

Laixi Shi

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Education

2018 – Present **Ph.D. Candidate, Electrical and Computer Engineering**, *Carnegie Mellon University, PA, USA.*,
Advisor: Yuejie Chi.

Honors: Liang Ji-Dian Graduate Fellowship (2021)
National Science Foundation (NSF) Student Travel Grants for ICASSP (2020)
Computing Research Association (CRA-WP) Grad Cohort for Women Travel Support (2020)
The ACM International Workshop on Device-Free Human Sensing (DFHS) Travel Grant (2019)
Women in Machine Learning Scholarship (2019)
Women in Data Science and Mathematics Travel Support (2019)
Presidential Fellowship granted by Carnegie Mellon University (2018)
Carnegie Institute of Technology Dean's Fellow granted by Carnegie Mellon University (2018)

2014 – 2018 **B.Eng., Electronic Engineering**, *Tsinghua University*, Beijing, China.

Honors: Excellent Honors Graduate granted by Tsinghua University (2018)
The First Prize in 35th Tsinghua University Academic Challenge Cup (2017)
Technology Innovation Excellence Award granted by Tsinghua University (2015 – 2017)
Enterprise Sponsored Scholarship granted by Tsinghua University (2017)
National Scholarship granted by the government of China (2016)
Qualcomm Scholarship granted by Tsinghua University (2016)
Outstanding Project of Undergraduate Research Promotio Competition of Tsinghua Unviersity (2016)
The First Prize in National Physics Contest for College Student (2015)
The Silver Medal of Chinese Physics Olympiad (2014)

Ongoing Research

2019.12-Present **Self-Calibrated Compressive Sensing via Nonconvex Optimization**,
Dept. of Electrical and Computer Engineering, Carnegie Mellon University,
Research Assistant, Advisor: Yuejie Chi.

We propose an efficient and provable nonconvex optimization approach for self-calibrated compressive sensing, which is an important extension of multi-channel sparse blind deconvolution in the overcomplete case.

2020.9-Present **Sample Complexity Analysis for Offlin/Online Reinforcement Learning Algorithms**,
Dept. of Electrical and Computer Engineering, Carnegie Mellon University,
Research Assistant, Advisor: Yuejie Chi.

We propose sample efficient model-free algorithms for online and offline reinforcement learning and provide non-asymptotic convergence guarantee for the proposed algorithms.

2020.5-Present **Improving robustness of a sequence of estimation problems**,
Mitsubishi Electric Research Laboratories (MERL),
Research Intern, Mentor: Dehong Liu.

This confidential project involves abnormal estimation detection of a sequence of problems, low rank matrix reconstruction, and sparsity.

Previous Research Experience

- 2018.9–2019.11 **Multi-channel Sparse Blind Deconvolution via Nonconvex Optimization**,
Dept. of Electrical and Computer Engineering, Carnegie Mellon University,
Research Assistant, Advisor: Yuejie Chi.
We propose an efficient and provable nonconvex optimization approach for multi-channel sparse blind deconvolution based on manifold gradient descent with random initialization.
- 2018.9–2020.3 **Multiple Occupants Localization through Vibration Sensing**,
Dept. of Electrical and Computer Engineering, Carnegie Mellon University, Pittsburgh, USA,
Research Assistant, Advisor: Yuejie Chi, Shijia Pan, Pei Zhang, Hae Young Noh.
We propose a non-intrusive pedestrian sensing system that localizes multiple pedestrians walking in a sensing area through ambient structural vibrations.
- 2016.8–2018.8 **Micro Hand Gesture Recognition System using Ultrasonic Active Sensing**,
Dept. of Electronic Engineering, Tsinghua University, Beijing, China,
Research Assistant, Advisor: Yimin Liu.
We proposed a system, which uses micro dynamic hand gestures for recognition to achieve human–computer interaction (HCI). The implemented system, called hand-ultrasonic gesture (HUG), consists of ultrasonic active sensing, pulsed radar signal processing, and time-sequence pattern recognition by machine learning.
- 2017.7 – 2018.1 **Improving Pedestrian Safety in Urban Cities Using a Wearable Acoustic System**,
Intelligent and Connected Systems Lab, Columbia University, New York, USA,
Advisor: Xiaofan Jiang.
This project aims at using an acoustic wearable system on the headset to detect and localize approaching cars in order to alert the pedestrian of the danger.
- 2016.5 – 2016.9 **Collaborative Distributed System based on cars/Unmanned Aerial Vehicle Coordinated Formation Design**,
SRT (Students Research Training) program, Tsinghua University, Beijing, China,
Advisor: Yuan Shen.
We developed a multiple robot collaborative localization and navigation system using a self-made mobile robot platform. The robots in our system are equipped with a wireless distributed localization system based on UWB (Ultra Wide Band), which enables them automatically to form a pre-defined formation with mutual localization information.

Publications & Preprints

- [1] [Laixi Shi](#), Dehong Liu, Jay Thornton. "Robust Camera Pose Estimation For Image Stitching" IEEE International Conference on Image Processing (ICIP) 2021.
- [2] [Laixi Shi](#), Dehong Liu, Masaki Umeda, and Norihiko Hana. "Fusion-Based Digital Image Correlation Framework for Strain Measurement" International Conference on Acoustics, Speech, and Signal Processing (ICASSP) 2021.
- [3] [Laixi Shi](#) and Yuejie Chi. "Manifold Gradient Descent Solves Multi-channel Sparse Blind Deconvolution Provably and Efficiently." IEEE Transactions on Information Theory (2021). A short conference version has been accepted by International Conference on Acoustics, Speech, and Signal Processing (ICASSP) 2020.
- [4] [Laixi Shi](#), Yue Zhang, Shijia Pan, and Yuejie Chi. "Data Quality-Informed Multiple Occupant Localization using Floor Vibration Sensing." The 21st International Workshop on Mobile Computing Systems and Applications, 2020, Texas, USA.
- [5] [Laixi Shi](#), Mostafa Mirshekari, Jonathon Fagert, Yuejie Chi, Hae Young Noh, Pei Zhang, and Shijia Pan. "Device-free Multiple People Localization through Floor Vibration." First ACM Workshop on Device-Free Human Sensing, 2019, New York, USA.
- [6] Sang Yu, [Laixi Shi](#), and Yimin Liu. "Micro hand gesture recognition system using ultrasonic active sensing." IEEE Access 6 (2018): 49339-49347.

Work Experience

2020.5 – 8 **Mitsubishi Electric Research Laboratories (MERL)**, *Boston, United States*,

Mentor: Dehong Liu.

This confidential project involves blind deconvolution, image fusion and stitching, and perspective-n-point.

2017.3 – 6 **Momenta**, *Beijing, China*,

Mentor: Gang Sun, Le Shan.

I worked on computer graphics by displaying the HD semantic mapping of the road condition extracted by the deep-learning based perception system of the autonomous vehicles, which used to demonstrate the effect of the real-time “brains” for full autonomous driving.

Selected Teaching and Professional Services

Review: ICLR (2022), Neurips (2021), ICML (2020-2021), WiML 2019.

Teaching: 18202 Mathematical Foundations of Electrical Engineering, Grad TA, CMU ECE Department, 2020.

Presentations: Multi-channel Sparse Blind Deconvolution via Nonconvex Optimization (Poster). 2021 IEEE East Asian School of Information Theory.

Skills

Languages: Python, Matlab, etc.

Technologies: Tensorflow, Pytorch, OpenGL, OpenCV, Altium Designer, OpenSceneGraph, OGRE, etc