

TIANAO LI

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📍 Department of Computer Science, Northwestern University, Evanston, IL

EDUCATION

Northwestern University

Ph.D. student in Computer Science

Research advisor: Emma Alexander

Evanston, IL

Sept. 2023 - Present

Tsinghua University

B.Eng. in Electronic Engineering, Magna Cum Laude

Curricular Certificate in Astronomy

GPA: 3.85/4.0 (top 15%)

Research advisor: Cheng Ma

Beijing, P.R. China

Aug. 2019 - Jun. 2023

Beijing No.4 High School

High School Diploma

Beijing, P.R. China

Sept. 2016 - Jun. 2019

HONORS & AWARDS

- 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, computer graphics, and machine learning. Specifically, I enjoy solving **inverse problems** using domain-specific knowledge (e.g., optics and geometry) in computational photography, astronomical imaging, and biomedical imaging.

PUBLICATIONS

- [1] **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

Biophotonics Lab, Tsinghua University

Undergraduate Researcher

Oct. 2022 - Jun. 2023

Advisor: **Prof. Cheng Ma, Prof. Emma Alexander**

- Applied physics-informed machine learning to image reconstruction in photoacoustic computed tomography (PACT), where image qualities are usually degraded by unknown variations in the speed of sound 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 outperforms previous algorithms in shape error of recovered galaxies.
- Paper published on *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) implementation of NeRF.
- Implemented a Point Cloud classification network with D^2NN .

INVITED TALKS

Galaxy Image Deconvolution for Weak Gravitational Lensing with Unrolled Plug-and-Play ADMM

PKU Computational Scientific Imaging Group, Peking University

Dec. 2023

Astro Imaging Workshop, Northwestern University

Jul. 2023

SKILLS

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

SELECTED PROJECTS

Fire Detection [Github]

Jun. 2022

- A Python implementation of a non-deep learning fire detection pipeline.
- Pipeline comprises of three parts: color space classifier, color component classifier and texture classifier.
- The model was trained and tested on the BoWFire Dataset and is able to detect fire from static images with an accuracy of 80%.

Video-Audio Signal Processing [Github]

Dec. 2021

- Developed joint video-audio processing algorithms in Python.
- The algorithm is capable of recognizing faces from videos clips, recognizing voices from audios and separating speeches from videos with given visual and audio information of the speakers.

Video Editing Based on Rhythm Matching [Github] [Video]

Jul. 2021

- Developed a video-editing algorithm in Matlab.
- The algorithm was designed to create a video from a given set of video clips and a piece of background music to best match the clips' audio rhythm with the background music.

EXTRACURRICULAR

- Vice president of Tsinghua Astronomy Society (2021-22).
- Head of school observatory (2021-22).
- Organized astronomy summer camp for junior high students in Guizhou, China in Aug. 2021.
- Volunteer at Tsinghua Q&A Workshop with a total service hour of 180h.