

Shumian Xin

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Research Interests

My research is in the area of computer vision and computational imaging. I am interested in exploring novel imaging systems to empower computers with strong visual sensing capabilities and developing computational photography tools for photographers to unleash their creativity. I have experience in both vision algorithm development and optical hardware setup, working on imaging systems with advanced sensors, including time-of-flight sensors, dual-pixel cameras, and light field cameras.

I will graduate in late 2022 or early 2023, and am currently looking for a full-time position in the industry, working on computer vision research and applications.

Education

- **Carnegie Mellon University, Robotics Institute** Aug 2017 – Present
Doctor of Philosophy in Robotics (Ongoing)
Advisors: Prof. Ioannis Gkioulekas and Prof. Srinivasa Narasimhan
- **Carnegie Mellon University, Electrical and Computer Engineering** Aug 2015 – Dec 2016
Master of Science in Electrical and Computer Engineering
Overall GPA: 3.93/4.00
- **Xi'an Jiaotong University, Electrical Engineering** Sep 2011 – Jun 2015
Bachelor of Engineering in Electrical Engineering
Overall Grade: 93.3/100 Ranking: 1/398
Enrolled in the gifted program for advanced students of China

Publications

- **Defocus Map Estimation and Deblurring from a Single Dual-Pixel Image** [[webpage](#), [paper](#), [code](#)]
Shumian Xin, Neal Wadhwa, Tianfan Xue, Jonathan Barron, Pratul Srinivasan, Jiawen Chen, Ioannis Gkioulekas, and Rahul Garg
IEEE International Conference on Computer Vision (ICCV), 2021
Oral Presentation
- **A Theory of Fermat Paths for Non-Line-of-Sight Shape Reconstruction** [[webpage](#), [paper](#), [code](#)]
Shumian Xin, Sotiris Nouisias, Kiriakos N. Kutulakos, Aswin C. Sankaranarayanan, Srinivasa G. Narasimhan, and Ioannis Gkioulekas
IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2019
Oral Presentation, Best Paper Award out of 5000 submissions

Industry Experience

- **Research Intern & Student Researcher** May – Nov 2020
Google Research *Hosts: Rahul Garg and Neal Wadhwa* Mountain View, CA, USA
- Research work accepted to ICCV 2021 as an oral presentation

Research Experience

- **3D Reconstruction using Differential Imaging (PhD Thesis)** Aug 2017 – Present
CMU Imaging Lab *Advisors: Prof. Ioannis Gkioulekas and Prof. Srinivasa Narasimhan*
 - Leveraging differential imaging, an imaging mechanism that takes multiple measurements with infinitesimal changes in illumination, camera, or the scene, for challenging 3D reconstruction problems, including non-line-of-sight (NLOS) imaging, single-shot depth from defocus, and specular object reconstruction

- Explored the seemingly impossible NLOS imaging problem of reconstructing objects which are completely occluded and outside the line-of-sight of a camera, proposed a novel theory of Fermat paths for NLOS shape reconstruction, and obtained high-resolution results as if the NLOS objects were directly visible
 - Collaborated with Google and Adobe colleagues and proposed a single-shot depth from defocus method using commercial dual-pixel sensors, and formulated an optimization problem to jointly recover the defocus map and all-in-focus image of an unknown scene from a single potentially-defocused dual-pixel image
 - Currently working on reconstructing purely specular objects with near-field illumination and a light field camera by exploiting the geometric and radiometric properties of specular reflection
- **Rendering Tools for Light Transport Parsing** Jun 2016 – Mar 2017
CMU Illumination and Imaging Lab *Advisor: Prof. Srinivasa Narasimhan*
- Rendered photorealistic images with a modern ray tracer (PBRT) to simulate various imaging schemes, e.g. epipolar-only, non-epipolar-only, and depth-gating, based on light transport and epipolar geometry
- **Light Field Stereo** Jan – May 2016
CMU Image Science Lab *Advisor: Prof. Aswin Sankaranarayanan*
- Proposed a new stereo configuration by replacing regular cameras with light field cameras, which are essentially camera arrays with very small baselines
 - Formulated an optimization problem for depth estimation by combining large and small baselines
- **A Computer Vision Feature-Selection Framework** Jul – Sep 2014
UCLA The Roychowdhury Group *Advisor: Prof. Vwani Roychowdhury*
- Evaluated performance of various feature detectors and descriptors for multiple image categories
 - Developed a framework to automatically select the optimal feature extractor for given images
 - Received Outstanding Research and Presentation Skills Award in UCLA-CSST Program

Invited Talks

- **A Theory of Fermat Paths for Non-Line-of-Sight Shape Reconstruction** [\[link\]](#) Jun 2020
- Keynote speaker, Computational Cameras and Displays (CCD) Workshop, CVPR

Professional Service and Teaching

- **Journal and Conference Reviewer**
- IEEE Transactions on Computational Imaging, Optics Express, ICCV
- **Student Volunteer**
- International Conference on Computational Photography (ICCP) 2018, 2022
- **Teaching Assistant**
- 16-720 Computer Vision, Carnegie Mellon University Fall 2019, Spring 2020

Awards

- **Microsoft Research PhD Fellowship Finalist** 2020
- **CVPR Best Paper Award** 2019
- **UCLA-CSST Scholarship** 2014
- Awarded to students in the Cross-disciplinary Scholars in Science and Technology (CSST) program for conducting summer research at UCLA
- **National Scholarship** 2013, 2014
- Highest scholarship for Chinese undergraduate students

Technical Skills

- **Programming Languages and Libraries:** Python, C++, Matlab, PyTorch, Tensorflow, JAX, OpenCV
- **Tools:** Linux Script, LaTeX, HTML