# Ioannis Gkioulekas

Smith Hall Rm 225
Robotics Institute, Carnegie Mellon University
5000 Forbes Avenue
Pittsburgh, PA 15213

(617) 840 9778
igkioule@cs.cmu.edu
http://www.cs.cmu.edu/~igkioule/

| | |
|---|---|
| **Research Interests** | I work on computational imaging, which can be broadly described as coming up with systems that combine imaging (optics, sensors, illumination) and computation (physics-based modeling and rendering, inverse algorithms, learning) in innovative, unexpected, and meaningful ways. Particular problems I am interested in include imaging around walls or through skin, lightweight depth sensing, material acquisition, adaptive imaging, efficient rendering, and the integration of physics-based simulation, learning, and optics. I am also more broadly interested in computer vision and computer graphics. |

**Education**

**Harvard University** — September 2009 - August 2016
PhD in Engineering Sciences
Advisor: Prof. Todd Zickler

**Harvard University** — September 2009 - March 2014
Master in Engineering Sciences
Advisor: Prof. Todd Zickler

**National Technical University of Athens** — September 2004 - July 2009
Diploma in Electrical and Computer Engineering
Thesis supervisor: Prof. Petros Maragos

**Professional Experience**

**Assistant Professor** — February 2017 - present
Robotics Institute, Carnegie Mellon University

**Postdoctoral Fellow** — September 2016 - January 2017
Harvard School of Engineering and Applied Sciences
Advisor: Prof. Todd Zickler

**Graduate Research Assistant** — September 2009 - August 2016
Harvard School of Engineering and Applied Sciences
Advisor: Prof. Todd Zickler

**Undergraduate Research Assistant** — September 2008- July 2009
Computer Vision, Speech Communication and Signal Processing Group, NTUA
Supervisor: Prof. Petros Maragos

**Undergraduate Research Assistant** — September 2007 - August 2008
Intelligent Robotics and Automation Laboratory, NTUA
Supervisor: Prof. Costas Tzafestas

**Publications**

*Under Review*

[1] Determining Generic Point Configurations From Unlabeled Path or Loop Lengths
Submitted to Transactions of the American Mathematical Society, 2018
**I. Gkioulekas**, S. Gortler, L. Theran, T. Zickler

*Journal Publications*

[2] Interferometric Transmission Probing with Coded Mutual Intensity
ACM Transactions on Graphics, 2020
A. Kotwal, A. Levin, **I. Gkioulekas**

[3] Langevin Monte Carlo Rendering with Gradient-based Adaptation
ACM Transactions on Graphics, 2020
F. Luan, S. Zhao, K. Bala., **I. Gkioulekas**

[4] Path-Space Differentiable Rendering
ACM Transactions on Graphics, 2020
C. Zhang, B. Miller, K. Yan., **I. Gkioulekas**, S. Zhao

[5] Effect of geometric sharpness on translucent material perception
Journal of Vision, 2020
B. Xiao, S. Zhao, **I. Gkioulekas**, W. Bi, K. Bala

[6] A Differential Theory of Radiative Transfer
ACM Transactions on Graphics (SIGGRAPH Asia), 2019
C. Zhang, L. Wu, C. Zheng, **I. Gkioulekas**, R. Ramamoorthi, S. Zhao

[7] Ellipsoidal Connections for Time-Gated Rendering
ACM Transactions on Graphics, 2019
A. Pediredla, A. Veeraraghavan, **I. Gkioulekas**

[8] A Monte Carlo Framework for Rendering Speckle Statistics in Scattering Media
ACM Transactions on Graphics, 2019
C. Bar, M. Alterman, A. Levin, **I. Gkioulekas**

[9] Micron-scale Light Transport Decomposition Using Interferometry
ACM Transactions on Graphics, 2015
**I. Gkioulekas**, A. Levin, F. Durand, and T. Zickler

[10] Looking Against the Light: How Perception of Translucency Depends on Lighting
Direction
Journal of Vision, 2014
B. Xiao, B. Walter, **I. Gkioulekas**, T. Zickler, E. Adelson, and K. Bala

[11] Inverse Volume Rendering with Material Dictionaries
ACM Transactions on Graphics, 2013
**I. Gkioulekas**, S. Zhao, K. Bala, T. Zickler, and A. Levin

[12] Understanding the Role of Phase Function in Translucent Appearance
ACM Transactions on Graphics, 2013
**I. Gkioulekas**, B. Xiao, S. Zhao, E. Adelson, T. Zickler, and K. Bala

[13] Toward Wide-Angle Microvision Sensors
IEEE Transactions on Pattern Analysis and Machine Intelligence, 2013
S. Koppal, **I. Gkioulekas**, T. Young, H. Park, K. Crozier, G. Barrows, and T. Zickler

*Refereed Conference Publications*

[14] A Theory of Fermat Paths for 3-D Imaging Sonar Reconstruction
IEEE International Conference on Intelligent Robots and Systems, 2019
E. Westman, **I. Gkioulekas**, M. Kaess

[15] Towards Reflectometry from Interreflections
IEEE International Conference on Computer Vision, 2019
K. Shem-Tov, S.P. Bangaru, A. Levin, **I. Gkioulekas**

[16] Towards Learning-based Inverse Subsurface Scattering
IEEE International Conference on Computer Vision, 2019
C. Che, F. Luan, S. Zhao, K. Bala, **I. Gkioulekas**

[17] A Volumetric Albedo Framework for 3D Imaging Sonar Reconstruction
IEEE International Conference on Robotics and Automation, 2020
E. Westman, **I. Gkioulekas**, M. Kaess

[18] Convolutional Approximations to the General Non-Line-of-Sight Imaging Operator
IEEE International Conference on Computer Vision, 2019
B. Ahn, A. Dave, A. Veeraraghavan, **I. Gkioulekas**, A. Sankaranarayanan

[19] Monte-Carlo Simulation of the Memory Effect in Random Media Beyond the Diffusion Limit
SPIE/OSA European Conference on Biomedical Optics, 2019
C. Bar, M. Alterman, **I. Gkioulekas**, A. Levin

[20] Exploiting Speckle Statistics in Random Media Beyond the Diffusion Limit
OSA Computational Optical Sensing and Imaging, 2019
C. Bar, M. Alterman, **I. Gkioulekas**, A. Levin

[21] Beyond Volumetric Albedo—A Surface Optimization Framework for Non-Line-of-Sight Imaging
IEEE Conference on Computer Vision and Pattern Recognition, 2019
C.-Y. Tsai, A. Sankaranarayanan, **I. Gkioulekas**

[22] A Theory of Fermat Paths for Non-Line-of-Sight Shape Reconstruction
IEEE Conference on Computer Vision and Pattern Recognition, 2019
S. Xin, S. Nousias, K. Kutulakos, A. Sankaranarayanan, S. Narasimhan, **I. Gkioulekas**

[23] STORM: Super-resolving Transients by OveRsampled Measurements
IEEE International Conference on Computational Photography, 2019
A. Pediredla, A. Raghuram, S. Narasimhan, **I. Gkioulekas**, A. Veeraraghavan

[24] An Evaluation of Computational Imaging Techniques for Heterogeneous Inverse Scattering
European Conference on Computer Vision, 2016
**I. Gkioulekas**, A. Levin, and T. Zickler

[25] On the Appearance of Translucent Edges
IEEE Conference on Computer Vision and Pattern Recognition, 2015
**I. Gkioulekas**, B. Walter, E. Adelson, K. Bala, and T. Zickler

[26] Dimensionality Reduction Using the Sparse Linear Model
Advances in Neural Information Processing Systems, 2011
**I. Gkioulekas** and T. Zickler

[27] Wide-angle Micro sensors for Vision on a Tight Budget
IEEE Conference on Computer Vision and Pattern Recognition, 2011
S. J. Koppal, **I. Gkioulekas**, T. Zickler and G. Barrows

[28] Spatial Bayesian Surprise for Image Saliency and Quality Assessment
International Conference on Image Processing, 2010
**I. Gkioulekas**, G. Evangelopoulos and P. Maragos

*Preprints*

[29] Inverse Transport Networks
arXiv:1809.10820
C. Che, F. Luan, S. Zhao, K. Bala, **I. Gkioulekas**

*Refereed Workshop Publications*

[30] Does Geometric Sharpness Affect Perception of Translucent Material?
Vision Science Society Annual Meeting, 2018
B. Xiao, W. Bi, S. Zhao, **I. Gkioulekas**, and K. Bala

[31] Effects of Shape and Color on the Perception of Translucency
Vision Science Society Annual Meeting, 2012
B. Xiao, **I. Gkioulekas**, A. Dunn, S. Zhao, T. Zickler, E. Adelson, and K. Bala

*Theses*

[32] A Framework for Inverse Scattering
Doctoral Dissertation, School of Engineering and Applied Sciences, Harvard University,
August 2016
**I. Gkioulekas**

[33] Computational Modeling of Visual Attention
Diploma Thesis, School of Electrical and Computer Engineering, National Technical
University of Athens, July 2009 (in Greek)
**I. Gkioulekas**

*Supervised Theses*

[34] Towards Shape Reconstruction through Differentiable Rendering
Master of Science in Computer Science, Carnegie Mellon University, January 2019
Sai Praveen Bangaru

| **Supervised Students and Postdoctoral Researchers** | *Postdoctoral researchers* | |
| --- | --- | --- |
| | Adithya Pediredla (Robotics Institute) | March 2019 - present |
| | *Doctoral students* | |
| | Chengqian Che (Robotics Institute) | September 2017 - present |
| | Alankar Kotwal (Robotics Institute) | September 2017 - present |
| | Shumian Xin (Robotics Institute) | September 2017 - present |
| | Arjun Teh (Computer Science Department) | September 2018 - present |
| | Byeongjoo Ahn (Electrical and Computer Engineering) | March 2019 - present |
| | Bakari Hassan (Electrical and Computer Engineering) | September 2019 - present |
| | *Master students* | |
| | Sai Praveen Bangaru (Master of Science in Computer Science) | January 2018 - August |

2019

Yuan Dong (Master of Science in Computer Vision)    January 2019 - December 2019
Congrui Hetang (Master of Science in Computer Vision)    January 2019 - December 2019
Shirsendu Halder (Master of Science in Robotics)    September 2019 - present

*Undergraduate students*

| | |
|---|---|
| Alan Jaffe (Computer Science Department) | January 2018 - August 2018 |
| Jiatian Sun (Computer Science Department) | April 2018 - present |
| Hang Yin (Computer Science Department) | March 2019 - August 2019 |
| Jessica Cao (Computer Science Department) | September 2019 - December 2019 |
| Jan Orlowski (Computer Science Department) | September 2019 - December 2019 |
| Po Ryan (Computer Science Department) | June 2020 - present |
| Vaishnavi Mantha (Computer Science Department) | June 2020 - present |

**Funding**

"Reconstructing Model Dimensionality from Physical Parts in Noisy Machining Environments," Lockheed Martin Corporation, 2019-2021.

"Physics and Learning Integration Using Differentiable Rendering," NSF CISE CHS, 2019-2022.

Gift from Amazon Web Services, 2019.

Gift from Allegheny General Hospital, 2018.

"Computational Photo-Scatterography: Unraveling Scattered Photons for Bio-imaging," NSF Expeditions, 2018-2021.

"Active Illumination and Imaging across Millisecond to Picosecond Time Scales for General LOS/NLOS Scene Understanding," DARPA REVEAL Phase 2, 2018-2020.

"Obtaining Multipath & Non-line-of-sight Information by Sensing Coherence & Intensity with Emerging Novel Techniques," DARPA REVEAL Phase 2, 2018-2020.

"Obtaining Multipath & Non-line-of-sight Information by Sensing Coherence & Intensity with Emerging Novel Techniques," DARPA REVEAL Phase 1, 2017-2018.

**Invited Talks**

"Towards computational interferometry", ICERM Workshop on Computational Imaging, Brown University, 2019.

"Optical high-resolution imaging deep inside the body", BIRS Computational Light Transport Workshop, Banff International Research Station, 2019.

"Bridging the gap between physical optics propagation and physically-based rendering", BIRS Computational Light Transport Workshop, Banff International Research Station, 2019.

"Computational Photo-Scatterography", 2018 NSF Expeditions in Computing PI Meeting, 2018.

"Towards imaging systems that make sense of multi-path light", Department of Elec-

trical and Computer Engineering, Carnegie Mellon University, 2018.
—"—, National Robotics Engineering Center, Carnegie Mellon University, 2018.

"Computational Imaging for Inverse Scattering", SPIE BIOS, Photonics West, 2017.
—"—, IS&T Electronic Imaging, 2016.
—"—, New England Computer Vision Workshop, 2016.
—"—, Graphics Seminar, Cornell University, 2016.
—"—, International Conference on Computational Photography, 2016.
—"—, Information and Systems Seminar, Harvard University, 2016.

"An Evaluation of Computational Imaging Techniques for Heterogeneous Inverse Scattering", ECCV, 2016.
—"—, Graphics Seminar, MIT, 2016.

"Making Sense of Multi-path Light", Department of Computer Science, University of Toronto, 2016.
—"—, Robotics Institute, Carnegie Mellon University, 2016.

"Micron-scale Light Transport Decomposition Using Interferometry", SIGGRAPH, 2016.
—"—, Camera Culture Seminar, Media Lab, MIT, 2016.
—"—, Graphics Seminar, MIT, 2016.

"Understanding Translucency: Perception, Acquisition, and Computer Vision", Graphics Seminar, University of Toronto, 2015.

"Inverse Volume Rendering with Material Dictionaries", SIGGRAPH Asia, 2014.
—"—, Graphics Seminar, MIT, 2014.

"Understanding the Role of Phase Function in Translucent Appearance", SIGGRAPH, 2014.
—"—, Graphics Seminar, University of California Berkeley, 2014.
—"—, Graphics Seminar, MIT, 2013.

| | |
|---|---|
| **Awards** | **Sloan Research Fellowship** (2020) |
| | **Best Paper Award** (CVPR 2019) |
| | **Outstanding Reviewer Award with Distinction** (CVPR 2019) |
| | **Outstanding Reviewer Award** (CVPR 2017) |
| | **Outstanding Reviewer Award** (ECCV 2016) |
| | **Outstanding Reviewer Award** (CVPR 2016) |
| | **Outstanding Reviewer Award** (ICCV 2015) |
| | **Harvard Certificate of Distinction in Teaching** (Fall 2012, 2013, 2014) |
| | **John A. and Elizabeth S. Armstrong Fellowship** (2010) |
| | **Harvard School of Engineering and Applied Sciences Graduate Fellowship** (2009-2011) |
| | **Greek State Scholarships' Foundation Award** for Excellence in Undergraduate Studies (2008-2009) |
| | **KARY Award**, awarded to top students of the ECE Department at NTUA (2008-2009) |
| | **Agricultural Bank of Greece Award** for Excellence in Undergraduate Studies (2005-2009) |
| | **President of the Hellenic Republic Award** for Excellence in High School studies (2004) |

| | |
|---|---|
| **Teaching Experience** | **Instructor**, 16-385 - Computer Vision, Carnegie Mellon University, Spring 2018, 2019. |
| | **Instructor**, 15-463/663/862 - Computational Photography, Carnegie Mellon University, Fall 2017, 2018. |
| | **Teaching Fellow**, CS283 - Computer Vision, Harvard University, Fall 2010, 2012, 2013, 2014, 2015. |
| | **Lab Assistant**, National Technical University of Athens<br>Programming Techniques, Spring 2006.<br>Introduction to Programming, Fall 2005, Fall 2006. |
| **Professional Service** | **Associate Editor**, International Journal of Computer Vision (2020 - present).<br>**Program Committee**, Pacific Graphics 2020.<br>**Finance Chair**, International Conference on Computational Photography (ICCP) 2020.<br>**Chair**, Workshop on Computational Cameras and Displays (CCD) 2019 (held in conjuction with CVPR).<br>**Session Chair**, International Conference on Computational Photography (ICCP) 2019.<br>**Program Committee**, International Conference on Computational Photography (ICCP) 2019.<br>**Program Committee**, Pacific Graphics 2019.<br>**Panelist**, National Science Foundation, CISE RI 2019.<br>**Panelist**, National Science Foundation, CISE CHS 2019.<br>**Panelist**, National Science Foundation, CISE CHS 2018.<br>**Chair**, Workshop on Computational Cameras and Displays (CCD) 2018 (held in conjuction with CVPR).<br>**Session Chair**, International Conference on Computational Photography (ICCP) 2018.<br>**Local Arrangements Chair**, International Conference on Computational Photography (ICCP) 2018.<br>**Program Committee**, International Conference on Computational Photography (ICCP) 2018.<br>**Panelist**, National Science Foundation, CISE CHS 2018.<br>**Program Committee**, Conference on Computer Vision and Pattern Recognition (CVPR) 2016.<br>**Reviewer**, Conference on Computer Vision and Pattern Recognition (CVPR) (2013-2020), International Conference on Computer Vision (ICCV) (2013-2020), European Conference on Computer Vision (ECCV) (2014-2020), British Machine Vision Conference (BMVC) (2016-2018), Asian Conference on Computer Vision (ACCV) (2016-2018), IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI) (2013-2020), IEEE Transactions on Image Processing (IP) (2014-2016), International Journal of Computer Vision (2012-2020), ACM SIGGRAPH (2014-2020), ACM SIGGRAPH Asia (2016-2020), ACM Transactions on Graphics (TOG) (2014-2020), ACM Transactions on Applied Perception (2014-2015), Eurographics (2016-2019), High-Performance Graphics (2017-2019), Pacific Graphics (2017-2020), Journal of Optical Society of America (2017-2019), IS&T Color and Imaging Conference (CIC) (2018-2019).<br>**Member**, Institute of Electrical and Electronics Engineers (IEEE) (2007 - present)<br>**Member**, Association for Computing Machinery (ACM) (2009 - present)<br>**Member**, Technical Chamber of Greece (2010 - present)<br>**Treasurer**, IEEE NTUA Student Branch (2008-2009) |

| | | |
|---|---|---|
| **University Service** | Robotics Institute, Ph.D. Admissions Committee | 2018 - present |
| | Robotics Institute, MSCV Admissions Committee (reviewer) | 2017 - 2018 |
| | Host for faculty candidates Manolis Savva (2018), Matthew O'Toole (2018), Tali Dekel (2019), Abe Davis (2019). | |
| **Outreach Activities** | **Co-instructor**, Gelfand Weekend Series "Camera and Displays". | April 2019 |
| | **Co-organizer**, Gelfand Summer Workshop "From Photons to Photos". | July 2019 |
| **Other Information** | Citizenship: Greek<br>Languages: Greek (native), English (fluent), German (intermediate), French (intermediate) | |