Xinyang Li

Ph.D., Postdoctoral Fellow, Assistant Research Fellow
Department of Automation, Tsinghua University
The Laboratory of Imaging and Intelligent Technology
Address: Room 307, Central Main Building, Tsinghua University, Beijing, China, 100084
E-mail : xinyangli@tsinghua.edu.cn
Telephone : (+86) 17600540528
Homepage : https://xinyang-li.github.io

Education & Employment

2023 – Present	**Shuimu Postdoctoral Fellow, Assistant Research Fellow, Department of Automation, Tsinghua University**
2018 – 2023	**Ph.D. in Control Science and Engineering, Tsinghua University,**
	Dissertation: High-sensitivity Fluorescence Imaging
	Advisor: Prof. Qionghai Dai & Prof. Haoqian Wang
2014 – 2018	**B.S. in Automation, Department of Automation, Xi'an Jiaotong University**

Research Interest

As the extension of human vision, imaging instruments have extended our observational capability to unprecedented scales and precision, leading to a series of scientific discoveries. Despite the widespread application of optical imaging in various fields such as life sciences, medicine, materials science, and astronomy, the further improvement of imaging performance has long been constrained by two fundamental physical limits: the shot-noise limit of sensitivity and the diffraction limit of resolution. To address these cutting-edge challenges, I am dedicated to interdisciplinary research at the intersection of **artificial intelligence**, **optical imaging**, and **neuroscience**. Through innovations in imaging mechanisms, system architecture, and downstream intelligent algorithms, I have improved the imaging performance and promoted new discoveries in life sciences. In the past 5 years, I have published 16 papers in international journals, including 5 first-author papers in Nature series journals, such as *Nature Biotechnology*, *Nature Methods*, *Nature Computational Science*, and *Light: Science & Applications*. I served as the reviewer for *IEEE TCSVT*, *Scientific Reports*, and *Biomedical Optics Express*, and was invited as a special lecturer at the 2023 International Conference on Artificial Intelligence. My current work is focused on **(1) intelligence imaging**, **(2) quantum enhanced imaging and optical computing**, **(3) neural imaging robot**.

Academic Achievements

Publications (# represents co-first author; * represents corresponding author)

Representative publications:

[1] **Xinyang Li***, Yixin Li*, Yiliang Zhou, Jiamin Wu, Zhifeng Zhao, Jiaqi Fan, Fei Deng, Zhaofa Wu, Guihua Xiao, Jing He, Yuanlong Zhang, Guoxun Zhang, Xiaowan Hu, Xingye Chen, Yi Zhang, Hui Qiao, Hao Xie, Yulong Li, Haoqian Wang#, Lu Fang#, Qionghai Dai#. "Real-time denoising enables high-sensitivity fluorescence time-lapse imaging beyond the shot-noise limit." *Nature Biotechnology* (2023): 282-292.

[2] **Xinyang Li***, Guoxun Zhang*, Jiamin Wu, Yuanlong Zhang, Zhifeng Zhao, Xing Lin, Hui Qiao, Hao Xie, Haoqian Wang#, Lu Fang#, and Qionghai Dai#. "Reinforcing neuron extraction and spike inference in calcium imaging using deep self-supervised denoising." *Nature Methods* (2021): 1395-1400.

[3] **Xinyang Li***, Yuanlong Zhang*, Jiamin Wu#, Qionghai Dai#. "Challenges and opportunities in bioimage analysis." *Nature Methods* (2023): 958-961.

[4] **Xinyang Li***, Xiaowan Hu*, Xingye Chen*, Jiaqi Fan, Zhifeng Zhao, Jiamin Wu#, Haoqian Wang#, Qionghai Dai#. "Spatial redundancy transformer for self-supervised fluorescence image denoising." *Nature Computational Science* (2023): 1067-1080.

[5] **Xinyang Li***, Guoxun Zhang*, Hui Qiao*, Feng Bao, Yue Deng, Jiamin Wu, Yangfan He, Jingping Yun, Xing Lin, Hao Xie, Haoqian Wang#, Qionghai Dai#. (2021). Unsupervised content-preserving transformation for optical microscopy. *Light: Science & Applications*, (2021): 44-54.

Other publications (sorted by date):

[6] Zhifeng Zhao*, Yiliang Zhou*, Bo Liu*, Jing He*, Jiayin Zhao, Yeyi Cai, Jingtao Fan, **Xinyang Li**, Zilin Wang, Zhi Lu, Jiamin Wu#, Hai Qi#, Qionghai Dai#. "Two-photon synthetic aperture microscopy for minimally invasive fast 3D imaging of native subcellular behaviors in deep tissue." *Cell* (2023): 2475-2491 e22.

[7] Guoxun Zhang*, Xiaopeng Li*, Yuanlong Zhang*, Xiaofei Han, **Xinyang Li**, Jinqiang Yu, Boqi Liu, Jiamin Wu#, Li Yu#, Qionghai Dai#. Bio-friendly long-term subcellular dynamic recording by self-supervised image enhancement microscopy. *Nature Methods* (2023): 1-14.

[8] Yuanlong Zhang*, Guoxun Zhang*, Xiaofei Han, Jiamin Wu, Ziwei Li, **Xinyang Li**, Guihua Xiao, Hao Xie, Lu Fang,# Qionghai Dai#. Rapid detection of neurons in widefield calcium imaging datasets after training with synthetic data. *Nature Methods* (2023): 747-754.

[9] Yi Zhang*, Yuling Wang*, Mingrui Wang, Yuduo Guo, **Xinyang Li**, Yifan Chen, Zhi Lu, Jiamin Wu#, Xiangyang Ji#, Qionghai Dai#. "Multi-focus light-field microscopy for high-speed large-volume imaging." *PhotoniX* (2022): 1-20.

[10] Soheil Soltani, Ashkan Ojaghi, Hui Qiao, Nischita Kaza, **Xinyang Li**, Qionghai Dai, Adeboye O. Osunkoya, Francisco E. Robles#. "Prostate cancer histopathology using label-free multispectral deep-UV microscopy quantifies phenotypes of tumor aggressiveness and enables multiple diagnostic virtual stains." *Scientific Reports* (2022): 9329.

[11] **Xinyang Li**, Zhifeng Zhao, Guoxun Zhang, Hui Qiao, et al. & Qionghai Dai. High-fidelity fluorescence image restoration using deep unsupervised learning. *OSA Biophotonics Congress: Biomedical Optics* (2020), Invited oral presentation.

[12] **Xinyang Li***, Yuanlong Zhang*, Kan Liu, Hao Xie, Haoqian Wang, Lingjie Kong#, Qionghai Dai. "Adaptive optimization for axial multi-foci generation in multiphoton microscopy." *Optics express* (2019): 35948-35961.

[13] Chaowei Zhuang, **Xinyang Li**, Yuanlong Zhang, Lingjie Kong, Hao Xie#, Qionghai Dai#. "Photobleaching imprinting Enhanced background rejection in line-scanning temporal focusing microscopy." *Frontiers in Chemistry* (2020): 1185.

[14] Yuanlong zhang*, **Xinyang Li***, Hao Xie, Lingjie Kong#, Qionghai Dai. "Hybrid spatio-spectral coherent adaptive compensation for line-scanning temporal focusing microscopy." *Journal of Physics D: Applied Physics* (2018): 024001.

[15] Shi, Ruheng, Cheng Jin, Hao Xie, Yuanlong Zhang, **Xinyang Li**, Qionghai Dai, Lingjie Kong#. "Multi-plane, wide-field fluorescent microscopy for biodynamic imaging in vivo." *Biomedical Optics Express* (2019): 6625-6635.

[16] Zhang, Yuanlong*, Tiankuang Zhou*, Xuemei Hu, **Xinyang Li**, Hao Xie, Hu Fang, Lingjie Kong#, Qionghai Dai. "Overcoming tissue scattering in wide-field two-photon imaging by extended detection and computational reconstruction." *Optics Express* (2019): 20117-20132.

Lectures

- **Xinyang Li**, “High-sensitivity imaging and computing beyond the standard quantum limit: from AI to quantum”, *College of AI at Tsinghua University*, Public research talk, December 2024.
- **Xinyang Li**, “Deep self-supervised denoising enables ultrasensitive fluorescence imaging beyond the shot-noise limit”, *The 3rd CAAI International Conference on Artificial Intelligence*, invited talk on intelligent microscopy, July 2023.
- **Xinyang Li**, “Real-time denoising of fluorescence imaging using DeepCAD-RT”, *Tsinghua Laboratory of Brain and Intelligence*, Lab Seminar, April 2023.
- **Xinyang Li**, “Deep self-supervised denoising enables ultrasensitive fluorescence imaging beyond the shot-noise limit”, *Tsinghua IDG/McGovern Institute for Brain Research*, Seminar on Neuroscience Frontiers, September 2022.
- **Xinyang Li**, “Reinforcing neuron extraction and spike inference in calcium imaging using deep self-supervised denoising”, *Peking University*, Lab Seminar, March 2022.
- **Xinyang Li**, “High-fidelity fluorescence image restoration using deep unsupervised learning”, *OSA Biophotonics Congress*, Oral Presentation, April 2020.

Funding

[1] China Postdoctoral Science Foundation, General Project, 2023M741962, High-sensitivity quantum imaging of living cells, 2023/11-2025/07, 80,000 RMB, under research, project leader.

[2] Tsinghua University Independent Research Program, 20197010007, Functional imaging of mouse cortex in ultra-large field-of-view to explore the neural mechanisms of wakefulness and

anesthesia transition, 2019/03-2020/08, 80,000 RMB, completed, project leader.

[3] Beijing Natural Science Foundation, Key Research Project, 24Z30039, Cross-scale multimodal computational light-field intravital imaging technology and its application in stroke research, 2024-07-01 to 2024-06-30, 3,000,000 RMB, under research, subproject leader.

[4] National Natural Science Foundation of China (NSFC), Science Center Program, 62088102, Cognitive computing, 2021/01-2025/12, 60,000,000 RMB, under research, participant.

[5] National Natural Science Foundation of China (NSFC), Major Research Instrument Development Program, 61927802, Two-photon light-field computational imaging instrument, 2021/01- 2025/12, 7,790,000 RMB, under research, participant.

[6] National Natural Science Foundation of China (NSFC), General Project, 62171254, Research on functional connection methods of whole-brain multimodal optoelectronic information, 2022/01-2025/12, 570,000 RMB, under research, participant.

[7] National Natural Science Foundation of China (NSFC), General Project, 62175126, Research on resistance quenching mechanism of single-photon avalanche detectors and applications, 2022/01-2025/12, 580,000 RMB, under research, participant.

[8] National Natural Science Foundation of China (NSFC), General Project, 62171252, Research on neuron extraction based on prior knowledge and data-driven depth estimation model, 2022/01-2025/12, 630,000 RMB, under research, participant.

[9] National Natural Science Foundation of China (NSFC), General Project, 62071271, Intravital super-resolution computational imaging based on light field microscopy, 2021/01-2024/12, 540,000 RMB, under research, participant.

Honors & Awards

- ✧ **2023** Tsinghua Shuimu Scholars
- ✧ **2023** Beijing Outstanding Graduates
- ✧ **2023** Tsinghua University Outstanding Graduates
- ✧ **2023** Tsinghua University Outstanding Doctoral Dissertation
- ✧ **2023** Tsinghua McGovern Annual Scholarly Presentation Award
- ✧ **2022** National Scholarship,
- ✧ **2021** Tsinghua McGovern Award for Outstanding Research Achievement
- ✧ **2021** National Scholarship
- ✧ **2021** The First Prize of Tsinghua Laboratory Construction Contributions
- ✧ **2018** Outstanding Graduate Cadre
- ✧ **2017** National Scholarship
- ✧ **2016** National Scholarship
- ✧ **2016** Outstanding Student Cadre
- ✧ **2015** National Scholarship

Media Coverage

(Translated into English)

- “Some people bypass problems, but I want to solve problems”, **People's Daily Overseas Edition**,

my statement was chosen as the headline of the news.

- "Be daring to do disruptive scientific research", **Guangming Daily**, my statement and research achievement were reported.
- "The team of Qionghai Dai at Tsinghua University released a real-time denoising method to realize ultrasensitive fluorescence imaging beyond the photon noise limit", Tsinghua University News, my research results were reported.
- "Qionghai Dai and Haoqian Wang's team developed a real-time denoising method to achieve ultrasensitive fluorescence imaging beyond the shot-noise limit", Top news on the homepage of Tsinghua University Shenzhen International Graduate School, my research results were reported.
- "Nature Methods | Qionghai Dai's team proposed a self-supervised learning method for calcium imaging denoising", Counselor's Office of the State Council, my research results were reported.
- "Academic Express | Qionghai Dai's team breaks the shot-noise limit to realize real-time ultrasensitive fluorescence imaging", Tsinghua IDG/McGovern Institute for Brain Science, my research results were reported.
- "Nat. Methods | CAAI President Qionghai Dai's team developed a self-supervised learning method to break the shot-noise limit of fluorescence calcium imaging", Journal of Intelligent Systems, my research results were reported.
- "NBT | Qionghai Dai's team breaks the shot-noise limit and achieves real-time ultrasensitive fluorescence imaging", BioArt, the most influential academic WeChat public account in life sciences, my research results were reported.
- "NBT (IF=68) | Successive Progress! Qionghai Dai and collaborators developed real-time high-sensitivity fluorescence imaging technology", WeChat public account iNature, my research results were reported.