

## Ce Liu

### Title

*Senior Research Scientist*  
Google Research

*Research Affiliate*  
Computer Science and Artificial Intelligence Laboratory (CSAIL)  
Massachusetts Institute of Technology

### Contact Information

Address:  
Google  
355 Main St  
Cambridge, MA 02142

Phone: +1 650-338-9314 (C)

Email: [celiu@google.com](mailto:celiu@google.com), [celiu@mit.edu](mailto:celiu@mit.edu)

Homepage: <http://people.csail.mit.edu/celiu/>

### Education

Ph.D. *Beyond pixels: exploring new representations and applications for motion analysis*  
Department of Electrical Engineering and Computer Science  
Massachusetts Institute of Technology

M.E. *Hierarchical shape models for face localization*  
Department of Automation  
Tsinghua University

B.E. *Control*  
Department of Automation  
Tsinghua University

### Working Experiences

- 2014~now, Research Scientist at Google
- 2010~now, Research Affiliate and Guest Lecturer at CSAIL MIT
- 2012~2013, Adjunct Assistant Professor, Boston University
- 2010~2014, Technical consultant with Bing, Microsoft Corp.
- 2010~2014, Researcher at Microsoft Research New England
- 2009~2010, Postdoc at Microsoft Research New England
- Fall 2008, Teaching Assistant of class 6.870 *Object Recognition and Scene Understanding*

- Summer 2008, Research Intern at Adobe System Incorporation
- Spring 2006, Teaching Assistant of class 6.098/6.882 *Computational Photography*
- Summer 2005, Research Intern at Interactive Visual Media Group, Microsoft Research
- 2002~2003, Assistant Researcher, Microsoft Research Asia

## Academic Activities

- 2014, Co-organizer of Tutorial “Dense Image Correspondences for Computer Vision” at CVPR, Columbus, Ohio
- 2013, Co-organizer of Tutorial “Dense Image Correspondences for Computer Vision” at ICCV, Sydney, Australia
- 2013, Workshop chair, CVPR
- 2012, Chair, Machine Learning Workshop, Hong Kong
- 2012, Session chair, Information Theory and Application (ITA) workshop
- 2011, NSF IIS panelist
- 2010~now, organized Microsoft Research New England Vision Seminars
- 2004~now, reviewers/program committee of IEEE Trans. on Pattern Analysis and Machine Intelligence, IEEE Trans. on Image Processing, ACM SIGGRAPH, International Journal of Computer Vision, Journal of Optical Society of America, CVPR, ICCV, ECCV, NIPS

## Interns

- Zheng Wu (BU), *Efficient multi-class object detectors*, 2010
- Jianxiong Xiao (MIT), *Graph-based knowledge representation for web images*, 2010
- Deqing Sun (Brown), *Video super resolution and video deblocking*, 2010
- Kevin Karsch (UIUC), *Converting 2D videos to 3D*, 2011
- Michael Rubinstein (MIT), *Annotation propagation via image graphs*, 2011
- Katherine Bouman (MIT), *Large-scale object detection systems*, 2012
- Phillip Isola (MIT), *Semantic layer world for image parsing*, 2012
- Soumya Gosh (Brown), *Patch-based Gaussian mixture models for image recognition*, 2013
- Vicente Ordonez Roman (UNC), *Semantic segmentation using deep learning features*, 2014
- Tianfan Xue (MIT), *De-reflectance and de-fencing*, 2014

## Research Interests

My research is in the area of computer vision, computer graphics, computational photography, applied machine learning, crowd computing and web-scale information retrieval.

## Programming Skills

C/C++, C#, Matlab, Scope, Python.

## Awards

- Outstanding Reviewer Award, IEEE Conference on Computer Vision and Pattern Recognition (CVPR) 2009, 2010

- **Best Student Paper Award**, IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2009
- Xerox Fellowship, 2007
- **Outstanding Student Paper Award**, Neural Information Processing Systems (NIPS), 2006
- Microsoft Fellowship, 2005-2006
- Webster Fellowship, MIT, 2003
- 1st Prize of Mathematical Contest on Modeling (undergraduate), USA, 1998
- 1st Prize of Mathematical Contest on Modeling (undergraduate), China, 1997
- Outstanding student of Tsinghua University, 1996
- 1st Prize of National Physics Competition (high school), China, 1994
- Diamond Prize of National Painting Contest, 1990
- One of 1000 Young Artists of China, 1987

## Publications

Google scholar (<http://scholar.google.com/citations?user=j7MW4iYAAAAAJ&hl=en>)

## Book Chapters

1. C. Liu, J. Yuen and A. Torralba and W. T. Freeman. SIFT flow: dense correspondence across different scenes and its application. In A. Blake, P. Kohli, and C. Rother, eds., *Advances in Markov Random Fields for Vision and Image Processing*. MIT Press, 2011.
2. W. T. Freeman and C. Liu. Markov Random Fields for Super-resolution and Texture Synthesis. In A. Blake, P. Kohli, and C. Rother, eds., *Advances in Markov Random Fields for Vision and Image Processing*, Chapter 10. MIT Press, 2011.

## Thesis

3. C. Liu. Beyond pixels: exploring new representations and applications for motion analysis. *Doctoral Thesis*. Massachusetts Institute of Technology. 2009.

## Journal Papers

4. K. Karsch, C. Liu and S. B. Kang. DepthTransfer: depth extraction from video using nonparametric sampling. To appear at *IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI)*, 2014.
5. C. Liu and D. Sun. On Bayesian adaptive video super resolution. *IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI)*, pp. 346-360, Vol. 36, Issue 2, Feb 2014.
6. L. Sharan, C. Liu, E. H. Adelson and R. Rosenholtz. Recognizing materials using perceptually inspired features. *International Journal of Computer Vision (IJCV)*, pp. 348-371, Vol. 103, Issue 3, July 2013.
7. C. Liu, J. Yuen and A. Torralba. Nonparametric Scene Parsing via Label Transfer. *IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI)* 2011. Vol. 33, No. 12, 2011

8. C. Liu, J. Yuen and A. Torralba. SIFT flow: dense correspondence across different scenes and its application. *IEEE Transactions on Pattern Analysis and Machine Intelligence* (TPAMI). Vol. 33, No. 5, 2011.
9. C. Liu, R. Szeliski, S. B. Kang, C. L. Zitnick and W. T. Freeman. Automatic estimation and removal of noise from a single image. *IEEE Transactions on Pattern Analysis and Machine Intelligence* (TPAMI), Vol. 30, No. 2, pp. 299-314, February 2008.
10. C. Liu, H.Y. Shum and W.T. Freeman. Face hallucination: theory and practice. *International Journal of Computer Vision* (IJCV), Vol. 75, No. 1, pp. 115-134, October 2007.
11. C. Liu, A. Torralba, W.T. Freeman, F. Durand and E.H. Adelson. Motion magnification. *ACM Transactions on Graphics (SIGGRAPH 2005)*, pp. 519-526, August 2005.
12. C.Y. Wu, C. Liu, H.Y. Shum, Y.Q. Xu and Z.Y. Zhang. Automatic eyeglasses removal from face images. *IEEE Transactions on Pattern Analysis and Machine Intelligence* (TPAMI), Vol. 26, No. 3, pp. 322-336, March 2004.
13. S. C. Yan, C. Liu, S. Z. Li, H.J. Zhang, H. Shum, Q. S. Cheng. Face alignment using texture constrained active shape models. *Image and Vision Computing*, Vol. 21, Issue 1, Pages 69-75, January 2003.
14. L. Liang, C. Liu, Y.Q. Xu, B.N. Guo and H.Y. Shum. Real-time texture synthesis by patch based sampling. *ACM Transactions on Graphics* (TOG), Vol. 20, No. 3, pp. 127-150, July 2001.

### Peer-Reviewed Conference Papers<sup>1</sup>

15. D. Wei, C. Liu and W.T. Freeman. A Data-driven Regularization Model for Stereo and Flow. To appear at *International Conference on 3D Vision (3DV)*, 2014. **Oral presentation.**
16. L. Xu, J. Jia and C. Liu. Separable Deep Convolutional Neural Network for Image Deconvolution. To appear at *Neural Information Computing Systems (NIPS)*, 2014
17. H. Mobahi, C. Liu and W. T. Freeman. A Compositional Model for Low-Dimensional Image Set Representation. *IEEE Conference on Computer Vision and Patter Recognition (CVPR)*, 2014
18. D. Sun, C. Liu and H. Pfister. Local Layering for Joint Motion Estimation and Occlusion Detection. *IEEE Conference on Computer Vision and Patter Recognition (CVPR)*, 2014. **Oral presentation.**
19. P. Isola and C. Liu. Scene collaging: analysis and synthesis of natural images with semantic layers. *International Conference on Computer Vision (ICCV)*, 2013
20. X.-J. Wang, L. Zhang and C. Liu. Duplicate discovery from billions of images. In *Proceedings of Big Data Workshop, IEEE Conference on Computer Vision and Patter Recognition (CVPR)*, 2013

---

<sup>1</sup> The acceptance rate of oral papers is about 5% at top vision/learning conferences such as CVPR/ECCV/NIPS/ICML.

21. B. Liu, F. Sadeghi, M. Tappen, O. Shamir and C. Liu. Probabilistic label trees for efficient large scale image classification. *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2013
22. M. Rubinstein, A. Joulin, C. Liu and J. Kopf. Unsupervised joint object discovery and segmentation in Internet images. *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2013.
23. J. Kim, C. Liu and K. Grauman. Deformable spatial pyramid matching for fast dense correspondences. *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2013.
24. X.-J. Wang, Z. Xu, L. Zhang, C. Liu and Y. Rui. Towards Indexing Representative Images on the Web. *ACM International Conference on Multimedia (ACM MM)*, 2012. **Oral presentation.**
25. M. Rubinstein, C. Liu and W.T. Freeman. Annotation Propagation: Automatic Annotation of Large Image Databases via Dense Image Correspondence. *European Conference on Computer Vision (ECCV)*, 2012.
26. K. Karsch, C. Liu and S.B. Kang. Depth Extraction from Video Using Non-parametric Sampling. *European Conference on Computer Vision (ECCV)*, 2012. **Oral presentation.**
27. M. Tappen and C. Liu. A Bayesian Approach to Alignment-based Image Hallucination. *European Conference on Computer Vision (ECCV)*, 2012.
28. D. Sun and C. Liu. Non-causal Temporal Prior for Video Deblocking. *European Conference on Computer Vision (ECCV)*, 2012.
29. O. Tamuz, C. Liu, S. Belongie, O. Shamir and A. Kalai. Adaptively Learning the Crowd Kernel. *28th International Conference on Machine Learning (ICML)*, 2011. **Oral presentation.**
30. C. Liu and D. Sun. A Bayesian Approach to Adaptive Video Super Resolution. *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)* 2011. **Oral presentation.**
31. M. Rubinstein, C. Liu, P. Sand, F. Durand, W.T. Freeman. Motion Denoising with Application to Time-lapse Photography. *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)* 2011.
32. C. Liu and W. T. Freeman. A High-Quality Video Denoising Algorithm based on Reliable Motion Estimation. *European Conference on Computer Vision (ECCV)* 2010. **Oral presentation.**
33. C. Liu, L. Sharan, E. H. Adelson and R. Rosenholtz. Exploring features in a Bayesian framework for material recognition. *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)* 2010.
34. J. Yuen, B. Russell, C. Liu, and A. Torralba. LabelMe video: Building a Video Database with Human Annotations. *IEEE International Conference on Computer Vision (ICCV)*, Oct 2009.

35. C. Liu, J. Yuen, and A. Torralba. Nonparametric scene parsing: label transfer via dense scene alignment. *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)* 2009. **Oral presentation. Best Student Paper Award.**
36. C. Liu, J. Yuen, A. Torralba, J. Sivic and W. T. Freeman. Scene alignment using generalized optical flow. *European Conference on Computer Vision (ECCV)*, 2008. **Oral presentation.**
37. C. Liu, W. T. Freeman, E. H. Adelson and Y. Weiss. Human-Assisted Motion Annotation. *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2008. **Oral presentation.**
38. B. Russell, A. Torralba, C. Liu, R. Fergus and W. T. Freeman. Object recognition by scene alignment. *Advances in Neural Information Processing Systems (NIPS)*, 2007.
39. M. Tappen, C Liu, W. T. Freeman and E. H. Adelson. Learning Gaussian conditional random fields for low-level vision. *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pp. 1-8, 2007.
40. C. Liu, W.T. Freeman and E.H. Adelson. Analysis of contour motions. *Advances in Neural Information Processing Systems (NIPS)*, 2006. **Oral presentation. Outstanding Student Paper Award.**
41. C. Liu, W.T. Freeman, R. Szeliski and S.B. Kang. Noise estimation from a single image. *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pp. 901-908, 2006. Oral presentation. **Oral presentation.**
42. L. Yuan, F. Wen, C. Liu and H.Y. Shum. Synthesizing dynamic texture with closed-loop linear dynamic system. *European Conference on Computer Vision (ECCV)*, 2004. **Oral presentation.**
43. C. Liu and H.Y. Shum. Kullback-Leibler boosting. *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pp. 587-594, 2003. **Oral presentation.**
44. Z.Q. Liu, C. Liu, H.Y. Shum and Y.Z. Yu. Pattern-based texture metamorphosis. *Pacific Conference on Computer Graphics and Applications*, pp. 184-193, 2002. **Oral presentation.**
45. S.C. Yan, C. Liu, S. Z. Li, L. Zhu, Z, H.J. Zhang, H.Y. Shum and Q. S. Cheng. Texture constrained active shape models. *ECCV 2002 Workshop on Generative Model Based Vision*. Copenhagen, Denmark. May, 2002.
46. C. Liu, H.Y. Shum and S.C. Zhang. Hierarchical shape model for automatic face localization. *European Conference on Computer Vision (ECCV)*, pp. 687-703, 2002.
47. C.Y. Wu, C. Liu, H.Y. Shum, Y.Q. Xu and Z.Y. Zhang. Automatic eyeglasses removal from face images. *Asian Conference on Computer Vision*, pp. 193-198, 2002. **Oral presentation.**
48. C. Liu, H.Y. Shum and C.S. Zhang. Two-step approach to hallucinating faces: global parametric model and local nonparametric model. *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*. Vol. 1, pp. 192-198, 2001. **Oral presentation.**

49. C.Y. Wu, C. Liu and J. Zhou. Eyeglasses verification by support vector machine. *IEEE Pacific Ring Conference on Multimedia*, pp. 1126-1131, 2001.
50. C. Liu, S.C. Zhu and H.Y. Shum. Learning inhomogeneous Gibbs model of faces by minimax entropy. *IEEE International Conference on Computer Vision (ICCV)*, pp. 281-287, 2001.

### Tech Report

51. J. Yuen, C. L. Zitnick, C. Liu, and A. Torralba. A framework for encoding object-level image priors. Microsoft Research Technical Report, MSR-TR-2011-99, 2011.

### Papers under Review

52. Hossein Mobahi, Ce Liu and William T. Freeman. A Synthesis Approach to Learning the Geometry Space of Images. Submitted to *Computer Vision and Image Understanding*, 2014
53. M. Rubinstein, C. Liu and W.T. Freeman. Joint inference on large-scale image dataset. Submitted to *International Journal on Computer Vision (IJCV)*, 2014

### Referred Abstracts

54. L. Sharan, C. Liu, E. H. Adelson and R. Rosenholtz. A computational model for material recognition. Presented at *Vision Science Society (VSS)*, Naples, Florida, May 2010.
55. C. Liu, E. H. Adelson and W. T. Freeman. Human-assisted motion annotation for real-world videos. Presented at *Vision Science Society (VSS)*, Naples, Florida, May 2008.

### Talks

Oct 2001	Microsoft	Face hallucination: global parametric and local nonparametric model
Feb 2002	U.C. Berkley	Face hallucination: global parametric and local nonparametric model
Aug 2005	SIGGRAPH	Motion magnification
Jun 2006	CVPR	Automatic noise estimation from a single image
Dec 2006	NIPS	Analysis of contour motions
Mar 2008	CSAIL MIT	Bridging the gap between human and computer analysis on motion
May 2008	VSS	Human-assisted motion annotation for real-world videos
Jun 2008	CVPR	Human-assisted motion annotation
Aug 2008	Xerox	How to make the computer see the moving world
Oct 2008	University of Cambridge	SIFT flow: dense correspondence across scenes
Oct 2008	ECCV	SIFT flow: dense correspondence across scenes
Oct 2008	CSAIL MIT	Go beyond pixels--exploring new representations and applications for motion analysis

Dec 2008	SEAS Harvard	Go beyond pixels--exploring new representations and applications for motion analysis
Jan 2009	SUnS Workshop	Dense scene alignment
Mar 2009	MSR New England	Beyond pixels--exploring new representations and applications for motion analysis
May 2009	CSAIL MIT	Beyond pixels--exploring new representations and applications for motion analysis
Jun 2009	CVPR	Nonparametric scene parsing: label transfer via dense scene alignment
Jul 2009	UCSD	SIFT flow: dense scene alignment and its applications
Oct 2009	Brown Univ.	SIFT flow: dense scene alignment and its applications
Oct 2009	Dartmouth	SIFT flow: dense scene alignment and its applications
Dec 2009	Boston Univ.	Beyond pixels--exploring new representations and applications for motion analysis
Apr 2010	NYU	Exploring new models and features for visual recognition
Apr 2010	MIT	Guest lecture on computer vision
May 2011	MIT	Guest lecture on computer vision
Aug 2011	CV Frontier	Foundation & core in computer vision: a system perspective
Jun 2011	CVPR	A Bayesian approach to adaptive video super resolution
Sep 2011	Harvard	What's a good motion representation
Oct 2011	U.T. Austin	Sparsity via dense correspondences for videos and large-scale image databases
Oct 2011	U.C. Florida	Sparsity via dense correspondences for videos and large-scale image databases
Oct 2011	Adobe Research	Exploring temporal sparsity for video enhancement
Dec 2011	MSRA	A dense correspondence framework for nonparametric image editing and understanding
Dec 2011	CS Dept, Tsinghua Univ.	A dense correspondence framework for nonparametric image editing and understanding
Dec 2011	IIIS, Tsinghua	The art of visual modeling
Jan 2012	MS Bing	A correspondence-first approach to visual understanding
Jul 2012	CUHK	A dense correspondence approach framework for visual computing
May 2013	MIT	Exploring across-scene correspondences for computer vision
Sep 2013	Lincoln Lab	Dense Image Correspondences for Computer Vision
Oct 2013	Stanford	Dense Image Correspondences for Computer Vision
Dec 2013	ICCV	Dense Image Correspondences for Computer Vision
Dec 2013	ICCV	Database smoothness transfer for stereo and optical flow
Jan 2014	MIT	Introduction to Internet Image Search
Mar 2014	MSR	Image Recognition via Image Search

## Patents

1. W. T. Freeman and C. Liu. Occluding contour detection and storage for digital photography. US Patent 7,715,589. 2010.
2. R. S. Szeliski, S. B. Kang, C. Liu and L. Zitnick. Region-based image denoising. US Patent 7587099. 2009.
3. C. Liu, S. Paris and P. Smaragdis. Combined visual and auditory processing. US Patent 8699858 B2, 2008
4. C. Liu. Material recognition from an image. US Patent 8565536 B2, 2010
5. C. Liu. Methods and apparatus for reducing structured noise in video. US Patent App 20120105728 A1
6. C. Liu et. al. Multi-modal approach to search query input. US Patent App 20120117051. 2010.
7. C. Liu et. al. Adaptive interactive search. US Patent App 20120296776. 2011.
8. C. Liu. Adaptive super resolution for video enhancement. US Patent 8594464. 2011.
9. C. Liu. Adaptively learning a similarity model. US Patent App 20120296900. 2011.
10. C. Liu et. al. Automatic 2D-to-Stereoscopic video conversion. US Patent App 20130147911. 2011.
11. C. Liu et. al. System and method for semantically annotating images. US Patent App 20130202205. 2012
12. C. Liu et. al. Bayesian Approach to Alignment-based Image Hallucination. US Patent App. 20140169700. 2012
13. C. Liu et. al. Layered Image Parsing. US Patent App. 2013
14. C. Liu et. al. Image Recognition by Image Search. US Patent App. 2013