography)

University of Illinois, Spring 2012, Fall 2013

- › Lectured on image-based lighting, rendering methods, and 3D reconstruction
- › Developed, tested and graded course projects

### Guest Lecturer

University of Illinois, 2010-2015

- › Courses: Computer Graphics, Computer Vision, Computational Photography

### TA (Computer Graphics)

University of Missouri, Spring 2009

- › Instructed classes of over 30 graduate and undergraduate students
- › Guided students to develop 3D simulations using OpenGL and QT

## Residential Advisor

University of Missouri, 2006-2008

- › Instructed courses for incoming freshman
- › Provided academic and social advising to a diverse population of students

## AWARDS

- › [Digital Design of the Year – Dezeen Awards](#), 2018.
- › [Best Overall New Product – Infocomm](#), 2018.
- › [CVPR Outstanding Reviewer](#), 2017.
- › [Cozad New Venture Competition Winner](#), 2014.
- › Beckman Institute Artificial Intelligence Award, 2013.
- › [Lemelson-MIT Illinois Student Prize](#), 2012.
- › National Science Foundation Graduate Research Fellowship (NSFGRF), 2010.
- › National Defense Science and Engineering Graduate Fellowship (NDSEG), 2010.
- › Diffenbaugh Fellowship, 2009.
- › Phyllis Ann Heysell Scholarship, 2009.
- › [CRA Outstanding Undergraduate Award – Finalist](#), 2009.
- › Barry M. Goldwater Scholar, 2008.
- › Curtis and Barbara Benton Scholarship in Engineering, 2008.
- › John M. Kuhlman Scholarship, 2008.
- › Arts and Science Quadrangle Award, 2008.
- › Helen M. Barrett Memorial Scholarship, 2008.
- › Ralph K. and Maxine J. Hibbs Scholarship, 2007.
- › Outstanding Student Award in Engineering, 2007.
- › William R. Kimmel Engineering Scholarship, 2007.
- › Lloyd E. Hightower Fund for Excellence in Engineering, 2006.
- › Missouri Bright Flight Scholar, 2006.
- › Missouri University Excellence Award, 2006.

## PRESS

- › [No Headset Required: Lightform Is AR In The Real World](#)
- › [Lightform: The Magical Little Device that Transforms While Rooms into Screens](#)
- › [Lightform raises \\$5M to turn old projectors into augmented reality machines](#)
- › [Lightform unveils \\$699 augmented-reality projection device from the brains behind Xbox IllumiRoom](#)
- › [Lightform computer brings glasses-free augmented reality 'anywhere'](#)
- › [Lightform Emerges With \\$2.6 Million For Glasses-Free AR Tech](#)
- › [Projection AR to make every surface come alive! Our investment in Lightform.](#)
- › [How to Grab a Drink Without Leaving Virtual Reality.](#) Discover Magazine (online), Feb 2015.
- › [Student Startup Luminous Brings Projection Mapping Out of the Arena](#) CS @ Illinois Press, June 2014.
- › [Wearable Device Technology & Projection Mapping Startup Win Top Prizes at Cozad New Venture Competition.](#) UIUC Press Release, April 2014.

- › [UI Computer Science Student Wins \\$30,000 Prize](#). News Gazette, Mar 2012.
- › [CS Graduate Student Named Winner of the \\$30,000 Lemelson-MIT Illinois Student Prize](#). UIUC Press Release, Mar 2012.
- › [CGI: Now as easy as ABC](#). Wired UK, Feb 2012.
- › [Whose Fingers Are On The Victoria's Secret Model's Shoulder?](#) NPR, Feb 2012.
- › [Software Realistically Adds 3-D Objects to Old Photos](#). IEEE Spectrum, Dec 2011.
- › [Smart Image Editor Adds Fake Objects to Photos](#). New Scientist, Dec 2011.
- › [Way Cooler Than Photoshop: Add 3D Objects to 2D Photos](#). The Atlantic, Oct 2011.
- › [Software Seamlessly Inserts New Objects Into Existing Photographs](#). Popular Science, Oct 2011.
- › [Kevin Karsch, Image Adventurer](#). Daily Brink, Oct 2011.
- › [New Technology Can Convert Pictures into 3-D Images](#). Daily Illini, Oct 2011.
- › [Today's 'What Hath God Wrought?' Tech Moment](#). The Atlantic, Oct 2011.

## SKILLS

- › **Languages:** C/C++, Python, Matlab
- › **Libraries:** OpenCV, Qt/QML, OpenGL/GLES, PCL, Libav/FFmpeg, Tensorflow
- › **Software:** Git, Jira, Blender, Figma, Adobe Ps/Ae/Ai/Dn
- › **Project management:** Scrum, Kanban