

# Noah Snavely

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## Positions Held

<b>Associate Professor of Computer Science</b> , Cornell Tech	2014-present
<b>Technical Staff</b> , Google Research	2014-present
<b>Co-Founder and Chief Scientist at TaggPic</b>	2012-2014
<b>Assistant Professor of Computer Science</b> , Cornell University	2009-2014

## Education

<b>University of Washington</b> , Seattle, WA Ph.D. in Computer Science and Engineering, December 2008 Advisors: Steven M. Seitz and Richard Szeliski	2003-2008
<b>University of Arizona</b> , Tucson, AZ B.S. in Computer Science and Mathematics with Honors, May 2003	1999-2003

## Honors and Awards

ECCV Best Paper Award (with Kevin Matzen)	2014
SIGGRAPH Significant New Researcher Award	2014
Presidential Early Career Award for Scientists and Engineers (PECASE)	2013
Cornell College of Engineering Mr. & Mrs. Richard F. Tucker Teaching Excellence Award	2012
NSF CAREER Award	2012
Alfred P. Sloan Fellow	2012
Technology Review, TR35: 35 Technology Innovators under 35	2011
Microsoft Research New Faculty Fellow	2011
CVPR 2011 Best-Paper Runner-up	2011
ACM Doctoral Dissertation Award Honorable Mention	2009
University of Washington CSE William Chan Memorial Dissertation Award	2009
University of Washington 6th Chapter Thesis Award	2009
Microsoft Live Labs Fellow	2007-2008
NSF Graduate Research Fellow	2003-2007
Achievement Rewards for College Scientists (ARCS) Fellow	2003-2006
Runner-up, CRA Outstanding Undergraduate Award	2003

## Journal and SIGGRAPH Publications

1. Robert Anderson, David Gallup, Jonathan T. Barron, Janne Kontkanen, Noah Snavely, Carlos Hernandez Esteban, Sameer Agarwal, Steven M. Seitz. "Jump: Virtual Reality Video." *ACM Transactions on Graphics (Proceedings of SIGGRAPH Asia)*, 2016.
2. Daniel Hauagge, Scott Wehrwein, Kavita Bala, Noah Snavely. "Photometric Ambient Occlusion for Intrinsic Image Decomposition." *Transactions on Pattern Analysis and Machine Intelligence (PAMI)*, 2016.
3. Albert Liu, Steve Marschner, Noah Snavely. "Caliber: Camera Localization and Calibration Using Rigidity Constraints." *International Journal of Computer Vision (IJCV)*, 2015.

4. Song Cao and Noah Snavely. "Graph-Based Discriminative Learning for Location Recognition." *International Journal of Computer Vision (IJCV)*, 2014.
5. Sean Bell, Noah Snavely, Kavita Bala. "Intrinsic Images in the Wild." *ACM Transactions on Graphics (Proceedings of SIGGRAPH)*, 2014.
6. Sean Bell, Noah Snavely, Kavita Bala. "OpenSurfaces: A Richly Annotated Catalog of Surface Appearance." *ACM Transactions on Graphics (Proceedings of SIGGRAPH)*, 2013.
7. David Crandall, Andrew Owens, Noah Snavely, Daniel P. Huttenlocher. "SfM with MRFs: Discrete-Continuous Optimization for Large-Scale Structure from Motion." *IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI)*, 35(12), 2013.
8. Chun-Po Wang, Steve Marschner, Noah Snavely. "Estimating Dual-scale Properties of Glossy Surfaces from Step-edge Lighting." *ACM Transactions on Graphics (Proceedings of SIGGRAPH Asia)*, 2011.
9. Sameer Agarwal, Yasutaka Furukawa, Noah Snavely, Brian Curless, Steven M. Seitz, Richard Szeliski. "Reconstructing Rome." *Trans. IEEE Computer (Cover Feature)*, 43(6), 40-47. June 2010.
10. Noah Snavely, Ian Simon, Michael Goesele, Richard Szeliski, Steven M. Seitz. "Scene Reconstruction and Visualization from Community Photo Collections." *Proceedings of the IEEE* 98(8), 1370-1390. August 2010.
11. Noah Snavely, Rahul Garg, Steven M. Seitz, Richard Szeliski. "Finding Paths through the World's Photos." *ACM Transactions on Graphics (Proceedings of SIGGRAPH 2008)*, 27(3), pp. 11-21, 2008.
12. Noah Snavely, Steven M. Seitz, Richard Szeliski. "Modeling the World from Internet Photo Collections." *International Journal of Computer Vision (IJCV)*, 80(2), pp. 99-115, November 2008.
13. Noah Snavely, Steven M. Seitz, Richard Szeliski. "Photo Tourism: Exploring Photo Collections in 3D." *ACM Transactions on Graphics (Proceedings of SIGGRAPH 2006)*, 25(3), pp. 835-846, 2006.
14. Li Zhang, Noah Snavely, Brian Curless, Steven M. Seitz. "Spacetime Faces: High-resolution Capture for Modeling and Animation." *ACM Transactions on Graphics (Proceedings of SIGGRAPH 2004)*, 23(3), pp. 548-558, 2004.
15. Noah Snavely, Saumya Debray, Greg Andrews. "Unspeculation, Unsheduling, Unpredication: Reverse Engineering Itanium Executables." *IEEE Transactions on Software Engineering*, 31(2), pp. 99-115, February 2005.

## Conference Publications

1. Tinghui Zhou, Matthew Brown, Noah Snavely, and David Lowe. "Unsupervised Learning of Depth and Ego-Motion from Video." In *Proceedings of Computer Vision and Pattern Recognition (CVPR)*, 2017.
2. Paul Upchurch, Jacob Gardner, Kavita Bala, Robert Pless, Noah Snavely, Kilian Weinberger. "Deep Feature Interpolation for Image Content Changes." In *Proceedings of Computer Vision and Pattern Recognition (CVPR)*, 2017.
3. Balazs Kovacs, Sean Bell, Noah Snavely, Kavita Bala. "Shading Annotations in the Wild." In *Proceedings of Computer Vision and Pattern Recognition (CVPR)*, 2017.
4. Kyle Wilson, David Bindel, Noah Snavely. "When is Rotations Averaging Hard?" In *Proceedings of European Conference on Computer Vision (ECCV)*, 2016.
5. John Flynn, Ivan Neulander, James Philbin, Noah Snavely. "DeepStereo: Learning to Predict New Views from the Worlds Imagery." In *Proceedings of Computer Vision and Pattern Recognition (CVPR)*, 2016.

6. Kevin Matzen, Noah Snavely. "BubbLeNet: Foveated Imaging for Visual Discovery." In *Proceedings of International Conference on Computer Vision (ICCV)*, 2015.
7. Scott Wehrwein, Kavita Bala, Noah Snavely. "Shadow Detection and Sun Direction in Photo Collections." In *Proceedings of 3DV*, 2015.
8. Sean Bell, Paul Upchurch, Noah Snavely, Kavita Bala. "Material Recognition in the Wild with the Materials in Context Database." In *Proceedings of Computer Vision and Pattern Recognition (CVPR)*, 2015.
9. Kevin Matzen, Noah Snavely. "Scene Chronology." In *Proceedings of the European Conference on Computer Vision (ECCV)*, 2014. **Best paper award.**
10. Kyle Wilson, Noah Snavely. "Robust Global Translations using 1DSfM." In *Proceedings of the European Conference on Computer Vision (ECCV)*, 2014.
11. Daniel Hauagge, Scott Wehrwein, Paul Upchurch, Kavita Bala, Noah Snavely. "Reasoning about Photo Collections using Models of Outdoor Illumination." In *Proceedings of the British Machine Vision Conference (BMVC)*, 2014.
12. Song Cao, Noah Snavely. "Minimal Scene Descriptions from Structure from Motion Models." In *Proceedings of Computer Vision and Pattern Recognition (CVPR)*, 2014.
13. Kevin Matzen, Noah Snavely. "NYC3DCars: A Dataset of 3D Vehicles with Geographic Context." In *Proceedings of International Conference on Computer Vision (ICCV)*, 2013.
14. Kyle Wilson, Noah Snavely. "Network Principles for SfM: Disambiguating Repeated Structures with Local Context." In *Proceedings of International Conference on Computer Vision (ICCV)*, 2013.
15. Daniel Cabrini Hauagge, Scott Wehrwein, Kavita Bala, Noah Snavely. "Photometric Ambient Occlusion." In *Proceedings of Computer Vision and Pattern Recognition (CVPR)*, 2013.
16. Song Cao, Noah Snavely. "Graph-Based Discriminative Learning for Location Recognition." In *Proceedings of Computer Vision and Pattern Recognition (CVPR)*, 2013.
17. Chun-Po Wang, Kyle Wilson, Noah Snavely. "Creating Georegistered Point Clouds using Geographic Data." In *Proceedings of 3DV*, 2013.
18. Yunpeng Li, Noah Snavely, Daniel P. Huttenlocher, Pascal Fua. "Worldwide Pose Estimation using 3D Point Cloud Models." In *Proceedings of the European Conference on Computer Vision (ECCV)*, 2012.
19. Yin Lou, Noah Snavely, Johannes Gehrke. "MatchMiner: Mining Spanning Structure in Large Image Collections." In *Proceedings of the European Conference on Computer Vision (ECCV)*, 2012.
20. Daniel Cabrini Hauagge, Noah Snavely. "Image Matching using Local Symmetry Features." In *Proceedings of Computer Vision and Pattern Recognition (CVPR)*, 2012.
21. Amir Sadvnik, Yi-I Chiu, Noah Snavely, Shimon Edelman, Tsuhan Chen. "Image Description with a Goal: Building Efficient Discriminating Expressions for Images." In *Proceedings of Computer Vision and Pattern Recognition (CVPR)*, 2012.
22. Adarsh Kowdle, Noah Snavely, Tsuhan Chen. "Recovering Depth of a Dynamic Scene Using Real World Motion Prior." In *Proc. International Conference on Image Processing*, 2012. **Best student paper award.**
23. David Crandall, Andrew Owens, Noah Snavely, Daniel P. Huttenlocher. "Discrete-Continuous Optimization for Large-Scale Structure from Motion." In *Proceedings of Computer Vision and Pattern Recognition (CVPR)*, 2011. **Best paper award runner-up.**
24. Rahul Garg, Deva Ramanan, Noah Snavely, Steven M. Seitz. "Where's Waldo: Matching People in Images of Crowds." In *Proceedings of Computer Vision and Pattern Recognition (CVPR)*, 2011.

25. Kathleen Tuite, Noah Snavely, Dun-Yu Hsiao, Nadine Tabing and Zoran Popović. "PhotoCity: Training Experts at Large-scale Image Acquisition through a Competitive Game." In *Proceedings of Conference on Human Factors in Computing Systems (CHI)*, 2011.
26. Yunpeng Li, Noah Snavely, Daniel P. Huttenlocher. "Location Recognition using Prioritized Feature Matching." In *Proceedings of the European Conference on Computer Vision (ECCV)*, 2010.
27. Sameer Agarwal, Noah Snavely, Steven M. Seitz, Richard Szeliski. "Bundle Adjustment in the Large." In *Proceedings of the European Conference on Computer Vision (ECCV)*, 2010.
28. Kathleen Tuite, Noah Snavely, Dun-Yu Hsiao, Adam M. Smith, Zoran Popović. "Reconstructing the World in 3D: Bringing Games with a Purpose Outdoors." In *Proceedings of Foundations of Digital Games (FDG)*, 2010.
29. Ruogu Fang, Kevin D. Tang, Noah Snavely, Tsuhan Chen. "Towards Computational Models of Kinship Verification." In *Proc. International Conference on Image Processing*, 2010. **Best paper award.**
30. Sameer Agarwal, Noah Snavely, Ian Simon, Steven M. Seitz, Richard Szeliski. "Building Rome in a Day." In *Proceedings of the International Conference on Computer Vision (ICCV)*, 2009.
31. Rahul Garg, Hao Du, Steven M. Seitz, Noah Snavely. "The Dimensionality of Scene Appearance." In *Proceedings of the International Conference on Computer Vision (ICCV)*, 2009.
32. Noah Snavely, Steven M. Seitz, Richard Szeliski. "Skeletal Graphs for Efficient Structure from Motion." In *Proceedings of Computer Vision and Pattern Recognition (CVPR)*, 2008.
33. Sameer Agarwal, Noah Snavely, Steven M. Seitz. "Fast Algorithms for  $L_\infty$  Problems in Multiple View Geometry." In *Proceedings of Computer Vision and Pattern Recognition (CVPR)*, 2008.
34. Michael Goesele, Noah Snavely, Brian Curless, Steven M. Seitz, Hugues Hoppe. "Multi-View Stereo for Community Photo Collections." In *Proceedings of the International Conference on Computer Vision (ICCV)*, 2007.
35. Ian Simon, Noah Snavely, Steven M. Seitz. "Scene Summarization for Online Image Collections." In *Proceedings of the International Conference on Computer Vision (ICCV)*, 2007.
36. Pravin Bhat, C. Lawrence Zitnick, Noah Snavely, Aseem Agarwala, Maneesh Agrawala, Michael Cohen, Brian Curless, Sing Bing Kang. "Using Photographs to Enhance Videos of a Static Scene." In *Proceedings of the Eurographics Symposium on Rendering (EGSR)*, pp. 327-338, 2007.
37. Pravin Bhat, Ke Zheng, Noah Snavely, Aseem Agarwala, Maneesh Agrawala, Michael Cohen, Brian Curless. "Piecewise Image Registration in the Presence of Multiple Large Motions." In *Proceedings of Computer Vision and Pattern Recognition (CVPR)*, pp. 2491-2497, 2006.
38. Noah Snavely, C. Lawrence Zitnick, Sing Bing Kang, Michael Cohen. "Stylizing 2.5-D Video." In *Proceedings of the International Symposium on Non-Photorealistic Animation and Rendering (NPAR)*, pp. 63-69, 2006.
39. Noah Snavely, Saumya Debray, Greg Andrews. "Unspeculation." In *Proceedings of the International Conference on Automated Software Engineering (ASE)*, pp. 205-214, 2003.

## Workshop Papers

1. Song Cao, Noah Snavely. "Learning to Match Images in Large-Scale Collections." *ECCV Workshop on Web-Scale Vision and Social Media*, 2012.
2. Ryan S. Kaminsky, Noah Snavely, Steven M. Seitz, Richard Szeliski. "Alignment of 3D Point Clouds to Overhead Images." *IEEE Workshop on Internet Vision*, 2009.

## Students Advised

### Ph.D. Students Advised and Co-Advised

Zhengqi Li, expected 2021.

Scott Wehrwein, expected 2018.

Paul Upchurch, expected 2018.

Kevin Matzen, *Computer Vision for Spatio-Temporal Analysis of Internet Photo Collections*, 2016. Next affiliation: Facebook Research.

Sean Bell, *Understanding Visual Appearance on the Web using Large-Scale Crowdsourcing and Deep Learning*, 2016. Next affiliation: Co-founder at Grokstyle.

Kyle Wilson, *Robustly Modeling the World from Photos*, 2016. Next affiliation: Assistant Professor at Washington College.

Song Cao, *Graph-based Learning from Large Image Collections*, 2015. Next affiliation: Amazon Research.

Daniel Cabrini Hauagge, *Vision Under Changing Scene Appearance: Describing the World Through Light and Symmetries*, 2014. Next affiliation: Post-doc at Cornell Tech.

### Other Students Advised and Co-Advised

Jeremy Feinstein, Cornell B.S. 2014.

Brian Orecchio, Cornell M.Eng. 2013.

Ariel Schwartz, Cornell B.S. 2013.

Chun-Po Wang, Cornell M.S. 2012. Current employment: Google.

Gautam Kamath, Cornell B.S. 2012. Ph.D. candidate at MIT.

Yu (Richard) Cheng, Cornell B.S. 2012.

Aaron Chuang, Cornell M.Eng. 2011.

Zhe (Elena) Yang, Cornell B.S. 2011.

Andrew Owens, Cornell B.S. 2010. Currently Ph.D. candidate at MIT.

### Thesis Committees

Chris Sweeney (UCSB CS)

Michal Havlena (Czech Technical University)

Yong-Dian Jian (Georgia Tech)

Austin Abrams (Washington University)

Hani Altwaijry (Cornell CS)

Mohammad Moghimi (Cornell CS)

Ivaylo Boyadzhiev (Cornell CS)

Yue Gao (Cornell CS)

Yin Lou (Cornell CS)

Ruben Sibos (Cornell CS)

Tsung-Yi Lin (Cornell ECE)

Ruogu Fang (Cornell ECE)

Sergei Fotin (Cornell ECE)

Zhaoyin Jia (Cornell ECE)

Jennifer Padgett (Cornell MAE)

Yiting Xie (Cornell ECE)

Frank Havlak (Cornell MAE)

Peter Radecki (Cornell MAE)

Kevin Wyffels (Cornell MAE)

## Teaching

Introduction to Computer Vision (CS5670)	Fall 2017
Cornell CURIE Academy	Summer 2015
Introduction to Computer Vision (CS4670/5670)	Fall 2013
Intro to Computing with Matlab and Robotics (CS1114)	Spring 2013
Introduction to Computer Vision (CS4670/5670)	Fall 2012
Intro to Computing with Matlab and Robotics (CS1114)	Spring 2012
Special Topics in Computer Vision (CS7670)	Fall 2011
Computer Vision (CS6670)	Spring 2011
Introduction to Computer Vision (CS4670)	Fall 2010
Intro to Computing with Matlab and Robotics (CS1114)	Spring 2010
Computer Vision (CS6670)	Fall 2009
Intro to Computing with Matlab and Robotics (CS1114)	Spring 2009

## Patent

Navigating Images Using Image-Based Geometric Alignment and Object-Based Control, with Steven M. Seitz and Richard Szeliski. *Patent pending.*

## Invited Talks

### **VR+AR**

Coalition for Queens (C4Q), February 2018.

### **Viewly Supervised 3D Vision and Graphics**

CVPR Bridge to 3D Workshop, July 2017.

### **Planet-Scale Visual Understanding**

Intel, November 2015.

UT Austin Computer Science Colloquium, February 2015.

University of Arizona Cognitive Science Colloquium, February 2015.

SIGGRAPH Significant New Researcher Talk, August 2014.

### **Grounding Vision in the Real World**

RSS RGB-D Workshop, July 2014.

### **3D Vision Beyond Geometry**

Bay Area Vision Meeting, June 2014.

### **The Distributed Camera**

BigVision Workshop, CVPR 2014.

Stanford University, November 2013.

UC Berkeley, November 2013.

Princeton University, October 2013.

Microsoft Faculty Retreat, July 2013

Carnegie Mellon University, April 2013.

University of Pennsylvania, April 2013.

University of Virginia, **Top Gun Series**, December 2012.

Facebook, August 2012.

Google Mountain View, August 2012.

Google New York, July 2012.

International Workshop in Computer Vision (Siracusa, Italy), May 2012.

MIT, March 2012.

### **Place Graphs**

CVPR Workshop on Visual Analysis and Geo-Localization of Large-Scale Imagery, July 2013.

### **A World-wide Geometric Database for Location Recognition**

ECCV Workshop on Visual Analysis and Geo-Localization of Large-Scale Imagery, November 2012.  
Czech Technical University, Prague, October 2012.

### **Building the World from Images**

University of Rochester, September 2011.  
University of Maryland, Baltimore County, April 2011.

### **Modeling the World from Internet Photo Collections**

Kodak Research, December 2010.  
Rochester Institute of Technology, December 2010.

### **Building Rome in a Day**

Microsoft Research Asia, July 2010.  
Tsinghua University, July 2010.  
Peking University, July 2010.

### **PhotoCity: Reconstructing the World through an Online Game**

Microsoft Research, April 2010.

### **Exploiting Online Photo Collections**

International Conference on Computation Photography (ICCP) 2010 Tutorial, March 2010.

### **Modeling and Visualizing the World through Internet Photo Collections**

MIT, Cambridge, MA, November 2008.  
Harvard University, Cambridge, MA, November 2008.  
University of North Carolina, Chapel Hill, January 2009.  
MIT Lincoln Labs, Lexington, MA, March 2009.  
NASA Goddard Space Flight Center, Greenbelt, MD, April 2009.

### **Navigating the World's Photographs** (with Steven M. Seitz and Michael Goesele)

Nokia Research Center, Palo Alto, CA, April 2007.  
Google Tech Talk, Mountain View, CA, July 2007.

### **Photosynth, Object Movies, and other Cool Stuff** (with Drew Steedly)

Microsoft Research Symposium on Computational Photography, July 2007.

### **Photo Tourism and Photosynth** (with Rick Szeliski and Blaise Agüera y Arcas)

Keynote, University of Washington Computer Science and Engineering Affiliates Meeting, October 2006.

### **Photo Tourism** (with Rick Szeliski)

BIRS Workshop on Mathematical Methods in Computer Vision, Banff, Alberta, October 2006.

## **Tutorials**

### **State of the art 3D reconstruction techniques: Very large scale 3D reconstruction and the role of priors** (with Yasutaka Furukawa)

Computer Vision and Pattern Recognition (CVPR) 2014

### **Scene Reconstruction from Community Photo Collections** (with Michael Goesele and Hendrik Lensch)

Computer Vision and Pattern Recognition (CVPR) 2010.

### **Photo Tourism and IM2GPS** (with James Hays)

Computer Vision and Pattern Recognition (CVPR) 2009.

## **Professional activities**

Program Chair, 3DV 2016.

Program Committee, SIGGRAPH 2017 & 2012, ECCV 2016 & 2014, CVPR 2015 & 2013, SIGGRAPH Asia 2013.

Associate Editor, *Transactions on Graphics (TOG)*, 2013-present.

Associate Editor, *Transactions on Pattern Analysis and Machine Intelligence (PAMI)*, 2014-present.