TIANAO LI

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Department of Computer Science, Northwestern University, Evanston, IL 60208

EDUCATION

Northwestern University Evanston, IL
Ph.D. student in Computer Science *Sept. 2023 - Present*
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

- 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

Bio-Inspired Vision Lab, Northwestern University
Graduate Research Assistant *Sept. 2023 - Present*
Advisor: **Prof. Emma Alexander**
- Working on inverse problems in scientific computational imaging.

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.
- Network was trained and evaluated on simulated data.

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 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) implemention 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

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, Northwestern University *Jul. 2023*

SKILLS

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

SELECTED PROJECTS

Fire Detection [Github] *Jun. 2022*

• A Python implemention 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

• 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*