Kevin Karsch

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EDUCATION

PhD in Computer Science — University of Illinois Urbana-Champaign

- Thesis: Inverse Rendering Techniques for Physically Grounded Image Editing
- Topics: Computer Vision, Computer Graphics, Machine Learning, Numerical Optimization
- Advisors: David Forsyth, Derek Hoiem

BS in Mathematics, Computer Science — University of Missouri-Columbia

- Summa Cum Laude with Departmental Honors in Mathematics and Computer Science

EXPERIENCE

Co-founder, CTO — Lightform, 2014-Present

- **Company highlights**:
  - Delivered multiple AR products from conception to shipping, including the first all-in-one AR projector
  - Developed the most consumer-friendly projected AR software on the market today
  - Patented novel research, including core company IP and a smart-home projection device
  - Acquired 11,000+ customers in two years since Lightform's first hardware product release
- As an **executive**, defined 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 an **engineering manager**, supervised projects with various team sizes and experience levels:
  - Engaged regularly with customers, analytics and stakeholders to define and revise product roadmap
  - Promoted exceptional team members into leadership roles for new product initiatives
  - Shipped new products annually while maintaining legacy product compatibility for existing customers
  - Installed processes and implemented scrum practices for iterative development
- As a **research engineer**, developed and patented proprietary 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 for projection
- As a **software engineer**, contributed multi-platform production code in use by customers:
  - Developed and maintained the application layer running on Lightform devices
  - Implemented graphics/UI/network components and infrastructure for Lightform desktop software
  - Regularly contributed features and patches across all Lightform products
  - Performed regular code reviews and mentored junior developers

Co-founder — Subliminl, 2012-2014

- Developed a mobile application for seamlessly inserting advertisements into images and video
- Created a method for inserting 2D animations into existing video content

Computer Vision Engineer Lumenco, 2012-2014

- Developed software for displaying glasses-free, 3D media via autostereoscopy
- Created an algorithm to synthesize extreme viewpoints from stereo images and videos

Computer Vision Engineer Precision Augmented Reality Works, 2013

- 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

- 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

- 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

- 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

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

Intern Department of Defense, 2008

- 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

- 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

PUBLICATIONS

- Zicheng Liao, **Kevin Karsch**, Hongyi Zhang, David A. Forsyth. An Approximate Shading Model with Detail Decomposition for Object Relighting, *IJCV 2019*.
- Brittany Factura, 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**, 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.

ACADEMIC SERVICE

- Reviewer. *CVPR, ECCV, ICCV, SIGGRAPH, SIGGRAPH Asia, TPAMI, IJCV*, 2012-Present.

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

PRESS

- Lightform Turning Surfaces Into Screens
- 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.
- Student Startup Lumenous Brings Projection Mapping Out of the Arena
- Wearable Device Technology & Projection Mapping Startup Win Top Prizes at Cozad New Venture Competition.
- UI Computer Science Student Wins $30,000 Prize.
- CS Graduate Student Named Winner of the $30,000 Lemelson-MIT Illinois Student Prize.
- CGI: Now as easy as ABC.
- Whose Fingers Are On The Victoria's Secret Model's Shoulder?
- Software Realistically Adds 3-D Objects to Old Photos.
- Smart Image Editor Adds Fake Objects to Photos.
- Way Cooler Than Photoshop: Add 3D Objects to 2D Photos.
- Software Seamlessly Inserts New Objects Into Existing Photographs.
- Kevin Karsch, Image Adventurer.
- New Technology Can Convert Pictures into 3-D Images.
- Today's 'What Hath God Wrought?' Tech Moment.

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.

SKILLS

- **Languages**: C/C++ (11/14/17), Python, Matlab
- **Libraries**: OpenCV, Qt/QML, OpenGL/GLES, Libav/FFmpeg, PCL, Tensorflow
- **Build**: CMake, Conan, Docker, Yocto, Jenkins
- **Software**: Git, Jira, Figma, Adobe Ps/Ae/Ai/Dn, Blender, Unity
- **Project management**: Scrum, Kanban