

# Kevin Karsch

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<http://kevinkarsch.com>

- Education**
- PhD in Computer Science** 2009 - Present  
*University of Illinois at Urbana-Champaign*  
Research areas: computer vision, computer graphics  
Advisor: David Forsyth  
GPA: 3.90/4.00
- BS in Computer Science, BS in Mathematics** 2005 - 2009  
*University of Missouri-Columbia*  
Summa Cum Laude, University Honors  
Departmental Honors in Computer Science, Mathematics  
Major GPA: 4.00/4.00
- Research Projects**
- Automatic 2D-to-Stereo**
- Converting monoscopic images and videos to stereoscopic (“3D”) pairs via dense depth estimation and new-view synthesis
- Physically grounded image editing**
- Extracting 3D scene information from single images; enabling seamless object insertion, removal, and relocation
- Intrinsic image decomposition**
- Using learning approaches to decompose images into different subcomponents (sometimes called intrinsic images), which provide estimates of surface reflectance and lighting information for an image
- Aesthetic enhancement for images**
- Developing algorithms to aid users in creating aesthetically pleasing images; current projects include automatic cropping, dynamic rim lighting, and automatic camera positioning
- Active contours on meshes**
- Re-parameterizing active contours with meshed surfaces rather than image pixels; applications include time-coherent animated vector art as well as geometric surface properties (curvature, concavities, etc)
- Mobile augmented reality interface design**
- Creating a novel user interface for military head mounted displays (HMDs); determining the best representation for visualizing occluded objects with HMDs
- Point cloud reconstruction**
- Inferring local and global statistics from a sequence of LIDAR scanned points in order to reconstruct a mesh; specifically for detecting falling rock near highways and robot navigation
- Medical image segmentation**
- A novel framework for generalized medical image segmentation; allows for robust segmentation with little to no user input

## Shape and structural analysis in medical images

- Statistical analysis of brain structures to determine the causes of certain diseases, such as autism and phenylketonuria

## Patents

- Karsch, K.; Liu, C.; Kang, S. B. 2011. "Automatic 2D-to-Stereoscopic Video Conversion." US Patent Pending, filed Dec 2011.
- Karsch, K.; Hedau, V.; Forsyth, D.; Hoiem, D. 2011. "Inserting Objects into Content." US Patent Pending, filed Dec 2011.

## Selected Publications

- Karsch, K.; Liu, C.; Kang, S. B. "Automatic 2D-to-3D video conversion using non-parametric depth sampling." *CVPR* (submitted), 2012.
- Karsch, K.; Hedau, V.; Forsyth, D.; Hoiem, D. "Rendering synthetic objects into legacy photographs." *ACM Transactions on Graphics (Proceedings of SIGGRAPH Asia)*, 30(6), 2011.
- Karsch, K.; Hart, J. C. "Snaxels on a Plane." *NPAR '11: Proceedings of the 9th International Symposium on Non-Photorealistic Animation and Rendering*, pp. 35-42, 2011. **Best paper honorable mention**
- Karsch, K.; He, Q.; Duan, Y. "A fast, semi-automatic brain structure segmentation algorithm for magnetic resonance imaging." *IEEE International Conference on Bioinformatics and Biomedicine*, 2009. [19% acceptance]
- He, Q.; Karsch, K.; Duan, Y. "Semiautomatic 3D segmentation of brain structures from MRI." *Int. J. Data Mining and Bioinformatics*, 5(2), pp 158-173, 2011.
- Livingston, M.; Ai, Z.; Karsch, K.; Gibson, G. "User interface design for military AR applications." *Virtual Reality*, 15(2), pp 175-184, 2011.
- He, Q.; Karsch, K.; Duan, Y. "A novel algorithm for automatic brain structure segmentation from MRI." *Proceedings of the 4th International Symposium of Visual Computing*, 2008.
- Karsch, K.; Grinstead, B.; He, Q.; Duan, Y. "Web based brain volume calculation for magnetic resonance images." *30th Annual International Conference of the IEEE Engineering in Medicine and Biology Society*, August, 2008.
- He, Q.; Karsch, K.; Duan, Y. "Abnormalities in MRI traits of corpus callosum in autism subtype." *30th Annual International Conference of the IEEE Engineering in Medicine and Biology Society*, August, 2008.
- Karsch, K.; Drzymala, R. E. "Electronic transmission of Gamma Knife records to a radiation oncology record and verify system and e-mail." Presented at the *50th Annual Meeting of the AAPM, Med. Phys.* 35, 2827, July 2008.
- He, Q.; Christ, S.; Karsch, K.; Peck, D.; Duan, Y. "Shape analysis of corpus callosum in phenylketonuria." *SPIE Symposium on Medical Imaging*, 2010.
- He, Q.; Christ, S.; Karsch, K.; Moffitt, J.; Peck, D.; Duan, Y. "Detecting 3D corpus callosum abnormalities in phenylketonuria." *Int. J. Computational Biology and Drug Design*, 2(4), 2009.
- Duan, Y.; He, Q.; Yin, X.; Gu, X.; Karsch, K.; Miles, J. "Detecting corpus callosum abnormalities in autism subtype using planar conformal mapping." *J. Communications in Numerical Methods in Engineering*, April 2009.

- He, Q.; Duan, Y.; Yin, X.; Gu, X.; Karsch, K.; Miles, J. “Shape analysis of corpus callosum in autism subtype using planar conformal mapping.” *Medical Imaging 2009: Biomedical Applications in Molecular, Structural, and Functional Imaging. Proceedings of SPIE*, Vol. 7262, pp. 726217-726217-8, February 2009.
- He, Q.; Duan, Y.; Yin, X.; Gu, X.; Karsch, K.; Miles, J. “Detecting thalamic abnormalities in autism using cylinder conformal mapping.” *Proceedings of the 4th International Symposium of Visual Computing*, 2008.
- Drzymala, R. E.; Karsch, K.; Alaly, J.; Khullar, D.; Wu, Y.; Deasy, J. O. “Import of Gamma Knife Model C treatment plans into CERR.” Presented at the *50th Annual Meeting of the AAPM, Med. Phys.* 35, 2827, July 2008.

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<b>Academic Honors</b> (* Nationally competitive)	* 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	2008
	* 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	

<b>Work Experience</b>	<b>Research Intern</b> , Microsoft Research	Summer 2011
	<ul style="list-style-type: none"> <li>• Developed a single image depth estimation technique; also works for video</li> <li>• Created a new-view synthesis algorithm for generating stereo images from a color image and depth (based on image warping)</li> <li>• Built a stereo plus depth data collection rig to collect training examples</li> <li>• Advised by Sing Bing Kang and Ce Liu</li> </ul>	
	<b>Graduate Research Assistant</b> , University of Illinois	2009 - Present
	<ul style="list-style-type: none"> <li>• Constructed a single image lighting estimation algorithm</li> <li>• Built an extensive user interface to demonstrate the capabilities of this algorithm</li> <li>• Developing a method to create NPR vector graphics from 3D geometry</li> <li>• Advised by Prof. John Hart, Prof. David Forsyth, and Prof. Derek Hoiem</li> </ul>	
	<b>Research Intern</b> , Naval Research Laboratory	Summer 2009
<ul style="list-style-type: none"> <li>• Researched and implemented innovative graphical representations for occluded objects in the Battlefield Augmented Reality System (BARS)</li> <li>• Conducted a user study to determine which representation should be used in an augmented reality system in development for unmounted US military soldiers</li> </ul>		
<b>Undergraduate Research Assistant</b> , University of Missouri	2007 - 2009	
<ul style="list-style-type: none"> <li>• Authored and presented research projects in both computer graphics and vision</li> </ul>		

- Participated in weekly seminars to discuss advances in computer graphics research
- Designed and developed software to aid current research experiments

**Teaching Assistant (Computer Graphics)**, University of Missouri 2009

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

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

- Led a team of four students to implement a unique news-based iPhone application
- Learned modern development strategies from engineers at Apple Headquarters

**Research Intern**, Department of Defense Summer 2008

- Implemented a mesh segmentation algorithm using a deviation of mean-shift
- Presented research at the NDIA's Maneuver Support and Technology Conference
- Developed automatic terrain visualization software

**Undergraduate Research Assistant**, Washington University Summer 2007

- Created a robust documentation system used daily by physicians
- Collaborated with a research team to develop a treatment review system
- Researched methods to improve patient care by enhancing treatment software

**Residential Advisor**, University of Missouri 2006 - 2008

- Instructed a one-hour course for incoming freshman
- Provided academic and social advising to a diverse population of students
- Coordinated with other residential advisors in planning campus-wide events

<b>Organizations</b>	ACM SIGGRAPH Student Member	2011 - Present
	IEEE Student Member	2009 - Present
	College of Engineering Honors Undergraduate Research	2007 - 2009
	College Avenue Residence Hall Treasurer and Student Director	2006 - 2008
	University of Missouri Game Design Club	2005 - 2009
	University of Missouri General Honors Program	2005 - 2009
	University of Missouri Honors Student Organization	2005 - 2009

<b>Software Proficiency</b>	<u>Languages:</u> C/C++, MATLAB, Java, Python, Lua, Objective-C, Haskell
	<u>Other:</u> OpenGL, CUDA, GLSL, DirectX, QT, FLTK, GLUT, Cocoa, Maya

<b>Research Interests</b>	Computer graphics
	Computer vision

<b>Teaching Interests</b>	Computer graphics
	Computer vision
	Calculus, real analysis
	Numerical analysis
	Object-oriented programming