TIANAO LI

https://lukeli0425.github.io tianaoli@u.northwestern.edu https://github.com/Lukeli0425/
Department of Computer Science, McCormick School of Engineering, Northwestern University, Evanston, IL 60208

EDUCATION

Northwestern University — Evanston, IL
Ph.D. Candidate in Computer Science — *Sept. 2023 - Present*
GPA: 3.97/4.0
Research advisor: Emma Alexander

Tsinghua University — Beijing, P.R. China
B.Eng. in Electronic Engineering, Magna Cum Laude — *Aug. 2019 - Jun. 2023*
Curricular Certificate in Astronomy
GPA: 3.85/4.0 (top 15%)
Research advisor: Cheng Ma, Lu Fang

Beijing No.4 High School — Beijing, P.R. China
High School Diploma — *Sept. 2016 - Jun. 2019*

HONORS & AWARDS

- Best Poster Honorable Mention, Midwest Machine Learning Symposium 2025 — *Jun. 2025*
- Outstanding Graduate, Tsinghua University (top 10%) — *Jun. 2023*
- Scholarship of Comprehensive Excellence, Tsinghua University (top 10%) — *Oct. 2022*
- Scholarship of Comprehensive Excellence, Tsinghua University (top 10%) — *Oct. 2021*
- Scholarship of Social Work, Tsinghua University — *Oct. 2020*

RESEARCH INTERESTS

My research interest is in the field of computational imaging, which lies at the intersection of optics, signal processing, computer vision, and machine learning. Specifically, I am interested in developing physics-based and uncertainty-aware methods to solve inverse problems in computational photography, medical imaging, and astronomical imaging.

PUBLICATIONS

[1] **Tianao Li**, Manxiu Cui, Cheng Ma, Emma Alexander. "**Coordinate-based Speed of Sound Recovery for Aberration-Corrected Photoacoustic Computed Tomography**". *IEEE/CVF International Conference on Computer Vision (ICCV)*, 2025.

[2] **Tianao Li**, Emma Alexander. "**Galaxy Image Deconvolution for Weak Gravitational Lensing with Unrolled Plug-and-Play ADMM**". *Monthly Notices of the Royal Astronomical Society: Letters*, 2023.

RESEARCH EXPERIENCE

NSF-Simons AI Institute for the Sky (SkAI Institute)
Graduate Student Researcher — *Jan. 2025 - Present*
Advisor: **Prof. Emma Alexander, Prof. Tjitske Starkenburg**
- Remove distortions from astrophysical images by modeling the image formation process, initially focus on simpler distortion models (convolution, noising), and subsequently, develop a system to handle gravitational lensing.
- Develop a differentiable image synthesis pipeline comprising three components: implicit image representations to act as per-image prior, conditional generative model (normalizing flows or diffusion) to capture data distribution, and differentiable nonlinear forward model to capture physics-based distortions; and uncertainty quantification.

Bio-Inspired Vision Lab, Northwestern University
Graduate Research Assistant *Sept. 2023 - Present*
Advisor: **Prof. Emma Alexander**
• Inverse problems in scientific and medical imaging.
• Machine learning for astronomical imaging.
• Depth from differential defocus (DfDD).

Biophotonics Lab, Tsinghua University
Undergraduate Researcher *Oct. 2022 - Jun. 2023*
Advisor: **Prof. Cheng Ma**
• Applied physics-based machine learning to image reconstruction in photoacoustic computed tomography (PACT), where image qualities are usually degraded by unknown variations in the speed of sound (SoS) through tissues.

Bio-Inspired Vision Lab, Northwestern University
Research Intern (remote) *Apr. 2022 - Feb. 2023*
Advisor: **Prof. Emma Alexander**
• Applied physics-inspired machine learning to the PSF deconvolution problem in galaxy images in ground-based sky surveys, significantly reducing systematic error in weak gravitational lensing shear measurements. Adopted an end-to-end optimized unrolled network to learn the priors with Plug-and-Play ADMM.
• The proposed method outperformed previous algorithms in the shape error of recovered galaxies.
• Paper published in *Monthly Notices of the Royal Astronomical Society* (MNRAS).

SIGMA Lab, Tsinghua University
Research Assistant *Sept. 2021 - Feb. 2022*
Advisor: **Prof. Lu Fang**
• Collaborated with a Ph.D. student on a Deep Diffractive Neural Network (D^2NN) implemention of NeRF.
• Implemented a Point Cloud classification network with D^2NN.

INVITED TALKS

Probabilistic Imaging of Galaxies for Weak Gravitational Lensing
Open SkAI 2025 *Sep. 2025*

Galaxy Image Deconvolution for Weak Gravitational Lensing with Unrolled Plug-and-Play ADMM
ECE Seminar, Department of Electrical & Computer Engineering, Boston University *Jul. 2024*
Center for Interdisciplinary Exploration and Research in Astrophysics, Northwestern University *Jan. 2024*
PKU Computational Scientific Imaging Group, Peking University *Dec. 2023*
Astro Imaging Workshop 2023, Northwestern University *Jul. 2023*

SKILLS

• **Coding:** Python, PyTorch, TensorFlow, Matlab, C/C++, JavaScript, Git, LaTeX
• **Language:** English (Fluent), Mandarin (Native)

EXTRACURRICULAR

• Volunteer at Tsinghua Q&A Workshop with a total service hour of 180h. *Apr. 2021 - Jun. 2023*
• Vice president of Tsinghua Astronomy Society. *Sept. 2021 - Jun. 2022*
• Head of school observatory. *Sept. 2021 - Jun. 2022*
• Organized astronomy summer camp for junior high students in Guizhou, China. *Aug. 2021*